



module  
handbook  
curriculum 2020-2025

# Chemistry

Study Program of Chemistry  
Faculty of Sains and Technology  
UIN Syarif Hidayatullah Jakarta

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## I. CURRICULUM STRUCTURE

### SEMESTER I

| No | Code        | Compulsory Courses                | Credit    | ECTS         |
|----|-------------|-----------------------------------|-----------|--------------|
| 1  | FST 6096101 | Basic Chemistry I                 | 3         | 4.13         |
| 2  | FST 6096102 | Basic Chemistry Laboratory Work I | 1         | 2.46         |
| 3  | FST 6097114 | Basic Physic                      | 2         | 2.75         |
| 4  | NAS 6013203 | Indonesian Language               | 3         | 4.13         |
| 5  | FST 6094225 | Calculus                          | 2         | 2.75         |
| 6  | UIN 6032201 | Islamic Studies                   | 4         | 5.5          |
| 7  | FST 6097115 | Basic Physic Laboratory Work      | 1         | 2.46         |
| 8  | UIN 6021204 | Arabic Language                   | 3         | 4.13         |
| 9  | UIN 6033205 | Qiroah practice and Worship       | 2         | 2.75         |
|    |             | <b>Number of credits</b>          | <b>21</b> | <b>31.06</b> |

### SEMESTER II

| No | Code        | Compulsory Courses                                       | Credit | ECTS |
|----|-------------|----------------------------------------------------------|--------|------|
| 1  | FST 6096103 | Basic Chemistry II                                       | 3      | 4.13 |
| 2  | FST 6096104 | Basic Chemistry Laboratory Work II                       | 1      | 2.46 |
| 3  | FST 6096105 | Organic Chemistry I                                      | 3      | 4.13 |
| 4  | FST 6096106 | Organic Chemistry Laboratory Work I                      | 1      | 2.46 |
| 5  | FST 6097116 | Advance Physic                                           | 2      | 2.75 |
| 6  | FST 6096107 | Chemical Laboratory Management                           | 2      | 2.75 |
| 7  | FST 6095201 | Basic Biology                                            | 2      | 2.75 |
| 8  | NAS 6112201 | Pancasila and civic education                            | 3      | 4.13 |
| 9  | FST 6091101 | Introduction to Information and Communication Technology | 2      | 2.75 |
| 10 | FST 6096108 | Qualitative Analytical Chemistry                         | 2      | 2,75 |
| 11 | FST 6096109 | Qualitative Analytical Chemistry Laboratory Work         | 1      | 2.46 |

|  |  |                          |           |              |
|--|--|--------------------------|-----------|--------------|
|  |  | <b>Number of credits</b> | <b>22</b> | <b>33,52</b> |
|--|--|--------------------------|-----------|--------------|

### SEMESTER III

| No | Code        | Compulsory Courses                                 | Credit    | ECTS         |
|----|-------------|----------------------------------------------------|-----------|--------------|
| 1  | FST 6096110 | Organic Chemistry II                               | 3         | 4.13         |
| 2  | FST 6096111 | Organic Chemistry Laboratory Work II               | 1         | 2.46         |
| 3  | FST 6096112 | Quantitative Analytical Chemistry                  | 3         | 4.13         |
| 4  | FST 6096113 | Quantitative Analytical Chemistry Laboratory Work  | 1         | 2.46         |
| 5  | FST 6096114 | Chemical Thermodynamics                            | 3         | 4.13         |
| 6  | FST 6096115 | Chemical Thermodynamics Laboratory Work            | 1         | 2.46         |
| 7  | FST 6096116 | Inorganic Structure and Reactivity                 | 3         | 4.13         |
| 8  | FST 6096117 | Inorganic Structure and Reactivity Laboratory Work | 1         | 2.46         |
| 9  | UIN 6032202 | Islam and Science                                  | 3         | 4.13         |
|    |             | <b>Number of credits</b>                           | <b>19</b> | <b>30.49</b> |
|    |             | <b>Elective courses</b>                            | <b>2</b>  | <b>2.75</b>  |
|    |             | <b>Total of credits</b>                            | <b>21</b> | <b>33.24</b> |
|    |             | <b>Elective courses available (Max for 2)</b>      |           |              |
| 1  | FSH 6046126 | IPR (Intellectual Property Rights)                 | 2         | 2.75         |
| 2  | FST 6096319 | Management of Hazardous Materials                  | 2         | 2.75         |
| 3  | FST 6092038 | Halal Food Standardization and Management          | 2         | 2.75         |

### SEMESTER IV

| No | Code        | Compulsory Courses                           | Credit | ECTS |
|----|-------------|----------------------------------------------|--------|------|
| 1  | FST 6096121 | Transition Metals and Coordination Chemistry | 3      | 4.13 |
| 2  | FST 6096122 | Transition Metals and Coordination Chemistry | 1      | 2.46 |

|   |             |                                                      |           |              |
|---|-------------|------------------------------------------------------|-----------|--------------|
|   |             | Laboratory Work                                      |           |              |
| 3 | FST 6096123 | Chemical Dynamics                                    | 3         | 4.13         |
| 4 | FST 6096124 | Chemical Dynamics<br>Laboratory Work                 | 1         | 2.46         |
| 5 | FST 6096125 | Structure and Function of<br>Biomolecules            | 3         | 4.13         |
| 6 | FST 6096126 | Biochemistry Laboratory<br>Work                      | 1         | 2.46         |
| 7 | FST 6096127 | Chemical Separation<br>Techniques                    | 3         | 4.13         |
| 8 | FST 6096128 | Chemical Separation<br>Techniques Laboratory<br>Work | 1         | 2.46         |
| 9 | FST 6094106 | Elementary statistics                                | 3         | 4.13         |
|   |             | <b>Number of credits</b>                             | <b>19</b> | <b>30.49</b> |
|   |             | <b>Elective courses</b>                              | <b>4</b>  | <b>5.5</b>   |
|   |             | <b>Total of credits</b>                              | <b>23</b> | <b>35.99</b> |
|   |             | <b>Elective courses available<br/>(Max for 2)</b>    |           |              |
| 1 | FST 6096329 | Polymer Chemistry                                    | 2         | 2.75         |
| 2 | FST 6096330 | Chemical Process Industry                            | 2         | 2.75         |
| 3 | FST 6096331 | Functional Food                                      | 2         | 2.75         |
| 4 | FST 6095106 | Microbiology                                         | 2         | 2.75         |
| 5 | FST 6096332 | Organic Chemical<br>Synthesis                        | 2         | 2.75         |

## SEMESTER V

| No | Code        | Compulsory Courses                           | Credit    | ECTS         |
|----|-------------|----------------------------------------------|-----------|--------------|
| 1  | FST 6096133 | Metabolism                                   | 3         | 4.13         |
| 2  | FST 6096134 | Natural Product Chemistry                    | 2         | 2.75         |
| 3  | FST 6096135 | Natural Product Chemistry<br>Laboratory Work | 1         | 2.46         |
| 4  | FST 6096136 | Atomic and Molecular<br>Spectroscopy         | 2         | 2.75         |
| 5  | FST 6096137 | Instrument Analysis<br>Laboratory Work       | 1         | 2.46         |
| 6  | FST 6096138 | Food Chemistry<br>Laboratory Work            | 1         | 2.46         |
| 7  | FST 6096139 | Food Chemistry                               | 3         | 4.13         |
| 8  | UIN 6014203 | English                                      | 3         | 4.13         |
|    |             | <b>Number of credits</b>                     | <b>16</b> | <b>25.27</b> |
|    |             | <b>Elective courses</b>                      | <b>4</b>  | <b>5.5</b>   |
|    |             | <b>Total of credits</b>                      | <b>20</b> | <b>30.77</b> |

|   |             | <b>Elective courses available<br/>(max for 2)</b> |   |      |
|---|-------------|---------------------------------------------------|---|------|
| 1 | FST 6096340 | Electrochemistry                                  | 2 | 2.75 |
| 2 | FST6096341  | Bioinorganic                                      | 2 | 2.75 |
| 3 | FST 6096342 | Mineral Chemistry                                 | 2 | 2.75 |
| 4 | FST 6096343 | Enzymology                                        | 2 | 2.75 |
| 5 | FST 6096344 | Catalyst Chemistry                                | 2 | 2.75 |
| 6 | FST 6096345 | Colloid Chemistry                                 | 2 | 2.75 |
| 7 | FST 6096346 | Petroleum Chemistry                               | 2 | 2.75 |
| 8 | FST 6096347 | Mineral Metabolism                                | 2 | 2.75 |

## SEMESTER VI

| No | Code        | Compulsory Courses                                     | Credit    | ECTS         |
|----|-------------|--------------------------------------------------------|-----------|--------------|
| 1  | FST 6096148 | Structure Elucidation                                  | 2         | 2.75         |
| 2  | FST 6092035 | Technopreneurship                                      | 2         | 2.75         |
| 3  | FST 6096149 | Food Technology                                        | 3         | 4.13         |
| 4  | UIN 6000208 | Research Methodology                                   | 3         | 4.13         |
| 5  | FST 6096150 | Environmental Chemistry<br>Laboratory Work             | 1         | 2.46         |
| 6  | FST 6096151 | Environmental Chemistry                                | 2         | 2.75         |
|    |             | <b>Number of credits</b>                               | <b>13</b> | <b>18,97</b> |
|    |             | <b>Elective courses</b>                                | <b>6</b>  | <b>8,25</b>  |
|    |             | <b>Total of credits</b>                                | <b>23</b> | <b>27.22</b> |
|    |             | <b>Elective courses available<br/>(Max for 5)</b>      |           |              |
| 1  | FST 6096352 | Inorganic Chemical<br>Synthesis                        | 2         | 2.75         |
| 2  | FST 6096353 | Cosmetic and Medicinal<br>Chemistry                    | 2         | 2.75         |
| 3  | FST 6096354 | Environmental Impact<br>Management Analysis<br>(AMDAL) | 2         | 2.75         |
| 4  | FST 6096355 | Toxicology                                             | 2         | 2.75         |
| 5  | FST 6096356 | Food Safety Control                                    | 2         | 2.75         |
| 6  | FST 6096357 | Biotechnology                                          | 2         | 2.75         |
| 7  | FST 6096358 | Radiation Chemistry and<br>Applications                | 2         | 2.75         |
| 8  | FST 6096359 | Halal Food Analysis                                    | 2         | 2.75         |
| 9  | FST 6096360 | Additive Chemistry                                     | 2         | 2.75         |

**SEMESTER VII**

| No | Code        | Compulsory Courses                | Credit    | ECTS         |
|----|-------------|-----------------------------------|-----------|--------------|
| 1  | FST 6096161 | Colloquium                        | 2         | 2.75         |
| 2  | UIN 6000207 | Job training/Internship (PKL)     | 4         | 5.5          |
| 3  | UIN 6000206 | Community Service Program (KKN)   | 4         | 5.5          |
|    |             | <b>Number of credits</b>          | <b>10</b> | <b>13.75</b> |
|    |             | <b>Elective courses</b>           | <b>4</b>  | <b>5.50</b>  |
|    |             | <b>Total of credits</b>           | <b>14</b> | <b>19.25</b> |
|    |             | <b>Elective courses available</b> |           |              |
| 1  | FST 6095237 | Environmental Toxicology          | 2         | 2.75         |
| 2  | FST 6096362 | Zeolite                           | 2         | 2.75         |
| 3  | FST 6096363 | Bioorganic                        | 2         | 2.75         |
| 4  | FST 6096364 | Biochemical Laboratory Technique  | 2         | 2.75         |
| 5  | FST 6096120 | Natural resource management       | 2         | 2.75         |
| 6  | FST 6096365 | Biofuels                          | 2         | 2.75         |
| 7  | FST6095123  | Bioinformatics                    | 2         | 2.75         |
| 8  | FST 6096367 | Computational Chemistry           | 2         | 2.75         |

**SEMESTER VIII**

| No | Code        | Compulsory Courses       | Credit   | ECTS         |
|----|-------------|--------------------------|----------|--------------|
| 1  | UIN 6000312 | Bachelor Thesis          | 6        | 13.60        |
| 2  | UIN 6000313 | Seminar                  | 1        | 1.25         |
|    |             | <b>Number of credits</b> | <b>7</b> | <b>14.85</b> |

|                           |                    |                    |
|---------------------------|--------------------|--------------------|
| <b>Compulsory Courses</b> | 127 Credits        | 198.14 ECTS        |
| <b>Elective Courses</b>   | 20 Credits         | 27.50 ECTS         |
| <b>Total</b>              | <b>147 Credits</b> | <b>225,64 ECTS</b> |

### FST 6096101 Basic Chemistry I

|                                           |                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Basic Chemistry I                                                                                                                                                                                                                                                                                                                                                  |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                                      |
| Module Identification Code                | FST 6096101                                                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 1                                                                                                                                                                                                                                                                                                                                                                  |
| Person(s) responsible for the module      | Ahmad Fathoni, M.Si; Nurhasni, M.Si                                                                                                                                                                                                                                                                                                                                |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The course topics are delivered through lectures which are enriched with relevant examples and followed by short discussion and structured activities (homework, quizzes). Students are divided into discussion groups of 3 to 4 members. Each group becomes a discussion center for its members in solving a given problem before being presented in class forum. |
| Workload                                  | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br><br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br><br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours                                                                                                                       |
| Credit points                             | 3 Credit Hours = 4.13 ECTS                                                                                                                                                                                                                                                                                                                                         |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                       |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                               |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                              |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 20%, Structured assignment 20%                                                                                                                                                                                                                                                                                              |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                                                    |

## II. MAIN COMPETENCY COURSES

(MAC)

Students are able to explain basic theoretical concepts in chemistry that can support understanding in a more specific field of chemistry.

Module content

Lecture (Class Work)

1. Materials and Its Changes
2. Atomic Structure
3. Periodic System of Elements
4. Chemical Bonds
5. Stoichiometry (Basic calculations)
6. Solution and Stoichiometry (Concentration of substance)
7. Chemical Equilibrium
8. Acid base
9. Introduction to Organic Chemistry

Recommended Literatures

1. Chang, Raymond. 2005. Basic Chemistry: Core Concepts. 3rd edition. Erlangga. Jakarta.
2. Oxtoby, D.W., H.P. Gillis, and Norman H.N. 2003. Principles of Modern Chemistry. 4th edition. Erlangga, Jakarta.

**FST 6096102 Basic Chemistry Laboratory Work I**

|                                           |                                                                                                                                                                                                                            |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Basic Chemistry Laboratory Work I                                                                                                                                                                                          |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                              |
| Module Identification Code                | FST 6096102                                                                                                                                                                                                                |
| Semester(s) in which the module is taught | 1                                                                                                                                                                                                                          |
| Person(s) responsible for the module      | Ahmad Fathoni, M.Si ; Agus Rimus Liandi, M.Si ;<br>Nurul Amilia, M.Si                                                                                                                                                      |
| Language                                  | English and Indonesia                                                                                                                                                                                                      |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                   |
| Teaching methods, Contact hours           | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                          |
| Workload                                  | <ul style="list-style-type: none"><li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li><li>• Structured activities: 150 min x 14 wks = 35 h</li><li>• Exam: lecture 2 h x 2 times = 4 h;</li></ul> Total = 74 hours |
| Credit points                             | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Enrolled in this course<br>Minimum 80% attendance in lecture                                         |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | None                                                                                                 |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                     |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                      |
| Students are able to conduct experiments and analyse data in basic chemistry experiments which can support understanding in a more specific field of chemistry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                      |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                      |
| Lecture (Class Work) <ol style="list-style-type: none"> <li>1. Experiment 1: Introduction to Chemical Laboratory Equipment as well</li> <li>2. Experiment 2: Solution Making</li> <li>3. Experiment 3: Changes in the Physical and Chemical Properties of Elements and Compounds</li> <li>4. Experiment 4: Chemical reaction</li> <li>5. Experiment 5: Limiting Reaction</li> <li>6. Experiment 6: Unsaturated, saturated and supersaturated solutions</li> <li>7. Experiment 7: Titration and Acid Base Equilibrium: pH Indicators and Measurements</li> <li>8. Experiment 8: Buffer Solution</li> <li>9. Experiment 9: Chemical equilibrium</li> </ol> |                                                                                                      |
| Recommended Literatures <ol style="list-style-type: none"> <li>1. Module of Basic Chemistry Laboratory Work I</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                      |

### FST 6097114 Basic Physics

|                                           |                                                          |
|-------------------------------------------|----------------------------------------------------------|
| Module Name                               | Basic Physics                                            |
| Module level, if applicable               | Undergraduate                                            |
| Module Identification Code                | FST 6097114                                              |
| Semester(s) in which the module is Taught | 1                                                        |
| Person(s) responsible for the module      | Muhammad Nafian, M.Si.                                   |
| Language                                  | Indonesian                                               |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry |

|                                                                                                                               |                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours                                                                                               | The course topics are delivered through Problem-based learning and Inquiry-based learning. The lectures are enriched with relevant examples, followed by short discussion and structured activities (homework, quizzes).                   |
| Workload                                                                                                                      | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours |
| Credit points                                                                                                                 | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                         |
| Admission and examination requirements                                                                                        | Enrolled in this course • Minimum 80% attendance in lecture                                                                                                                                                                                |
| Recommended prerequisites                                                                                                     | None                                                                                                                                                                                                                                       |
| Media employed                                                                                                                | Classical teaching tools with white/glass board and PowerPoint presentation with LCD/smart TV                                                                                                                                              |
| Forms of assessment                                                                                                           | Midterm exam 40%, Final exam 40%, Quiz 10%,<br><br>Structured assignment 10%                                                                                                                                                               |
| <b>Intended Learning Outcome</b>                                                                                              |                                                                                                                                                                                                                                            |
| Students are able to understand and apply how a physical system is seen from the perspective of mechanics and thermodynamics. |                                                                                                                                                                                                                                            |
| <b>Module content</b>                                                                                                         |                                                                                                                                                                                                                                            |

1. Measurement of physical quantities and vector properties
2. Motion in one, two and three dimensions
3. Newton's laws and their applications
4. Work and kinetic energy
5. Law of conservation of energy
6. Law of conservation of linear momentum
7. Rotational dynamics
8. Angular momentum
9. Gravity
10. Fluid mechanics
11. Temperature and kinetic theory of gasses
12. Heat and the first law of thermodynamics
13. Second law of thermodynamics
14. Thermal processes and properties

References :

1. Paul Tipler, Physics for Scientists and Engineers, 5th Edition, W.H. Freeman  
Publisher

2. Halliday, R., Walker., Fundamental of Physics, 7th Edition. USA: John Wiley & Sons, Inc, 2006
3. D.C.Giancoli, General Physics, Prentice Hall Inc, 1984

### NAS 6013203 Indonesian Language

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Indonesian Language                                                                                                                                                                                                                                     |
| Module level, if applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Undergraduate                                                                                                                                                                                                                                           |
| Module Identification Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NAS6013203                                                                                                                                                                                                                                              |
| Semester(s) in which the module is taught                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2                                                                                                                                                                                                                                                       |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Neneng Nurjanah, M.Hum.                                                                                                                                                                                                                                 |
| Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Indonesian                                                                                                                                                                                                                                              |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Collaborative learning & discussion-based learning, class discussion, structured activities (homework, quizzes).                                                                                                                                        |
| Workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br/> Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h<br/> Total = 124 hours</p> |
| Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                      |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Enrolled in this course</li> <li>• Minimum 80% attendance in lecture</li> </ul>                                                                                                                                |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -                                                                                                                                                                                                                                                       |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Board, LCD Projector, Laptop/Computer                                                                                                                                                                                                                   |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Assignments (including quizzes And assignment): 40%</li> <li>• Midterm exam: 30%</li> <li>• Final exam: 30%</li> </ul>                                                                                         |
| <b>Intended Learning Outcome</b> <ol style="list-style-type: none"> <li>1. Speaking Skills in Academic Presentation: Students are able to speak in scientific presentations.</li> <li>2. Understanding the Development of the Indonesian Language: Students can understand the development of the Indonesian language.</li> <li>3. Understanding the Use of Letters and Words: Students can understand the use of letters and words.</li> <li>4. Understanding Borrowed Words and Punctuation: Students can understand borrowed words and punctuation.</li> <li>5. Proper Diction Usage: Students are able to use appropriate diction.</li> <li>6. Crafting Effective Sentences: Students are able to create effective sentences.</li> </ol> |                                                                                                                                                                                                                                                         |

7. Constructing Proper Paragraphs: Students are able to create proper paragraphs.
8. Understanding Plagiarism: Students understand plagiarism.
9. Essay Planning Abilities: Students are able to plan an essay.
10. Effective Reasoning Skills: Students are able to reason accurately.
11. Utilizing Scientific Notation Efficiently: Students are able to use scientific notation efficiently.
12. Producing Short Writings Correctly: Students are able to produce short writings correctly.
13. Reproduction of Writing Accurately: Students are able to reproduce writings accurately.

#### **Module content**

1. Speaking in Scientific Presentations;
2. Development of the Indonesian Language;
3. Usage of Letters and Words;
4. Borrowed Elements, Punctuation, and Transliteration;
5. Diction/Word Choice;
6. Effective Sentences;
7. Paragraphs;
8. Scientific Ethics/Plagiarism;
9. Essay Planning;
10. Reasoning;
11. Scientific Notation;
12. Short Writing Production;
13. Writing Reproduction.

#### **Recommended Literatures**

1. Arifin, E. Zainal dan S. Amran Tasai. Cermat Berbahasa Indonesia. Jakarta : Akademika Pressido, 2006
2. Akhadiyah, Sabarti dan Sakura Ridwan. Pembinaan Kemampuan Menulis bahasa Indonesia. Jakarta : Airlangga, 1993
3. Finoza, Lamuddin. Komposisi Bahasa Indonesia. Jakarta : Diksi Insan Mulia, 2001.
4. Gani, Ramlan A dan Mahmudah Fitriyah Z.A. Disiplin Berbahasa Indonesia. Jakarta : PTIK Press, 2010.
5. Hs., Widjono. Bahasa Indonesia. Jakarta : Grasindo, 2007.
6. Keraf, Gorys. Komposisi. Ende : Nusa Indah, 1993.
7. Putra, R. Masri Sareb Putra. Kiat Menghindari Plagiat. How to Avoid Plagiarisme. Jakarta : Indeks, 2011.

**FST 6094126 Calculus**

|                             |               |
|-----------------------------|---------------|
| Module Name                 | Calculus      |
| Module level, if applicable | Undergraduate |
| Module Identification Code  | FST 6094126   |

|                                           |                                                                                                                                                                                                                                     |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Semester(s) in which the module is Taught | 1                                                                                                                                                                                                                                   |
| Person(s) responsible for the module      | Nina Valentika, S.Si., M.Si.                                                                                                                                                                                                        |
| Language                                  | Indonesian                                                                                                                                                                                                                          |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                            |
| Teaching methods, Contact hours           | Lecture, class discussion, structured activities (homework, quizzes).                                                                                                                                                               |
| Workload                                  | Lecture (class): (2 x 50 min) x 14 weeks = 23,33 h<br>Structured activities: 2 h x 14 weeks = 28 h<br>Independent study: 2 h x 14 weeks = 28 h<br>Exam: 50 min x 2 (mid test and final test) x 2 times = 3.33 h;<br>Total = 82,66 h |
| Credit points                             | 2 Credit Hours $\approx$ 2.755 ECTS                                                                                                                                                                                                 |
| Admission and examination Requirements    | <ul style="list-style-type: none"><li>• Enrolled in this course</li><li>• Minimum 80% attendance in lecture</li></ul>                                                                                                               |
| Recommended prerequisites                 | Student should be proficient in elementary algebra                                                                                                                                                                                  |
| Media employed                            | Board, LCD Projector, Laptop/Computer                                                                                                                                                                                               |
| Forms of assessment                       | <ul style="list-style-type: none"><li>• Assignments (including quizzes and group project): 30%</li><li>• Midterm exam: 30%</li><li>• Final exam: 40%</li></ul>                                                                      |

**Intended Learning Outcome**

After attending this lecture, student will:

1. Able to explain the Basic Concepts of the Real Number System, inequality, absolute value, coordinate systems and straight lines.
2. Able to explain the meaning of function, its definition and theorems.
3. Be able to explain the meaning of Limit, its definition and theorems.
4. Able to apply derivatives.
5. Able to explain derivative search rules, definitions and theorems, its implementation.
6. Able to understand Logarithmic Functions.
7. Able to understand Trigonometric Inverse Functions and hyperbolic functions.

**Module content**

1. Real Number System
2. Absolute Value and Inequality
3. Coordinate System and Straight Lines
4. Line Equations
5. Functions and Operations on Functions
6. Trigonometric Functions
7. Introduction to Limits, In-Depth Study of Limits, and Limit Theorems
8. Limits Involving Trigonometric Functions
9. Limits at Infinity, Infinite Limits

10. Continuity of Functions
11. Derivatives, Rules for Finding Derivatives, Sine and Cosine Rules
12. Chain Rule, Leibniz Notation
13. Higher-Order Derivatives, Maximum and Minimum Values, Monotonicity and Convexity
14. Antiderivatives and Introduction to Differential Equations
15. Applications of Integration (Area under Curves, Solid Objects' Volume, Disks, and Rings)
16. Transcendental Functions

#### Recommend Literatures

1. Edwin J. Purcell and Dale Varberg. 1999. Calculus and Analytical Geometry. Volume 1. translation I. Njoman Susila, Bana Kartasasmita, Rawuh. Erlangga. Jakarta.
2. Anton, H. 1988. Calculus, third edition. Jhon Wiley dan Sons. New York.
3. Martono, K. 1999. Calculus. Erlangga. Jakarta.
4. Mursita, D. 2006. Matematika Dasar. Rekayasa Sains. Bandung.
5. Ashhar, B. 2014. Application of Derivatives in Maximum Profit Analysis Problems. Al-Khwarizmi: Journal of Mathematics and Natural Sciences Education. 2(1): 1-14
6. Nuraeni Z. 2017. Application of differential equations in population number estimation. Scientific Journal of Mathematics Education. 5(1): 9-16.

**UIN 6032201 Islamic Studies**

|                                           |                                                                                                                                                                                                                                             |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Islamic Studies                                                                                                                                                                                                                             |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                               |
| Module Identification Code                | UIN6032201                                                                                                                                                                                                                                  |
| Semester(s) in which the module is Taught | 1                                                                                                                                                                                                                                           |
| Person(s) responsible for the module      | Dr. Saifudin, M.Pd.I                                                                                                                                                                                                                        |
| Language                                  | English and Indonesia                                                                                                                                                                                                                       |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                    |
| Teaching methods, Contact hours           | Collaborative learning & discussion-based learning, class discussion, structured activities (homework, quizzes).                                                                                                                            |
| Workload                                  | Lecture (class): (4 CH x 50 min) x 14 weeks = 46.6 h<br>Structured activities: (1.5 h x 4 CH) x 14 weeks = 84 h.<br>Independent study: (0.5 h x 4 CH) x 14 weeks = 28 h<br>Exam: lecture 50 min x 4 CH x 2 w = 6.6 h<br>Total = 165.2 hours |
| Credit points                             | 4 Credit Hours $\approx$ 5.5 ECTS                                                                                                                                                                                                           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Admission and examination Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Enrolled in this course<br>Minimum 80% attendance in lecture          |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | None                                                                  |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Classical teaching tools with white board and PowerPoint presentation |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10% |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                       |
| Students are able to explain the basic concepts of Islam properly and correctly. Students are able to describe the sources, history, position, and values and methodologies of Islamic religious teachings. Students are able to apply the values of Islamic teachings in social life academically.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                       |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                       |
| <ol style="list-style-type: none"> <li>1. Introduction, Object/Scope, Objectives, History and Methodology of Islamic Studies</li> <li>2. The Concept of Man, the Universe, and Religion in Islam</li> <li>3. Islam: Its Definition, Sources, Position, Functions, and History</li> <li>4. Qur'an (Meaning, Position and Function, and Its History in Islam)</li> <li>5. Hadith (Meaning, Object of Study, Position and Function of History in Islam)</li> <li>6. Islamic Doctrine and Teachings (Aqidah, Sharia and Morals), Its Branches and Hierarchy and Relations.</li> <li>2. Tawhid and the Prophetic Concept: Meaning, Scope. Its Position and Function in Islam</li> <li>3. Qadla, Qadar and the Deeds of Beings in Islam: Their Definition, Object of Study, Position, Function, and Wisdom</li> <li>4. Eschatology/Last Days in Islam: Definition, Object of Study and Position, and Its Events</li> <li>5. Shirk, Kufr, Nifaq, Fisq and al-Kabair According to Islam</li> <li>6. Islam and its Shari'ah: Definition, Types, Functions, Objects of Study, Sources and History, and the Process of Tasyri'nya</li> <li>7. The Concept of Morals, Ethics and Morals in Islam</li> <li>8. Islam and its Civilization: History and Development of Islam from the Time of the Prophet SAW to Indonesian Islam</li> <li>9. 14. Islam in Indonesia: Concept, Implementation and Social History</li> </ol> |                                                                       |

## Recommended Literatures

### Main

1. Quran al-Karim
2. Al-Kutub al-Sittah (Saheeh al-Bukhari, Saheeh Muslim, Sunan al-Tirmidhi, Sunan al-Nasai, and Sunan Ibn Majah)
3. Ibn Hisham, Abu Muhammad Abd al-Malik, Al-Sirah al-Nabawiyah, 2002. Cairo: Dar al-Ghad al-Jadid.
4. Ibn Rushd, 2004. Bidayah al-Mujtahid wa Nihayah al-Muqtashid, Cairo: Daral-Hadith.
5. al-Jaziri, Abu Bakr Jabir. 2004. Aqidah al-Mu'min, Medina: Maktabah al-'Ulûm wa al-Hikam.
6. Khalil, Moenawar. 1993. Completeness of Prophet Muhammad's Date, Jakarta: Moon Star.
8. al-Razi, Fakhruddin, Mafâtih al-Ghaib, Beirût: Dâr Ihyâal-Turâts al-'Arabî, 1429 AH.
9. Al-Yubi, Muhammad Sa'ad ibn Ahmad, 1998. Maqâshid al-Sharîah al-Islâmiyah, Riyadl: Dar al-Hijrah li al-Nasyr wa al-Tawzi'.

