ANDHRAPRADESHSTATECOUNCILOFHIGHEREDUCATION B.Sc HONOURS

CHEMISTRY : MAJOR

w.e.f - AY - 2023-24

Course structure

SEMESTER	Course Code	Title	Hr/ week	Credits
I	1	EssentialsandapplicationsofMathematical,Physicaland Chemical sciences	5	4
	2	AdvancesinMathematical,PhysicalandChemicalsciences	5	4
II	3	General&InorganicChemistry-(T)	3	3
		General&InorganicChemistry-(P)	2	1
	4	InorganicChemistry-I- (T)	3	3
		InorganicChemistry-I- (P)	2	1
III	5	FundamentalsinOrganicChemistry- (T)	3	3
		FundamentalsinOrganicChemistry- (P)	2	1
	6	OrganicChemistry(Halogen&OxygenOrganicCompounds)- (T)	3	3
		OrganicChemistry(Halogen&OxygenOrganicCompounds- (P)	2	1
	7	PhysicalChemistry-I(SolutionsandElectrochemistry)-(T)	3	3
		PhysicalChemistry-I(SolutionsandElectrochemistry)-(P)	2	1
	8	Inorganic&PhysicalChemistry-(T)	3	3

		Inorganic&PhysicalChemistry-(P)	2	1
IV	9	PhysicalChemistry-II(StatesofMatter,PhaseRule&surface Chemistry) - (T)	3	3
		PhysicalChemistry-II(StatesofMatter,PhaseRule&surface Chemistry) - (P)	2	1
	10	General&PhysicalChemistry- (T)	3	3
		General&PhysicalChemistry- (P)	2	1
	11	NitrogencontainingOrganicCompounds&Spectroscopy.- (T)	3	3
		NitrogencontainingOrganicCompounds&Spectroscopy.- (P)	2	1
V	12 A	AnalyticalMethodsinChemistry-Quantitativeanalysis	3	3
		AnalyticalMethodsinChemistry-Quantitativeanalysis	2	1
		OR		
	12 B	EnvironmentalChemistry	3	3
		EnvironmentalChemistry	2	1
	13A	ChromatographyandInstrumentalmethodsofAnalysis	3	3
		ChromatographyandInstrumentalmethodsofAnalysis	2	1
		OR		
	13 B	GreenChemistryandNanotechnology	3	3
		GreenChemistryandNanotechnology	2	1
	14 A	SyntheticOrganicChemistry		
		SyntheticOrganicChemistry		

		OR		
	14 B	IndustrialChemistry-FertilisersandSurfacecoatings		

		IndustrialChemistry-FertilisersandSurfacecoatings		
	15 A	AnalysisofOrganicCompounds		
		AnalysisofOrganicCompounds		
		OR		
	15 B	IndustrialChemistry-Polymersandwateranalysis		
		IndustrialChemistry-Polymersandwateranalysis		
VI		Internship		
VII	16 A	Inorganic Chemistry:Advance Studies in Complexes andGroup theory	3	3
		InorganicChemistry:AdvanceStudiesinComplexesandGroup theory	2	1
		OR		
	16 B	InorganicMaterialsofIndustrialimportance	3	3
		InorganicMaterialsofIndustrialimportance	2	1
	17 A	SpectroscopyofOrganiccompounds	3	3
		SpectroscopyofOrganiccompounds	2	1
		OR		
	17 B	StereoChemistryandNaturalProducts	3	3
		StereoChemistryandNaturalProducts	2	1

	18 A	PhysicalChemistry:Thermodynamics,Electrochemistryand Chemical Kinetics.	3	3
		PhysicalChemistry:Thermodynamics,Electrochemistryand Chemical Kinetics.	2	1

		OR		
	18 B	InstrumentalMethodsofChemicalAnalysis	3	3
		InstrumentalMethodsofChemicalAnalysis	2	1
SEC	19 A	Green Chemistry	3	3
		Green Chemistry	2	1
		OR		
	19 B	AnalysisofDrugs,Foods,DairyProducts&BioChemical Analysis		
		AnalysisofDrugs,Foods,DairyProducts&BioChemicalAnalysis		
	20 A	PolymerChemistry		
		PolymerChemistry		
		OR		
	20 B	IndustrialChemicalsandEnvironment		
		IndustrialChemicalsandEnvironment		
		OpenOnlinetransdisciplinarycourse		
	21 A	InorganicChemistry:MetalCluster,Electronicspectraof Complex compounds and Bio- inorganic chemistry		

