Module Description

Module name	Medical Instrumentation
Module level, if applicable	Bachelor of Science
Code, if applicable	23H02132403
Subtitle, if applicable	-
Course, if applicable	-
Semester(s) in which the module is taught	6th
Person responsible for the module	Prof. Dr. Arifin, M.T.
Lecturer	1. Prof. Dr. Arifin, M.T. 2. Prof. Dr. Syamsir Dewang, M.Sc. 3. Dr. Ir. Bidayatul Armynah, M.T.
Language	Indonesian Language [Bahasa Indonesia]
Relation to Curriculum	Undergraduate degree program, elective, 6th semester
Type of teaching, contact hours	Teaching methods: [Focus group discussion], [~~simulation~~], [~~case study~~], [collaborative learning], [~~project-based learning~~], [~~problem-based learning~~]. Teaching forms: [lecture], [~~tutorial~~], [seminar], [~~practicum~~], [~~research~~], [~~internship~~], [~~community service~~] CH: 08.00 - 16.00
Workload	For this course, students are required to meet a minimum of 136.00 hours in one semester, which consist of: - 40.00 hours for lecture, - 48.00 hours for structured assignments, - 48.00 hours for private study.

Credit points	3 credit points (equivalent with 5.1 ECTS)
Requirements according to the examination regulations	Students have participated in at least 80% of the learning activities (Academic Regulations, Chapter VII)
Recommended prerequisites	Physics Electronics 1, Physics Electronics 2 and Instrumetation System
Module objectives/intended learning outcomes	After completing the course, Students are able: **Intended Learning Outcomes (ILO):** **ILO 1:** Students will have relatively deep understood in classical and basic quantum physics. [ILO 1] – Kn **ILO 2:** Students will be able to use the fundamental principles of physics in modeling and computation to solve the complex physical problem. [ILO 2] – Kn **ILO 3:** Students will be able to use the basic principles of physics in technology application. [ILO 3] – Kn **Course Learning Objective (CLO):** 1. Mastering the basic concepts of medical instrumentation. 2. Mastering the fundamental principles of sensors. 3. Mastering knowledge about technology and its application in amplifiers and signal processing. 4. Mastering knowledge about physics-based technology and its application in the basics of biopotentials, biopotential electrodes, and biopotential amplifiers. 5. Applying logical, critical, systematic, and innovative thinking in measuring blood pressure and heart rate, as well as blood flow and volume. 6. Applying logical, critical, systematic, and innovative thinking in measuring the respiratory system and chemical biosensors. 7. Able to formulate physical symptoms and problems through analysis based on observation and/or experimentation in clinical laboratory instrumentation and medical imaging systems. 8. Able to formulate physical symptoms and problems through analysis based on observation and/or experimentation in therapy equipment, prosthetics, and electrical safety systems. **Sub CLO:**

	ILO 1 ⇒ CLO-1: Able to explain the principles and applications of physics & instruments in the basic concepts of medical instrumentation ILO 1 ⇒ CLO-2: Able to explain the principles and applications of physics & instruments in the basic principles of sensors ILO 2 ⇒ CLO-3: Able to master knowledge of technology and its application in the manufacture of amplifiers & signal processing in medical instrumentation ILO 2 ⇒ CLO-4: Able to master knowledge of technology and its application to the basics of biopotentials, biopotential electrodes & biopotential amplifiers in medical instrumentation ILO 3 ⇒ CLO-5: Able to apply logical, critical, systematic and innovative thinking in measuring blood pressure & heart rate as well as measuring blood flow & volume. ILO 3 ⇒ CLO-6: Able to apply logical, critical, systematic and innovative thinking in measuring respiration system and chemical biosensors. ILO 3 ⇒ CLO-7: Able to identify clinical laboratory instruments & medical imaging systems. ILO 3 ⇒ CLO-8: Able to identify therapeutic & prosthetic equipment as well as electrical safety systems.
Content	Students will learn about: 1. Basic Concepts of Medical Instrumentation 2. Principles of Sensors 3. Amplifiers and Signal Processing 4. Basics of Biopotentials 5. Biopotential Electrodes 6. Biopotential Amplifiers 7. Blood Pressure and Heart Rate Measurement 8. Blood Flow and Volume Measurement 9. Respiratory System Measurement 10. Chemical Biosensors 11. Clinical Laboratory Instrumentation 12. Medical Imaging Systems 13. Therapy Equipment & Prosthetics 14. Electrical Safety Systems
Forms of Assessment	Assessment techniques: [~~observation~~], [~~participation~~], [~~performance~~], [written test], [~~oral test~~] Assessment forms: [~~quiz~~], [mid examination], [final examination], [assignment], [~~report~~], [~~presentation~~]

	Assignment = 40% Mid examination = 30% Final examination = 30% CLO 1 ⇒ ILO 1: Mid examination number 1 (5%) (Mid examination: written text) CLO 2 ⇒ ILO 1: Mid examination number 2 (5%) (Mid examination: written text) CLO 3 ⇒ ILO 2: Mid examination number 3 (5%) (Mid examination: written text) CLO 4 ⇒ ILO 2: Question in Assignment 1 (20%) Mid examination number 4 (5%) Mid examination number 5 (5%) Mid examination number 6 (5%) (Assignment: written text and mid examination: written text) CLO 5 ⇒ ILO 3: Final examination number 1 (5%) (Final examination: written text) CLO 6 ⇒ ILO 3: Final examination number 2 (5%) (Final examination: written text) CLO 7 ⇒ ILO 3: Question in Assignment 2 (20%) Final examination number 3 (5%) Final examination number 4 (5%) (Assignment: written text and final examination: written text) CLO 8 ⇒ ILO 3: Final examination number 5 (5%) Final examination number 6 (5%) (Final examination: written text)
Study and examination requirements and forms of examination	**Study and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade. **Form of examination:** Written exam: Essay
Media employed	LED, Whiteboard, Learning Management System (SIKOLA)
Reading list	**Main:** 1. John G. Webster, Medical Instrumentation, Application and Design, 4th Edition, John Wiley & Sons, 2010. 2. R. S. Khandpur, Biomedical Instrumentation, Technology and Applications, 2nd Edition, Tata Mc Graw Hill, 2003. **Support:** 1. David Prutchi & Michael Norris, Design and Development of Medical Electronic Instrumentation, John Wiley & Sons, 2005.