### Supporter

1. Abd. Hakim, Atang and Jaih Mubarak, 2000. Islamic Studies Methodology, Bandung: Remaja Rosdakarya.
2. 'Abdul Hamîd, 'Irfan , tth. Dirasât fi al-Firaq wa al-'Aqâid al-Islamiyah, Baghdâd: Mathba'ah As'ad.
3. Abdul Baqi, Muhammad Fuad, tth. Al-Mu'jam al-Mufahras li al-Fâzh al-Qur'ânal-al-Karîm, Bandung: CV Diponegoro, tth.
4. Abdurrahman, Dudung, et al. 2009. History of Islamic Civilization: from Classical to Modern Period, Yogyakarta: LESFI.

### FST 6097115 Basic Physics Laboratory Work

|                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                                                       | Basic Physics Laboratory Work                                                                                                                                                                                                           |
| Module level, if applicable                                                                                                                                                                                                                                                                                                                                       | Undergraduate                                                                                                                                                                                                                           |
| Module Identification Code                                                                                                                                                                                                                                                                                                                                        | FST 6097115                                                                                                                                                                                                                             |
| Semester(s) in which the module is taught                                                                                                                                                                                                                                                                                                                         | 1                                                                                                                                                                                                                                       |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                                              | Ryan Rizaldy, M.Si.                                                                                                                                                                                                                     |
| Language                                                                                                                                                                                                                                                                                                                                                          | English and Indonesia                                                                                                                                                                                                                   |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                                            | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                                                   | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                                       |
| Workload                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> <li>Total = 74 hours</li> </ul> |
| Credit points                                                                                                                                                                                                                                                                                                                                                     | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                                      |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                            | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                            |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                         | None                                                                                                                                                                                                                                    |
| Media employed                                                                                                                                                                                                                                                                                                                                                    | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                    |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                               | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                                        |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                         |
| Students are expected to be able to identify and describe the methods used in practicum and how to process practicum data and be able to apply them both in research and in everyday life.                                                                                                                                                                        |                                                                                                                                                                                                                                         |
| Module content                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                         |
| Lecture (Class Work) <ol style="list-style-type: none"> <li>1. Introduction to Laboratory Equipment and Materials, as well as Standard Operating Procedures (SOP).</li> <li>2. Measurement and Error</li> <li>3. Force Vectors</li> <li>4. Gravitational Acceleration</li> <li>5. Collisions</li> <li>6. Moment of Inertia</li> <li>7. Surface Tension</li> </ol> |                                                                                                                                                                                                                                         |

8. Linear Expansion Coefficient
9. Volume Expansion Coefficient
10. Joule's Constant

#### Heat Capacity

#### Recommended Literatures

1. Tipler, Paul A., Fisika untuk Sains dan Teknik, Jilid 1 dan 2, Edisi 3, terjemahan "Physics for Scientists and Engineer", Penerbit Erlangga, Jakarta, 1998.
2. Halliday, D. and Resnick, R., Fisika, Jilid 1 dan 2, Edisi 3, terjemahan, "Physics", Penerbit Erlangga, Jakarta, 1984.
3. Leybold didactic, <http://www.leybold-didactic.de/>

Hikam, M., Praktikum Fisika Dasar, Edisi XVI, Jurusan Fisika, Universitas Indonesia, Depok, 1996.

### UIN 6021204 Arabic Language

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Arabic Language                                                                                                                                                                                                                                         |
| Module level, if applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Undergraduate                                                                                                                                                                                                                                           |
| Module Identification Code                                                                                                                                                                                                                                                                                                                                                                                                                                                    | UIN6021204                                                                                                                                                                                                                                              |
| Semester(s) in which the module is Taught                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                       |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                                                                                                                                                          | Dr. Saifudin, M.Pd.I                                                                                                                                                                                                                                    |
| Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Arabic, Indonesian                                                                                                                                                                                                                                      |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                                                                                                                                                               | The course topics are delivered through communicative approaches, total physical response, task-based learning, storytelling, and language games which are enriched with relevant examples and followed by short discussion and assignment.             |
| Workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br/> Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h<br/> Total = 124 hours</p> |
| Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                      |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                        | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                            |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                     | None                                                                                                                                                                                                                                                    |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                   |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                   |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                         |
| <p>Students are able to understand basic knowledge of Arabic and its methods orally and in writing using good and correct Arabic and Indonesian in the development of the academic world and the non-academic world. Able to communicate both orally and in writing using Arabic and Indonesian in the development of the academic and non-academic world. Mastering the four skills of Arabic, istima', kalam, qira'ah and kitabah and implementing them in social life.</p> |                                                                                                                                                                                                                                                         |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                         |

1. Sentences: ta'rîf, aqsâm, syakl, 'alâmât, wa misâl (Words: definition, division, characteristics/forms, characteristics/signs and examples)
2. Isim Nakirah-Ma'rifah wa mudzakar-Muannats: ta'rîf, aqsâm, 'alâmât, wa misâl
3. Isim Mufrad, Mutsanna, wa Jama': ta'rîf, aqsâm, 'alâmât, wa misâl
4. Isim Jama': ta'rîf, aqsâm, 'alâmât, wa misâl
5. 'Adad and Ma'dud: ta'rîf, aqsâm, 'alâmât, tashrîf, wa misâl
6. Isim Isyarah: ta'rîf, aqsâm, 'alâmât, tashrîf, wa misâl
7. Isim Istifham : ta'rîf, aqsâm, 'alâmât, syakl, wa misâl
8. Isim Dlamir : ta'rîf, aqsâm, 'alâmât, tashrîf, wa misâl
9. Fi'il Madli : ta'rîf, aqsâm, 'alâmât, tashrîf, wa misâl
10. Fi'il Mudlari : ta'rîf, aqsâm, 'alâmât, tashrîf, wa misâl
11. Fi'il Amr : ta'rîf, aqsâm, 'alâmât, tashrîf, wa misâl
12. Ma'ful: ta'rîf, aqsâm, 'alâmât, syakl, wa misâl
13. Number of ismiyah : ta'rîf, aqsâm, 'alâmât, tarkîb, wa misâl
14. Total fi'liyah: ta'rîf, aqsâm, 'alâmât, tarkîb, wa misâl

#### Recommended Literatures

1. Abd al-Fattâh Shabrî and 'Ali 'Umar, al-Qirâ-ah al-Râshidah, (Egypt: Dar al-Ma'arif, 1945).
2. Fu'ad Ni'mah, Mulakhash Qawâ'id al-Lughah al-'Arabiyah, (Surabaya: al-Hidayah, tth).
3. Mahmud Yunus, al-Muthâla'ah al-Haditsah, (Jakarta: Maktabah al-Sa'diyah Putra, 1937).
4. Majmu'ah, Al-'Arabiyah baina Yadaik, 2008.
5. Sayyid Ahmad al-Hâsyimî, al-Qawâ'id al-Asâsiyah li al-Lughah al-'Arabiyah, (Cairo: Muassasah al-Mukhtar, 2006).

### UIN 6033205 Qiroah Practicum and Worship

|                                           |                                                                                                                                                                                   |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Practicum Qira'ah and Worship                                                                                                                                                     |
| Module level, if applicable               | Undergraduate                                                                                                                                                                     |
| Module Identification Code                | UIN6033205                                                                                                                                                                        |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                 |
| Person(s) responsible for the module      | Dr. Saifudin, M.Pd.I.                                                                                                                                                             |
| Language                                  | English and Indonesia                                                                                                                                                             |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                          |
| Teaching methods, Contact hours           | The course topics are delivered through direct instruction from instructors, guided practice sessions, individualized feedback, recitation circles for peer learning and support. |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h</p> <p>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.</p> <p>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h</p> <p>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h</p> <p>Total = 82.6 hours</p> |
| Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2 Credit Hours $\approx$ 2.755 ECTS                                                                                                                                                                                                                               |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Enrolled in this course</p> <p>Minimum 80% attendance in lecture</p>                                                                                                                                                                                           |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | None                                                                                                                                                                                                                                                              |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                             |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                             |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                   |
| <p>Students are able to understand the theories of Tajweed and Qira'at science properly and correctly. Students are able to read the Qur'an based on the provisions of the science of qira'at and the science of tajweed. Students are able to memorize the Qur'an at least two juz in addition to juz 30 in the Qur'an. Students master the principles, theories and concepts of worship in Islam based on schools of jurisprudence properly and precisely. Students are able to carry out various types of worship and lead religious rituals properly and correctly.</p> |                                                                                                                                                                                                                                                                   |

## Module content

### **Practicum Qiroah**

1. The Concept of Hijâiyah Letters: Classification, Types, and Makharij and Characteristics of Letters
2. Al-Qamariyah and al-Shamsiyah
3. Ahkâm al-Nûn al-Sâkinah wa al-Tanwîn
4. Ahkâm al-Mîm al-Sâkinah
6. Idlghâm al-Mutaqâribain wa al-Mutajânisain
7. Ahkâm al-Madûd (1 and 2)
8. Al-Qalqalah
9. Al-Washl wa al-Waqf
10. Qirâah Gharîbah
11. Types of Qirâat in the al Quran
12. Memorize Juz Amma, Juz 28, Juz 29 and Surah Al-Kahf, Al-Rahman, Al-Waqi'ah, Al-Mulk, Al Sajdah, Yasin,

### **Practicum Worship**

1. The Concept of Worship in Islam
2. Taharah (Hadas, Uncleaness, Wudlu, Tayamum, Bathing)
3. Concepts and Practices of Dressing According to Islam
4. Dhikr and Prayer
5. Obligatory Prayers (5 Times Prayer, Jama' and Qashar, Prayer in the Vehicle and Khauf)

6. Sunnah prayers (Rawatib, Tahajjud/Tarawih, Dluha, Istikharah, Istisqa, Kusuf/Khusuf)
7. Tajhiz al-Janazah (Pre-Death, Tajhiz al-Janazah Process: Bathing, Shrouding, Praying and Burying, and related matters)
8. Zakat/Alms (Compulsory and Sunnah)
9. Fasting (Compulsory, Sunnah and Haram)
10. Hajji and 'Umrah
11. Marriage and Family in Islam
12. Eating, Drinking and Communicating Manners
13. Mu'amalah (Types of Business in Islam)

## Recommended Literatures

### **Practicum Qiroah**

1. Quran al-Karim
2. Muna al-Baitfi, 1438 AH. Al-Tajwîd al-Mustawâ al-Awwal.
3. 'Abdul Qâdir, 'Abdullah Hailuz, 2008. Al-Muyassar al-Mufîd fî 'Ilm al-Tajwîd, (Jordan).

### **Practicum Worship**

1. A-Quran al-Karim
2. Al-Kutub al-Sittah (Saheeh al-Bukhari, Saheeh Muslim, Sunan al-Tirmidhi, Sunan al-Nasai, and Sunan Ibn Majah)
3. Ibn Hajar al-'Asqalani, 2000. Bulûgh al-Marâm min Adillat al-Ahkam, Riyadl: Dar al-Athlas li al-Nasyr wa al-Tawzi'.
4. Ibn Hisham, Abu Muhammad Abd al-Malik, 2002. al-Sirah al-Nabawiyah, Cairo: Dar al-Ghad al-Jadid.
5. Ibn Rushd, 2004. Bidayah al-Mujtahid wa Nihayah al-Muqtashid, Cairo: Daral-Hadith.
6. Al-Jaziri, Abu Bakr Jabir. 2004. Aqidah al-Mu'min, Medina: Maktabah al-'Ulûm wa al-Hikam.

### FST 6096103 Basic Chemistry II

|                                           |                                                          |
|-------------------------------------------|----------------------------------------------------------|
| Module Name                               | Basic Chemistry II                                       |
| Module level, if applicable               | Undergraduate                                            |
| Module Identification Code                | FST 6096103                                              |
| Semester(s) in which the module is taught | 2                                                        |
| Person(s) responsible for the module      | Ahmad Fathoni, Msi; Nurhasni, M.Si                       |
| Language                                  | English and Indonesia                                    |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry |

|                                        |                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours        | The course topics are delivered through lectures which are enriched with relevant examples and followed by short discussion and structured activities (homework, quizzes). Students are divided into discussion groups of 3 to 4 members. Each group becomes a discussion center for its members in solving a given problem before being presented in class forum. |
| Workload                               | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h</p> <p>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p>                                                                                                        |
| Credit points                          | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                                                 |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                       |
| Recommended prerequisites              | None                                                                                                                                                                                                                                                                                                                                                               |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                              |
| Forms of assessment                    | Midterm exam 30%, Final exam 30%, Quiz 20%, Structured assignment 20%                                                                                                                                                                                                                                                                                              |
| Intended Learning Outcome              |                                                                                                                                                                                                                                                                                                                                                                    |

Students are able to explain basic theoretical concepts in chemistry that can support understanding in a more specific field of chemistry.

#### Module content

##### Lecture (Class Work)

1. Chemical kinetics
2. Colligative Properties of Solutions
3. Colloids
4. Energy in chemical reactions
5. Thermodynamics
6. Electrochemistry and redox reactions
7. Nuclear Chemistry
8. Introduction to environmental chemistry

##### Recommended Literatures

1. Chang, Raymond. 2005. Basic Chemistry: Core Concepts. 3rd edition. Erlangga. Jakarta.

2. Oxtoby, D.W., H.P. Gillis, and Norman H.N. 2003. Principles of Modern Chemistry. 4th edition. Erlangga, Jakarta.

### FST 6096104 Basic Chemistry Laboratory Work II

|                                                                                                                                                                    |                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                        | Basic Chemistry Laboratory Work II                                                                                                                                                                                             |
| Module level, if applicable                                                                                                                                        | Undergraduate                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                                                         | FST 6096104                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                                                          | 2                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                                               | Ahmad Fathoni, M.Si ; Agus Rimus Liandi, M.Si ; Nurul Amilia, M.Si                                                                                                                                                             |
| Language                                                                                                                                                           | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                                             | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                                                    | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                                                           | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                                                      | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                             | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                          | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                                                     | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                                                | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                                                          |                                                                                                                                                                                                                                |
| Students are able to conduct experiments and do analyze data in basic chemistry experiments which can support understanding in a more specific field of chemistry. |                                                                                                                                                                                                                                |
| Module content                                                                                                                                                     |                                                                                                                                                                                                                                |
| Lecture (Class Work)<br>1. Experiment 1: Reaction kinetics                                                                                                         |                                                                                                                                                                                                                                |

2. Experiment 2: Paper chromatography
3. Experiment 3: Lowering the freezing point of the solution
4. Experiment 4: Reduction
5. Experiment 5: Colloid
6. Experiment 6: Gas formation reaction
7. Experiment 7: Ionic reaction formula
8. Experiment 8: Use of a Uv-vis spectrophotometer
9. Experiment 9: Making coconut oil without heating

Recommended Literatures

1. Module of Basic Chemistry Laboratory Work II

**FST 6096105 Organic Chemistry I**

|                             |                     |
|-----------------------------|---------------------|
| Module Name                 | Organic Chemistry I |
| Module level, if applicable | Undergraduate       |

|                                           |                                                                                                                                                                                                                                                                                       |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Identification Code                | FST 6096105                                                                                                                                                                                                                                                                           |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                                                                     |
| Person(s) responsible for the module      | Dr. Siti Nurbayti, M.Si                                                                                                                                                                                                                                                               |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                 |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                              |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of traditional lectures, problem-solving sessions, case studies, and group discussions to reinforce concepts and applications. Additionally, assignments for in-depth study, such as literature reviews and synthesis projects. |
| Workload                                  | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h</p> <p>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p>                           |
| Credit points                             | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Enrolled in this course<br>Minimum 80% attendance in lecture                          |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Basic Chemistry                                                                       |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Classical teaching tools with whiteboard and PowerPoint presentation; Molecular model |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Quiz 15%, Structured assignment 15%<br>Midterm exam 30%, Final exam 40%               |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                       |
| Students are expected to be able to analyze the structure, physical properties, chemical properties and reactivity of organic compounds (alkanes, alkenes, alkynes, alcohols, ethers, alkyl halides, benzene and their derivatives).                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                       |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                       |
| Lectures (Class Work) <ol style="list-style-type: none"> <li>1. Introduction to Organic Chemistry</li> <li>2. Atoms and Molecules</li> <li>3. Orbital and Their Role in Covalent Bonding</li> <li>4. Alkanes and Cycloalkanes</li> <li>5. Stereochemistry</li> <li>6. Alkyl Halides: Substitution and Elimination Reactions</li> <li>7. Alcohols and Ethers</li> <li>8. Alkenes and Alkynes</li> <li>10. Aromaticity and Benzene</li> <li>11. Substituted Benzenes</li> </ol>                                                                                                                                                      |                                                                                       |
| Recommended Literatures <ol style="list-style-type: none"> <li>1. Fessenden, R.J. &amp; J.S.Fessenden. 1986. <i>Organic Chemistry</i>. Volume 1. Second edition. Translators: A.H. Pudjaatmaka &amp; N.M. Surdia. Erlangga Publishers. Jakarta.</li> <li>2. Carey, F.A. 2003. <i>Organic Chemistry</i>. 5th Edition. McGraw Hill. York.</li> <li>3. McMurry, J. 2012. <i>Organic Chemistry</i>. 8th Edition. Brooks/Cole. USA.</li> <li>4. Bruice, P.Y. 2015. <i>Organic Chemistry</i>. 8th Edition. Prentice Hall. New Jersey.</li> <li>5. Smith, J.G. 2020. <i>Organic Chemistry</i>. 6th Edition. McGraw Hill. York.</li> </ol> |                                                                                       |

### FST 6096106 Organic Chemistry Laboratory Work I

|                                                                                                                                        |                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                            | Organic Chemistry Laboratory Work I                                                                                                                                                                                            |
| Module level, if applicable                                                                                                            | Undergraduate                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                             | FST 6096106                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                              | 2                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                   | Dr. Siti Nurbayti, M.Si;<br>Agus Rimus Liandi, M.Si;<br>Tarso Rudiana, M.Si.                                                                                                                                                   |
| Language                                                                                                                               | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                 | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                        | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                               | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                          | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                 | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                              | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                         | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                    | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                              |                                                                                                                                                                                                                                |
| Students have an understanding of the basic principles of laboratory management and work safety and security practices in laboratories |                                                                                                                                                                                                                                |
| Module content                                                                                                                         |                                                                                                                                                                                                                                |

Lectures (Lab Work)

1. Introduction
2. Separation and Purification of Liquids and Solids
3. Qualitative Analysis of Hydrocarbons, Alcohols and Phenols
4. Qualitative Analysis of Aldehydes and Ketones
5. Carboxylic Acids and Esters
6. Terter-Butyl Chloride Synthesis
7. Geometry Keisomeran
8. Pyric acid synthesis
9. Orange Synthesis II

Recommended Literatures

1. Organic Chemistry Practicum Module I

**FST 6097116 Advanced Physics**

|                             |                  |
|-----------------------------|------------------|
| Module Name                 | Advanced Physics |
| Module level, if applicable | Undergraduate    |

|                                           |                                                                                                                                                                                                                                            |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Identification Code                | FST 6097116                                                                                                                                                                                                                                |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                          |
| Person(s) responsible for the module      | Ryan Rizaldy, M.Si.                                                                                                                                                                                                                        |
| Language                                  | English and Indonesia                                                                                                                                                                                                                      |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                   |
| Teaching methods, Contact hours           | The course topics are delivered through Problem-based learning and Inquiry-based learning. The lectures are enriched with relevant examples, followed by short discussion and structured activities (homework, quizzes).                   |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                         |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                               |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                       |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                      |
| Forms of assessment                       | Midterm exam 30%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                      |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                            |

Students can identify and elucidate several fundamental concepts of Advanced Physics and are capable of using this understanding to formulate solutions for various issues from a chemical perspective and develop them in research activities

#### Module content

##### Lecture (Class Work)

1. A Brief History of Quantum Theory
2. Atomic Structure and Spectroscopy
3. Molecular Structure and Symmetry
4. Magnetic Resonance
5. Diffraction Techniques
6. Crystal Structure and Solid-State Bonding
7. Properties of Solid Materials

##### Recommended Literatures

1. P Atkins, J d Paula, J Keeler - Atkins' Physical Chemistry, Oxford University Press (2018)
2. McQuarrie, Donald A. Quantum Chemistry, 2nd Edition. University Science Books, (2007).

**FST 6096107 Chemical Laboratory Management**

|                                           |                                                                                                                                                                                                                                                                                     |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Chemical Laboratory Management                                                                                                                                                                                                                                                      |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                       |
| Module Identification Code                | FST 6096107                                                                                                                                                                                                                                                                         |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                                                                   |
| Person(s) responsible for the module      | Drs. Dede Sukandar, M.Si, Dr. Sandra Hermanto, Ahmad Fathoni, MSi                                                                                                                                                                                                                   |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                               |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                            |
| Teaching methods, Contact hours           | The course topics are delivered through a blend of theoretical instruction on laboratory safety, equipment operation, and protocol adherence alongside practical demonstrations. Besides that, hands-on training and case studies are also conducted with a small group discussion. |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours |
| Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                         |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                               |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | None                                                                                                                                                                                                                                       |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                      |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                      |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                            |
| Students have an understanding of the basic principles of laboratory management and work safety and security practices in laboratories                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                            |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                            |
| Lecture (Class Work) <ol style="list-style-type: none"> <li>1. Governance of the Chemical Laboratory</li> <li>2. Case Study of Observation and Evaluation of Chemical Laboratory Governance</li> <li>3. Laboratory Safety and Security Culture.</li> <li>4. Case Study Observation and Evaluation of Laboratory Safety and Security Culture.</li> <li>5. Assessing Hazards and Risks in the Laboratory.</li> <li>6. Chemical Handling and MSDS</li> <li>7. Case Study and Evaluation of Chemical Handling Observations and MSDS</li> <li>8. Chemical Storage Management and CIMS</li> <li>9. Observation and Evaluation Case Study of Chemical Storage Management and CIMS</li> <li>10. Working with Laboratory Equipment</li> <li>11. Chemical Laboratory Waste Management</li> <li>12. Case Study of Observation and Evaluation of Chemical Waste Management</li> </ol> |                                                                                                                                                                                                                                            |
| Recommended Literatures <ol style="list-style-type: none"> <li>1. Robert H. Hill &amp; David C. Finster, 2010, Laboratory Safety For Chemistry Students, A John Wiley&amp;Sons, INC., Publication</li> <li>2. OSHA, 2011, Laboratory Safety Guidance, <a href="http://www.OSHA.gov">www.OSHA.gov</a></li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                            |



**FST 6095201 Basic Biology**

|                                           |                                                                                                                                                                                                                                            |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Basic Biology                                                                                                                                                                                                                              |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                              |
| Module Identification Code                | FST 6095201                                                                                                                                                                                                                                |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                          |
| Person(s) responsible for the module      | Mardiansyah, M.Si.                                                                                                                                                                                                                         |
| Language                                  | English and Indonesia                                                                                                                                                                                                                      |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                   |
| Teaching methods, Contact hours           | The course topics are delivered through Problem-based learning and Inquiry-based learning. The lectures are enriched with relevant examples, followed by short discussion and structured activities (homework, quizzes).                   |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                         |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                               |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                       |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                      |
| Forms of assessment                       | Formative assessment includes assignments, quizzes, attendance, active participation in learning, and etiquette/ethics, accounting for 40%.<br>Midterm Exam 30%. Final Exam 30%.                                                           |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                            |

Students have an understanding of the basic concepts of living organisms, the scientific method, cell structure and cycle, cellular metabolism, biodiversity, and the development of biotechnology

#### Module content

##### Lecture

1. Introduction and Basic Characteristics of Specific Living Organisms
2. The Origin of the Universe Based on Scientific Theory and the Quran
3. The Origin of Living Creatures Based on Scientific Theory and the Quran
4. Cells, Cell Organelles, and Their Functions
5. Cellular Metabolism
6. Cell Cycle
7. Gametogenesis
8. Basic Structure of Animal Tissues
9. Basic Structure of Plant Tissues
10. Patterns of Inheritance in Living Organisms
11. Biodiversity
12. Basic Concepts of Ecology
13. Conservation and Management of Natural Resources
14. Biotechnology

##### Recommended Literatures

1. Campbell et al. 2006. Biology Concept and Connection. Pearson Benjamin Cummings. San Francisco.
2. Wijayanti F. 2015. Biologi Konservasi. UIN Press. Jakarta.
3. Mader, S.S. 2001. Understanding human anatomy and physiology. Mc.Graw-Hill Companies. Amerika Utara
4. Tim Biologi. 2006. Biologi Dasar. UIN Jakarta Press. Jakarta

### NAS 6112201 Pancasila and civic education

|                                           |                                                                                                                                                                                                                                                                             |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Pancasila and Civic Education                                                                                                                                                                                                                                               |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                               |
| Module Identification Code                | NAS6112201                                                                                                                                                                                                                                                                  |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                                                           |
| Person(s) responsible for the module      | Dr. Gerafina Djohan, MA                                                                                                                                                                                                                                                     |
| Language                                  | Indonesian                                                                                                                                                                                                                                                                  |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | Project-based learning & problem-based learning, class discussion, structured activities (homework, quizzes).                                                                                                                                                               |
| Workload                                  | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br/>           Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h<br/>           Total = 124 hours</p> |

|                                        |                                                                                                                                                                 |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Credit points                          | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                              |
| Admission and examination requirements | <ul style="list-style-type: none"> <li>• Enrolled in this course</li> <li>• Minimum 80% attendance in lecture</li> </ul>                                        |
| Recommended prerequisites              | -                                                                                                                                                               |
| Media employed                         | Board, LCD Projector, Laptop/Computer                                                                                                                           |
| Forms of assessment                    | <ul style="list-style-type: none"> <li>• Assignments (including quizzes and assignment): 40%</li> <li>• Midterm exam: 30%</li> <li>• Final exam: 30%</li> </ul> |

#### Intended Learning Outcome

After completing this course, the students should have:

1. Explaining the History of the Formulation of Pancasila
2. Stressing the Importance of Civic Education as a Platform for Shaping the Character of the Civilized Indonesian Nation
3. Describing the Competency Standards of Civic Education
4. Presenting the Scope of Pancasila and Civic Education Material
5. Concluding the Importance of Civic Education for the Development of a Democratic Culture in Indonesia

#### Module content

1. History of the Formulation of Pancasila
2. Pancasila as a National Ideology
3. Pancasila as a Paradigm for Community, Nation, and State Life
4. Islamic Perspectives on the Content of Pancasila
5. National Identity
6. Globalization
7. Democracy
8. Constitution and Legislation in Indonesia
9. State, Religion, and Citizenship
10. Human Rights (HAM)
11. Regional Autonomy
12. Good Governance
13. Corruption Prevention
14. Civil Society

#### Recommended Literatures

1. Ubaedillah, A. 2015. Pendidikan Kewarganegaraan. Jakarta: Prenada Media Group.
2. Endang Saefudin Anshari. 1985. Piagam Jakarta. Pustaka, bandung

### FST 6091101 Introduction to Information and Communication Technology

|                                           |                                                                                                                                                                                                                                                                   |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Introduction to Information and Communications Technology                                                                                                                                                                                                         |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                     |
| Module Identification Code                | FST6091101                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                                                 |
| Person(s) responsible for the module      | Mohamad Irvan Septiar Musti, M.Si                                                                                                                                                                                                                                 |
| Language                                  | Indonesian                                                                                                                                                                                                                                                        |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry.                                                                                                                                                                                                         |
| Teaching methods, Contact hours           | Project-based learning & problem-based learning, class discussion, structured activities (homework, quizzes).                                                                                                                                                     |
| Workload                                  | <p>Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h</p> <p>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.</p> <p>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h</p> <p>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h</p> <p>Total = 82.6 hours</p> |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                |
| Admission and examination requirements    | <ul style="list-style-type: none"> <li>• Enrolled in this course</li> <li>• Minimum 80% attendance in lecture</li> </ul>                                                                                                                                          |
| Recommended prerequisites                 | -                                                                                                                                                                                                                                                                 |
| Media employed                            | Board, LCD Projector, Laptop/Computer                                                                                                                                                                                                                             |
| Forms of assessment                       | <ul style="list-style-type: none"> <li>• Assignments (including quizzes and assignment): 40%</li> <li>• Midterm exam: 30%</li> <li>• Final exam: 30%</li> </ul>                                                                                                   |
| <b>Intended Learning Outcome</b>          |                                                                                                                                                                                                                                                                   |

After completing this course

1. Students are able to understand the history, role, and benefits of Information and Communication Technology (ICT).
2. Students are able to explain an overview of computer systems.
3. Students are able to explain the concepts and tasks of operating systems.
4. Students are able to explain the history of Unix, Linux, and Windows operating systems.
5. Students can explain the definition, benefits, and workings of computer networks and the internet.
6. Students are able to explain the processes that occur at the OSI Layer.
7. Students are able to explain the types of IP Addresses and how they work.
8. Students can understand the development of computing and cloud computing.
9. Students are able to explain the architecture, storage media, and security mechanisms in cloud computing.

10. Students have the ability to describe various types of databases and provide explanations regarding the benefits of databases. Additionally, students can identify the uses and practical applications of databases in various industries and sectors.
11. Students have the ability to describe and understand the fundamental concepts of the Data Ecosystem, encompassing various important aspects of data management.
12. Students have the ability to comprehensively explain programming languages. They understand the definition and purpose of programming languages and also comprehend the significant role of programming languages in software development.
13. Students have the ability to comprehensively describe various aspects of cybercrime. They understand the definition of cybercrime, referring to illegal or harmful activities conducted online, including attacks and violations of computer systems and networks.