VIII		InorganicChemistry:MetalCluster,Electronicspectraof Complex compounds and Bio- inorganic chemistry		
		OR		
	21 B	OrganometallicChemistry		
		OrganometallicChemistry		
	22 A	Modern Organic synthesisandNaturalProductsModern		

		Modern Organic synthesisandNaturalProductsModern		
		OR		
	22 B	ChemistryofNatural products		
		ChemistryofNatural products		
	23 A	PhysicalChemistry:QuantumAndMolecularSpectroscopy		
		PhysicalChemistry:QuantumAndMolecularSpectroscopy		
		OR		
	23 B	AnalyticalMethodsofAnalysis		
		AnalyticalMethodsofAnalysis		
SEC	24 A	PharmaceuticalandMedicinalChemistry		
		PharmaceuticalandMedicinalChemistry		
		OR		
	24 B	PesticidesandGreenChemistry		
		PesticidesandGreen Chemistry		
	25A	CorrosionandItsPrevention		

		OR		
		CorrosionandItsPrevention		
	25 B	Material&EnergyBalancesandUtilitiesinChemicalIndustry		
		Material&EnergyBalancesandUtilitiesinChemicalIndustry		
		Open Online transdisciplinarycourse		

I-SEMESTER

COURSE1:ESSENTIALS AND APPLICATIONS OF MATHEMATICAL,PHYSICAL AND CHEMICAL SCIENCES

Hours: 5hrs/week Credits:4

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. Thecourse aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enablingthem toapply scientificprinciples toreal-world situations.

Learningoutcomes:

1. Applycriticalthinkingskillstosolve complexproblemsinvolvingcomplex numbers, trigonometric ratios, vectors, and statistical measures.
2. To Explain the basic principles and concepts underlying a broad range of fundamentalareas of physics and to Connect their knowledge of physics to everyday situations
3. To Explain the basic principles and concepts underlying a broad range of fundamentalareas of chemistry and to Connect their knowledge of chemistry to daily life.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical

Principles canbeusedtoexplain and predict phenomena indifferent contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALSOFMATHEMATICS: 9hrs

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus- Amplitude form and conversions

TrigonometricRatios:TrigonometricRatiosandtheirrelations–Problemsoncalculationof

angles Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems Statistical Measures: Mean, Median, Mode of a data and problems

UNITII:ESSENTIALSOFPHYSICS: 9hrs

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNITIII:ESSENTIALSOFCHEMISTRY:: 9hrs

efinitionandScopeofChemistry-Importanceof Chemistryindailylife-Branchesofchemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV:APPLICATIONSOFMATHEMATICS,PHYSICS&CHEMISTRY:9hrs

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNITV:ESSENTIALS OFCOMPUTERSCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommendedbooks:

1. FunctionsofonecomplexvariablebyJohn.B.Conway,Springer- Verlag.

2. ElementaryTrigonometrybyH.S.Halland S.R.Knight

3. VectorAlgebrabyA.R.Vasishtha,KrishnaPrakashanMedia(P)Ltd.4.BasicStatisticsby B.L.Agarwal, New age international Publishers

5. UniversityPhysicswith ModernPhysicsby Hugh D.Young andRogerA.Freedman

6. FundamentalsofPhysics byDavidHalliday,Robert Resnick,andJearlWalker

7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.

8. PhysicsforTechnologyand Engineering"byJohnBird

9. Chemistryin dailylifebyKirpalSingh

10. Chemistryofbiomolecules byS. P. Bhutan

11. FundamentalsofComputers byV.Raja Raman

12. CyberSecurityEssentialsbyJamesGraham,RichardHoward,Ryan Olson

STUDENTACTIVITIES

UNIT I:ESSENTIALSOF MATHEMATICS:

1:ComplexNumber Exploration

Providestudentswithasetofcomplex numbersinboth rectangularandpolar forms.

Theywillplotthecomplexnumbersonthecomplexplaneandidentifytheirproperties2: Trigonometric Ratios Problem Solving

Givestudentsasetofproblemsthatrequirethecalculationoftrigonometricratiosandtheir relations.