#### **Module content**

1. Introduction: History of the Development of Information and Communication Technology
2. Computer system
3. Operating system
4. Computer Networks and Internet Networks
5. Reference Model (OSI Layer)
6. IP Address Basics
7. Cloud Computing System
8. Architecture, Security Mechanisms and Storage Media in Cloud Computing
9. Database Basics
10. Ecosystem Data
11. Programming language
12. Cyber Crime and Security

#### **Recommended Literatures**

1. Bunrap, Pete.et al. (2019). *The Cybersecurity Body of Knowledge. The National Cyber Security Center.*
2. Andrew S Tanenbaum., David J Wetherall.(2011).*Computer Netwrok.* 5th ed. Pearson Education.
3. Andrew S Tanenbaum., Herbert Bos. (2015). *Modern Operating System.* 5th ed. Pearson Education.
4. Andrew S Tanenbaum., Albert S Woodhull. (2006). *Operating System Design and Application.* 3rd ed. Pearson Education.
5. William Stallings. (2012). *Operating System Internal and Design Principles.* 7th ed. Pearson Education.
6. Huawei Technologies Co., Ltd. (2019). *Cloud Computing Technology.* Springer

|                             |                                  |
|-----------------------------|----------------------------------|
| Module Name                 | Qualitative Analytical Chemistry |
| Module level, if applicable | Undergraduate                    |
| Module Identification Code  | FS09T 60961                      |

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Semester(s) in which the module is taught | 2                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Nurhasni, M.Si ; Dr. Hendrawati, M.Si                                                                                                                                                                                                                                                                                                     |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                  |
| Teaching methods, Contact hours           | The course topics are delivered through Collaborative learning and discussion-based learning strategies that align theoretical concepts with practical applications by integrating case studies, assignments or structured activities (homework, quizzes), and fostering collaborative efforts between course and laboratory instructors. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Basic Chemistry II                                                                                                                                                                                                                                                                                                                        |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Formative assessment includes assignments, quizzes, attendance, active participation in learning, and etiquette/ethics, accounting for 40%. Midterm Exam 30%. Final Exam 30%.                                                                                                                                                             |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

1. Students are capable of understanding the role of analytical chemistry in various fields and industries.
2. Students are capable of comprehending the concepts and techniques of qualitative inorganic analysis experiments.
3. Students are capable of evaluating semi-micro qualitative inorganic analysis.
4. Students are capable of understanding cation reactions.
5. Students are capable of understanding anion reactions.
6. Students are capable of applying systematic qualitative inorganic analysis techniques.

7. Students are capable of understanding reactions of less common ions.
8. Students are capable of understanding the separation of cation and anion groups.

#### Module content

##### Lecture (Course Work)

1. Introduction: the role of analytical chemistry in various fields / industries
2. Qualitative Inorganic Analysis Experimental Techniques
3. Semimicro Qualitative Inorganic Analysis
4. Cation reactions
5. Anion reaction
6. Systematic Qualitative Inorganic Analysis
7. Reactions of some less common ions
8. Separation of cation and anion groups

##### Recommended Literatures

1. Vogel. 1990. Buku Teks Analisis Anorganik Kualitatif Makro dan Semimikro. Jilid I dan II, Kalman Media Pustaka. Jakarta.
2. Haryadi, W. 1993. Ilmu Kimia Analitik Dasar. Gramedia, Jakarta.
3. Khopkar. 1990. Konsep Dasar Kimia Analitik. UI Press. Jakarta
4. D.A. Skoog; D. M. West; F. J. Holler "Fundamental of Analytical Chemistry" 7th ed: Saunders College Publishing, 1990, Orlando.
5. J. H. Kennedy "Analytical Chemistry: Praticice" 2nd ed. Saunders College Publishing. 1990. Orlando

### FST 6096109 Qualitative Analytical Chemistry Laboratory Work

|                                                                                                                                                                    |                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                        | Qualitative Analysis Chemistry Practicum                                                                                                                                                                                              |
| Module level, if applicable                                                                                                                                        | Undergraduate                                                                                                                                                                                                                         |
| Module Identification Code                                                                                                                                         | FST 6096109                                                                                                                                                                                                                           |
| Semester(s) in which the module is taught                                                                                                                          | 2                                                                                                                                                                                                                                     |
| Person(s) responsible for the module                                                                                                                               | Dr. Meyliana Wulandari, M.Si, Nurhasni, M.Si                                                                                                                                                                                          |
| Language                                                                                                                                                           | English and Indonesia                                                                                                                                                                                                                 |
| Relation in Curriculum                                                                                                                                             | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                              |
| Teaching methods, Contact hours                                                                                                                                    | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                                     |
| Workload                                                                                                                                                           | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> <p>Total = 74 hours</p> |
| Credit points                                                                                                                                                      | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                                    |
| Admission and examination requirements                                                                                                                             | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                          |
| Recommended prerequisites                                                                                                                                          | None                                                                                                                                                                                                                                  |
| Media employed                                                                                                                                                     | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                  |
| Forms of assessment                                                                                                                                                | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                                      |
| Intended Learning Outcome                                                                                                                                          |                                                                                                                                                                                                                                       |
| Students are able to identify cations and anions based on visual observation in laboratory, in accordance with the principle prevailing at the International level |                                                                                                                                                                                                                                       |
| Module content                                                                                                                                                     |                                                                                                                                                                                                                                       |

Lecture (Lab Work)

1. Group I cation identification
2. Group II cation identification
3. Group II cation identification (continued)
4. Group III cation identification
5. Group IV cation identification
6. Identification of group V cations
7. Anion identification

Recommended Literatures

1. Harvey, David. 1956. Modern analytical Chemistry. International edition 2000. McGraw-Hill Book Co-Singapore Company.
2. D.A. Skoog; D. M. West; F. J. Holler "Fundamentals of Analytical Chemistry" 7th ed: Saunders College Publishing, 1990, Orlando.

**FST 6096110 Organic Chemistry II**

|                                           |                         |
|-------------------------------------------|-------------------------|
| Module Name                               | Organic Chemistry II    |
| Module level, if applicable               | Undergraduate           |
| Module Identification Code                | FST 6096110             |
| Semester(s) in which the module is taught | 3                       |
| Person(s) responsible for the module      | Dr. Siti Nurbayti, M.Si |

  

|                        |                                                          |
|------------------------|----------------------------------------------------------|
| Language               | English and Indonesia                                    |
| Relation in Curriculum | Compulsory course for undergraduate program in Chemistry |

|                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                     | The course topics are delivered through a combination of traditional lectures, problem-solving sessions, case studies, and group discussions to reinforce concepts and applications. Additionally, assignments for in-depth study, such as literature reviews and synthesis projects. |
| Workload                                                                                                                                                                                                                                                                                                            | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br/>           Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h<br/>           Total = 124 hours</p>           |
| Credit points                                                                                                                                                                                                                                                                                                       | 3 Credit Hours (2-3) $\approx$ 4.13 ECTS                                                                                                                                                                                                                                              |
| Admission and examination requirements                                                                                                                                                                                                                                                                              | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                          |
| Recommended prerequisites                                                                                                                                                                                                                                                                                           | Organic Chemistry I                                                                                                                                                                                                                                                                   |
| Media employed                                                                                                                                                                                                                                                                                                      | Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                                                                                                  |
| Forms of assessment                                                                                                                                                                                                                                                                                                 | Quiz 15%, structured assignment 15%, Midterm Exam 30%, Final Exam 40%                                                                                                                                                                                                                 |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                       |
| Students can analyze the structure, physical properties, chemical properties, and reactivity of organic compounds (aldehydes, ketones, carboxylic acids, carboxylic acid derivatives, amines, polycyclic, heterocyclic, and carbohydrates)                                                                          |                                                                                                                                                                                                                                                                                       |
| Module content                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                       |
| Lecture (Class Work) <ol style="list-style-type: none"> <li>1. Aldehydes and Ketones</li> <li>2. Carboxylic Acids</li> <li>3. Derivatives of Carboxylic Acids</li> <li>4. Carbonyl Condensations</li> <li>5. Amines</li> <li>6. Polycyclic and Heterocyclic Aromatic Compounds</li> <li>7. Carbohydrates</li> </ol> |                                                                                                                                                                                                                                                                                       |

#### Recommended Literatures

1. Fessenden, R.J. & J.S.Fessenden. 1986. Organic Chemistry. Volume 2. Second edition. Translators: A.H. Pudjaatmaka & N.M. Surdia. Erlangga Publishers. Jakarta.
2. Carey, F.A. 2003. *Organic Chemistry*. 5th Edition. McGraw Hill. York.
3. McMurry, J. 2012. *Organic Chemistry*. 8th Edition. Brooks/Cole. USA.
4. Bruice, P.Y. 2015. *Organic Chemistry*. 8th Edition. Prentice Hall. New Jersey.
5. Smith, J.G. 2020. *Organic Chemistry*. 6th Edition. McGraw Hill. York.

#### FST 6096111 Organic Chemistry Laboratory Work II

|                                           |                                                                              |
|-------------------------------------------|------------------------------------------------------------------------------|
| Module Name                               | Organic Chemistry Laboratory Work II                                         |
| Module level, if applicable               | Basic                                                                        |
| Module Identification Code                | FST 6096111                                                                  |
| Semester(s) in which the module is taught | 3                                                                            |
| Person(s) responsible for the module      | Dr. Siti Nurbayti, M.Si,<br>Agus Rimus Liandi, M.Si,<br>Tarso Rusdiana, M.Si |
| Language                                  | English and Indonesia                                                        |

|                                                                                               |                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relation in Curriculum                                                                        | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                               | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                      | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                 | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                        | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                     | None                                                                                                                                                                                                                           |
| Media employed                                                                                | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                           | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                     |                                                                                                                                                                                                                                |
| Students discuss several models of organic chemical synthesis in research activities based on |                                                                                                                                                                                                                                |

synthesis design

Module content

Lecture (Lab Work)

1. Introduction
2. Synthesis of adipic acid compounds
3. Synthesis of iodoform compounds
4. Synthesis of salicylic acid compounds
5. Synthesis of Aspirin Compounds
6. Synthesis of phenyl benzoate compounds
7. Synthesis of aceanylide compounds
8. Synthesis of Dibenzalacetone Compounds
9. Synthesis of oxalic acid compounds

Recommended Literatures

Organic Chemistry Practicum Module II

### FST 6096112 Quantitative Analysis Chemistry

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Quantitative Analytical Chemistry                                                                                                                                                                                                                                                                                                         |
| Module level, if applicable               | Basic                                                                                                                                                                                                                                                                                                                                     |
| Module Identification Code                | FST 6096112                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 3                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Dr. Hendrawati, M.Si, Nurhasni, M.Si                                                                                                                                                                                                                                                                                                      |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                  |
| Teaching methods, Contact hours           | The course topics are delivered through Collaborative learning and discussion-based learning strategies that align theoretical concepts with practical applications by integrating case studies, assignments or structured activities (homework, quizzes), and fostering collaborative efforts between course and laboratory instructors. |
| Workload                                  | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h</p> <p>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p>                                                                               |

|                                        |                                                                          |
|----------------------------------------|--------------------------------------------------------------------------|
| Credit points                          | 3 Credit Hours $\approx$ 4.13 ECTS                                       |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture             |
| Recommended prerequisites              | Qualitative Analytical Chemistry                                         |
| Media employed                         | Classical teaching tools with whiteboard and PowerPoint presentation     |
| Forms of assessment                    | Quiz 15%, structured assignment 15%,<br>Midterm Exam 30%, Final Exam 40% |
| Intended Learning Outcome              |                                                                          |

Students are able to use the gravimetric and titrimetric method in accordance with the principle prevailing at the International level

#### Module content

##### Lecture

1. Basic Principles of Quantitative Chemical Analysis
2. How to Sample Preparation
3. Accuracy and Error in Quantitative Analysis
4. Gravimetric Analysis
5. Volumetric Analysis
6. Neutralization Analysis
7. Reduction-Oxidimetric Analysis
8. Complexometric Analysis
9. Precipitometry Reaction
10. Introduction to Instrument Analysis
11. Applications of analytical chemistry in research.

##### Recommended Literatures

1. Vogel. 1990. Textbook of Quantitative Inorganic Analysis. Volume I Kalman Media Library. Jakarta.
2. Haryadi, W. 1993. Basic Analytical Chemistry. Gramedia, Jakarta.
3. Underwood, A.L., and Day, R.A. 2002. Quantitative Chemical Analysis. Erlangga. Jakarta.
4. Khopkar. 1990. Basic Concepts of Analytical Chemistry. UI Press. Jakarta .
5. Supportive journals.

### FST 6096113 Quantitative Analytical Chemistry Laboratory Work

|                                                                                                                                        |                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                            | Quantitative Analytical Chemistry Laboratory Work                                                                                                                                                                              |
| Module level, if applicable                                                                                                            | Undergraduate                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                             | FST 6096113                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                              | 3                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                   | Dr. Meyliana Wulandari, M.Si, Nurhasni, M.Si                                                                                                                                                                                   |
| Language                                                                                                                               | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                 | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                        | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                               | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                          | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                 | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                              | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                         | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                    | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                              |                                                                                                                                                                                                                                |
| Students are able to use the gravimetric and titrimetric method in accordance with the principle prevailing at the International level |                                                                                                                                                                                                                                |
| Module content                                                                                                                         |                                                                                                                                                                                                                                |

Lecture (Lab Work)

1. Introduction
2. Experiment I: Determination of water content and crystalline water by gravimetric method
3. Experiment II: Determination of  $\text{SO}_4$  content by gravimetric method

4. Experiment III: Determination of Fe(III) content in Mohr's salt by gravimetric method
5. Experiment IV: Determination of Cu content in terusi by gravimetric method
6. Experiment V: Neutralization titration
7. Experiment VI: Precipitation titration using argentometric method
8. Experiment VII: Iodometric titration
9. Experiment VIII: Complexometric titration
10. Experiment IX: Permanganometric titration
11. Experiment X: Comparison of gravimetric and titrimetric results

Recommended Literatures

1. Hendrawati dan Nurhasni. 2017. Pedoman Praktikum Kimia Analitik II. Program Studi Kimia, Fakultas Sains dan Teknologi UIN Syarif Hidayatullah Jakarta.

**FST 6096114 Chemical Thermodynamics**

|                                           |                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Chemical Thermodynamics                                                                                                                                                                                                                                                                                                                                              |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                                        |
| Module Identification Code                | FST 6096114                                                                                                                                                                                                                                                                                                                                                          |
| Semester(s) in which the module is taught | 3                                                                                                                                                                                                                                                                                                                                                                    |
| Person(s) responsible for the module      | Isalmi Aziz, MT                                                                                                                                                                                                                                                                                                                                                      |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                             |
| Teaching methods, Contact hours           | The principle of student-centered learning (SCL) places the student at the center of the learning process. The SCL methods used include a combination of small group discussions, simulations, discovery learning, self-directed learning, cooperative learning, collaborative learning, contextual instruction, project-based learning, and problem-based learning. |

|          |                                                                                                                                                                                                                                                      |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Workload | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p> |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                                                  |                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Credit points                                                                                                                                                                                                                                                                    | 3 Credit Hours (2-3) $\approx$ 4.13 ECTS                                 |
| Admission and examination requirements                                                                                                                                                                                                                                           | Enrolled in this course<br>Minimum 80% attendance in lecture             |
| Recommended prerequisites                                                                                                                                                                                                                                                        | Advanced Physics                                                         |
| Media employed                                                                                                                                                                                                                                                                   | Classical teaching tools with whiteboard and PowerPoint presentation     |
| Forms of assessment                                                                                                                                                                                                                                                              | Quiz 15%, structured assignment 15%,<br>Midterm Exam 30%, Final Exam 40% |
| Intended Learning Outcome                                                                                                                                                                                                                                                        |                                                                          |
| Students have an understanding of the theories and/or concepts in gas systems and chemical thermodynamics.                                                                                                                                                                       |                                                                          |
| Module content                                                                                                                                                                                                                                                                   |                                                                          |
| Lecture <ol style="list-style-type: none"> <li>1. Properties and Laws of Gases</li> <li>2. First Law of Thermodynamics</li> <li>3. Thermochemistry</li> <li>4. Second Law of Thermodynamics</li> <li>5. Gas Phase Equilibrium</li> <li>6. Third Law of Thermodynamics</li> </ol> |                                                                          |
| Recommended Literatures <ol style="list-style-type: none"> <li>1) PW. Atkins, 1994, Kimia Fisik, Ed 1, Erlangga</li> <li>2) SK. Dogra, 1990, Kimia Fisik dan Soal-Soal, Ed 1, UI Press</li> <li>3) Artikel Jurnal yang berhubungan dengan materi pembelajaran</li> </ol>         |                                                                          |

### FST 6096115 Chemical Thermodynamics Laboratory Work

|                                           |                                                |
|-------------------------------------------|------------------------------------------------|
| Module Name                               | Chemical Thermodynamics Laboratory Work        |
| Module level, if applicable               | Undergraduate                                  |
| Module Identification Code                | FST 6096115                                    |
| Semester(s) in which the module is taught | 3                                              |
| Person(s) responsible for the module      | Agus Rimus Liandi, M.Si, Nurmaya Arofah, M.Eng |
| Language                                  | English and Indonesia                          |

|                                                                                                                                     |                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relation in Curriculum                                                                                                              | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                     | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                            | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                       | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                              | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                           | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                      | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                 | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                           |                                                                                                                                                                                                                                |
| Students are able to have an understanding and skills in determining physical quantities of a chemical system based on experiments. |                                                                                                                                                                                                                                |
| Module content                                                                                                                      |                                                                                                                                                                                                                                |

#### Lecture (Lab Work)

1. Introduction
2. Practicum on determining specific weights and mixture levels,
3. Melting point determination practicum
4. Calorimeter setting practicum,
5. Hess's law practicum,
6. Practicum of the equation of ideal gases and molecular weights of volatile compounds,
7. Deep energy change practicum,
8. Liquid viscosity practicum,
9. Hydrogen bonding practicum.

#### Recommended Literatures

1. Chemical Thermodynamics Practicum Module
2. Atkins, Peter., De Paula, Julio. 2006. Physical Chemistry. W. H. Freeman
3. Atikins, Peter., De Paula, Julio., Friedman, Ron. 2014. Physical Chemistry: Quanta, Matter and Change. W. H. Freeman

### FST 6096116 Inorganic Reactivity Structures

|                                           |                                                                                                                                                                                                                                                                                       |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Inorganic Reactivity Structure                                                                                                                                                                                                                                                        |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                         |
| Module Identification Code                | FST 6096116                                                                                                                                                                                                                                                                           |
| Semester(s) in which the module is taught | 3                                                                                                                                                                                                                                                                                     |
| Person(s) responsible for the module      | Dr. Yusraini Dian Inayati Siregar, M.Si,<br>Yulyani Nur Azizah, M.Si                                                                                                                                                                                                                  |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                 |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                              |
| Teaching methods, Contact hours           | The lecturer delivers the material using lecture methods, interactive discussions, and engages in various activities with students, such as discussing articles related to the development of science materials research, and limited presentations either individually or in groups. |
| Workload                                  | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br><br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br><br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br><br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours                                      |
| Credit points                             | 3 Credit Hours (2-3) $\approx$ 4.13 ECTS                                                                                                                                                                                                                                              |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                          |
| Recommended prerequisites                 | Basic Chemistry II                                                                                                                                                                                                                                                                    |
| Media employed                            | Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                                                                                                  |
| Forms of assessment                       | Quiz 15%, structured assignment 15%,<br>Midterm Exam 30%, Final Exam 40%                                                                                                                                                                                                              |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                       |

Students have an understanding of the properties of main group elements, their abundance in nature, extraction methods, and the applications of these elements or their compounds in everyday life.

#### Module content

##### Lecture

1. Periodic system of elements
  2. Atomic structure and electron configuration
  3. Chemical bonds
  4. The theory of the formation of inorganic compounds and their reactivity
  5. Inorganic reactions in an aqueous medium
  6. Inorganic reactions in non-aqueous medium
  7. Alkalis and alkaline soils
  8. Aluminum, carbon and nitrogen
  9. Oxygen, halogens, noble gases
- UV-Vis Spectrophotometry Instruments

##### Recommended Literatures

###### **Main:**

1. Cotton, F.A. and Wilkinson, G. (1989). *Basic Inorganic Chemistry* (S. Suharto, Tkuietg translation). Jakarta: UI-Press.
2. Atkins, P., Overton, T., Rourke, J., Shriver, D. F., Weller, M., and Armstrong, F., 2009, Shriver and Atkins' Inorganic Chemistry, 5th ed., Oxford University Press, UK
3. Housecroft, C.E and Sharpe, A.G. (2005). Inorganic Chemistry, 2nd Edition. England: Pearson Prentice Hall.
4. Housecroft, C.E and Sharpe, A.G. (2008). Inorganic Chemistry, 3rd Edition. England: Pearson Prentice Hall.

###### **Supporter:**

Scientific journal articles from *websites* and other appropriate media

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Inorganic Reactivity Structure Laboratory Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Module Identification Code                | FST 6096117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is Taught | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Person(s) responsible for the module      | Dr. Yusraini Dian Inayati Siregar, Yulyani, M.Si                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Workload                                  | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Credit points                             | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Admission and examination Requirements    | Enrolled in this course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Recommended prerequisites                 | Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Media employed                            | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Forms of assessment                       | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Intended Learning Outcome                 | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Module content                            | <ol style="list-style-type: none"> <li>1. Students are able to apply methods for purification, separation of mixtures, and ion exchange.</li> <li>2. Students extract the elemental content from raw materials and synthesize the extracted results into useful compounds.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Recommended Literatures                   | <ol style="list-style-type: none"> <li>1. Purification of table salt (rock salt) through crystallization and precipitation.</li> <li>2. Softening hard water using ion exchange resin.</li> <li>3. Reduction potential of halogen elements and classification of their reducing power.</li> <li>4. Synthesis of alum (potassium aluminum sulfate) from waste food and beverage can packaging.</li> <li>5. Extraction and characterization of aluminum oxide from mud.</li> <li>6. Physical separation of components from mixtures.</li> <li>7. Production of calcium sulfate (<math>\text{CaSO}_4</math>) from limestone.</li> <li>8. Synthesis of sodium hydroxide (<math>\text{NaOH}</math>).</li> <li>9. Synthesis and purification of potassium dichromate (<math>\text{K}_2\text{Cr}_2\text{O}_7</math>) compound.</li> </ol> |
|                                           | Chalid, SY., Saridewi, N. 2017. Pedoman Praktikum Kimia Anorganik I. Program Studi Kimia, Fakultas Sains dan Teknologi, UIN Syarif Hidayatullah, Jakarta.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**UIN 6032202 Islam and Science**

|                                           |                                                          |
|-------------------------------------------|----------------------------------------------------------|
| Module Name                               | Islam and Science                                        |
| Module level, if applicable               | Basic                                                    |
| Module Identification Code                | UIN6032202                                               |
| Semester(s) in which the module is taught | 3                                                        |
| Person(s) responsible for the module      | Dr. Saifudin, MPd.I                                      |
| Language                                  | Indonesian                                               |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry |

|                                 |                                                                                                                                                                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours | The course topics are delivered through lectures which are enriched with relevant examples and followed by short discussion. Students are divided into ten groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br/>         Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h<br/>         Total = 124 hours</p> |
| Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                      |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Enrolled in this course • Minimum 80% attendance in lecture                                                                                                                                                                                                             |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | None                                                                                                                                                                                                                                                                    |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                   |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                                   |
| <b>Intended Learning Outcome</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                         |
| Students are able to master the concepts, theories and principles of Islamic teachings and its branches in depth. Students are able to understand the sources, history, position, and values as well as the methodology of Islamic religious teachings. Students are able to analyze the history, theory, methodology and value of Islamic sciences in order to develop holistic Islamic thinking. Students are able to integrate the values of Islamic teachings and science in social life and academically. |                                                                                                                                                                                                                                                                         |
| <b>Module content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                         |

1. Introduction, Learning: History, Object/Scope, Objectives, and Methodology of Islamic and Science Courses
2. Humans, the Universe, and Islam and Their Relations
3. Islam: Religion, Philosophy, Science, and Civilization
4. Soul, Heart, Reason and Knowledge: Position, Relationship and Process and Formation of Knowledge
5. The Concept of Science in Islam: Definition, Source, Methodology, Object of Study, Position, Function, and Hierarchy/Structure of Science
6. Adab and Culture of Science in Muslim Societies: Concepts, Systems, Values and Social History
7. Epistemology, Ontology and Axiology as well as Logic and Language of Science from an Islamic Perspective
8. History of the Growth and Development of Science in Islam: Theological and Historical Studies
9. Ushuluddin and Sharia Sciences: Concept, Scope, Methodology and Role in Life
10. Natural and Health Sciences in Islam: Concept, Scope, Methodology and Role in Life
11. Humanities and Social Sciences in Islam: Concept, Scope, Methodology and Role in Life
12. Islam, Technological Engineering and Social Change: Information Technology, Biotechnology, Cyber War, Climate Change and Social Disruption
13. The Future and Challenges of Science in the Islamic World: Secularism, Liberalism, Colonialism and Taqlidism and Their Impact on Human Civilization
14. Islamization and Integration of Knowledge in Islam: Concept and Implementation in Islamic Higher Education

## Recommended Literatures

1. *Al-Quran al-Karim dan Terjemah Tafsiriyah*
2. *Al-Kutub al-Sittah (Shahih al-Bukhari, Shahih Muslim, Sunan al-Tirmidzi, Sunan al-Nasai, dan Sunan Ibn Majah).*
3. Abu Samrah, Maḥmūd Aḥmad wa al-Barghūṣī 'Imād Aḥmad. 2016. *Al-Islām wa al-'Ilm*, (al-Quds Palestina: Jami'ah al-Quds).
4. Arif, Syamsuddin. 2008. *Orientalis dan Diabolisme Pemikiran*, Jakarta: Gema Insani Press.
5. Bakar, Osman, 1994. *Tauhid dan Sains*, Bandung: Pustaka Hidayah.
6. Bakhtiar, Amsal. 2004. *Filsafat Ilmu*, Jakarta: PT. Rajagrafindo.
7. al-Fārabī, 1996. *Iḥshā al-'Ulūm*, Beirut: Dar wa Maktabah al-Hilal.
8. al-Ghazālī, Abu Ḥāmid Muḥammad bin Muḥammad al-Thūsī, 1968. *Iḥyā 'Ulūm al-Dīn*, Beirut: Dar al-Ma'rifah, jilid ke-1.
9. al-Ghazālī, 2000. *Maqāshid al-Falāsifah*, Dimsiyiq: Mathba'ah al-Dhibah
10. Ḥamādah, Ḥusain, 1987. *Tārīkh al-Ulūm 'inda al-'Arab*, Beirut: al-Syirkah al-'Alamiyah li al-Kitab.
11. Ḥamūr, Aḥmad Ibrāhīm, 1987. *al-Ḥadlārah al-Islāmiyah*, Mesir: Dar al-Kutub al-Mishriyah.
12. Ḥasbu al-Nabī, Manshūr Maḥmūd. tth. *Al-Islām wa al-'Ilm*, Kairo: Dar al-Ma'arif.
13. Ḥasan, Ghālib, 2001. *Nazhariyah al-'Ilm fī Alqur'ān*, Beirut: Dar al-Hadi.
14. al-Ḥalū 'Abduh wa Jābir, Bahrād. tth, al-Wāfī fī Tārīkh al-'Ulūm 'inda al-'Arab, Dar al-Fikr al-Lubnani.
15. Hoodbhoy, Pervez. 1992. *Islam and Science, Religion Orthodoxy and the Batle for Rationality*, Malaysia: S. Abdul Majeed Co. Edisi berjudul *Indonesia Ikhtiar Menegakkan Rasionalitas Antara Sains dan Ortodoksi Islam*, 1996. Bandung: Mizan.
16. Ibn Rusyd, 2004. *Bidayah al-Mujtahid wa Nihayah al-Muqtashid*, Kairo: Dar al-Hadis.
17. al-Jaziri, Abu Bakar Jabir. 2004. *Aqidah al-Mu'min*, Madinah: Maktabah al-'Ulūm wa al-Hikam.
18. Khalaf, Abdul Wahhab. 1978. *Ushul Fiqh*, Dar al-'Ilm.
19. Mahzar, Armahedi, 2004. *Revolusi Integralisme Islam*, Bandung: Mizan.
20. Mathews, Michael R (Ed.). 2009. *Science, Wordlview and Education*, Springer.
21. Al-Muḥasibī, al-Ḥarits ibn Asad. 1971. *Al-'Aql wa Fahm Alqurān*, (Beirut: Dar al-Fikr).
22. Nasoetion, Andi Hakim. 1989. *Pengantar ke Filsafat Sains*, Bogor: Litera AntarNusa
23. al-Razi, Fakhruddin, *Mafātīh al-Ghaib*, Beirut: Dār Iḥyāal-Turāts al-'Arabī, 1429 H.
24. Rabī' Muḥammad Syahātah 1998. *Al-Turāts al-Nafsī 'inda 'Ulamā al-Muslimīn*, (al-Iskandariyah: Dar al-Ma'rifah al-Jami'iyah).
25. Sarwar. H.G. 1994. *Filsafat Al-Quran*, Jakarta:PT RajaGrafindo Persada.
26. Suriasumantri, Jujun S. 1995. *Filsafat Ilmu Sebuah Pengantar Populer*, Jakarta: PT Sinar Harapan.
27. Wan Daud, Wan Mohd Nor, 1998. *The Educational Philosophy and Practice of Syed Muhammad Naquib al-Attas*, diterjemahkan oleh Hamid Fahmy dkk, *Filsafat dan Praktik Pendidikan Islam Syed M. Naquib al-Attas*, Bandung: Mizan.
28. Wan Daud, Wan Mohd Nor, 2019. *Budaya Ilmu*, Kualalumpur: CASIS-HAKIM
29. Al-Yubi, Muhammad Sa'ad ibn Ahmad, 1998. *Maqāshid al-Syarīah al-Islāmiyah*, Riyadh: Dar al-Hijrah li al-Nasyr wa al-Tawzi'.
30. Zahra, Muhammad. 2008. *Ushul Fiqh*, Jakarta: Pustaka Firdaus.
31. Zarabuzu, Jamaluddin, *Mā Huwa al-Islām*, 1434 H. Arab Saudi: Wizarah li al-Syāun al-Islāmiyah wa al-Awqāf wa al-Da'wah
32. 'Abd al-Mun'im, 1992. Muḥammad, *Al-'Adab al-'Arabi fī al-'Ashr al-'Abbasi*,

Beirut: Dar al-Jail.