Studentswillsolvetheproblemsusingtheappropriatetrigonometricfunctions(sine,cosine, tangent, etc.) and trigonometric identities.

3:VectorOperationsandApplications

Providestudentswithaset ofvectorsinCartesianform.

Students will perform vector additionand subtraction operations tofind the resultantvectors.They will also calculate the scalar and vector products of given vectors.

4:StatisticalMeasuresandDataAnalysis

Givestudentsadatasetcontainingnumericalvalues.

Studentswillcalculatethemean,median,andmodeofthedata,aswellasotherstatistical measures if appropriate (e.g., range, standard deviation).

Theywillinterprettheresultsandanalyzethecentraltendenciesand distributionofthe data.

UNITII: ESSENTIALSOF PHYSICS:

1. Concept Mapping

Dividestudents intogroups andassign eachgrouponeof the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encouragestudentstousevisualelements,arrows,andlabelstorepresentconnectionsand interdependencies between concepts.

2. LaboratoryExperiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Providethenecessarymaterials,instructions,andsafetyguidelinesforconductingthe experiment.

Studentswillworkinsmallgroupstocarryouttheexperiment,collectdata,andanalyzethe results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNITIII:ESSENTIALSOF CHEMISTRY

1:Chemistry inDaily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life wherechemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

2:PeriodicTable Exploration

Providestudents withacopy ofthe periodictable.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3:ChemicalChangesandClassificationofMatter

Provide students with various substances and chemical reactions, such as mixing acids andbases or observing a combustion reaction.

Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4:BiomoleculesInvestigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.

Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

Theycancreateinformativeposters orpresentationstopresent theirfindingstothe class.

UNITIV:APPLICATIONS OFMATHEMATICS, PHYSICS &CHEMISTRY

1:InterdisciplinaryCaseStudies

Dividestudentsintosmallgroupsandprovidethemwithinterdisciplinarycasestudiesthat involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2:DesignandInnovationProject

Challengestudentstodesignanddevelopapracticalsolutionorinnovationthatintegrates mathematics, physics, and chemistry principles.

Studentscanchooseaspecificproblemorareaofinterest,suchasrenewableenergy, environmental conservation, or materials science.

3:LaboratoryExperiments

Assignstudentslaboratoryexperimentsthatdemonstratethepracticalapplicationsof mathematics, physics, and chemistry.

Examplesincludeinvestigatingtherelationshipbetweenconcentrationandreactionrate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

.4:MathematicalModeling

Presentstudentswithreal-worldproblemsthat requiremathematicalmodelingand analysis.

UNITV:ESSENTIALSOFCOMPUTER SCIENCE:

1. Identifyingtheattributesofnetwork(Topology,serviceprovider,IPaddressand bandwidth of
2. yourcollegenetwork)andpreparereportcovering networkarchitecture.
3. Identifythetypesofmalwaresandrequiredfirewallstoprovide security.
4. LatestFraudtechniquesusedbyhackers.

I -SEMESTER

COURSE 2: ADVANCESINMATHEMATICAL,PHYSICALANDCHEMICAL SCIENCES

Hours:5hrs/week Credits:4

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them tothelatestdevelopmentsinthesedisciplines,fosteringcriticalthinking,researchskills,andthe ability to contribute to scientific advancements.

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.
2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.
3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.
3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.
5. Understandandconvertbetweendifferentnumbersystems,suchasbinary,octal,decimal,and hexadecimal. Differentiate between analog and digital signals and understand their characteristics.Gainknowledgeofdifferenttypesoftransmissionmedia,suchaswired(e.g.,

coppercables,fiberoptics)andwireless(e.g.,radiowaves,microwave,satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS 9hrs

Straight Lines: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines

LimitsandDifferentiation:Standardlimits –Derivativeofafunction –Problemsonproduct rule and quotient rule

Integration: Integrationasareverseprocessofdifferentiation–Basicmethodsofintegration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNITII:ADVANCES INPHYSICS: 9hrs

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNITIII:ADVANCES IN CHEMISTRY:9hrs

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNITIV:ADVANCEDAPPLICATIONSOFMATHEMATICS,PHYSICS&CHEMISTRY 9hrs

MathematicalModellingapplicationsinphysicsandchemistryApplicationofRenewableenergy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine,

Applicationofbiophysics:BiophysicalImaging,Biomechanics,Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solidwastemanagement,Environmentalremediation-GreenTechnology,Watertreatment. UNIT V:

Advanced Applications of computer Science 9hrs

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommendedbooks:

1. CoordinateGeometrybyS.L.Lony,ArihantPublications

2. CalculusbyThomasand Finny, PearsonPublications

3. MatricesbyA.R.VasishthaandA.K.Vasishtha,KrishnaPrakashanMedia(P)Ltd.

4. "RenewableEnergy:PowerforaSustainable Future"byGodfreyBoyle

5. "EnergyStorage:ANontechnicalGuide"byRichardBaxter

6. "Nanotechnology:PrinciplesandApplications"bySulabha K. KulkarniandRaghvendra A. Bohara

7. "Biophysics:AnIntroduction"byRodneyCotterill

8. "MedicalPhysics:Imaging" byJamesG. Webster

9. "ShapeMemoryAlloys: PropertiesandApplications" byDimitrisC. Lagoudas

10. NanomaterialsandapplicationsbyM.N.Borah

11. EnvironmentalChemistry by Anil.K.D.E.

12. DigitalLogicDesignbyMorrisMano

13. DataCommunication& NetworkingbyBahrouzForouzan.

STUDENTACTIVITIES

UNITI:ADVANCES IN BASIC MATHEMATICS

1:StraightLines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

2:LimitsandDifferentiationProblemSolving

Studentswillapplythe conceptoflimits tosolvevariousproblemsusingstandard limits.

Encouragestudentstointerprettheresultsandmakeconnectionstoreal-worldapplications, such as analyzing rates of change or optimizing functions.

3:Integration Exploration

Students will explore theconcept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or

integrationbyparts.

Studentscandiscussthesignificanceofintegrationinvariousfields,suchasphysicsand chemistry

4:MatricesManipulation

Studentswillperformoperationsonmatrices,includingscalarmultiplication,matrix multiplication, and matrix transpose.

Studentscanapplytheirknowledgeofmatricestoreal-worldapplications,suchassolving systems of equations or representing transformations in geometry.

UNITII:ADVANCES INPHYSICS:

1:CaseStudies

Providestudentswithreal-worldcasestudiesrelatedtorenewableenergy,nanotechnology, biophysics, medical physics, or shape memory materials.

Studentswillanalyzethecasestudies,identifythechallengesorproblemspresented,and propose innovative solutions based on the recent advances in the respective field.

They will consider factors such as energy generation, energy storage, efficiency,

sustainability,materialsdesign,biomedicalapplications,ortechnologicaladvancements.

2:ExperimentalDesign

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

Theywill discusstheimplicationsoftheirexperimentalresultsinthecontextofrecentadvances in the field.

3:GroupDiscussionandDebate

Organize a group discussion or debate session where students will discuss the ethical, social,and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNITIII:ADVANCES IN CHEMISTRY:

1. ExperimentalDesignand Simulation

Insmallgroups,students willdesignexperimentsorsimulationsrelatedtotheassignedtopic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.

Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.

Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

2. CaseStudiesandDiscussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.

Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.

For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

3:Group Project

Assignstudentsto workin groupsto developa projectrelated tooneofthe topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.

Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.

Encouragecreativity,critical thinking,andcollaborationthroughoutthe project.

UNITIV:ADVANCEDAPPLICATIONSOFMATHEMATICS,PHYSICS& CHEMISTRY

1:MathematicalModellingExperiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.

Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.

Theywilldiscusstheaccuracyand limitationsoftheirmodel,proposeimprovements, and

interpret the implications of their findings in the context of renewable energy or the specific application area.

2:CaseStudies andGroup Discussions

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.

Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery ofradiation therapy in medical physics or designing a mathematical model to optimize waste management practices.

Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.

Encouragecreativity,criticalthinking,andcollaborationthroughouttheproject. UNIT

V: Advanced Applications of computer Science

1. Students must be able to convert numbers from other number system to binary number systems

2. Identifythenetworkingmediausedforyourcollegenetwork

3. Identifyallthenetworkingdevicesusedinyourcollegepremises.