33. Abdul Baqi, Muhammad Fuad, tth. *Al-Mu'jam al-Mufahras li al-Fâzh al-Qur'ân al-al-Karîm*, Bandung: CV Diponegoro, tth.

34. Abdurrahman, Dudung, dkk. 2009. *Sejarah Peradaban Islam: dari Masa Klasik hingga Modern*, Yogyakarta: LESFI.
35. al-Baidlâwî, Nâshiruddîn Abû Saïd Abdullah bin ‘Umar bin Muḥammad al-Syairâzî, *Tafsîr al-Baidlâwî*, Beirut: Dar Ihya al-Turats, 1418 H, juz V.
36. al-Fairûz-âbâdî, Majduddin Muḥammad bin Ya’qûb, 1993. *Al-Qâmûs al-Muhîth*, Kairo: Dar al-Ḥadîts.
37. al-Ḥusaini, M.H. al-Ḥamid, 2000. *Membangun Peradaban: Sejarah Muhammad Saw Sejak Sebelum Diutus Menjadi Nabi*, Bandung: Pustaka Hidayah.
38. Ibn Ḥazm, 1997. *Al-Akhlâq wa al-Siyar fî Mudâwâh al Nufûs*, Beirut: Dar al-Afâq al-Jadidah.
39. Ibn Khaldûn, 1992. *Kitab al-‘Ibrar, wa Diwan al-Mubtada’ wa al-Khabar, fî Ayyam al-‘Arab wa al-‘Ajam wa al-Barbar, wa man Asharuhum min Dzawi al-Sulthân al-‘Akbar* (Libanon : Dar al-Kutub al-‘Ilmiyah).
40. al-Khatîb, Muḥammad ‘Ajjaj, 1997. *Al-Sunnah Qabla al- Tadwîn*, Beirut, Libanon, Maktabah Dar al-Fikr, 1997.
41. al-Mawardi, Abû al-Ḥasan ‘Ali bin Muḥammad bin Ḥabîb, tth. *Adâb al-Dunyâ wa al-Dîn*, Jeddah: al-Ḥaramain.
42. al-Qaththân, Manna al-Khalîl, 1973. *Mabâḥits fî ‘Ulûm al-Qur’ân*, Riyâdh: Mansyûrât al-‘Ashr al-Ḥadîts.
43. al-Qaradlawi, Yusuf. 1981. *Kaifa Nata’amul ma’a al-Sunnah al-Nbawiyah*, al-Ma’had al-‘Ali li al-Fikr al-Islami, 1981.
44. Shaleh, Qomarudin, dkk, 1986. *Asbabun Nuzul*, Bandung: Diponegoro.
45. al-Syarastanî, Muḥammad ‘Abdul Karim bin Aḥmad Abû Bakar Aḥmad, *Al-Milal wa al-Niḥal*, Beirut: Dar al-Fikr, tth.
46. al-Thahhân, Maḥmûd, *Taisîr Musthalah al-Ḥadîts*, Jeddah: Makthabah al-Ḥaramain, 1985 M.
47. al-Thabari, 2000. *Jâmi’ al-Bayân fî Ta’wîl Alqurân*, tahkik Aḥmad Muḥammad Syâkir, tt: Muassah al-Risalah.
48. Yatim, Badri, 1997. *Sejarah Peradaban Islam*, Jakarta: RajaGrafindo Persada.

### FST 6096121 Transition Metals and Coordination Chemistry

|                                           |                                                                      |
|-------------------------------------------|----------------------------------------------------------------------|
| Module Name                               | Metal Transition and Chemical Coordination                           |
| Module level, if applicable               | Undergraduate                                                        |
| Module Identification Code                | FST 6096121                                                          |
| Semester(s) in which the module is taught | 4                                                                    |
| Person(s) responsible for the module      | Dr. Yusraini Dian Inayati Siregar, M.Si,<br>Yulyani Nur Azizah, M.Si |
| Language                                  | English and Indonesia                                                |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry             |

|                                        |                                                                                                                                                                                                                                                                                       |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours        | The lecturer delivers the material using lecture methods, interactive discussions, and engages in various activities with students, such as discussing articles related to the development of science materials research, and limited presentations either individually or in groups. |
| Workload                               | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h.<br><br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br><br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br><br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours                                     |
| Credit points                          | 3 Credit Hours (2-3) $\approx$ 4.13 ECTS                                                                                                                                                                                                                                              |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                          |
| Recommended prerequisites              | Inorganic Reactivity Structures                                                                                                                                                                                                                                                       |
| Media employed                         | Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                                                                                                  |
| Forms of assessment                    | Quiz 15%, structured assignment 15%,<br>Midterm Exam 30%, Final Exam 40%                                                                                                                                                                                                              |

### Intended Learning Outcome

1. Students are capable of analysing the role of transition metals, especially in the form of their compounds, in various fields of study, including health, agriculture, industry, mining, and fisheries.
2. Students can differentiate between various theories of complex compound formation, including valence bond theory, hybridization theory, crystal field theory, and molecular orbital theory in the formation of complex compounds.
3. Students can combine their knowledge of inorganic material instrumentation to develop research that benefits society.

### Module content

#### Lecture (Class work)

1. The electron configuration of transition elements and the tendency in periods and groups.
2. Transition elements of series I, II and III; physical, chemical properties and their use in the fields of health and agriculture.
3. Transition elements of series I, II and III; physical, chemical properties and their use in industry, mining and animal husbandry.

4. Formulation of complex compounds: Nomenclature, bonding and coordination number
5. Formation of complex compounds through valence bond theory: The concept of effective atomic numbers.
6. Formation of complex compounds through hybridization theory.
7. The formation of complex compounds through octahedral Crystal Field Theory (CFT).
8. The formation of complex compounds through tetrahedral Crystal Field Theory (CFT) as well as distortion and the Jahn-Teller theorem.
9. Formation of complex compounds through the Molecular Orbital Theory
10. Spectroscopic term; principal quantum number (n), azimuth quantum number (l), spin quantum number (s) d1-d10.
11. crystallography; Miller Index
12. XRD (X-Ray Diffraction) spectroscopic instrument
13. Electron Microscopy Instruments (SEM, TEM, SEM-EDX)
14. UV-Vis Speciphotometry Instrument

## Recommended Literatures

### **Main:**

1. Atkins, P., Overton, T., Rourke, J., Shriver, D. F., Weller, M., and Amstrong, F., 2009, Shriver and Atkins' Inorganic Chemistry, 5th ed., Oxford University Press, UK
2. Miessler, D. L. and Tarr, D. A., 2004, Inorganic Chemistry, 3rd ed., Prentice Hall International, USA.
3. Housecroft, CE., Sharpe, AG. 2005. Inorganic Chemistry second edition. Pearson Prentice Hall: England.
4. Sugiyarto, KH. 2010. Inorganic Transition Chemistry. Department of Chemistry Education FMIPA Yogyakarta State University.

### **Supporter:**

Scientific journal articles from *websites* and other appropriate media

### FST 6096122 Transition Metals and Coordination Chemistry Laboratory Work

|                                           |                                                                      |
|-------------------------------------------|----------------------------------------------------------------------|
| Module Name                               | Transition Metals and Coordination Chemistry Laboratory Work         |
| Module level, if applicable               | Undergraduate                                                        |
| Module Identification Code                | FST 6096122                                                          |
| Semester(s) in which the module is taught | 4                                                                    |
| Person(s) responsible for the module      | Dr. Yusraini Dian Inayati Siregar, M.Si,<br>Yulyani Nur Azizah, M.Si |
| Language                                  | English and Indonesia                                                |

|                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relation in Curriculum                                                                                                                                                                                                                         | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                                                                                                                                | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                                                                                                                                  | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                                                                                         | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                                                                                                      | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                                                                                                                                 | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                                                                                                                            | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                                                                                                                                      |                                                                                                                                                                                                                                |
| 1. Students are skilled in employing various methods for the synthesis of inorganic materials using laboratory equipment and materials.<br>2. Students can draw conclusions from observations and the characterization of inorganic materials. |                                                                                                                                                                                                                                |
| Module content                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                |

Lecture (Lab work)

1. Experiment 1: Iron Corrosion
2. Experiment 2: Making Mohr Salt
3. Experiment 3: Creation of coordination complex (potassium trioxalatorate)
4. Experiment 4:  $\text{ZnSO}_4$  synthesis
5. Experiment 5: Ni-DMG synthesis
6. Experiment 6: Synthesis of Complex Salts and Copper Double Salts (II)
7. Experiment 7: The Power of Ammonia and Water Ligands in Ni(II) Complex
8. Experiment 8: The Power of Ammonia and Water Ligands in Cu(II) Complexes
9. Experiment 9: Redox Stability of  $\text{KCrO}_4$  and  $\text{KMnO}_4$
10. Experiment 10: Synthesis of the complex  $[\text{Co}(\text{NH}_3)_4\text{CO}_3]\text{NO}_3$

Recommended Literatures

1. Inorganic Chemistry Practicum Module

**FST 6096123 Chemical Dynamics**

Module Name

Chemical Dynamics

Module level, if applicable

Undergraduate

|                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Identification Code                                                                                                                                                            | FST 6096123                                                                                                                                                                                                                                                                                                                                                                      |
| Semester(s) in which the module is taught                                                                                                                                             | 4                                                                                                                                                                                                                                                                                                                                                                                |
| Person(s) responsible for the module                                                                                                                                                  | Isalmi Aziz, MT                                                                                                                                                                                                                                                                                                                                                                  |
| Language                                                                                                                                                                              | English and Indonesia                                                                                                                                                                                                                                                                                                                                                            |
| Relation in Curriculum                                                                                                                                                                | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                         |
| Teaching methods, Contact hours                                                                                                                                                       | The principle of student-centered learning (SCL) focuses on placing the student at the center of the learning process. The SCL methods used include a combination of small group discussions, simulations, discovery learning, self-directed learning, cooperative learning, collaborative learning, contextual instruction, project-based learning, and problem-based learning. |
| Workload                                                                                                                                                                              | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h</p> <p>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p>                                                                                                                      |
| Credit points                                                                                                                                                                         | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                                                               |
| Admission and examination requirements                                                                                                                                                | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                     |
| Recommended prerequisites                                                                                                                                                             | Chemical Thermodynamics                                                                                                                                                                                                                                                                                                                                                          |
| Media employed                                                                                                                                                                        | Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                                                                                                                                                                                             |
| Forms of assessment                                                                                                                                                                   | Midterm exam 30%, Final exam 40%,<br>Presentation 20%, Structured assignment 10%                                                                                                                                                                                                                                                                                                 |
| Intended Learning Outcome                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                  |
| Students have an understanding of the theories and/or concepts in phase equilibrium, ideal solutions and colligative properties, adsorption, electrochemistry, and chemical kinetics. |                                                                                                                                                                                                                                                                                                                                                                                  |
| Module content                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                  |

Lecture (Class work)

1. Phase Equilibrium
2. Ideal Solutions and Colligative Properties
3. Adsorption
4. Electrochemistry
5. Chemical Kinetics

Recommended Literatures

1. PW. Atkins, 1994, Physical Chemistry, 1st Ed, Erlangga.
2. SK. Dogra, 1990, Physical Chemistry and Problems, 1st Ed, UI Press.
3. Triyono, 2013, Chemical Equilibrium, 2nd Ed, UGM Press.
4. Journal articles related to the course material.

### FST 6096124 Chemical Dynamics Laboratory Work

|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                    | Chemical Dynamics Laboratory Work                                                                                                                                                                                              |
| Module level, if applicable                                                                                                                                                                                                    | Undergraduate                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                                                                                                                     | FST 6096124                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                                                                                                                      | 4                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                                                                                                           | Agus Rimus Liandi, M.Si., ; Nurmaya Arofah, M.Eng                                                                                                                                                                              |
| Language                                                                                                                                                                                                                       | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                                                                                                         | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                                                                                                                | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                                                                                                                  | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                                                                         | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                                                                                      | Chemical Thermodynamics                                                                                                                                                                                                        |
| Media employed                                                                                                                                                                                                                 | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                                                                                                            | Midterm Exam = 20%, Final Exam = 20%,<br>Lab Work (Practical) = 60%                                                                                                                                                            |
| Intended Learning Outcome                                                                                                                                                                                                      |                                                                                                                                                                                                                                |
| Students have the ability to apply fundamental concepts of chemical kinetics theory in chemical kinetics laboratory practices.                                                                                                 |                                                                                                                                                                                                                                |
| Module content                                                                                                                                                                                                                 |                                                                                                                                                                                                                                |
| Lecture (Lab work) <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Module 1 Non Electrolyte Solutions (Roult's Law)</li> <li>3. Module 2 Boiling Point Rise</li> <li>4. Module 3 Surface Tension</li> </ol> |                                                                                                                                                                                                                                |

5. Module 4 Water Phenol Binary System
6. Module 5 Distribution Coefficient
7. Module 6 Adsorption
8. Module 7 Electrochemical and Electrolysis Cells
9. Module 8 Kinetics and Reaction Rate

Module 9 Arrhenius Equation and Activation Energy

#### Recommended Literatures

1. Chemical Dynamics Practicum Module

### FST 6096125 Structure and Function of Biomolecules

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Structure and Function of Biomolecules                                                                                                                                                                                                                                                                                                                                                             |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                      |
| Module Identification Code                | FST 6096125                                                                                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 4 (Four)                                                                                                                                                                                                                                                                                                                                                                                           |
| Person(s) responsible for the module      | Dr. La Ode Sumarlin, M. Si Dr. Sandra Hermanto, M.Si                                                                                                                                                                                                                                                                                                                                               |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The course topics are delivered through theoretical instruction, interactive discussions, case studies, and practical applications to deepen understanding which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group is assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h</p> <p>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p>                                                                                                                                        |
| Credit points                             | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                                                                                 |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                       |
| Recommended prerequisites                 | Basic Biology and General Chemistry                                                                                                                                                                                                                                                                                                                                                                |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                              |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%),                                                                                                                                                                                                                                                                                                                           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | UAS (30%) |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |
| Students have the ability to apply and analyse the concepts underlying biomolecules for research activities and apply with problems solving in the health and food fields.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |
| <ol style="list-style-type: none"> <li>1. Introduction and Fundamental of Biochemistry</li> <li>2. Water and buffers</li> <li>3. Biomolecules in Cells/Cell Organelles</li> <li>4. Carbohydrates</li> <li>5. Lipids</li> <li>6. Amino Acids and Proteins</li> <li>7. Enzymes</li> <li>8. Nucleic Acid and Its Components</li> <li>9. Hormones</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                 |           |
| Recommended Literatures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |
| <ol style="list-style-type: none"> <li>1. Sumarlin, L. 2020. BIOCHEMISTRY: Basics of Biomolecules and Metabolism, Rajagrafindo, Jakarta</li> <li>2. Lehninger, A.L. 2000. Fundamentals of Biochemistry. Translation: Maggy Thenawidjaya. Erlangga. Jakarta.</li> <li>3. Stryer, L. 1988. Biochemistry 3rd ed. Freeman. San Francisco</li> <li>4. Lehninger, L. Albert, 1982, Principles of Biochemistry, Worth Publisher, Inc., USA.</li> <li>5. Mathew C.K. &amp; van Holde K.E., 1996, Biochemistry, 2 edition, Benjamin/Cummings Publishing Company, USA.</li> <li>6. Devlin M. Thomas, 1997, Textbook of Biochemistry, 4 edition, John Wiley &amp; Sons, Inc., USA.</li> <li>7. Voet, D &amp; J.G. Voet. Biochemistry 2nd ed. Wiley. York</li> </ol> |           |

### FST 6096126 Biochemistry Laboratory Work

|                                                                                                                                                                               |                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                   | Biochemistry Laboratory Work                                                                                                                                                                                                   |
| Module level, if applicable                                                                                                                                                   | Undergraduate                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                                                                    | FST 6096126                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                                                                     | 4                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                                                          | Dr. La Ode Sumarlin, M. Si<br>Dr. Sandra Hermanto, M.Si                                                                                                                                                                        |
| Language                                                                                                                                                                      | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                                                        | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                                                               | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                                                                 | 1 Credit Hours $\approx$ 2,46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                        | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                                     | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                                                                | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                                                           | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                                                                     |                                                                                                                                                                                                                                |
| Students can understand the techniques of qualitative and quantitative analysis of biomolecules (carbohydrates, proteins, lipids) and can apply them in biochemical research. |                                                                                                                                                                                                                                |
| Module content                                                                                                                                                                |                                                                                                                                                                                                                                |

#### Lecture (Lab work)

1. Qualitative Analysis and Hydrolysis of Carbohydrates
2. Qualitative Analysis of Lipids
3. Qualitative Analysis of Proteins
4. Temperature and pH Characteristics of Amylase Enzyme
5. Kinetics of Amylase Enzyme
6. Isolation of Glycogen from Bovine Liver
7. Isolation of Casein from Cow's Milk
8. Protein Quantification using the Lowry Method
9. Protein Content Determination (Kjeldahl Method)
10. Determination of Reducing Sugar Content (Redox Titration)
11. Determination of Fat Content (Soxhlet Extraction)

#### Recommended Literatures

1. Mathew C.K. & van Holde K.E., 1996, Biochemistry, 2nd edition, Benjamin/Cummings Publishing Company, USA.
2. Devlin M. Thomas, 1997, Textbook of Biochemistry, 4th edition, John Wiley & Sons, Inc., USA.
3. Lehninger, L. Albert, 1982, Principles of Biochemistry, Worth Publisher, Inc., USA.
4. James D. & Howland K., 1997, Protein Purification and Analysis, Research School of Biosciences, University of Kent Canterbury, UK.
5. Lewin B., 1997, Genes VI, First edition, Oxford University Press Inc., New York, USA.
6. Anna Poedjiadi, 1994, Dasar-dasar Biokimia, UI-Press, Jakarta.

**FST 6096127 Chemical Separation Technique**

|                                           |                                                                                                                                                                                                                                                                                             |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Chemical Separation Technique                                                                                                                                                                                                                                                               |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                               |
| Module Identification Code                | FST 6096128                                                                                                                                                                                                                                                                                 |
| Semester(s) in which the module is taught | 4 (Four)                                                                                                                                                                                                                                                                                    |
| Person(s) responsible for the module      | Dr. Sandra Hermanto, Ahmad Fathoni, MSi, Dr. Meyliana Wulandari, M.Si                                                                                                                                                                                                                       |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                       |
| Relation in Curriculum                    | Compulsory course for undergraduate Program in Chemistry                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through theoretical instruction, interactive discussions, case studies, and practical applications to deepen understanding which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. |

|                                        |                                                                                                                                                                                                                                      |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | Each group was assigned to work on a specific topic relevant to the lecture and presented in the class.                                                                                                                              |
| Workload                               | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours |
| Credit points                          | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                   |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                         |
| Recommended prerequisites              | None                                                                                                                                                                                                                                 |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                |

|                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                          | Midterm exam 40%, Final exam 40%, Quiz 10%,<br>Structured assignment 10% |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                          |
| Students are able to separate the analyte from the mixture with some methods, including: filtration, distillation, liquid-liquid extraction, thin layer chromatography, ion exchange chromatography, and electrophoresis, in accordance with the principle prevailing at the International level                                                                                                                             |                                                                          |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                          |
| Lecture (Lab Work) <ol style="list-style-type: none"> <li>1. Basic of Laboratory Skill and Technique</li> <li>2. Filtration and Crystallization</li> <li>3. Coagulation</li> <li>4. Distillation</li> <li>5. Solvent Extraction</li> <li>6. Thin Layer Chromatography</li> <li>7. Ionic Exchange Chromatography</li> <li>8. Solid Phase Extraction</li> <li>9. Column Chromatography</li> <li>10. Electrophoresis</li> </ol> |                                                                          |
| Recommended Literatures                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                          |
| <ol style="list-style-type: none"> <li>1. Harvey, David. 1956. Modern analytical Chemistry. International edition 2000. McGraw-Hill Book Co-Singapore Company.</li> </ol>                                                                                                                                                                                                                                                    |                                                                          |

### FST 6096128 Chemical Separation Techniques Laboratory Work

|                                                                                                                                                                                                    |                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                        | Chemical Separation Technique Laboratory Work                                                                                                                                                                                  |
| Module level, if applicable                                                                                                                                                                        | Undergraduate                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                                                                                         | FST 6096127                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                                                                                          | 4 (Four)                                                                                                                                                                                                                       |
| Person(s) responsible for the module                                                                                                                                                               | Dr. Sandra Hermanto, Ahmad Fathoni, MSi,<br>Dr. Meyliana Wulandari, M.Si                                                                                                                                                       |
| Language                                                                                                                                                                                           | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                                                                             | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                                                                                    | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                                                                                      | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                                             | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                                                          | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                                                                                     | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                                                                                | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                                                                                          |                                                                                                                                                                                                                                |
| Students are able to explain basic knowledge about Separation Method in Chemistry, both conventional and modern techniques, in accordance with the principle prevailing at the International level |                                                                                                                                                                                                                                |
| Module content                                                                                                                                                                                     |                                                                                                                                                                                                                                |
| Lecture (Class Work)                                                                                                                                                                               |                                                                                                                                                                                                                                |

#### Classification of chemical separation techniques

1. Conventional separation techniques (coagulation, precipitation, cristlization)
2. Distillation
3. Liquid-liquid extraction
4. Solid phase extraction
5. Thin Layer Chromatography and Paper Chromatography
6. High Performance Liquid Chromatography (KCKT)
7. Gas Chromatography
8. Gas Chromatography-Mass Spectrometer
9. Electrophoresis
10. Method Validation

#### Recommended Literatures

1. Harvey, David. 1956. Modern analytical Chemistry. International edition 2000. McGrow-Hill Book Co-Singapore Company.
2. Somenath Partners, 2003. Sample Preparation Techniques in Analytical Chemistry, John Wiley & Sons, Inc., Hoboken, New Jersey. USA

**FST 6094106 Elementary statistics**

|                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                             | Elementary Statistics                                                                                                                                                                                                                                                                                                |
| Module level, if applicable                                                                                                                                                             | Undergraduate                                                                                                                                                                                                                                                                                                        |
| Module Identification Code                                                                                                                                                              | FST 6094106                                                                                                                                                                                                                                                                                                          |
| Semester(s) in which the module is taught                                                                                                                                               | 4                                                                                                                                                                                                                                                                                                                    |
| Person(s) responsible for the module                                                                                                                                                    | Muhammad Manaqib, M.Sc                                                                                                                                                                                                                                                                                               |
| Language                                                                                                                                                                                | English and Indonesia                                                                                                                                                                                                                                                                                                |
| Relation in Curriculum                                                                                                                                                                  | Compulsory course for undergraduate program in Chemistry.                                                                                                                                                                                                                                                            |
| Teaching methods, Contact hours                                                                                                                                                         | The course topics are delivered through interactive lectures, hands-on activities, real-world examples, problem-solving exercises and group discussions. Students are divided into ten groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                                                                                                                                                                | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                           |
| Credit points                                                                                                                                                                           | 2 Credit Hours $\approx$ 2,75 ECTS                                                                                                                                                                                                                                                                                   |
| Admission and examination requirements                                                                                                                                                  | Enrolled in this course • Minimum 80% attendance in lecture                                                                                                                                                                                                                                                          |
| Recommended prerequisites                                                                                                                                                               | None                                                                                                                                                                                                                                                                                                                 |
| Media employed                                                                                                                                                                          | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                |
| Forms of assessment                                                                                                                                                                     | Midterm exam 30%, Final exam 30%, Formative 40%.                                                                                                                                                                                                                                                                     |
| Intended Learning Outcome                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                      |
| Students are capable of understanding basic statistical concepts, various types of data, summarizing them in the form of graphs and tables, and making decisions in hypothesis testing. |                                                                                                                                                                                                                                                                                                                      |

|                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module content                                                                                                                                                                                                                                                                                                                                                       |
| Lecture (Class work) <ol style="list-style-type: none"><li>1. Basic Statistics Concepts</li><li>2. Data Description</li><li>3. Probability</li><li>4. Normal Distribution</li><li>5. Hypothesis Testing</li><li>6. Correlation Analysis and Regression Analysis</li><li>7. Analysis of Variance (ANOVA)</li></ol>                                                    |
| Recommended Literatures <ol style="list-style-type: none"><li>1. Neil A. Weiss, 1983, Elementary Statistics, Addison Wesley.</li><li>2. Ronald E. Walpole, 1995, Probability and Statistics for Engineers and Scientists (4th Edition). ITB Publisher.</li><li>3. J. Supranto, 2009, Statistics: Theory and Applications, 7th Edition. Erlangga Publisher.</li></ol> |

**FST 6096133 Metabolism**

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Metabolism                                                                                                                                                                                                                                                                                                                                                                                         |
| Module level, if applicable               | Advance                                                                                                                                                                                                                                                                                                                                                                                            |
| Module Identification Code                | FST 6096133                                                                                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                                                                                                                                  |
| Person(s) responsible for the module      | Dr. La Ode Sumarlin, M. Si<br>Dr. Sandra Hermanto, M.Si                                                                                                                                                                                                                                                                                                                                            |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The course topics are delivered through theoretical instruction, interactive discussions, case studies, and practical applications to deepen understanding which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group is assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours                                                                                                                                                               |
| Credit points                             | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                                                                                 |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                       |
| Recommended prerequisites                 | Basic Biology, General Chemistry and Structure and Function of Biomolecule                                                                                                                                                                                                                                                                                                                         |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                              |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                                                                                 |

### Intended Learning Outcome

1. Students are able to detail and compare catabolic and anabolic processes which include energy production in the process of glycolysis, citric acid cycle, oxidative phosphorylation, gluconeogenesis, glycogenesis & glycogenolysis, photosynthesis, fat metabolism and nucleic acids (purines and pyrimidines).
2. Students are able to detail cross-metabolic regulatory processes, the role & characteristics of enzymes in metabolism.
3. Students can analyze the linkages and energy requirements (ATP) in the metabolic process of carbohydrates, proteins/amino acids, lipids and nucleic acids.
4. Students can analyze and provide arguments about the linkages between biomolecular metabolic processes on the possibility of disease disorders.
5. Students are able to detail the interrelationships between general metabolism in various important organs in an integrated manner.
6. Students are able to use knowledge about metabolism in analyzing and providing arguments against relevant articles.

### Module content

1. General Aspects of Metabolism (Pathway of Metabolism and Metabolic Regulation)
2. Carbohydrate metabolism includes Glycolysis, Citric Acid Cycle and Oxidative Phosphorylation, Gluconeogenesis, Glycogenesis & Glycogenolysis, and Photosynthesis.
3. Lipid metabolism (Oxidation of fatty acids and biosynthesis of fatty acids, fats and cholesterol)
4. Amino Acid Metabolism (transamination, oxidative deamination, urea cycle and amino acid biosynthesis)
5. Protein Biosynthesis (Transcription, Translation and Post-Translational Modification)
6. Nucleotide Metabolism (Oxidation and biosynthesis of purines & pyrimidines)  
Biosynthesis of Nucleic Acids (ATP, GTP and CTP)

### Recommended Literatures

1. Sumarlin, L. 2020. Biochemistry: *Basics of Biomolecules and the Concept of Metabolism*, Rajagrafindo, Jakarta
2. Lehninger, L. Albert, 1982, *Principles of Biochemistry*, Worth Publisher, Inc., USA.
3. Mathew C.K. & van Holde K.E., 1996, *Biochemistry*, 2nd edition, Benjamin/Cummings Publishing Company, USA.
4. Devlin M. Thomas, 1997, *Textbook of Biochemistry*, 4th edition, John Wiley & Sons, Inc., USA.
5. Stryer, L. 1995. *Biochemistry*, 4th Edn. W.H. Freeman. York.
6. Voet, D, and Voet, J.G. 1995. *Biochemistry*, 2nd Edn. John Wiley and Sons. York  
Anna Poedjiadi, 1994, *Fundamentals of Biochemistry*, UI-Press, Jakarta.

**FST 6096134 Natural Product Chemistry**

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Natural Product Chemistry                                                                                                                                                                                                                                                                                                                                                                          |
| Module level, if applicable               | Basic                                                                                                                                                                                                                                                                                                                                                                                              |
| Module Identification Code                | FST 6096134                                                                                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                                                                                                                                  |
| Person(s) responsible for the module      | Drs. Dede Sukandar, M.Si, Ahmad Fathoni, MSi, Tarso Rudiana, M.Si, Agus Rimus Liandi, M.Si                                                                                                                                                                                                                                                                                                         |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The course topics are delivered through theoretical instruction, interactive discussions, case studies, and practical applications to deepen understanding which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group is assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                         |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                 |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                       |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                                                               |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                              |
| Forms of assessment                       | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                                                                                                                                                              |

### Intended Learning Outcome

After attending this course students are expected to: 1. Be able to apply the process of isolating natural product compounds 2. Be able to apply the process of identifying natural product compounds 3. Be able to analyze the classification, structural variation, and nomenclature of natural product compounds 4. Be able to analyze the reactivity and stereochemistry of natural product compounds 5. Be able to synthesize the biogenetic origins of natural product compounds 6. Be able to synthesize the biological activity of natural product compounds 7. Be able to apply a metabolomics approach to natural materials 8. Be able to apply the biotransformation approach to natural materials

### Module content

#### Lecture (Class Work)

1. Isolation and identification of natural product compounds (terpenoids, steroids, phenylpropanoids, polyketides, flavonoids, alkaloids, and useful natural product compounds)
2. Classification and biosynthesis of terpenoids
3. Structure and stereochemistry of terpenoids
4. Cyclization and Wagner-Meerwein Rearrangement
5. Structure and Properties of Steroids
6. Structure and Activity of Steroids
7. Classification and Origin of Phenylpropanoids
8. Polyketide structure and biosynthesis
9. Properties and Synthesis of Phenylpropanoids and Polyketides
10. Classification and Structure of Flavonoids
11. Interconversion and Synthesis of Flavonoids
12. Alkaloid Classification and Structure
13. Alkaloids Rearrangement and Synthesis
14. Compound Useful Natural Ingredients

#### Metabolomics and biotransformation applications in natural materials

#### Recommended Literatures

1. Achmad, Sjamsul Arifin, 1986, Natural Products Chemistry, Karunika, Jakarta.
- Nakanishi, Koji, et.al, 1983, Natural Products Chemistry - Vol. 1,2,3, University Science Books, California.

### FST 6096135 Natural Material Chemistry Laboratory Work

|                                                                                                       |                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                           | Natural Product Chemistry Laboratory Work                                                                                                                                                                                      |
| Module level, if applicable                                                                           | Basic                                                                                                                                                                                                                          |
| Module Identification Code                                                                            | FST 6096135                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                             | 5                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                  | Ahmad Fathoni, M.Si; Tarso Rudiana, M.Si; Agus Rimus Liandi, M.Si                                                                                                                                                              |
| Language                                                                                              | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                       | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                              | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                         | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                             | None                                                                                                                                                                                                                           |
| Media employed                                                                                        | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                   | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                             |                                                                                                                                                                                                                                |
| Students are able to conduct experiments and do data analyze in Natural Product chemistry experiments |                                                                                                                                                                                                                                |
| Module content                                                                                        |                                                                                                                                                                                                                                |

#### Lecture (Class Work)

1. Sample preparation of natural materials
2. Extraction of natural product compounds
3. Phytochemical test
4. Analysis of bioactive components in plants: Total Phenolic
5. Analysis of bioactive components in plants: Total Flavonoids
6. Separation of the TLC method
8. Separation of the GCC method
9. Identification of natural product compounds with instruments
10. Bioactivity test on samples (antioxidants)

#### Recommended Literatures

1. Fathoni, Ahmad; Rudiana, Tarso; and Liandi, Agus Rimus. 2022. Natural Materials Chemistry Practicum Module. Jakarta: Chemistry Study Program FST UIN Jakarta
2. Achmad, Sjamsul Arifin, 1986, Organic Chemistry of Natural Materials, Karunika, Jakarta.
3. Nakanishi, Koji, et.al, 1983, Natural Products Chemistry - Vol. 1,2,3, University Science Books, California.

### FST 6096136 Atomic and Molecular Spectroscopy

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Atomic and Molecule Spectroscopy                                                                                                                                                                                                                                                                                                                                                                   |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                      |
| Module Identification Code                | FST 6096136                                                                                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 5 (Five)                                                                                                                                                                                                                                                                                                                                                                                           |
| Person(s) responsible for the module      | Dr. Sandra Hermanto, Dr. Yusraini DIS, M.Si,<br>Dr. Meyliana Wulandari, M.Si                                                                                                                                                                                                                                                                                                                       |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The course topics are delivered through theoretical instruction, interactive discussions, case studies, and practical applications to deepen understanding which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group is assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                         |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                 |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                       |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                                                               |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                              |
| Forms of assessment                       | Midterm exam 40%, Final exam 40%, Quiz 10%,<br>Structured assignment 10%                                                                                                                                                                                                                                                                                                                           |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                                                                                    |

Students are able to explain basic knowledge about atomic and molecular spectroscopy, in accordance with the principle prevailing at the International level

#### Module content

1. Basic of Atomic and Molecular Spectroscopy
2. UV-Vis Spectroscopy
3. Atomic Adsorption Spectroscopy
4. Infra-Red Spectroscopy
5. Mass Spectroscopy
6. Liquid Chromatography and Mass Spectroscopy (LC/MS)
7. Gas Chromatography and Mass Spectroscopy (GC/MS)

#### Recommended Literatures

1. Harvey, David. 1956. Modern analytical Chemistry. International edition 2000. McGraw-Hill Book Co.-Singapore Company.
2. Svenberg, S. 2003. Atomic and Molecular Spectroscopy, Basic Aspects and Practical Applications. Fourth Edition, Springer, Lund Sweden.

### FST 6096137 Instrumental Analysis Laboratory Work

|                                           |                                                                                                                                                                                                                                |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Instrumental Analysis Laboratory Work                                                                                                                                                                                          |
| Module level, if applicable               | Advance                                                                                                                                                                                                                        |
| Module Identification Code                | FST 6096137                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught | 5 (Five)                                                                                                                                                                                                                       |
| Person(s) responsible for the module      | Dr. Sandra Hermanto, Ahmad Fathoni, MSi,<br>Dr. Meyliana Wulandari, M.Si                                                                                                                                                       |
| Language                                  | English and Indonesia                                                                                                                                                                                                          |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                       |
| Teaching methods, Contact hours           | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                  | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                             | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                 | None                                                                                                                                                                                                                           |
| Media employed                            | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                       | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                |

Students are able to determine analyte concentration based on spectrophotometry UV-Vis, atomic absorption spectroscopy, high-performance liquid chromatography, and gas-chromatography, and determine the functional group using infra-red in accordance with the principle prevailing at the International level

#### Module content

##### Lecture (Class Work)

1. Introduction of UV-Vis spectrophotometer, calibration, and maximum wavelength measurement
2. Identification and determination of cyanocobalamin levels with a UV-Vis spectrophotometer
3. Determination of nitrite levels with a UV-Vis spectrophotometer
4. Determination of vitamin C levels with a UV-Vis spectrophotometer
5. Calibration of infra-red spectrophotometer
6. Functional group analysis of organic compounds with an infrared spectrometer
7. Determination of Ca(II) metal content in mineral water by atomic absorption spectroscopy
8. Determination of iron content in solid samples by wet destruction technique
9. Determination of essential oils composition by gas chromatography-mass spectrometer
10. Determination of caffeine concentration in energy drinks by HPLC

##### Recommended Literatures

1. Harvey, David. 1956. Modern analytical Chemistry. International edition 2000. McGraw-Hill Book Co.-Singapore Company.
2. D.A. Skoog; D. M. West; F. J. Holler "Fundamentals of Analytical Chemistry" 7th ed: Saunders College Publishing, 1990, Orlando.
3. J. H. Kennedy "Analytical Chemistry: Practice" 2nd ed. Saunders College Publishing. 1990. Orlando

### FST 6096138 Food Chemistry Laboratory Work

|                                           |                                                          |
|-------------------------------------------|----------------------------------------------------------|
| Module Name                               | Food Chemistry Laboratory Work                           |
| Module level, if applicable               | Undergraduate                                            |
| Module Identification Code                | FST 6096138                                              |
| Semester(s) in which the module is taught | 5                                                        |
| Person(s) responsible for the module      | Anna Muawanah, M.Si<br>Tarso Rusdiana, Msi               |
| Language                                  | English and Indonesia                                    |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry |

|                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                      | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                              |
| Workload                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> </ul> Total = 74 hours |
| Credit points                                                                                                                                                                                                                                                                                        | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                                                                                                                                               | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                                                                                                                                                            | None                                                                                                                                                                                                                           |
| Media employed                                                                                                                                                                                                                                                                                       | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                           |
| Forms of assessment                                                                                                                                                                                                                                                                                  | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                               |
| Intended Learning Outcome                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                |
| Students have skills in analyzing food components present in samples with different sample backgrounds, can design an experiment to study the chemical changes that occur in the food processing, can provide recommendations for problems that arise in food processing, storage, and food quality. |                                                                                                                                                                                                                                |
| Module content                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                |

#### Lecture (Class Work)

1. Analyzing the NaCl content in various food samples.
2. Analyzing the peroxide number in various food samples.
3. Qualitative analysis of nitrate and nitrite preservatives in processed meat food samples.
4. Analyzing formalin in various food samples.
5. Analyzing borax in various food samples.
6. Analyzing diastase enzyme activity in various food samples.
7. Yoghurt production.
8. Yoghurt characterization.
9. MDA analysis with a spectrophotometer.
10. Nicotine analysis.

#### Recommended Literatures

1. Apriyantono, Anton et al. 1989. Food Analysis. IPB Press Publisher. Bogor.
2. Baedhowie, M, and Sri Pranggonowati. 1983. Guidelines for Quality Control Practices in Agriculture 1 and 2, Ministry of Education and Culture.
3. Sudarmadi, Slamet, et al. 1997. Analysis Procedures for Food and Agricultural Materials, 4th edition. Liberty, Yogyakarta.
4. F.G. Winarno. 1999. Food Chemistry and Nutrition. Erlangga, Jakarta.

**FST 6096139 Food Chemistry**

|                                           |                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Food Chemistry                                                                                                                                                                                                                                                                                                                                      |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                       |
| Module Identification Code                | FST 6096139                                                                                                                                                                                                                                                                                                                                         |
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                                                                                   |
| Person(s) responsible for the module      | Dr. Sri Yadiat Chalid, M.Si, Anna Muawanah, M.Si                                                                                                                                                                                                                                                                                                    |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                               |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                            |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of problem-based learning and collaborative learning which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours                                                                                                                |
| Credit points                             | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                                  |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                        |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                               |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                                  |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                                     |

Students are expected to understand the concept of functional foods, their primary, secondary, and tertiary functions, food metabolism, digestive organs, the history of the development of functional foods in Japan, Europe, and Indonesia, in vitro and in vivo research to transform a food into a functional food that offers benefits to the body.

#### Module content

##### Lecture (Class Work)

1. The special nature of water and ice and its role support the quality of food.
2. Properties, reactions, modifications and benefits of components of monosaccharides, disaccharides, oligosaccharides and polysaccharides.
3. Physicochemical properties, stability and methods of analysis of water-soluble vitamins
4. Micro components of natural and artificial foodstuffs: toxicants, pigments, flavours, emulsifiers, stabilizers and preservatives etc
5. Protein digestibility value and protein quality and functional properties of proteins are beneficial in food processing technology
6. Properties and properties of food fats, reactions that occur in fats, the process of fat production and modification, and the role of fat in food products
7. Physicochemical properties, stability and methods of analysis of fat-soluble vitamins

Mineral classification, physicochemical properties and mineral stability

##### Recommended Literatures

1. Belitz, H.D., and Grosch, W. (1999). Food Chemistry. Springer German
2. Dame Barbara Clayton et.al. Complex Carbohydrates in Foods. Chapman and Hall, 1990.
3. Dominic W.S. Wong, 1989, Mechanism and theory in food Chemistry, Van Nostrand Reinhold, New York.
4. John M deMan, 1997, Food Chemistry, Translator Kosasih Padmawinata, ITB Bandung.
5. Kusnandar, Ferry; (2010) Food Chemistry Macro Components, Dian Rakyat, Jakarta
6. Winarno, F.G., 1999, Food Chemistry and Nutrition, Erlangga, Jakarta
7. Maggy Thenawidjaja Suhartono 2017 Protein - Easy and Evocative Biochemistry Series PT. Gramedia Widiasarana Jakarta
8. Suprayitno, E., & Sulistiyati, T. D. (2017). *Protein metabolism*. Universitas Brawijaya Press.
9. Kusnandar, F. (2005). Get to know the functional properties of proteins. *Bogor Agricultural University. Bogor.*
10. Muchtadi D. 2009. Introduction to Nutrition Science. Bandung Alfabeta
11. Kateren.S 2008. Introduction to Food Oil and Fat Technology. UI-Press. Jakarta
12. Rohman.A. 2019. Food Authentication Analysis Part I. Oils and Fats. Gajah Mada University Press. Yogyakarta
13. Mulyani HRA and Agus Sujarna. 2018.Fats and Oils. Universita Muhammadiyah Research Institute, Metro

### UIN 6014203 English

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | English                                                                                                                                                                                                                                                                     |
| Module level, if applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Undergraduate                                                                                                                                                                                                                                                               |
| Module Identification Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | UIN 6014203                                                                                                                                                                                                                                                                 |
| Semester(s) in which the module is taught                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5                                                                                                                                                                                                                                                                           |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Inni Ayati, M.Si.                                                                                                                                                                                                                                                           |
| Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Indonesian and English                                                                                                                                                                                                                                                      |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Compulsory course for undergraduate program in Chemistry.                                                                                                                                                                                                                   |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The course topics are delivered through interactive lectures, collaborative learning, problem-based learning, language workshops, and technology-assisted learning.                                                                                                         |
| Workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br/>           Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h<br/>           Total = 124 hours</p> |
| Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3 Credit Hours $\approx$ 4,13 ECTS                                                                                                                                                                                                                                          |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | None                                                                                                                                                                                                                                                                        |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Classical teaching tools with white/glass board and PowerPoint presentation with LCD/smart TV                                                                                                                                                                               |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Assignments (including quizzes and assignment): 40%, Midterm exam: 30%, Final exam: 30%                                                                                                                                                                                     |
| <b>Intended Learning Outcome</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. Able to implement reading strategies such as "skimming" and "scanning", identifying pronoun references, using punctuation correctly, recalling oral information, and introducing oneself.</li> <li>2. Understanding the main ideas and supporting ideas in a reading, using "verbs" and "adverbs" using "mind mapping", and discussing daily activities.</li> <li>3. Knowing the difference between facts and opinions in a reading, using adjectives appropriately, understanding simple opinions, and being able to describe someone.</li> <li>4. Identifying important information from the reading text, writing simple sentences, being able to ask and answer about directions.</li> <li>5. Able to draw conclusions from the reading text, understanding the use of pronouns and articles, writing a memo, making/receiving/declining meeting appointments.</li> <li>6. Paraphrasing sentences from the reading text, using the "simple present tense", writing a postcard, expressing likes or dislikes.</li> </ol> |                                                                                                                                                                                                                                                                             |



7. Identifying the meanings of words or phrases in the reading text, making conclusions, using the "simple future tense" appropriately, writing simple advertisements, and being verbally inviting.
8. Identifying the purpose of writing in a reading text, using the "simple past tense" correctly, writing personal information.

**Module content**

1. Mastering Effective Reading Strategies
2. Comprehension and Language Proficiency
3. Information Extraction and Language Expression Skills
4. Language Transformation and Expressing Preferences
5. Enhancing Vocabulary and Future Expressions
6. Understanding Writing Purpose and Past Expression

**Recommended Literatures**

1. Azkiyah, Siti Nurul et al.( 2020). General English 1 (A course for University Students). Malaysia: Oxford University Press.
2. Azar, B.S. (1999). Understanding and using English Grammar (3rded). New York: Pearson Education.
3. Cusack, B., & McCarter, S. (2007). Listening and Speaking skills. Oxford: MacMillan Publisher Limited
4. Hewings, M. (2002). Advanced Grammar in use: A self-Study. Cambridge: Cambridge University Press.

### FST 6096148 Structure Elucidation

|                                           |                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Structure Elucidation                                                                                                                                                                                                                                                                                                      |
| Module level, if applicable               | Advance                                                                                                                                                                                                                                                                                                                    |
| Module Identification Code                | FST 6096148                                                                                                                                                                                                                                                                                                                |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                          |
| Person(s) responsible for the module      | Drs. Dede Sukandar, M.Si, Agus Rimus Liandi, M.Si                                                                                                                                                                                                                                                                          |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                      |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                   |
| Teaching methods, Contact hours           | The course topics are delivered through a combination theoretical instruction with practical demonstrations, case studies, and problem-solving activities which are enriched with relevant examples and followed by short discussion. following Technology-Assisted Learning Utilize technology tools such as Origin Apps. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                 |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                         |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                               |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                       |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                      |
| Forms of assessment                       | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                                                                                      |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                            |

Students are expected to be able to clarify the basic principles in the process of determining the molecular structure of organic compounds based on UV-Vis, FTIR, MS, and NMR spectroscopy data, determine UV-Vis, FTIR, MS, and NMR spectroscopy data based on the molecular structure of organic compounds and apply them to structure determination molecular, qualitative, quantitative, metabolomics and biotransformation of organic compounds.

#### Module content

##### Lecture (Class Work)

1. Determination of the structure of organic compounds using UV-Vis, FTIR, NMR and MS spectroscopy.
2. Basic principles of UV-Vis spectrophotometry, components of UV-Vis spectrophotometry instruments, sample preparation for UV-Vis spectroscopy analysis and UV-Vis spectroscopy analysis, and determination of the molecular structure of compounds based on UV-Vis spectroscopy analysis,
3. Application of UV-Vis spectroscopy in the determination of molecular structure, analysis of qualitative, quantitative, metabolomics and biotransformation of organic compounds
4. The basic principles of IR spectroscopy, the interaction of IR rays with molecules, the absorption area of IR rays, and IR spectroscopy instruments, how to carry out sample preparation in IR spectroscopy analysis, IR spectroscopy analysis, and determination of molecular structure based on IR spectroscopy analysis
5. Application of IR spectroscopy in the determination of molecular structure, qualitative, quantitative, metabolomics and biotransformation of organic compounds
6. Basic principles of <sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectroscopy, <sup>1</sup>H-NMR and <sup>13</sup>C-NMR instruments, how to do sample preparation in <sup>1</sup>H-NMR and <sup>13</sup>C-NMR analysis, <sup>1</sup>H-NMR and <sup>13</sup>C-NMR chemical shifts, <sup>1</sup>H-NMR integration and <sup>13</sup>C-NMR, spin-spin coupling on <sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectroscopy, <sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectroscopy analysis and determination of the molecular structure of compounds based on <sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectroscopy
7. Application of <sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectroscopy in the determination of molecular structure for qualitative, quantitative, metabolomics and biotransformation of organic compounds
8. Explain the basic principles of MS spectroscopy, MS spectroscopy instruments, and how to do sample preparation in MS analysis, isoptopes in MS spectroscopy, ionization and fragmentation, isotopes in MS spectroscopy, qualitative analysis using MS spectroscopy, and determination of molecular structure based on MS spectroscopy
7. Application of MS spectroscopy in the determination of molecular structure, qualitative, quantitative, metabolomics and biotransformation of organic compounds

##### Recommended Literatures

1. Silverstein, R.M., Basler, Clayton, G. & Morril, Terence, C., *Spectrometric Identification of Organic Compounds*, 5th Edition, John Wiley & Sons, Inc., New York.

2. Wiliiam, Dudley H & Fleming, Ian, 1989, *Spectroscopic Methods In Organic Chemistry*, McGraw-Hill Book Company Europe, London

### FST 6092035 Technopreneurship

|                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                  | Technopreneurship                                                                                                                                                                                                                                                                                                                                   |
| Module level, if applicable                                                                                                                  | Undergraduate                                                                                                                                                                                                                                                                                                                                       |
| Module Identification Code                                                                                                                   | FST 6092035                                                                                                                                                                                                                                                                                                                                         |
| Semester(s) in which the module is taught                                                                                                    | 5                                                                                                                                                                                                                                                                                                                                                   |
| Person(s) responsible for the module                                                                                                         | Dr. Nur Inayah, M. Si /<br>Dr. Taufik Edy Sutanto, MSc.Tech                                                                                                                                                                                                                                                                                         |
| Language                                                                                                                                     | Indonesian                                                                                                                                                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                       | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                            |
| Teaching methods, Contact hours                                                                                                              | The course topics are delivered through a combination of project-based learning and problem-based learning which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                                                                                                                     | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                          |
| Credit points                                                                                                                                | $82.6 / 30 = 2.75$ ECTS                                                                                                                                                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                       | Enrolled in this course • Minimum 75% attendance in lecture                                                                                                                                                                                                                                                                                         |
| Recommended prerequisites                                                                                                                    | -                                                                                                                                                                                                                                                                                                                                                   |
| Media employed                                                                                                                               | Classical teaching tools with white board and Power Point presentation                                                                                                                                                                                                                                                                              |
| Forms of assessment                                                                                                                          | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                                                                                                               |
| Intended Learning Outcome                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                     |
| After completing the course, the Students will have the ability to develop an entrepreneurial spirit and analyze entrepreneurial activities. |                                                                                                                                                                                                                                                                                                                                                     |
| Module content                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                     |

#### Lecture (Class Work)

1. Technopreneurship and Inspiration
2. Motivation and Technopreneurship Opportunities
3. Technopreneurship Organizational Governance
4. Technopreneurship Ownership
5. Ethical Considerations in Technopreneurship
6. Technopreneurship Intelligence
7. Capital and Financial Management
8. Product Design
9. Forms of Marketing
10. Environmental Analysis
11. Competitor Analysis
12. Monitoring and Evaluation
13. Technopreneurship Revolution
14. Business Plan

#### Recommended Literatures

1. Inayah, Nur, Achmad Tjachja, and Moh. Irvan, 2021, *Introduction to Entrepreneurship*, Andi Publisher, Yogyakarta.
2. Rusman Hakim, *Success Tips for Entrepreneurship*, Gramedia, Jakarta, 2009.
3. Masykur Wiratno, *Introduction to Entrepreneurship: Basic Framework for Entering the Business World*, BPFE, Yogyakarta, 2010.
4. Peter F. Drucker, *Innovation and Entrepreneurship: Practice and Fundamentals*, Gelora Aksara Pratama, 2012.
5. H. Fatkul Muin, *Let's Be Entrepreneurs*, 2014.
6. Darmanto, *Entrepreneurship*, 2017.
7. Edy Dwi Kurniati, *Industrial Entrepreneurship*, 2017.
8. Dyanasari and Asnah, *Small Business Management and Entrepreneurship*, 2018.
9. Ika Sari Dewi, S.S., M.Si., and I.K. Sihombing, M.Si., *Entrepreneurship and Strategic Management of Rural SMEs*, 2019.
10. Muh. Saleh Malawat, *Entrepreneurship in Education*, 2019.
11. Nathanael Sitanggang and Putri Lynna A. Luthan, *Entrepreneurship Management in the Furniture Industry*, 2019.
12. Rachmat Hidayat, SKM., M.Kes, *Cultivating Entrepreneurial Spirit*, 2019.
13. Prof. Dr. H. Saban Fchdar, S.E., M.Si, Dr. Maryadi, S.E., M.M, *Business Ethics and Entrepreneurship*, 2019.

### FST 6096149 Food Technology

|                                           |                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Food Technonlogy                                                                                                                                                                                                                                                                                                                                    |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                       |
| Module Identification Code                | FST 6096149                                                                                                                                                                                                                                                                                                                                         |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                                   |
| Person(s) responsible for the module      | Dr. Sri Yadiat Chalid, M.Si<br>Anna Muawanah, M.Si                                                                                                                                                                                                                                                                                                  |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                               |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                            |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of problem-based learning and collaborative learning which are enriched with relevant examples and followed by short discussion. Students are divided into five groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h<br><br>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.<br><br>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h<br><br>Exam: lecture 50 min x 3 CH x 2 w = 5h<br>Total = 124 hours                                                                                                    |
| Credit points                             | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                                  |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                        |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                               |
| Forms of assessment                       | Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                                                  |

## Intended Learning Outcome

Students have the ability to explain techniques and concepts related to the production of healthy food and can apply them to research related to food based on local Indonesian ingredients, fish preservation technology, sugar, fats, and oils, and more

## Module content

### Lecture (Class Work)

1. History and Technology of Soy and Non-Soy Tempeh Production
2. Yogurt Production Technology
3. Cheese Production Technology
4. Wheat Technology and Bread Production
5. Noodle Production Technology
6. Fish Processing Technology
7. Sugar Technology
8. Fat and Oil Technology
9. Meat Technology
10. Egg Technology
11. Fruit and Vegetable Preservation Technology

### Food Processing and Preservation Technology with Biotechnology Processes (BTP)

### Recommended Literatures

#### Main Books:

1. Aju Tjatur Nugroho, 2022. Fermented Yogurt. MNC Publishing.
2. Buckle, K.A; Edwards, R.A; Fleet G.H; Wootton, W; (1987) Food Science, translated by Heru Purnomo Adiono, UI-Press, Jakarta.
3. Deddy Muchtadi, 2013, Principles of Protein Source Food Technology, Alfabeta Publisher, Bandung.

#### Supporting Material:

1. Articles from websites relevant to fermented milk or grain fermentation.

### UIN 6000208 Research Methodology

|                                           |                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Research Methodology                                                                                                                                                                                                                                                                                                               |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                      |
| Module Identification Code                | FST 6000208                                                                                                                                                                                                                                                                                                                        |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                  |
| Person(s) responsible for the module      | Dr. Sandra Hermanto, M.Si Dr. Hendrawati, M. Si                                                                                                                                                                                                                                                                                    |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                              |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                           |
| Teaching methods, Contact hours           | The course topics are delivered through Project-based learning & problem-based learning, case study analysis, guest lectures, peer review sessions, fieldwork, role-playing exercises, reflection journals, and consultation sessions enhance student engagement, critical thinking, and practical application of research skills. |
| Workload                                  | <p>Lecture (class): (3 CH x 50 min) x 14 weeks = 35 h</p> <p>Structured activities: (1.5 h x 3 CH) x 14 weeks = 63 h.</p> <p>Independent study: (0.5 h x 3 CH) x 14 weeks = 21 h</p> <p>Exam: lecture 50 min x 3 CH x 2 w = 5h</p> <p>Total = 124 hours</p>                                                                        |
| Credit points                             | 3 Credit Hours $\approx$ 4.13 ECTS                                                                                                                                                                                                                                                                                                 |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                       |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                               |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                              |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                 |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                    |

After completing this Research Methodology course, it is expected that students will be able to design a research proposal in chemistry and effectively communicate it through scientific seminars/presentations as part of their preparation for the final thesis defense, which is the ultimate stage in obtaining a bachelor's degree in chemistry

#### Module content

1. Lecture (Class Work)
2. The Essence of Scientific Research in the Field of Chemistry
3. Critical Thinking Skills
4. Identification and Formulation of Research Problems
5. Hypothesis Formulation
6. Experimental Research Design
7. Chemical Literature Review
8. Guidelines for Scientific Paper/Thesis Writing
9. Plagiarism Check and Introduction to Reference Manager Applications
10. Effective Presentation

#### Recommended Literatures

1. Sevilla, C.G, J.A. Ochave, T.G. Punsalan, B.P. Regala, dan C.G. Uriarte, 1988, An Introduction to Research Methods, Rex Printing Co, The Philippines.
2. Wilson, Jr., E.B; 1952, An Introduction to Scientific Research, McCraw Hill Book Company Inc., New York.
3. Pedoman Penulisan Skripsi dan Laporan PKL, 2018. Prodi Kimia FST UIN Syarif Hidayatullah Jakarta.
4. Suryana, Metodologi Penelitian, Model Praktis Penelitian Kualitatif dan Kuantitatif, Universitas Pendidikan Indonesia

### FST 6096150 Environmental Chemistry Laboratory Work

|                                           |                                                                                                                                                                                                                                         |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Enviromental Chemistry Laboratory Work                                                                                                                                                                                                  |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                           |
| Module Identification Code                | FST 6096150                                                                                                                                                                                                                             |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                       |
| Person(s) responsible for the module      | Nurmaya Arofah, M.Eng; Nurul Amilia, M.Si                                                                                                                                                                                               |
| Language                                  | English and Indonesia                                                                                                                                                                                                                   |
| Relation in Curriculum                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                |
| Teaching methods, Contact hours           | The laboratory practicum employs a combination of demonstration, structured inquiry, and problem-based learning teaching methods.                                                                                                       |
| Workload                                  | <ul style="list-style-type: none"> <li>• Lecture (practicum): (1 x 150 min) x 14 wks = 35h</li> <li>• Structured activities: 150 min x 14 wks = 35 h</li> <li>• Exam: lecture 2 h x 2 times = 4 h;</li> <li>Total = 74 hours</li> </ul> |
| Credit points                             | 1 Credit Hours $\approx$ 2.46 ECTS                                                                                                                                                                                                      |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                            |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                    |
| Media employed                            | Laboratory tools and equipment; Classical teaching tools with whiteboard and PowerPoint presentation                                                                                                                                    |
| Forms of assessment                       | Midterm Exam = 20%, Final Exam = 20%, Lab Work (Practical) = 60%                                                                                                                                                                        |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                         |

After this course, students will have the ability to apply fundamental concepts of environmental chemistry in environmental chemistry laboratory experiments

#### Module content

##### Lecture (Lab Work)

1. Introduction
2. Module 1: Introduction to Sampling Equipment and Air
3. Module 2: Water Sampling and In-Situ Parameter Measurement
4. Module 3: Ammonia (N-NH<sub>3</sub>) Analysis in Water Using the Phenate Method
5. Module 4: Sulfate (SO<sub>4</sub>)<sub>2</sub>- Analysis in Water by Spectrophotometry
6. Module 5: Lead and Cadmium Analysis in Water Using AAS (Atomic Absorption Spectrophotometer)
7. Module 6: Air Sampling and Noise Measurement
8. Module 7: Particulate Dust Measurement Using Gravimetric Methods
9. Module 8: Ammonia Air Measurement
10. Module 9: Nitrite Air Measurement
11. Module 10: SO<sub>2</sub> Air Measurement

##### Recommended Literatures

Environmental Chemistry Laboratory Module

### FST 6096151 Environmental Chemistry

|                                           |                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Environmental Chemistry                                                                                                                                                                                                                                                                                        |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                  |
| Module Identification Code                | FST 6096151                                                                                                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                              |
| Person(s) responsible for the module      | Dr. Hendrawati, M. Si                                                                                                                                                                                                                                                                                          |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                          |
| Relation in Curriculum                    | Compulsory courses for undergraduate program in Chemistry                                                                                                                                                                                                                                                      |
| Teaching methods, Contact hours           | The course topics are delivered through case-based learning, fieldwork, interactive lectures, collaborative projects, debates and discussions. Students are divided into several groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Module Name                               | Environmental Chemistry                                                                                                                                                                                                                                                                                        |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                  |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                     |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                             |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                   |
| Recommended prerequisites                 | Basic Chemistry, Analytical chemistry                                                                                                                                                                                                                                                                          |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                          |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                             |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                |

1. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including environmental pollution problems
2. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including Waste Problems
3. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including Water Pollution
4. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including Soil Pollution
5. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including Air Pollution
6. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including environmental toxicology
7. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise management of natural resources including Food and Drug Pollution
8. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise management of natural resources including pollution by industry

9. After attending this lecture, students are expected to be able to understand environmental problems scientifically, understand how to manage pollution and be able to design wise natural resource management including biogeochemical cycles

#### Module content

1. Pollution Problems
2. Water Pollution
3. Soil Pollution
4. Air Pollution
5. Environmental toxicology
6. Food and Drug Pollution
7. Pollution By industry
8. Biogeochemical cycles

#### Recommended Literatures

1. Ahmad Rukesih, Environmental Chemistry
2. Hefni Effendi, Chemistry of the aquatic environment.
3. Wardhana, W.A. 2004. Impact of Environmental Pollution. Andi. Yogyakarta.
4. Mahida, UN. 1986. Water pollution. Hawk. Jakarta.
5. Connel & Miller. 1995. Chemical Ecotoxicology of Pollution. UI Press. Jakarta.
6. Soemirat, Y. 2003. Environmental toxicology. UGM. Yogyakarta.
7. Darmono. 1995. Metals in the Biological Systems of Living Things. UI. Jakarta.
8. Soemarwoto O. 1988. Environmental Impact Analysis. UGM Press Yogyakarta
9. Sastrawijaya. 1991. Environmental Pollution. Rineka Cipta. Jakarta.
10. National & international journals

**FST 6096161 Colloquium**

|                                           |                       |
|-------------------------------------------|-----------------------|
| Module Name                               | Colloquium            |
| Module level, if applicable               | Undergraduate         |
| Module Identification Code                | FST 6096161           |
| Semester(s) in which the module is taught | 7                     |
| Person(s) responsible for the module      | Chair of Bc-Chemistry |
| Language                                  | English and Indonesia |

|                                                                                                                                         |                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relation in Curriculum                                                                                                                  | compulsory course for undergraduate program in Chemistry                                                                                                         |
| Teaching methods, Contact hours                                                                                                         | Research proposal presentation and discussion<br>Students are supervised by supervisors or more                                                                  |
| Workload                                                                                                                                | Structured activities and self-assignment<br>Total = 82.6 hours                                                                                                  |
| Credit points                                                                                                                           | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                               |
| Admission and examination requirements                                                                                                  | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                     |
| Recommended prerequisites                                                                                                               | None                                                                                                                                                             |
| Media employed                                                                                                                          | Paper, Laptop/Computer                                                                                                                                           |
| Forms of assessment                                                                                                                     | Assessment includes: the ability to deliver seminar proposal, the ability to answer and the accuracy of answers, language and attitude, paper format, timeliness |
| Intended Learning Outcome                                                                                                               |                                                                                                                                                                  |
| Students are able to write, present, and defend the research proposal as an initial step to conduct research in the field of chemistry. |                                                                                                                                                                  |
| Module content                                                                                                                          |                                                                                                                                                                  |
| The topic and content of the research proposal are discussed with the supervisor before starting the work.                              |                                                                                                                                                                  |
| References:<br>Articles and books related to the topics.                                                                                |                                                                                                                                                                  |



### UIN 6000207 Internship (PKL)

|                                                                                                                                                                          |                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                              | Internship (PKL)                                                                                                                                                                                              |
| Module level, if applicable                                                                                                                                              | Undergraduate                                                                                                                                                                                                 |
| Module Identification Code                                                                                                                                               | UIN 6000207                                                                                                                                                                                                   |
| Semester(s) in which the module is taught                                                                                                                                | 7                                                                                                                                                                                                             |
| Person(s) responsible for the module                                                                                                                                     | All the lecrurers                                                                                                                                                                                             |
| Language                                                                                                                                                                 | English and Indonesia                                                                                                                                                                                         |
| Relation in Curriculum                                                                                                                                                   | Compulsory course for undergraduate program in Chemistry                                                                                                                                                      |
| Teaching methods, Contact hours                                                                                                                                          | Students are supervised by supervisors (lecturer and field supervisor)                                                                                                                                        |
| Workload                                                                                                                                                                 | Internship: 25 days x 6 hours = 150 h<br>Structured and self-assignment: 15 h.<br>Total = 165 hours                                                                                                           |
| Credit points                                                                                                                                                            | 4 Credit Hours $\approx$ 5.5 ECTS                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                   | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                  |
| Recommended prerequisites                                                                                                                                                | None                                                                                                                                                                                                          |
| Media employed                                                                                                                                                           | Paper, Laptop/Computer                                                                                                                                                                                        |
| Forms of assessment                                                                                                                                                      | The elements of evaluation consist of a feasibility assessment topics, the level of student participation during internship, academic writing, presentation, and oral test about content of internship report |
| Intended Learning Outcome                                                                                                                                                |                                                                                                                                                                                                               |
| 1. Apply the knowledge of Chemistry to the problems in the field<br>2. Develop a good communication and teamwork<br>3. Write internship report in a comprehensive manner |                                                                                                                                                                                                               |
| Module content                                                                                                                                                           |                                                                                                                                                                                                               |
| Topic is appointed by university or group of students.                                                                                                                   |                                                                                                                                                                                                               |
| Recommended Literatures                                                                                                                                                  |                                                                                                                                                                                                               |
| Articles and Books related to the topics.                                                                                                                                |                                                                                                                                                                                                               |

### UIN 6000206 Community Service Program (KKN)

|                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                               | Community Service Program (KKN)                                                                                                                                                                                                                                                                                                                                                                                                                |
| Module level, if applicable                                                                                                               | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                                | UIN 6000206                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                                 | 7                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                      | All the lecrurers                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Language                                                                                                                                  | Indonesia                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Relation in Curriculum                                                                                                                    | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                                       |
| Teaching methods, Contact hours                                                                                                           | The students have 1 month preparation, 1 months stay and work in the village, and 1 month making a report.                                                                                                                                                                                                                                                                                                                                     |
| Workload                                                                                                                                  | Community services: 25 days x 6 hours = 150 h<br>Structured and self-assignment: 15 h.<br>Total = 165 hours                                                                                                                                                                                                                                                                                                                                    |
| Credit points                                                                                                                             | 4 Credit Hours $\approx$ 5.5 ECTS                                                                                                                                                                                                                                                                                                                                                                                                              |
| Admission and examination requirements                                                                                                    | Enrolled in this course                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Recommended prerequisites                                                                                                                 | The student has to register the Center for Community Service to the study load card (KRS) in Semester VI. The Center for Community Service can be done during free time between the sixth and the seventh semesters                                                                                                                                                                                                                            |
| Media employed                                                                                                                            | Paper, Laptop/Computer, and village.                                                                                                                                                                                                                                                                                                                                                                                                           |
| Forms of assessment                                                                                                                       | The final mark will be decided by considering some criteria involving the independence and teamwork ability, attitude and ethic, substance of the Center for Community Service. The components will be taken from the lecturers (during preparation until test at the end of the activities) and the chair of the village where the students work for the Center for Community Service. A: 80-100; B: 70-79,9; C: 60-69,9; D: 50-59,9; E: <50. |
| Intended Learning Outcome                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| After completing this course, the students should have strong insight in local wisdom and high sensitivity to the problems in the society |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Module content                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Topic is appointed by university or group of students.                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### UIN 6000312 Bachelor Thesis

|                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                           | Bachelor Thesis                                                                                                                                                                                                                                                                                                                                              |
| Module level, if applicable                                                                                                                                                                                                                                                                                                           | Undergraduate                                                                                                                                                                                                                                                                                                                                                |
| Module Identification Code                                                                                                                                                                                                                                                                                                            | UIN 6000312                                                                                                                                                                                                                                                                                                                                                  |
| Semester(s) in which the module is taught                                                                                                                                                                                                                                                                                             | 8                                                                                                                                                                                                                                                                                                                                                            |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                  | All the lecrurers                                                                                                                                                                                                                                                                                                                                            |
| Language                                                                                                                                                                                                                                                                                                                              | English and Indonesia                                                                                                                                                                                                                                                                                                                                        |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                | Compulsory course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                     |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                       | Students are supervised by supervisors or more                                                                                                                                                                                                                                                                                                               |
| Workload                                                                                                                                                                                                                                                                                                                              | Thesis Project:<br>Experimental lab and writing thesis 408 h                                                                                                                                                                                                                                                                                                 |
| Credit points                                                                                                                                                                                                                                                                                                                         | 6 Credit Hours $\approx$ 13.6 ECTS                                                                                                                                                                                                                                                                                                                           |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                | To be able to take the final exam students must complete courses (minimum 138 credits) without having a D grade.                                                                                                                                                                                                                                             |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                             | None                                                                                                                                                                                                                                                                                                                                                         |
| Media employed                                                                                                                                                                                                                                                                                                                        | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                        |
| Forms of assessment                                                                                                                                                                                                                                                                                                                   | Bachelor thesis conducted after the student completes his final project draft. The elements of evaluation consist of feasibility assessment topics, academic writing, presentation, and oral test about the content of the final project. final exam using the agreed system $80 \leq A \leq 100$ ; $70 \leq B < 80$ ; $60 \leq C < 70$ ; $60 \leq D < 50$ . |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                              |
| <ol style="list-style-type: none"> <li>1. Apply the knowledge, experience, and skills learned in Bc-Chemistryto the chosen topic and case.</li> <li>2. Write scientific papers in a comprehensive manner.</li> <li>3. Studentshave professional ethics and soft skill: presentation, communication, discussion, and reason</li> </ol> |                                                                                                                                                                                                                                                                                                                                                              |

### UIN 6000313 Seminar

|                                                                                                             |                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                 | Seminar                                                                                                                                                        |
| Module level, if applicable                                                                                 | Undergraduate                                                                                                                                                  |
| Module Identification Code                                                                                  | UIN 6000313                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                   | 8                                                                                                                                                              |
| Person(s) responsible for the module                                                                        | All the lecrurers                                                                                                                                              |
| Language                                                                                                    | English and Indonesia                                                                                                                                          |
| Relation in Curriculum                                                                                      | Compulsory course for undergraduate program in Chemistry                                                                                                       |
| Teaching methods, Contact hours                                                                             | Final project presentation and discussion<br>Students are supervised by supervisors or more                                                                    |
| Workload                                                                                                    | Structured assignment and self-assignment for total 37.4 h                                                                                                     |
| Credit points                                                                                               | 1 Credit Hours $\approx$ 1.25 ECTS                                                                                                                             |
| Admission and examination requirements                                                                      | To be able to take the final exam students must complete courses (minimum 138 credits) without having a D grade.                                               |
| Recommended prerequisites                                                                                   | None                                                                                                                                                           |
| Media employed                                                                                              | Classical teaching tools with white board and PowerPoint presentation                                                                                          |
| Forms of assessment                                                                                         | Assessment includes: the ability to deliver seminar papers, the ability to answer and the accuracy of answers, language and attitude, paper format, timeliness |
| Intended Learning Outcome                                                                                   |                                                                                                                                                                |
| Students are able to arrange and submit the results of their final assignment studies in scientific forums. |                                                                                                                                                                |
| Module content                                                                                              |                                                                                                                                                                |
| The topic and content of the final project are discussed with the supervisor before starting the work       |                                                                                                                                                                |
| Recommended Literatures                                                                                     |                                                                                                                                                                |
| Articles and Books related to the topics.                                                                   |                                                                                                                                                                |

### III. COMPLEMENTARY COMPETENCIES

#### FSH 6046126 IPR (Intellectual Property Rights)

|                                           |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Intellectual Property Rights (IPR)                                                                                                                                                                                                                                                           |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                |
| Module Identification Code                | FSH 6046126                                                                                                                                                                                                                                                                                  |
| Semester(s) in which the module is taught | 3                                                                                                                                                                                                                                                                                            |
| Person(s) responsible for the module      | Dr. Achmad Tjachja Nugraha, SP., MP.                                                                                                                                                                                                                                                         |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                        |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                       |
| Teaching methods, Contact hours           | The course topics are delivered through lectures which are enriched with relevant examples and followed by short discussion. Students are divided into several groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                   |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                           |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                 |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                         |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                        |
| Forms of assessment                       | Midterm exam 30%, Final exam 40%, Quiz 10%, Structured assignment 20%                                                                                                                                                                                                                        |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                              |

Students can explain and identify the basic concepts and legal regulations of Intellectual Property Rights and are able to use their understanding to explain and implement various intellectual property outcomes produced by chemical aspects in the comprehensive management of Intellectual Property Rights.

#### Module content

1. Introduction to Intellectual Property Rights
2. Understanding Intellectual Property Rights in Industry
3. History of Intellectual Property Rights Worldwide
4. History of Intellectual Property Rights in Indonesia
5. Implementation of Intellectual Property Rights on Products
6. Introduction and Explanation of Industrial Design
7. Introduction and Explanation of Trade Secrets
8. Introduction and Implementation of Patent and Copyright Laws
9. Introduction and Implementation of Trademark Law
10. Introduction and Implementation of Integrated Circuit Layout
11. Introduction and Implementation of Geographical Indications
12. Issues of Individual Intellectual Property Rights
13. Issues of Group/Corporate Intellectual Property Rights
14. Resolution of Intellectual Property Rights Issues

#### Recommended Literatures

1. Intellectual Property Handbook, Directorate General of Intellectual Property Rights, Ministry of Law and Human Rights
2. HAKI Law Book, Permata Pers, 2011, 319
3. Indonesia Legal Centre Publishing, Intellectual Property Law, Jakarta, 2006
4. World Intellectual Property Organization, Geneva, 2007

### FST 6096319 Management of Hazardous Materials

|                                           |                                                        |
|-------------------------------------------|--------------------------------------------------------|
| Module Name                               | Management of Hazardous Materials                      |
| Module level, if applicable               | Undergraduate                                          |
| Module Identification Code                | FST 6096319                                            |
| Semester(s) in which the module is taught | 3                                                      |
| Person(s) responsible for the module      | Nurmaya Arofah M.Eng                                   |
| Language                                  | English and Indonesia                                  |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry |

|                                        |                                                                                                                                                                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours        | The course topics are delivered through a blend of theoretical instruction on laboratory management, case studies, simulations, regulatory compliance training, and small group discussion.                                                |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                         |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                               |
| Recommended prerequisites              | None                                                                                                                                                                                                                                       |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                      |
| Forms of assessment                    | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                      |
| Intended Learning Outcome              |                                                                                                                                                                                                                                            |

Students have an understanding of the management of hazardous and toxic chemicals as well as radioactive substances on a Laboratory and Industrial scale, including transportation, distribution, storage, use, and/or disposal.

#### Module content

1. Introduction, Laboratory Safety and Security Culture, Establishing an Effective Security System
2. Basics of Hazardous and Toxic Material Management in the Qur'an and Hadith, Regulations for Hazardous Material Management
3. Definition of Hazardous and Toxic Substances and Green Chemistry (Environmentally Friendly Chemistry)
4. Hazardous Chemical Labeling System, Storage, and Transportation
5. Properties, Characteristics, and Classification of Hazardous and Toxic Materials
6. Fire and Fire Extinguishment
7. Radioactivity
8. Hazardous Waste Management
9. Introduction to Hazardous Waste and Radioactive Waste Management Technology
10. Chemical Inventory and Management System (Case Study)

#### Recommended Literatures

1. National Research Council, 2010, Laboratory Safety and Security in Chemical Laboratories: Wise Chemical Management Guide. The National Academies Press, Washington, 2010.
2. Thamzil Las, Hazardous Materials Chemistry and Occupational Safety in Laboratories, Faculty of Mathematics and Natural Sciences, University of Indonesia, 2000.
3. Wardana, A. W., 2007, Nuclear Technology: Radiation Protection and Its Applications. Andi, Yogyakarta.
4. Damanhuri, E., 2010, Lecture Notes on the Management of Hazardous and Toxic Materials, Environmental Engineering Program, Faculty of Civil and Environmental Engineering, Bandung Institute of Technology.
5. GOVERNMENT REGULATION OF THE REPUBLIC OF INDONESIA NUMBER 74 OF 2001 CONCERNING THE MANAGEMENT OF HAZARDOUS AND TOXIC MATERIALS.

Shonnard, A., 2002, Green Engineering: Environmentally Conscious Design of Chemical Processes. Prentice Hall PTR.

### FST 6096320 Halal Food Standardization and Management

|                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                                          | Halal Food Standardization and Management                                                                                                                                                                                                                                                                                       |
| Module level, if applicable                                                                                                                                                                                                                                                                                                                          | Undergraduate                                                                                                                                                                                                                                                                                                                   |
| Module Identification Code                                                                                                                                                                                                                                                                                                                           | FST 6096320                                                                                                                                                                                                                                                                                                                     |
| Semester(s) in which the module is taught                                                                                                                                                                                                                                                                                                            | 3                                                                                                                                                                                                                                                                                                                               |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                                 | Dr. Sandra Hermanto, M.Si                                                                                                                                                                                                                                                                                                       |
| Language                                                                                                                                                                                                                                                                                                                                             | English and Indonesia                                                                                                                                                                                                                                                                                                           |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                               | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                          |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                                      | The course topics are delivered through a blend of theoretical instruction, case studies, practical demonstrations, regulatory compliance training, and interactive discussions to impart knowledge and skills in Halal food standardization and management. There are also an industry guest lecturer from the Halal industry. |
| Workload                                                                                                                                                                                                                                                                                                                                             | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                      |
| Credit points                                                                                                                                                                                                                                                                                                                                        | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                              |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                               | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                    |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                            | Islamic Studies                                                                                                                                                                                                                                                                                                                 |
| Media employed                                                                                                                                                                                                                                                                                                                                       | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                           |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                  | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                           |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>Students can understand concepts related to the essence and philosophy of halal food, identification of critical points for animal, vegetable, microbial and synthetic ingredients and mixed ingredients.</li> <li>Students understand the Law on Halal Food Regulations and its implementation in</li> </ol> |                                                                                                                                                                                                                                                                                                                                 |

society

3. Students are able to understand the principles, criteria and implementation of the Halal Assurance System

Students are able to understand instrumental and non-instrumental techniques to analyze the halalness of food products

#### Module content

1. Fundamental Philosophy and Legal Aspect of Halal Food
2. Controversy on Halal Food Products
3. Identification of Halal Critical Points (Animal, Vegetable, Microbial and Synthetic)
4. General Guidelines for RPH Production
5. Food Regulation Law & Implementation of the Halal Regulation Law
6. Halal Assurance System (HAS 23000)

#### Guidelines for Halal Certification & Implementation of SJH

#### Recommended Literatures

1. Dr. Yusuf Qardhawi, 1995, *Halal & Haram in Islam*.
  2. Mian N. Riaz, Muhammad M. Chaudry, 2004, *Halal Food Production*, CRC Press LLC, USA.
  3. Institute for the Assessment of Food, Drugs & Cosmetics, 2008, *General Guidelines for the Halal Assurance System*.
  4. Director General of the Ministry of Health of the Republic of Indonesia, *Government Regulation No. 69 of 1999 concerning Food*.
  5. Law No. 11 of 2020 concerning Job Creation
- Law No. 33 of 2014, concerning Halal Product Guarantee.

**FST 6096329 Polymer Chemistry**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Polymer Chemistry                                                                                                                                                                                                                                                                                                                         |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6096329                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 4                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Tarso Rudiana, M.Si                                                                                                                                                                                                                                                                                                                       |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Organic Chemistry I and II                                                                                                                                                                                                                                                                                                                |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%,<br>Presentation 20%, Structured assignment 20%                                                                                                                                                                                                                                                          |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

Students are able to analyze and explain the basic concepts of polymer chemistry, polymer classification, polymer structure, polymer nomenclature, physical and chemical properties of polymers, polymerization reactions, polymerization techniques, polymer modification, polymer product characterization, thermoplastic and thermoset polymers, polymer fibers, elastomers, natural polymers, and specialty polymers.

#### Module content

##### Lecture (Class work)

1. Introduction
2. Basic Concepts of Polymer Chemistry
3. Classification of Polymer Compounds
4. Structure of Polymer Compounds
5. Polymer Nomenclature
6. Physical and Chemical Properties of Polymers
7. Polymerization Reactions
8. Polymerization Techniques
9. Modification and Processing of Polymer Products
10. Characterization of Polymer Products
11. Thermoplastic and Thermoset Polymers
12. Polymer Fibers
13. Elastomers
14. Natural Polymers and Specialty Polymers

##### Recommended Literatures

1. Stevens, M.P., 2001. Polymer Chemistry: An Introduction. Alih Bahasa Iis Sopyan. Jakarta: Pradnya Paramita.
2. Rochmadi and Permono, A. 2015. Mengenal Polimer dan Polimerisasi. Yogyakarta: Gadjah Mada University Press.
3. Burhanuddi. 2016. Pengantar Teknologi Polimer. Pekan Baru: UR Press.
4. Davis, J.F. Polymer Chemistry. Willey.
5. Budiman Anwar, dkk., 2009. Kimia Polimer, Jakarta. Universitas Terbuka Press.

**FST 6096330 Chemical Process Industry**

|                                           |                           |
|-------------------------------------------|---------------------------|
| Module Name                               | Chemical Process Industry |
| Module level, if applicable               | Undergraduate             |
| Module Identification Code                | FST 6096330               |
| Semester(s) in which the module is taught | 4                         |
| Person(s) responsible for the module      | Drs. Dede Sukandar, M.Si  |

|                                        |                                                                                                                                                                                                                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Language                               | English and Indonesia                                                                                                                                                                                                                                                          |
| Relation in Curriculum                 | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                         |
| Teaching methods, Contact hours        | The course topics are delivered through industry case studies, industrial visits, and industry group discussions, Students are divided into five groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                     |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                             |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                   |
| Recommended prerequisites              | None                                                                                                                                                                                                                                                                           |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                          |
| Forms of assessment                    | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                             |
| Intended Learning Outcome              |                                                                                                                                                                                                                                                                                |

Students are capable of applying units and process variables.  
Students are capable of designing equipment used in the industry.  
Students are capable of analysing mass and energy balances of a process.  
Students are capable of analysing the industrial chemical production process.

#### Module content

##### Lecture (Class work)

1. Process Units and Modifiers
2. Chemical industry tools
3. Mass and energy balance
4. Industrial-scale chemical product manufacturing process (gas, carbon, ceramics, cement, glass, fertilizer, salt, acid, nitrogen, biodiesel industries)

#### Recommended Literatures

##### **Main:**

1. Austin, G,T, 1996, Chemical Process Industry, Erlangga, Jakarta
2. Yuliani HR. 2019. Mass Balance and Energy Balance, Deepublish Publishers, Yogyakarta

##### **Supporter:**

1. Isalmi Aziz. 2013. Industrial Chemistry. UIN Press Jakarta
2. Kirk Orthmer, Encyclopedy Chemystri

Articles from *websites* and other appropriate media

**FST 6096331 Functional Food**

|                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                                                                                                                                                                                              | Functional Food                                                                                                                                                                                                                                                                                                                           |
| Module level, if applicable                                                                                                                                                                                                                                                                                                                              | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                                                                                                                                                                                                                                                                                                                               | FST 6096331                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module                                                                                                                                                                                                                                                                                                                     | Dr. Sri Yadiat Calid, M.Si                                                                                                                                                                                                                                                                                                                |
| Language                                                                                                                                                                                                                                                                                                                                                 | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                                                                                                                                                                                                                                                                                                                                   | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours                                                                                                                                                                                                                                                                                                                          | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                                                                                                                                                                                                                                                                                                                                 | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                                                                                                                                                                                                                                                                                                                                            | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements                                                                                                                                                                                                                                                                                                                   | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                | None                                                                                                                                                                                                                                                                                                                                      |
| Media employed                                                                                                                                                                                                                                                                                                                                           | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                      | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                        |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                           |
| Students are expected to understand the concept of functional foods, their primary, secondary, and tertiary functions, food metabolism, digestive organs, the history of the development of functional foods in Japan, Europe, and Indonesia, in vitro and in vivo research to transform a food into a functional food that offers benefits to the body. |                                                                                                                                                                                                                                                                                                                                           |

## Module content

### Lecture (Class work)

1. Course contract
2. Macro components of food carbohydrates, proteins, fats and dietary fiber as well as human digestive organs
3. The nature or function of *primary*, *secondary* and *tertiary* of food or food
4. History of functional food and development of FUSHO (Japan) and Europe
5. The development of functional food in Indonesia according to BPOM and food experts
6. Functional properties of food as a source of antioxidants to ward off free radicals and design studies in vitro and in vivo to prove the antioxidant properties of food
7. Functional properties of foodstuffs that can inhibit angiotensin converting enzyme (*ACE*) and in vitro and in vivo research designs to prove the antihypertensive properties of foodstuffs
8. Functional properties as a cholesterol lowerer and designed studies in vitro and in vivo to prove its cholesterol-lowering properties
9. The role of active food components that can inhibit the enzyme alpha glucosidase in vitro and in vivo to prove the nature of food as an antidiabetic
10. The functional properties of food as pre and probiotics, the role of dietary fiber and lactic acid bacteria (BAL) in vitro and in vivo to prove the properties of food as pre and probiotic
11. Research on various tempeh as antioxidant, antihypertensive, cholesterol-lowering and antidiabetic functional foods in vitro and in vivo

Research on fermented milk as an antioxidant, antihypertensive, cholesterol-lowering and antidiabetic functional food in vitro and in vivo

### Recommended Literatures

- **Main Book :**

Functional food aspects of health, evaluation, and regulation Tri Dewanti et al. **Malang** Brawijaya University 2017

- **Supporter:**

Articles from *websites* corresponding to fermented milk or fermented grains as functional foods antioxidant, antihypertensive, cholesterol-lowering and antidiabetic.

**FST 6095306 Microbiology**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Microbiology                                                                                                                                                                                                                                                                                                                              |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6095306                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 4                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Reno Fitri, M.Si.                                                                                                                                                                                                                                                                                                                         |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Biochemistry                                                                                                                                                                                                                                                                                                                              |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                                     |

### Intended Learning Outcome

After completing this course, it is expected that students will be able to understand the basic concepts and methods in the field of microbiology and relate them to other disciplines related to both fundamental and applied microbiology.

### Module content

1. Scope and History of Microbiology
2. Microorganism Growth
3. Environmental Factors Affecting Microorganism Growth
4. Common Methods in Microbiology
5. Microorganism Observation
6. Microorganism Control
7. Structure and Function of Subcellular Organelles in Microorganisms
8. Viruses
9. Bacteria
10. Fungi
11. Microalgae and Protozoa
12. Food Microbiology and Industry
13. Host-Parasite Interactions

### Recommended Literatures

1. Madigan, M.T., J.M. Martinko, K.S. Bender, D.H. Buckley, & D.H. Stahl. 2015. Brock's Microbiology. 14th ed. Pearson.
2. Black, J.G. 2012. Microbiology: Prinsip dan Penjelajahan. Edisi ke-8. John Wiley and Sons, Inc.
3. Pelczar Jr., M.J, E.C.S. Chan, & N.R. Krieg. 1986. Mikrobiologi. Edisi ke-5.
4. Hogg, S. 2005. Mikrobiologi Dasar. John Wiley & Sons Ltd.
5. Waluyo L. 2004. Mikrobiologi Umum. UMM Press.
6. Various microbiology journals and sources from the internet.

**FST 6096332 Organic Chemical Synthesis**

|                                           |                            |
|-------------------------------------------|----------------------------|
| Module Name                               | Organic Chemical Synthesis |
| Module level, if applicable               | Undergraduate              |
| Module Identification Code                | FST 96332                  |
| Semester(s) in which the module is taught | 4                          |
| Person(s) responsible for the module      | Agus Rimus Liandi, M.Si    |

|                                        |                                                                                                                                                                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Language                               | English and Indonesia                                                                                                                                                                                                                                                    |
| Relation in Curriculum                 | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                   |
| Teaching methods, Contact hours        | The course topics are delivered through Project-based learning & problem-based learning. Each student is given a problem project presented in class and discusses it. In one semester, there are also two industry guest lecturers from the chemical synthesis industry. |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                               |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                       |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                             |
| Recommended prerequisites              | Organic Chemistry I and II                                                                                                                                                                                                                                               |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                    |
| Forms of assessment                    | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                    |
| Intended Learning Outcome              |                                                                                                                                                                                                                                                                          |

1. Students are able to explain the basic principles of the retrosynthesis approach.
2. Students can apply the concept of retrosynthesis in disconnecting single functional groups C-X.
3. Students can analyze retrosynthesis pathways in disconnecting two functional groups C-X.
4. Students are able to explain issues in the synthesis of organic compounds using the concept of chemoselectivity.
5. Students can solve problems in the synthesis of organic compounds using the concept of protective groups.
6. Students can design research in the field of organic compound synthesis using various synthesis approaches.

#### Module content

1. Introduction to Course Syllabus.
2. Basic Principles of the Retrosynthesis Approach.
3. Disconnection of Single Functional Groups C-X.
4. Disconnection of Two Functional Groups C-X.
5. Chemo selectivity.
6. Protective Groups.
7. Design of Organic Compound Synthesis, including synthesis of organic compounds based on 5-membered heterocyclic compounds, synthesis of organic compounds based on 6-membered heterocyclic compounds, synthesis of organic compounds based on Spiro oxindoles, synthesis of organic compounds based on sulfur heterocycles, synthesis of organic compounds with green synthesis approaches (Microwave-assisted, ultrasound-assisted, Catalysis, Solvent-free, and others).

#### Recommended Literatures

##### Main:

1. Warren, S. 1982. Organic Synthesis: The Disconnection Approach. New York: John Wiley & Sons.
2. Budimarwanti, C. 2007. Lecture Notes on Organic Chemistry Synthesis. Yogyakarta: Faculty of Mathematics and Natural Sciences, Yogyakarta State University.

##### Supporting:

1. A.R. Liandi, A.H. Cahyana, A.J.F. Kusumah, A. Lupitasari, D.N. Alfariza, R. Nuraini, R.W. Sari, F.C. Kusumasari, Recent trends of spinel ferrites (MFe<sub>2</sub>O<sub>4</sub>: Mn, Co, Ni, Cu, Zn) applications as an environmentally friendly catalyst in multicomponent reactions: A review, *Case Stud. Chem. Env. Eng.* 7 (2023) 20266–20274
2. A.R. Liandi, A.H. Cahyana, R.T. Yunarti, T.P. Wendari, Facile synthesis of magnetic Fe<sub>3</sub>O<sub>4</sub>@Chitosan nanocomposite as an environmentally green catalyst in multicomponent Knoevenagel-Michael domino reaction, *Ceram. Int.* 48 (2022) 20266–20274.
3. A.H. Cahyana, A.R. Liandi, M. Maghdalena, R.T. Yunarti, T.P. Wendari, Magnetically separable Fe<sub>3</sub>O<sub>4</sub>/graphene oxide nanocomposite: An efficient

heterogeneous catalyst for spirooxindole derivatives synthesis, *Ceram. Int.* 48 (2022) 18316–18323.

4. A.R. Liandi, A.H. Cahyana, Synthesis and antioxidant activity of benzo[a]pyrano[2,3-c] phenazine derivative compound via one-pot multicomponent reaction, *J. Res. Pharm.* 26 (2022) 954–961.
5. A.H. Cahyana, A.R. Liandi, N. Anwar, An ionic liquids catalyst approach for the synthesis of pyrimidine derivatives using l-proline nitrate, *J. Appl. Pharm. Sci.* 12 (2022) 240–245.
6. A.H. Cahyana, A.R. Liandi, Y. Yulizar, Y. Romdoni, T.P. Wendari, Green synthesis of CuFe<sub>2</sub>O<sub>4</sub> nanoparticles mediated by Morus alba L. leaf extract: Crystal structure, grain morphology, particle size, magnetic and catalytic properties in Mannich reaction, *Ceram. Int.* 47 (2021) 21373–21380.
7. A.H. Cahyana, A.R. Liandi, Y. Safitri, R.T. Yunarti, Synthesis of 1,4-dihydropyridine with aromatic of cinnamaldehyde compound using NiFe<sub>2</sub>O<sub>4</sub> mnps catalyst and the activity test as an antioxidant, *Rasayan J. Chem.* 13 (2020) 1491–1497.
8. A.R. Liandi, R.T. Yunarti, M.F. Nurmawan, A.H. Cahyana, The Utilization of Fe<sub>3</sub>O<sub>4</sub> nanocatalyst in modifying cinnamaldehyde compound to Synthesis 2-amino-4H-chromene derivative, *Mater. Today Proc.* 22 (2020) 193–198.

**FST 6096341 Bioinorganic**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Bioinorganic                                                                                                                                                                                                                                                                                                                              |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6096341                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Dr. Sri Yadihal Chalid, M.Si                                                                                                                                                                                                                                                                                                              |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Inorganic Reactivity Structure<br>Transition Metals and Coordination Chemistry                                                                                                                                                                                                                                                            |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Midterm exam 30%, Final exam 30%, Quiz 10%,<br>Structured assignment 30% |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                          |
| Students are expected to understand the definition, metabolism of macro and micro minerals, their distribution in the body, minerals such as Ca, Cl, Mg, Se, Fe, macro mineral metabolism, micro mineral metabolism, interactions between these minerals, comprehend the consequences of deficiencies and excesses of macro and micro minerals in the body, and present the symptoms of deficiencies and excesses of minerals in the body                                                                                                                                                                                                              |                                                                          |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |
| <ol style="list-style-type: none"> <li>1. Lecture Contract and Orientation for Studies</li> <li>2. Definition of Macro and Micro Minerals</li> <li>3. Sodium (Na) and Chlorine (Cl) Minerals</li> <li>4. Fluids and Electrolytes in the Body</li> <li>5. Calcium (Ca) and Phosphorus (P) Metabolism</li> <li>6. Magnesium (Mg) Metabolism</li> <li>7. Iron (Fe) Metabolism</li> <li>8. Calcium (Ca) Metabolism</li> <li>9. Copper (Cu) Metabolism</li> <li>10. Iodine (Iod) Metabolism</li> <li>11. Selenium (Se) Metabolism</li> <li>12. Cobalt (Co) Metabolism</li> <li>13. Potassium (K) Metabolism</li> <li>14. Fluorine (F) Metabolism</li> </ol> |                                                                          |
| Recommended Literatures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                          |
| <ol style="list-style-type: none"> <li>1. Almtsier, Sunita. (2002). Prinsip dasar ilmu gizi. Jakarta: PT Gramedia Pustaka Utama.</li> <li>2. Gibson, R.S. (2005). Principles of nutritional assessment. Oxford University Press</li> <li>3. Kalkwarf, Heidi J. et al. (2003). Milk intake during childhood and adolescence, adult bone density, and osteoporotic fractures in US women. 18 Desember 2008. <a href="http://www.ajcn.org">http://www.ajcn.org</a></li> <li>4. Bahan jurnal mineral mikro dan makro dalam bentuk pdf secara on-line</li> </ol>                                                                                            |                                                                          |

**FST 6096342 Mineral Chemistry**

|                             |                   |
|-----------------------------|-------------------|
| Module Name                 | Mineral Chemistry |
| Module level, if applicable | Undergraduate     |
| Module Identification Code  | FST 6096342       |

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Nanda Saridewi, M.Si                                                                                                                                                                                                                                                                                                                      |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Inorganic Reactivity Structure<br>Transition Metals and Coordination Chemistry                                                                                                                                                                                                                                                            |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%,<br>Structured assignment 30%                                                                                                                                                                                                                                                                  |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

Students are able to explain the regularity of physical-chemical properties that determine crystal shape and duplication, know and can determine crystal classes along with their characteristics. The course also explains how to identify minerals based on their physical-chemical properties and understand mineral associations in relation to identifying igneous, pyroclastic, sedimentary, and metamorphic rock types, as well as the presence of minerals in alteration systems and gemstone formation. Students can understand the natural mineral extraction processes in Indonesia, distinguish between different physical and chemical mineral extraction processes, comprehend the synthesis process and applications of minerals found in Indonesia, and their benefits for technology and everyday life

#### Module content

1. Mining Law and Geological Potential
2. Crystallography, Amorphous, Rocks, Ores, and Natural Minerals
3. Types of Rock and Mineral Formation in Nature
4. Methods of Mineral Extraction
5. Physical and Chemical Properties, Extraction, and Applications of Gold
6. Physical and Chemical Properties, Extraction, and Applications of Copper
7. Physical and Chemical Properties, Extraction, and Applications of Nickel
8. Physical and Chemical Properties, Extraction, and Applications of Iron
9. Physical and Chemical Properties, Extraction, and Applications of Bauxite
10. Physical and Chemical Properties, Extraction, and Applications of Tin
11. Physical and Chemical Properties, Extraction, and Applications of Silver
12. Physical and Chemical Properties, Extraction, and Applications of Coal
13. Physical and Chemical Properties, Extraction, and Applications of Zeolites
14. Physical and Chemical Properties, Extraction, and Applications of Quartz Sand

#### Recommended Literatures

1. Suhala S and Arifin M, 1997, Industrial Minerals, Center for Mineral Technology Research and Development, Bandung.
2. Huheey, J.E., Keiter, E.A., and Keiter, R.L., 1993, Inorganic Chemistry, Principles of Structure and Reactivity, 4th ed., Harper Collins College Publisher, New York.
3. Effendy, 2007, New Perspectives in Coordination Chemistry, Volume 1, Bayumedia Publishing, Malang.
4. Miessler, D. L. and Tarr, D. A., 2004, Inorganic Chemistry, 3rd ed., Prentice Hall International, USA.
5. Atkins, P., Overton, T., Rourke, J., Shriver, D. F., Weller, M., and Armstrong, F., 2009, Shriver and Atkins' Inorganic Chemistry, 5th ed., Oxford University Press, UK.
6. Sugiyarto, K. H., 2012, Fundamentals of Transition Metal Inorganic Chemistry, Graha Ilmu, Yogyakarta.

|                                           |                            |
|-------------------------------------------|----------------------------|
| Module Name                               | Enzymology                 |
| Module level, if applicable               | Advance                    |
| Module Identification Code                | FST 6096343                |
| Semester(s) in which the module is taught | 5                          |
| Person(s) responsible for the module      | Dr. La Ode Sumarlin, M. Si |

|                                        |                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Language                               | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                 | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours        | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites              | Basic Biology and Basic Chemistry                                                                                                                                                                                                                                                                                                         |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                    | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                        |
| Intended Learning Outcome              |                                                                                                                                                                                                                                                                                                                                           |

1. Students are able to recognize various cellular processes, theories and applications of enzymes in the fields of health, food and the environment. .
2. Students are able to identify several concepts about enzymes in life processes, cells as reactors, enzymes as catalysts, enzyme reaction kinetics, classification and nomenclature of enzymes, temperature and pH of enzymes, enzyme inhibitors and their kinetics, concentration of enzymes and substrates, digestive enzymes, enzyme applications in the era of industrial progress in the 21st century, as well as enzyme isolation and purification
3. Students are able to combine their knowledge to produce solutions to problems related to the field of enzymes. and develop it in research activities.

#### Module content

1. Enzymes in the process of life,
2. Cells as reactors,

3. Enzymes as catalysts
4. Enzyme reaction kinetics
5. Classification and nomenclature of enzymes
6. Temperature and pH to enzymes
7. Enzyme inhibitors and their kinetics
8. Concentration of enzymes and substrates
9. Digestive enzymes
10. Application of enzymes in the era of industrial progress in the 21st century
11. Isolation and purification of enzymes.

#### Recommended Literatures

1. Mohamad Sadikin, M. 2002. Biochemistry Series: Biochemistry of Enzymes. Widya Medika. Jakarta
2. Voet, D&J.G. Voet. 1995. Biochemistry. 2ed. Willey, New York
3. Papers on the Internet.

**FST 6096344 Catalyst Chemistry**

|                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                               | Catalyst Chemistry                                                                                                                                                                                                                                                                                                                                                                                                             |
| Module level, if applicable                                                                                                                                               | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Module Identification Code                                                                                                                                                | FST 6096344                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                                                                                                                 | 5                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                                                                                                      | Dr. Yusraini Dian Inayati Siregar, M.Si<br>Nanda Sari Dewi, M. Si.                                                                                                                                                                                                                                                                                                                                                             |
| Language                                                                                                                                                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                                                          |
| Relation in Curriculum                                                                                                                                                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                         |
| Teaching methods, Contact hours                                                                                                                                           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. In one semester, there is also one industry guest lecturer from a relevant industry. |
| Workload                                                                                                                                                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                                                     |
| Credit points                                                                                                                                                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                                             |
| Admission and examination requirements                                                                                                                                    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                                                   |
| Recommended prerequisites                                                                                                                                                 | Inorganic Reactivity Structure<br>Transition Metals and Coordination Chemistry                                                                                                                                                                                                                                                                                                                                                 |
| Media employed                                                                                                                                                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                                                          |
| Forms of assessment                                                                                                                                                       | Midterm exam 30%, Final exam 40%, Quiz 10%,<br>Structured assignment 20%                                                                                                                                                                                                                                                                                                                                                       |
| Intended Learning Outcome                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1. Students are able to understand the principles of elements and compounds that can function as catalysts. They comprehend the components of catalysts, including active |                                                                                                                                                                                                                                                                                                                                                                                                                                |

components, supporters, promoters, and additives.

2. Students can understand how the catalytic activity accelerates the reaction rate, grasp the types of catalysts, their principles, advantages, and disadvantages. They understand the types of isotherms in the catalytic activity process, and they comprehend the factors influencing catalyst deactivation and methods of catalyst regeneration.
3. Students are capable of identifying types of adsorption isotherms and explaining the principles of catalyst adsorption and desorption.

Students can understand the principles of catalyst synthesis and characterization and design synthesis methods for applying catalysts in daily life.

#### Module content

1. Catalyst Principles
2. Catalyst Components
3. Types of Adsorption Isotherms
4. Principles of Adsorption and Desorption
5. Types of Catalysts
6. Catalyst Deactivation and Regeneration

#### Catalyst Synthesis and Characterization Methods

#### Recommended Literatures

1. Trisunaryanti, 2019, Catalyst Materials and Their Characteristics, UGM-Press, Yogyakarta.
2. Istadi, Catalyst Technology for Energy Conversion, Graha Ilmu, Yogyakarta.
3. Huheey, J.E., Keiter, E.A., and Keiter, R.L., 1993, Inorganic Chemistry, Principles of Structure and Reactivity, 4th ed., Harper Collins College Publisher, New York.
4. Miessler, D. L. and Tarr, D. A., 2004, Inorganic Chemistry, 3rd ed., Prentice Hall International, USA.

**FST 6096346 Petroleum Chemistry**

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Petroleum Chemistry                                                                                                                                                                                                                                                                                                                                                                                                            |
| Module level, if applicable               | Basic                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Module Identification Code                | FST 6096346                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Person(s) responsible for the module      | Drs. Dede Sukandar, M.Si, Isalmi Aziz, MT                                                                                                                                                                                                                                                                                                                                                                                      |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                                                          |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                         |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. In one semester, there is also one industry guest lecturer from a relevant industry. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                                                     |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                                             |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                                                   |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                                                          |
| Forms of assessment                       | Midterm exam 40%, Final exam 40%, Quiz 10%, Structured assignment 10%                                                                                                                                                                                                                                                                                                                                                          |

### Intended Learning Outcome

After attending this course students are expected to: 1. Be able to explain the history and process of the formation of petroleum 2. Be able to explain the composition of petroleum 3. Be able to apply petroleum classification 4. Be able to apply petroleum processing 5. Be able to apply petroleum products 6. Be able to implement testing of petroleum products 7. Be able to analyze the properties of petroleum 8. Be able to analyze the cracking of petroleum products 9. Be able to analyze petroleum polymerization 10. Be able to analyze the alkylation of petroleum 11. Be able to analyze hydrotreating 12. Be able to synthesize countermeasures for petroleum pollution 13. Be able to synthesize alternative energy to replace petroleum

### Module content

#### Lecture (Class Work)

1. Composition of petroleum
2. Classification of petroleum
3. Petroleum processing
4. Petroleum products
5. Testing of petroleum products
6. Properties of petroleum
7. Crude oil product cracking
8. Petroleum polymerization
9. Alkylation of petroleum
10. Petroleum hydrotreating
11. Prevention of oil pollution

#### Alternative energy to replace petroleum

#### Recommended Literatures

1. Waddam AL. 1980. *Chemical from Petroleum*. 4th ed. Gulf Publishing Company
- Nelson WL. 1958. *Petroleum Refinery Engineering*. 4th ed. Mc Graw Hill. York

**FST 6096347 Metabolism**

|                                           |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Metabolism                                                                                                                                                                                                                                                                                   |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                |
| Module Identification Code                | FST 6096347                                                                                                                                                                                                                                                                                  |
| Semester(s) in which the module is taught | 5                                                                                                                                                                                                                                                                                            |
| Person(s) responsible for the module      | Dr. La Ode Sumarlin, M. Si Dr. Sandra Hermanto, M. Si                                                                                                                                                                                                                                        |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                        |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                       |
| Teaching methods, Contact hours           | The course topics are delivered through lectures which are enriched with relevant examples and followed by short discussion. Students are divided into several groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (2 x 50 min) x 14 weeks = 23,33 h<br>Structured activities: 2 h x 14 weeks = 28 h<br>Independent study: 2 h x 14 weeks = 28 h<br>Exam: 2 x 50 min x 2 times = 3.33 h<br>Total = 82,66 h                                                                                     |
| Credit points                             | 2 Credit Hours $\approx$ 2.755 ECTS                                                                                                                                                                                                                                                          |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                 |
| Recommended prerequisites                 | Biochemistry                                                                                                                                                                                                                                                                                 |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                        |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                        |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                              |

1. Students are capable of providing arguments and explaining the theoretical concept of biomolecule metabolism.
2. Students can detail the interconnections between general metabolism in various vital organs in an integrated manner and the relationships between biomolecular metabolism processes in the potential emergence of disease disturbances.
3. Students are able to make strategic decisions and offer alternative solutions based on simple biochemical research, supported by data analysis skills and information technology.

#### Module content

1. General Aspects of Metabolism (Metabolism Overview and Metabolism Regulation)
2. Carbohydrate Metabolism includes Glycolysis, Citric Acid Cycle and Oxidative Phosphorylation, Gluconeogenesis, Glycogenesis & Glycogenolysis, and Photosynthesis.
3. Lipid Metabolism (Fatty Acid Oxidation and Fatty Acid, Lipid, and Cholesterol Biosynthesis)
4. Amino Acid Metabolism (Transamination, Oxidative Deamination, Urea Cycle, and Amino Acid Biosynthesis)
5. Protein Biosynthesis (Transcription, Translation, and Post-Translational Modification)
6. Nucleotide Metabolism (Purine & Pyrimidine Oxidation and Biosynthesis)
7. Nucleic Acid Biosynthesis (ATP, GTP, and CTP)
8. Metabolism Integration (Regulation of Metabolism in Vital Organs)

#### Recommended Literatures

1. Sumarlin, L. 2020. Biokimia: Dasar-Dasar Biomolekul dan Konsep metabolisme, Rajagrafindo, Jakarta
  2. Lehninger, L. Albert, 1982, Principles of Biochemistry, Worth Publisher, Inc., USA.
  3. Mathew C.K. & van Holde K.E., 1996, Biochemistry, 2nd edition, Benjamin/Cummings Publishing Company, USA.
  4. Devlin M. Thomas, 1997, Textbook of Biochemistry, 4th edition, John Wiley & Sons, Inc., USA.
  5. Stryer, L. 1995. Biochemistry, 4th Edn. W.H. Freeman. New York.
  6. Voet, D, and Voet, J.G. 1995. Biochemistry, 2nd Edn. John Wiley and Sons. New York
- Anna Poedjiadi, 1994, Dasar-dasar Biokimia, UI-Press, Jakarta.

### FST 6096352 Inorganic Chemical Synthesis

|                                           |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Inorganic Chemical Synthesis                                                                                                                                                                                                                                                                 |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                |
| Module Identification Code                | FST 6096352                                                                                                                                                                                                                                                                                  |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                            |
| Person(s) responsible for the module      | Nanda Saridewi, M.Si                                                                                                                                                                                                                                                                         |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                        |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                       |
| Teaching methods, Contact hours           | The course topics are delivered through lectures which are enriched with relevant examples and followed by short discussion. Students are divided into several groups of discussion. Each group was assigned to work on a specific topic relevant to the lecture and presented in the class. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                   |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                           |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                 |
| Recommended prerequisites                 | Inorganic Reactivity Structure<br>Transition Metals and Coordination Chemistry                                                                                                                                                                                                               |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                        |
| Forms of assessment                       | Midterm exam 30%, Final exam 40%, Quiz 10%, Structured assignment 20%                                                                                                                                                                                                                        |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                              |

After completing this course, it is expected that students will be able to identify and explain fundamental concepts related to the synthesis of inorganic chemical materials, the accompanying reactions, and the characterization of the resulting inorganic materials. They should also be capable of designing techniques for synthesizing materials in inorganic chemistry research.

#### Module content

1. Definition of Inorganic Chemical Synthesis and Its Components
2. Crystallography
3. Solid-Gas Reactions
4. Physical Vapor Deposition (PVD)
5. Chemical Vapor Deposition (CVD)
6. Metal Organic Vapor Deposition (MOCVD)
7. Solid-Liquid Reactions
8. Sol-Gel, Coating
9. Solvothermal, Hydrothermal
10. Sonochemistry, Co-precipitation, Microemulsion
11. Solid-State Reactions
12. Ceramics, Microwave
13. Nanomaterials
14. Characterization of Inorganic Materials
15. Design of Inorganic Chemistry Research

#### Recommended Literatures

1. Ningsih S.K.W. 2016. Sintesis Anorganik. UNP Press. Padang.
2. Huheey, J.E., Keiter, E.A., and Keiter, R.L., 1993, Inorganic Chemistry, Principles of Structure and Reactivity, 4th ed., Harper Collins College Publisher, New York
3. Skoog, D.A et al. 2001. Principles of instrumental analysis, fifth edition, Harcourt Publisher.

### FST 6096353 Cosmetic and Medicinal Chemistry

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                            | Cosmetic and Medicinal Chemistry                                                                                                                                                                                                                                                                                                                                                                                               |
| Module level, if applicable                                                            | Advance                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Module Identification Code                                                             | FST 6096353                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught                                              | 6                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Person(s) responsible for the module                                                   | Dr. La Ode Sumarlin, M. Si                                                                                                                                                                                                                                                                                                                                                                                                     |
| Language                                                                               | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                                                          |
| Relation in Curriculum                                                                 | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                         |
| Teaching methods, Contact hours                                                        | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. In one semester, there is also one industry guest lecturer from a relevant industry. |
| Workload                                                                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                                                     |
| Credit points                                                                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                                             |
| Admission and examination requirements                                                 | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                                                   |
| Recommended prerequisites                                                              | Basic Biology and Basic Chemistry                                                                                                                                                                                                                                                                                                                                                                                              |
| Media employed                                                                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                                                          |
| Forms of assessment                                                                    | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                                                                                                             |
| Intended Learning Outcome                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1. Students are able to recognize the history of medicine in Islam and support aspects |                                                                                                                                                                                                                                                                                                                                                                                                                                |

of Islamic integration.

Students are able to implement and analyze basic chemical concepts in the field of cosmetics and medicine as well as data analysis and use them as alternative solutions based on research in the field of Cosmetics and Medicine.

#### Module content

1. A Brief History of Medicine in Islam
2. Treatment in the Qur'an
3. Medicine
4. Route of drug administration
5. Medicinal Biopharmaceuticals
6. Receptors and Mechanism of Action of Drugs
7. Relationship of Structure and Activity
8. Alcohol in Drugs and Cosmetics
9. Cosmetic Restrictions
10. Natural and artificial cosmetics for Antiaging
11. Anti Acne, Hair and Hair Coloring
12. Critical point of halal cosmetics and medicine
13. Skin Cosmetics and Hypopigmentation Agents
14. Surfactants and Natural Pigments in Cosmetics

Chemical evaluation of the safety of cosmetic active ingredients.

#### Recommended Literatures

1. Sumarlin, L. 2020. Cosmetic and Medicinal Chemistry. PUSLITPEN LP2M UIN Syarif Hidayatullah Jakarta.
2. Tranggono, RI, Fatma L. 2007. Handbook of Cosmetic Science. Gramedia. Jakarta.
3. Important Medicines. Efficacy, Uses and side effects. Drs Tan Hoan Tjay and Drs Kirana Rahardja. Elex Media Komputindo. Jakarta
4. Article in various titles related to drugs and cosmetics.
5. Meyer R. Rosen, 2015. Harrys cosmeticology 9th Edition Volume 3 Full Online. Chemical Publishing Company

**FST 6096354 Environmental Impact Management Analysis (AMDAL)**

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Environmental Impact Management Analysis (AMDAL)                                                                                                                                                                                                                                                                                                                                                                               |
| Module level, if applicable               | Advance                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Module Identification Code                | FST 6096354                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Person(s) responsible for the module      | Dr. Hendrawati, M. Si                                                                                                                                                                                                                                                                                                                                                                                                          |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                                                          |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                         |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. In one semester, there is also one industry guest lecturer from a relevant industry. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                                                     |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                                             |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                                                   |
| Recommended prerequisites                 | Environmental Chemistry                                                                                                                                                                                                                                                                                                                                                                                                        |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                                                          |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                                                                                                             |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <ol style="list-style-type: none"> <li>1. Students are able to predict and solve environmental impact problems that arise from a plan of human activities in the environment, both at the Preconstruction, Construction, Operational and Post-Operational stages.</li> <li>2. Students are able to provide recommendations for environmental management and monitoring, both positive impacts and negative impacts on environmental components.</li> <li>3. Students are able to make decisions whether an activity/project is feasible or not environmentally feasible by considering physical, chemical, biological, socio-economic, socio-cultural and public health aspects (these aspects are studied through surveys to the community and also analysis of environmental components in the laboratory).</li> <li>4. Students analyze the use of natural resources that have an impact on the environment with an AMDAL approach</li> <li>5. Students understand the concepts and problems of natural resources</li> <li>6. Students understand environmentally sound natural resource management</li> <li>7. Students understand the relationship between position and natural resources</li> <li>8. Students master the concept of AMDAL as a tool for environmentally sound resource management</li> </ol> |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <ol style="list-style-type: none"> <li>1. Introduction to the History of the Development of Environmental Impact Analysis (AMDAL)</li> <li>2. Spatial Planning and Amdal</li> <li>3. National Policy on Environmental Protection and Management</li> <li>4. Economic and Environmental Linkages</li> <li>5. Development Activity Plan</li> <li>6. Screening of Amdal PPLH 05 of 2012</li> <li>7. Scoping (Geo-physical, Social Affairs, Biology)</li> <li>8. Alternative Studies in Amdal Studies</li> <li>9. Impact Forecasting</li> <li>10. RELIABLE Train Preparation</li> <li>11. Data Analysis Retrieval Method (MPAD)</li> <li>12. Environmental Management Plan and Environmental Monitoring Plan (RKL-RPL)</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| ANDAL Document Creation and RKL-RPL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Recommended Literatures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Mandatory:</b></p> <ol style="list-style-type: none"> <li>1. Fandeli, C. 2001. <i>Environmental Impact Analysis, Basic Principles and Exposure in Development</i>. Liberty, Yogyakarta.</li> <li>2. Fandeli, C. 2014. <i>Conservation Business, A New Approach in Resource and Environmental Management</i>, Gadjah Mada University Press, Yogyakarta.</li> <li>3. Mitchel B. B. Setiawan, and Dwita Hadi Rahmi. 2000. <i>Resource and Environmental Management</i> (Translation). Yogyakarta: Gadjah Mada</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

**Suggestion**

1. Anonymous. 2009. Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management
2. Anonymous. 2012. Government Regulation Number 27 of 2012 concerning Environmental Permits
3. Barton DN. 1994. *Economic Factor and Valuation of Tropical Coastal Resouces*. Norway: SMR Report University of Bergwn.
4. Baiquni, M. 2007. *Livelihood Strategies in Times of Crisis*, Ideas Media Yogyakarta.
5. Bruce Mitchell. 2000. *Resource and Environmental Management*, Gadjah Mada University Press, Yogyakarta
6. B. Setiawan. 2000. *Resource and Environmental Management*, Gadjah Mada University Press, Yogyakarta
7. Canter LW. 1977. *Environmental Impact Assessment*. New York: Mc Graw Hill
8. Dantje T. Sambel. 2015. *Environmental Toxicology*, Andi Offset
9. Fandeli, C. 2001. *Environmental Impact Analysis, Basic Principles and Presentation in Development*. Liberty, Yogyakarta.
10. Fandeli, C. 2014. *Conservation Business, A New Approach in Resource and Environmental Management*, Gadjah Mada University Press, Yogyakarta.
11. Fandeli, C. 2013. *Environmental Audit*, Gadjah Mada University Press, Yogyakarta.
12. Foley G. 1993. *Global Warming, Who Feels Hot*, Kophalindo, Panos, Jakarta
13. Haerumah H. 1979. *Environmental Planning and Management*.
14. Heryando, P. 1994. *Heavy Metal Pollution and Toxicology*, Rineka Cipta
15. Hadi, SP. 1995. *Social Aspects of EIA. History, Theory and Method*. Gadjah Mada University Press, Yogyakarta.
16. Kardine E.S. Malik. 2007. *Environmental management*
17. Metcall & Eddy, 1979. *Waste Water Engineering Treatment Disposal House*. Second Edition, Mc Graw Hill Publishing Co., Ltd., New Delhi.
18. Soemarwoto, O. 2001. *Environmental Impact Analysis*, Gadjah Mada University Press, Yogyakarta.
19. Sonny, K. 2005. *Environmental Ethics*, Kompas Media Nusantara
20. Sudarmadji, Prof, 2009. *Diklat of Environmental Quality Standards Lecture, Department of Environmental Science, Postgraduate Program, Gadjah Mada University, Yogyakarta*.
21. Suryo Purwono, Ir, MASc, PhD, 2009. *Environmental Quality Standards and Pollution Management, Department of Environmental Science, Postgraduate Program, Gadjah Mada University, Yogyakarta*.
22. Syriac. 1990. *Population, Ecology & environment*
23. SU Ritohardoyo, Dr. M.A. 2009. *Human Ecology, Department of Environmental Sciences, Postgraduate Program, Gadjah Mada University, Yogyakarta*.

**FST 6096355 Toxicology**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Toxicology                                                                                                                                                                                                                                                                                                                                |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6096355                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Dr. Sri Yadiat Chalid, M.Si                                                                                                                                                                                                                                                                                                               |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                      |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                                     |

### Intended Learning Outcome

Students are expected to understand the following topics: Definition, Absorption & distribution of toxic substances, Metabolism of toxic substances, Reactive metabolism, Elimination of toxic substances, Xenobiotic metabolism modification, Acute toxicity, Chronic toxicity: carcinogenesis, mutagenesis, teratogenesis, Target organ toxicity, Classes of toxic chemicals, Free radicals, Design of in vitro and in vivo research with experimental animals.

### Module content

1. Lecture contract and lecture orientation
2. Definitions of toxicology, xenobiotics, toxins
3. Absorption and distribution of toxicants
4. Metabolism of toxicants
5. Reactive metabolism
6. Elimination of toxicants
7. Modification of xenobiotic metabolism
8. Acute toxicity
9. Chronic toxicity: carcinogenesis, mutagenesis, teratogenesis
10. Target organs of toxicity
11. Classes of chemical toxicants
12. Free radicals (radikal bebas)
13. Antioxidants and sources
14. Testing antioxidant activity
15. Experimental animal research design
16. Extrapolation of data from experimental animals to humans

### Recommended Literatures

1. Dr.rer.nat. I Made Agus Gelgel Wirasuta, M.Si., Apt. Rasmaya Niruri, S.Si., General Toxicology
2. Basic Toxicology / Ted A. Loomis; translated by Imono Argo Donatus. State University of Malang. 1988
3. <https://www.journals.elsevier.com/toxicology>

Jurnal Radikal Bebas dan Antioksidan Elsevier

### FST 6096356 Food Safety Control

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Food Safety Control                                                                                                                                                                                                                                                                                                                       |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6096356                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Anna Muawanah, M.Si                                                                                                                                                                                                                                                                                                                       |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                      |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                                     |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

Students understand the principles and basic theories of food science, including knowledge of food materials and processing processes, to be applied in food safety control, guided by the food safety management system, which includes Standard Sanitation Operating Procedure (SSOP), Good Manufacturing Practice (GMP), and Hazard Analysis Critical Control Point (HACCP).

#### Module content

1. Concepts, Theories, and Food Safety Terms based on Regulations
2. Classification and Quality Standards for Food Products
3. Knowledge of Food Materials
4. Potential Critical Control Points for Food Product Damage
5. Principles of Food Processing at High and Low Temperatures
6. Principles of Food Processing without Temperature (Preservation with Salt, Sugar, and Acid)
7. Sanitation Standards in the Food Industry (SSOP)
8. GMP (Good Manufacturing Practice)
9. History and Principles of HACCP (Hazard Analysis Critical Control Point)
10. Implementation of HACCP (Hazard Analysis Critical Control Point)

11. Internal Audit of the HACCP Food Safety System
12. The Role of BPOM in the Food Safety System

#### Recommended Literatures

1. Food Law, Government Regulations, and Ministry of Health Regulations
2. Tien R. Muchtadi, 1997, Food Processing Technology, Laboratory Guidelines. IPB Bogor.
3. F.G. Winarno, 1999, Food Chemistry and Nutrition, Erlangga, Jakarta.
4. K.A Buckle et al., 1987, Food Science, Translated by Heru Purnomo Adiono, UIP, Jakarta.
5. F.G. Winarno, 2004, HACCP and Its Application in the Food Industry, MBrio Press, Bogor.
6. BPOM Good Manufacturing Practices, accessed from the BPOM website: <https://www.pom.go.id/new>

**FST 6096357 Biotechnology**

|                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                    | Biotechnology                                                                                                                                                                                                                                                                                                                             |
| Module level, if applicable                                                                                                                                                    | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                                                                                                                                                     | FST 6096357                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught                                                                                                                                      | 6                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module                                                                                                                                           | Nurul Amilia, M.Si                                                                                                                                                                                                                                                                                                                        |
| Language                                                                                                                                                                       | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                                                                                                                                                         | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours                                                                                                                                                | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                                                                                                                                                       | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                                                                                                                                                                  | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements                                                                                                                                         | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                                                                                                                                                      | Biochemistry                                                                                                                                                                                                                                                                                                                              |
| Media employed                                                                                                                                                                 | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                                                                                                                                                            | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                                     |
| Intended Learning Outcome                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                           |
| After completing this course, students are expected to understand the basic principles of biotechnology and be able to apply them in biotechnology-based research or industry. |                                                                                                                                                                                                                                                                                                                                           |

## Module content

1. History and Scope of Biotechnology
2. Basic Molecular Biology Concepts 1 (Prokaryotes, Eukaryotes, DNA, and RNA)
3. Basic Molecular Biology Concepts 2 (Gene Expression, Gene Regulation)
4. Basic Molecular Biology Concepts 3 (Proteins, Protein Synthesis, Protein Analysis Techniques)
5. Basic Molecular Biology Concepts 4 (DNA Extraction, PCR, Recombinant Technology)
6. Role of Bioinformatics
7. DNA Fingerprinting
8. Biotechnology Applications in Microbiology
9. Biotechnology Applications in the Food Industry
10. Biotechnology Applications in Agriculture and Animal Husbandry
11. Biotechnology Applications in Healthcare
12. Biotechnology Applications in Environmental and Energy Fields
13. Biodefense and Bioethics

## Recommended Literatures

1. Thieman & Palladino (2009). Introduction to Biotechnology. Pearson.
2. Susan Barnum (2004). Biotechnology: A Brief Introduction. Wadsworth Publishing.
3. Primrose SB (2001). Molecular Biotechnology. Panima Publishing.
4. Pasternak & Bernard (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press
5. Related Journals.

### FST 6096358 Radiation Chemistry and Applications

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Radiation Chemistry and Application                                                                                                                                                                                                                                                                                                                                                                                                 |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Module Identification Code                | FST 6096358                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Person(s) responsible for the module      | Nurmaya Arofah, M.Eng                                                                                                                                                                                                                                                                                                                                                                                                               |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                                                                                                               |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                                                                                                              |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. There is also one industry guest lecturer from a relevant industry or research institute. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                                                                                                          |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                                                                                                                  |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                                                                                                                        |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                                                                                                               |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                                                                                                                               |

## Intended Learning Outcome

Students are capable of providing alternative solutions related to issues related to the application of radiation in the field of chemistry

### Module content:

1. Introduction (History of Radiation: Atoms, Atomic Nuclei, and Radiation in the Qur'an)
2. Atomic Nucleus Structure and Composition
3. Radiation Sources, Types of Radiation, and Radioactive Decay Processes
4. Nuclear Reactions, Radiation Absorption, and Interaction with Matter
5. Radiolysis of Water
6. Effects of Radiation on Humans and Fundamentals of Radiation Protection
7. Effects of Radiation on Polymerization and Its Applications
8. Chemical Radiation Applications in Waste Management and Environmental Preservation
9. Chemical Radiation Applications in Food Preservation
10. Chemical Radiation Applications in the Energy Field

### Recommended Literatures

1. Spothheim, M., Mostafavi, M., Douki, T., And Belloni, J., 2008, Radiation Chemistry; From Basic to Application in Material and Life Sciences, L'actualité chimique, EDP Sciences, France.
2. Spinks, J.W.T. 1964, An Introduction To Radiation Chemistry, John Wiley & Sons, Sydney.
3. Additional: Sabarani, 2019, Atomic Structure Based on Chemistry and Quranic Perspective, Lantanida Journal Vol. 7 No. 1, 1-100.
4. Faires R.A & Boswed 1999, Radioisotope Laboratory Techniques.
5. Herald Enge, 1987, Introduction To Nuclear Physics.
6. Alatas, Z., et al, 2020, Smart Nuclear Book, National Nuclear Energy Agency.
7. Wardhana, Nuclear Technology "Radiation Protection and Its Applications," Andi, Yogyakarta.
8. Glenn F. Knoll 1989, Radiation Detection And Measurement.
9. Compilation of Nuclear Regulatory Legislation, Nuclear Energy Regulatory Agency (BAPETEN), Jakarta.
10. N. Nuryanthi, AR Syahputra, T Puspitasari, DS Pangerteni, R Kurniawan, 2020, Preparation of Zeolite-g-Polyacrylamide using Radiation-Induced Grafting and Its Adsorption Isotherms Study on Several Heavy Metal Ions, Macromolecular Symposia 391 (1).
11. TRD Larasati, N Mulyana, N Arofah, SP Sari, 2018, Reduction of Heavy Metals Cd (II) and Cr (VI) in a Continuous System Using Gamma-Irradiated Phanerochaete chrysosporium, Journal of Environmental Technology, 19 (1), 125-134.
12. AK Noor, P Ya'Puja, P Sugili, 2018, Effect of Gamma Irradiation, Coating, and Storage Duration on the Quality of Wet Crackers, National Seminar on Nuclear Technology Yogyakarta, 1978-0176.

### FST 6096359 Halal Food Analysis

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Halal Food Analysis                                                                                                                                                                                                                                                                                                                       |
| Module level, if applicable               | Advance                                                                                                                                                                                                                                                                                                                                   |
| Module Identification Code                | FST 6096359                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 6                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Dr. Sandra Hermanto, M.Si                                                                                                                                                                                                                                                                                                                 |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Atomic and Molecular Spectroscopy, Halal Food Standardization and Management                                                                                                                                                                                                                                                              |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                                                                                                                     |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

Students can understand and re-explain concepts related to food analysis, management of halal food laboratories, food regulations at the industrial level and in the community.

#### Module content

1. Basic Fundamentals of Halal Food Analysis
2. Conventional and Modern Food Analysis
3. Halal food analysis by Chromatography & Chemometric
4. Genomic & Proteomic for Halal Food Analysis
5. Method Validation of Halal Food Analysis

Halal Laboratory Management

#### Recommended Literatures

1. Dr. Yusuf Qardhawi, 1995, *Halal & Haram in Islam*.
  2. Mian N. Riaz, Muhammad M. Chaudry, 2004, *Halal Food Production*, CRC Press LLC, USA.
- Da Wen Sun. *Modern Technique for Food Authentication*, Elsevier 30 Corporate Drive, Suite 400, Burlington, MA 01803, USA

### FST 6096360 Additive Chemistry

|                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                                                                                                                                                                       | Additive Chemistry                                                                                                                                                                                                                                                                                                                        |
| Module level, if applicable                                                                                                                                                       | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                                                                                                                                                        | FST 6096360                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught                                                                                                                                         | 6                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module                                                                                                                                              | Anna Muawanah                                                                                                                                                                                                                                                                                                                             |
| Language                                                                                                                                                                          | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                                                                                                                                                            | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours                                                                                                                                                   | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                                                                                                                                                          | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                                                                                                                                                                     | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements                                                                                                                                            | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                                                                                                                                                         | Food Chemistry                                                                                                                                                                                                                                                                                                                            |
| Media employed                                                                                                                                                                    | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                                                                                                                                                               | Midterm exam 30%, Final exam 30%, Quiz 10%,<br>Structured assignment 30%                                                                                                                                                                                                                                                                  |
| Intended Learning Outcome                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                           |
| Students will understand the principles, theories, and applications of 27 types of food additives by discussing the chemical properties of food additive components, regulations, |                                                                                                                                                                                                                                                                                                                                           |

functions, and their utilization in food processing.

#### Module content

1. Antioxidants and Chelating Agents
2. Anti-Caking Agents and Humectants
3. Acidity Regulators and Carriers
4. Preservatives and Coatings
5. Flavors and Flavor Enhancers
6. Foaming and Firming Agents
7. Sweeteners and Antifoaming Agents
8. Colorants and Color Retention
9. Emulsifiers and Emulsifying Salts
10. Volume Enhancers and Flour Maturing Agents
11. Leavening Agents, Propellants, Packaging Gases, and Carbonating Substances
12. Gelling Agents, Thickeners, and Stabilizers

#### Substitutes for Banned Food Additives and Their Control

##### Recommended Literatures

1. Larry Branen, et al., 2002, food additive, Marcel Dekker, New York.
2. Smith, J., 1991, Food additive user's Handbook, Springer Science + Business Media, New York
3. El-Samragy, Y., 2016, Food additive, Ain Shams University Faculty of Agriculture Food Science Department Cairo, Egypt
4. Masagati, T., 2013, Chemistry of additive and Preservative, Wiley Blackwell, UK
5. Carolyn Fisher and Thomas R. 1997 Food Flavours. The Royal Society of Chemistry.
6. Belitz, H.D, and Grosch, W. 1999. Food Chemistry. Springer German
7. F.G. Winarno, 1999, Kimia Pangan dan Gizi, Erlangga, Jakarta.

De Man, J, 1992, Kimia Makanan, ITB press Bandung

**FST 6095237 Environmental Toxicology**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Enviromental Toxicology                                                                                                                                                                                                                                                                                                                   |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6095237                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 7                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Prof. Dr. Lily Surayya Eka Putri M.Env.<br>Stud Nurmaya Arofah M.Eng                                                                                                                                                                                                                                                                      |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | None                                                                                                                                                                                                                                                                                                                                      |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Midterm exam 30%, Final exam 30%, Quiz 10%,<br>Structured assignment 30%                                                                                                                                                                                                                                                                  |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

Students have an understanding of the impact of xenobiotics on the environment and human health.

#### Module content

1. Definition of Environment and Toxicology
  2. History of Environmental Toxicology in Islam
  3. Sources of Xenobiotics in the Environment
  4. Ecokinetics
  5. Effects of Xenobiotics on Humans
  6. Toxicokinetics and Toxicodynamics
  7. Factors Influencing Toxicity in the Environment (Biotic and Abiotic)
  8. Quantitative Toxicity Assessment
  9. Pesticide and Food Additive Toxicology
  10. Toxicology of Hazardous Metals
1. Toxicological Research on Air, Soil, and Water

#### Recommended Literatures

1. Manahan, Stanley E. (1992). Toxicological Chemistry. Tokyo: Lewis Publisher, second edition.
  2. Manahan, Stanley E. (1994). Environmental Chemistry. Tokyo: Lewis Publisher, sixth edition.
  3. Ardestani, M. M., Roja R, Mohammad M. Esfahani, O. H, Mohammad A. 2017, The Golden Age of Medieval Islamic Toxicology, Toxicology in the Middle Ages and Renaissance, Elsevier.
  4. Ghazi bin Muhammad, Reza Shah-Kazemi, and Alab Ahmed, 2010, The Holy Qur'an And The Environment the royal aal al-bayt institute for Islamic thought.
  5. Timbrell, J. 2000, Principles Of Biochemical Toxicology, UK Taylor & Francis.
- Sembel, D, T, 2015, Environmental Toxicology (Impact of Pollution from Various Chemicals in Everyday Life), Andi, Yogyakarta

**FST 6096362 Zeolite**

|                                           |                                                        |
|-------------------------------------------|--------------------------------------------------------|
| Module Name                               | Zeolite                                                |
| Module level, if applicable               | Undergraduate                                          |
| Module Identification Code                | FST 6096362                                            |
| Semester(s) in which the module is taught | 7                                                      |
| Person(s) responsible for the module      | Dr. Yusraini DIS, M.Si<br>Yulyani Nur Azizah, M.Si     |
| Language                                  | English and Indonesia                                  |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry |

|                                        |                                                                                                                                                                                                                                                       |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching methods, Contact hours        | The course topics are delivered through Collaborative learning & discussion-based which are enriched with relevant examples and followed by short group discussion. There are also two industry guest lecturers from the chemical synthesis industry. |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours            |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                    |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                          |
| Recommended prerequisites              | Inorganic Reactivity Structure<br>Transition Metals and Coordination Chemistry                                                                                                                                                                        |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                 |
| Forms of assessment                    | Midterm exam 30%, Final exam 30%, Quiz 10%,<br>Structured assignment 30%                                                                                                                                                                              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <ol style="list-style-type: none"> <li>1. Students are able to understand and explain the history, structure, and unique properties of zeolites.</li> <li>2. Students can explain and identify natural zeolite materials and synthetically produced zeolites through spectrofotometry/diffractogram characterization.</li> <li>3. Students can comprehend the principles of zeolite activity in various industrial applications such as ion exchange, catalysis, adsorption, and fertilizer.</li> </ol> |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <ol style="list-style-type: none"> <li>1. History and Understanding of Zeolites</li> <li>2. Natural Zeolites and Synthetic Zeolites</li> <li>3. Zeolite Structure</li> <li>4. Zeolite Synthesis Process</li> <li>5. Identification and Characterization of Zeolites</li> <li>6. Zeolites as Catalysts</li> <li>7. Zeolites as Adsorbents</li> <li>8. Zeolites as Ion Exchangers</li> <li>9. Zeolites as Fertilizers</li> </ol>                                                                          |
| Recommended Literatures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. Cejka, J., Bekkum, H.V., Corma, A., Schuth., F. (2007). Introduction to Zeolites: Science and Practice 3rd Edition. Elsevier: Hungary.</li> <li>2. Barrer Article (1940)</li> <li>3. Flanigen Article (1970)</li> <li>4. Journal Articles Related to Zeolite Applications</li> </ol>                                                                                                                                                                          |

**FST 6096363 Bioorganic**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Bioorganic                                                                                                                                                                                                                                                                                                                                |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6096363                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 7                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Tarso Rudiana,M.Si                                                                                                                                                                                                                                                                                                                        |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |
| Recommended prerequisites                 | Organic Chemistry I and II                                                                                                                                                                                                                                                                                                                |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Media employed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Classical teaching tools with white board and PowerPoint presentation |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30% |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                       |
| Students have an understanding of the theory and/or basic concepts of the utilization of natural organic compounds and their testing methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                       |
| Module content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                       |
| <ol style="list-style-type: none"> <li>1. "Bioactive compounds, pathways, and classification"</li> <li>2. "Techniques for separation and isolation of bioactive compounds"</li> <li>3. "Biological analysis methods"</li> <li>4. "Scaling up the production of natural products"</li> <li>5. "Quality testing of natural materials and their products"</li> <li>6. "Investigation of compound structures from nature and synthesis with biological activities"</li> <li>7. "Chemical structure-activity relationship"</li> <li>8. "Biological activities of organic compounds: antioxidants"</li> <li>9. "Biological activities of organic compounds: antibacterial"</li> <li>10. "Biological activities of organic compounds: degenerative diseases (anticancer)"</li> <li>11. "Biological activities of organic compounds: degenerative diseases (antidiabetes)"</li> </ol> |                                                                       |
| Recommended Literatures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                       |
| <ol style="list-style-type: none"> <li>1. Dewick, P.M., 2009, Medicinal Natural Products : A Biosynthetic Approach, 3rd ed., John Wiley &amp; Sons, West Sussex.</li> <li>2. Stanforth, S.P., 2006, Natural Product Chemistry at a Glance, Wiley-Blackwell Publishing, India.</li> <li>3. Sarker S.D., 2006, Natural Products Isolation, Humana Press, New Jersey.</li> <li>4. Siswandono dan Soekardjo, 2002. Kimia Medisinal. AUP.</li> <li>5. Harmita dan Radji. 2002. Analisis Hayati. EGC.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                    |                                                                       |

### FST 6096364 Biochemical Laboratory Technique

|                                           |                                  |
|-------------------------------------------|----------------------------------|
| Module Name                               | Biochemical Laboratory Technique |
| Module level, if applicable               | Advance                          |
| Module Identification Code                | FST 6096364                      |
| Semester(s) in which the module is taught | 7 (Seven)                        |

|                                        |                                                                                                                                                                                                                                                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Person(s) responsible for the module   | Dr. Sandra Hermanto, M.Si                                                                                                                                                                                                                      |
| Language                               | English and Indonesia                                                                                                                                                                                                                          |
| Relation in Curriculum                 | Elective course for undergraduate program in Chemistry                                                                                                                                                                                         |
| Teaching methods, Contact hours        | The course topics are delivered through a combination of theoretical instruction, hands-on laboratory practice, demonstrations, data analysis, and safety training which are enriched with relevant examples and followed by short discussion. |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours     |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                             |
| Admission and examination requirements | Enrolled in this course<br>• Minimum 80% attendance in lecture                                                                                                                                                                                 |
| Recommended prerequisites              | Structure and Function of Biomolecule                                                                                                                                                                                                          |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                          |
| Forms of assessment                    | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                          |
| Intended Learning Outcome              |                                                                                                                                                                                                                                                |

1. Students are able to choose and develop methods of analysis and characterization of biomolecules as well as being skilled at using biochemical research instruments such as autoclave, shaking incubator, laminar flow, pH-meter, spectrophotometer, centrifuge, DNA & Protein electrophoresis equipment, PCR tools and DNA Sequencer.
2. Students are able to apply biochemical research techniques in isolation, characterization and analysis of biomolecular species in a sample matrix.
3. Students are able to use various instrumental and non-instrumental techniques to isolate, characterize and analyze biomolecules.

#### Module content

1. Introduction to working in a biochemistry laboratory (work safety, solution preparation work and buffers, media formulation and sterilization)
2. Biomolecular Isolation Techniques (Cell lysis, Centrifugation, Dialysis, Precipitation and Crystallization)
3. Biomolecular Analysis Technique I (Carbohydrate & Lipid Test)
4. Biomolecular Separation & Purification Techniques (Chromatography)
5. Biomolecular Analysis Technique II (Kinetics/Enzyme Activity)
6. Biomolecular Analysis Techniques III (Measurement of protein/DNA content)
7. Biomolecular Analysis Technique IV (DNA and Protein Electrophoresis)
8. PCR (Polymerization Chain Reaction)
9. DNA sequencing

#### Bioinformatics in the Field of Biochemistry

#### Recommended Literatures

1. W. Mahn, *Fundamentals of Laboratory Safety*; Physical hazards in Academic Laboratory (1991), Van Nostrand Reinhold, New York.
2. E. Layne, in Method of Enzymology, Vol III, "*Spectrophotometric and Turbidimetric method For Measuring Protein*", Academic Press, New York.
3. David W. Burden & Donald B. Whitney, "*Biotechnology, Protein to PCR, A Course in Strategies and Lab Techniques*", Birkhauser, Boston, USA.

Rodney F. Boyer, 1993, "*Modern Experimental Biochemistry*", Second Edition, Benjamin Cummings Publishing, California, USA.

### FST 6096120 Natural Resource Management (PSDAL)

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Natural Resource Management (PSDAL)                                                                                                                                                                                                                                                                                                       |
| Module level, if applicable               | Advance                                                                                                                                                                                                                                                                                                                                   |
| Module Identification Code                | FST 6096120                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 7                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Dr. Hendrawati, M. Si                                                                                                                                                                                                                                                                                                                     |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective courses for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                   |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | <p>Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h</p> <p>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.</p> <p>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h</p> <p>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h</p> <p>Total = 82.6 hours</p>                                                                         |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | <p>Enrolled in this course</p> <p>Minimum 80% attendance in lectur</p>                                                                                                                                                                                                                                                                    |
| Recommended prerequisites                 | Environmental Chemistry                                                                                                                                                                                                                                                                                                                   |
| Media employed                            | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                                                                                                                     |
| Forms of assessment                       | Post Test (MCQ) Quiz (20%), Report (10%), Presentation (10%), UTS (30%), UAS (30%)                                                                                                                                                                                                                                                        |
| Intended Learning Outcome                 |                                                                                                                                                                                                                                                                                                                                           |

1. Students understand the concepts and problems of natural resources.
2. Students understand environmentally sound natural resource management
3. Students understand the relationship between position and natural resources
4. Students master the concept of AMDAL as a tool for environmentally sound resource management Identify various natural resources in the air, land and waters
5. Students can analyze the process of natural resource management that is environmentally sound
6. Students can analyze the relationship between population and natural resources
7. Students can analyze the use of natural resources that have an impact on the environment with a Quantitative and Qualitative Environmental Analysis approach

#### Module content

1. Introduction
2. Global environmental issues
3. Natural resource issues
4. Basic concepts of sustainable development (SDGs)
5. Regulations related to the empowerment of natural resources
6. Forest resources
7. Land resources
8. Water Resources
9. Air Resources
10. Marine and coastal resources
11. Energy and Mineral Resources
12. Population
13. The Role of Amdal in PSDA

#### Recommended Literatures

##### **Main:**

1. Syriac. 1990. Population, Ecology & environment
2. Kardine E.S. Malik. 2007. Environmental management
3. Mitchel B. B. Setiawan, and Dwita Hadi Rahmi. 2000. Resource and Environmental Management (Translation). Yogyakarta: Gadjah Mada University Press.

##### **Supporter:**

4. Anonymous. 2009. Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management
5. Anonymous. 2012. Government Regulation Number 27 of 2012 concerning Environmental Permits
6. Barton DN. 1994. Economic Factor and Valuation of Tropical Coastal Resouces. Norway: SMR Report University of Bergwn.
7. Baiquni, M. 2007. Livelihood Strategies in Times of Crisis, Ideas Media Yogyakarta.
8. Bruce Mitchell. 2000. Resource and Environmental Management, Gadjah Mada University Press, Yogyakarta
9. B. Setiawan. 2000. Resource and Environmental Management, Gadjah Mada

University Press, Yogyakarta

10. Canter LW. 1977. Environmental Impact Assessment. New York: Mc Graw Hill
11. Dantje T. Sambel. 2015. Environmental Toxicology, Andi Offset
12. Fandeli, C. 2001. Environmental Impact Analysis, Basic Principles and Exposure in Development. Liberty, Yogyakarta.
13. Fandeli, C. 2014. Conservation Business, A New Approach in Resource and Environmental Management, Gadjah Mada University Press, Yogyakarta.
14. Fandeli, C. 2013. Environmental Audit, Gadjah Mada University Press, Yogyakarta.
15. Foley G. 1993. Global Warming, Who Feels Hot, Kophalindo, Panos, Jakarta
16. Haerumah H. 1979. Environmental Planning and Management.
17. Heryando, P. 1994. Heavy Metal Pollution and Toxicology, Rineka Cipta
18. Hadi, SP. 1995. Social Aspects of EIA. History, Theory and Method. Gadjah Mada University Press, Yogyakarta.
19. Kardine E.S. Malik. 2007. Environmental management
20. Metcall & Eddy, 1979. Waste Water Engineering Treatment Disposal House. Second Edition, Mc Graw Hill Publishing Co., Ltd., New Delhi.
21. Soemarwoto, O. 2001. Environmental Impact Analysis, Gadjah Mada University Press, Yogyakarta.
22. Sonny, K. 2005. Environmental Ethics, Kompas Media Nusantara
23. Sudarmadji, Prof, 2009. Diktat of Environmental Quality Standards Lecture, Department of Environmental Science, Postgraduate Program, Gadjah Mada University, Yogyakarta.
24. Suryo Purwono, Ir, MASc, PhD, 2009. Environmental Quality Standards and Pollution Management, Department of Environmental Science, Postgraduate Program, Gadjah Mada University, Yogyakarta.
25. Syriac. 1990. Population, Ecology & environment
26. SU Ritohardoyo, Dr. M.A. 2009. Human Ecology, Department of Environmental Sciences, Postgraduate Program, Gadjah Mada University, Yogyakarta.

**FST 6096365 Biofuels**

|                                           |                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Name                               | Biofuel                                                                                                                                                                                                                                                                                                                                   |
| Module level, if applicable               | Undergraduate                                                                                                                                                                                                                                                                                                                             |
| Module Identification Code                | FST 6096365                                                                                                                                                                                                                                                                                                                               |
| Semester(s) in which the module is taught | 7                                                                                                                                                                                                                                                                                                                                         |
| Person(s) responsible for the module      | Drs. Dede Sukandar,<br>M.Si Isalmi Aziz                                                                                                                                                                                                                                                                                                   |
| Language                                  | English and Indonesia                                                                                                                                                                                                                                                                                                                     |
| Relation in Curriculum                    | Elective course for undergraduate program in Chemistry                                                                                                                                                                                                                                                                                    |
| Teaching methods, Contact hours           | The course topics are delivered through a combination of project-based learning and problem-based learning, where each student or group is assigned a problem project presented in class for discussion. Additionally, debates on current topics related to the subject matter are conducted to enhance critical thinking and engagement. |
| Workload                                  | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours                                                                                                |
| Credit points                             | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                                                                                                                        |
| Admission and examination requirements    | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                                                                                                                              |

|                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Recommended prerequisites                                                                                                                                                                                                                                                                                                                                                                               |                                                                       |
| Media employed                                                                                                                                                                                                                                                                                                                                                                                          | Classical teaching tools with white board and PowerPoint presentation |
| Forms of assessment                                                                                                                                                                                                                                                                                                                                                                                     | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30% |
| Intended Learning Outcome                                                                                                                                                                                                                                                                                                                                                                               |                                                                       |
| After completing this course, it is expected that students will be able to explain and identify various biofuels, as well as describe the manufacturing process and their physical and chemical properties.                                                                                                                                                                                             |                                                                       |
| Module content                                                                                                                                                                                                                                                                                                                                                                                          |                                                                       |
| <ol style="list-style-type: none"> <li>1. Introduction to Vegetable Fuel</li> <li>2. Biodiesel</li> <li>3. Bio hydrocarbon</li> <li>4. Bioethanol</li> <li>5. Bio-oil</li> <li>6. Biogas</li> <li>7. Bio briquette</li> </ol>                                                                                                                                                                           |                                                                       |
| Recommended Literatures: <ol style="list-style-type: none"> <li>1. Bahan Bakar Nabati, Tim Nasional Pengembangan BBN, Penebar Swadaya, 2002</li> <li>2. Dari Sampah Plastik menjadi Bensin dan Solar, Wega Trisunaryanti, UGM Press, 2018</li> <li>3. Teknologi Minyak Bumi, A. Hardjono, UGM Press, 2015</li> <li>4. Artikel dalam berbagai judul yang berkenaan dengan bahan bakar nabati.</li> </ol> |                                                                       |

**FST 6096367 Computational Chemistry**

|                                           |                                            |
|-------------------------------------------|--------------------------------------------|
| Module Name                               | Computational Chemistry                    |
| Module level, if applicable               | Undergraduate                              |
| Module Identification Code                | FST 6096367                                |
| Semester(s) in which the module is taught | 7                                          |
| Person(s) responsible for the module      | Ahmad Fathoni, M.Si<br>Rudi Heryanto, M.Si |
| Language                                  | English and Indonesia                      |

|                                        |                                                                                                                                                                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relation in Curriculum                 | Elective course for undergraduate program in Chemistry                                                                                                                                                                                     |
| Teaching methods, Contact hours        | The course topics are delivered through theoretical instruction, hands-on computer-based exercises, software demonstrations, problem-solving sessions, and data analysis.                                                                  |
| Workload                               | Lecture (class): (2 CH x 50 min) x 14 weeks = 23.3 h<br>Structured activities: (1.5 h x 2 CH) x 14 weeks = 42 h.<br>Independent study: (0.5 h x 2 CH) x 14 weeks = 14 h<br>Exam: lecture 50 min x 2 CH x 2 w = 3.3 h<br>Total = 82.6 hours |
| Credit points                          | 2 Credit Hours $\approx$ 2.75 ECTS                                                                                                                                                                                                         |
| Admission and examination requirements | Enrolled in this course<br>Minimum 80% attendance in lecture                                                                                                                                                                               |
| Recommended prerequisites              | NOne                                                                                                                                                                                                                                       |
| Media employed                         | Classical teaching tools with white board and PowerPoint presentation                                                                                                                                                                      |
| Forms of assessment                    | Midterm exam 30%, Final exam 30%, Quiz 10%, Structured assignment 30%                                                                                                                                                                      |

### Intended Learning Outcome

Students will be able to explore computational chemistry to help improve their advanced understanding of chemistry, understand the principles of chemical representation and how to manage its information, and be able to use various software for chemical information analysis, presentation, and visualization, including the determination and prediction of molecular characteristics

### Module content

1. Lecture Contracts and Lecture Orientation
2. Molecular Representation
3. Chemical Information Databases: PubChem & ChemSpider
4. ChemSketch
5. MS Excel for Data Analysis
6. Advanced MS Excel (Excel+)
7. Curve Fitting
8. Curve Fitting with Auto2Fit
9. Chemical Similarity
10. Structure-Activity Relationship (SAR) / Structure-Property Relationship (SPR)
11. HyperChem
12. QSAR with HyperChem

### Recommended Literatures

1. An Introduction to Chemoinformatics. Andrew R. Leach, V.J. Gillet. Springer Science & Business Media,
2. Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems By David Young (CytoclonalPharmaceutics Inc.). Wiley-Interscience :New York. 2001. xxvi + 382 pp.
3. A guide to Microsoft Excel 2013 for Scientists and Engineers. Liengme, B. V. (2016).