MARUDHAR KESARI JAIN COLLEGE FOR WOMEN (AUTONOMOUS)

Vaniyambadi – 635 751

PG & Research Department of Physics

for

Undergraduate Programme

Bachelor of Physics

From the Academic Year 2025-2026

CONTENT

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE AND POSTGRADUATE EDUCATION

1. Preamble

The curriculum for the U.G. Physics for universities and colleges is revised as per Learning Outcomes- based Curriculum Framework (LOCF). The learner centric courses are designed to enable the students to progressively develop a good understanding of the concepts of various domains in physics. Significant modification is the inclusion of the courses to equip students to face challenges in industries and make them employable. Skill development in different spheres and confidence building are given a special focus.

PROGRAMME OUTCOMES (PO)

Programme	**B.Sc., Physics**
Programme Code	**US10**
Duration	**3Years[UG]**
Programme Outcomes	**PO1:** Acquire knowledge in Physics to apply the knowledge in their day-to-day life for betterment of self and society. **PO2:** Develop critical, analytical thinking and problem-solving skills **PO3:** Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret, and draw conclusion from data. **PO4:** Address and develop solutions for societal and environmental needs of local regional and national development. **PO5:** Work independently and engage in lifelong learning and enduring proficient progress. **PO6:** Provoke employability and entrepreneurship among students along with ethics andcommunication skills. **PO7:** Understand the importance of ethical behavior in business contexts and be able to recognize and address ethical dilemmas they may encounter in their professional careers. **PO8:** Prepared for lifelong learning and professional development, including the ability to adapt to changes in technology, business practices, and economic conditions throughout their careers.
Programme Specific Outcomes:	**PSO1: Placement**: Acquire the ability to critically analyze complex real life problems using the laws of Physics with appropriate mathematical tools and thereby preparing the students to face various state/national level competitive exams. **PSO2: Entrepreneur:** Acquire employability and entrepreneurial skills through hands-on training in basic as well as advanced areas of Physics and to develop innovative scientific solutions for industrial and societal needs at local, regional, national and global levels. **PSO3: Contribution to the Society:** Create skills required for identifying socially relevant research problems, collection of data, analyze and interpret data leading to knowledge enhancement in addressing the societal challenges.

Eligibility for Admission:

Candidates for admission to the first year of the Bachelor of Physics course shall be required to have passed the 12th (Mathematics and Physics is the compulsory paper) by the Government of Tamilnadu or any equivalent.

Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation		25 Marks
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand / Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview	
Application (K3)	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Semester - I						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA11/24UFUR11	Tamil – I/Urdu-I	4	1	0	0	3
24UFEN11	English - I	4	1	0	0	3
24UPHC11	CC- I Properties of Matter & Acoustics	3	1	2	0	5
24UPHC12P	CC- II Practicals -I Properties of Matter & Acoustics	0	0	4	0	3
24UMAA13	EC-I Mathematics-I	3	1	0	0	3
24UPHS11/ 24UPHS12	SEC- I Home Electrical Installation/ Energy Physics	2	0	0	0	2
24UPHS13/ 24UPHS14	SEC – II Physics for Every Day Life / Astrophysics	1	1	0	0	2
24UPHF11	FC – Introductory Physics	1	1	0	0	2
TOTAL					**30**	23

Semester - III						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA31	Tamil - 3	4	1	0	0	3
24UFEN31	English - 3	4	1	0	0	3
24UPHC31	CC –5 General and Classical Mechanics	3	1	2	0	5
24UPHC32P	CC – 6 Practical III - Electricity	0	0	4	0	2
24UCHA31	EC - III Allied Chemistry - I	3	1	0	0	4
24UCHA32P	EC – IV Practical Allied Chemistry-I	0	0	2	0	2
24UPHS31/ 24UPHS32	SEC –IV 1. Nanoscience and Nanotechnology 2. Physics of Medical Instruments	1	0	1	0	2
24UAEC31	AEC – 2 Human Values and Professional Ethics	1	1	0	0	2
TOTAL					**30**	**23**

Semester - II						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA21	Tamil – II/Urdu - II	4	1	0	0	3
24UFEN21	English – II	4	1	0	0	3
24UPHC21	CC – III Heat & Thermodynamics and Statistical Physics	3	1	2	0	5
24UPHC22P	CC - IV Practical -II Heat & Thermodynamics and Statistical Physics	0	0	4	0	3
24UPHA21	EC-II Mathematics II	4	2	0	0	5
24UPHS21	SEC – III Elements of Computer Science	1	0	1	0	2
24UAEC21	AEC – I Life Skill through Yoga	1	1	0	0	2
TOTAL					**30**	**23**

Semester – IV						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA41	Tamil – 4	4	1	0	0	3
24UFEN41	English – 4	4	1	0	0	3
24UPHC41	CC – Optics and Laser Physics	5	1	0	0	5
24UPHC42P	CC – 8 Practical IV- Light Experiments	0	0	4	0	2
24UCHA41/ 24UPHA42	EC – V 1. Allied Chemistry – II 2.Numerical Methods and Programming in C	3	1	0	0	4
24UCHA41P/ 24UPHA42P	EC – VI 1. Chemistry Practical for Physical and Biological Sciences-II 2.Practical - Numerical Methods and Programming in C	0	0	2	0	2
24UPHS41	SEC –1. Physics Workshop Skills	1	1	0	0	2
24UAEC41	AEC – 3 Environmental Studies and Disaster Management	1	1	0	0	2
TOTAL					**30**	**23**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHC31	**GENERAL AND CLASSICAL MECHANICS**	Core	5	0	0	0	5	5	25	75	100

Learning Objectives

LO1	To have a basic understanding of the laws and principles of mechanics.
LO2	To apply the concepts of forces existing in the system.
LO3	To understand the forces of physics in everyday life
LO4	To analyse the theory and application of rigid body motion
LO5	To apply Lagrangian equation to solve complex problems

Unit	Content	Hours
1	**LAWS OF MOTION:** Newton's Laws– forces – equations of motion- motion of a particle in a uniform gravitational field. Gravitation: Kepler's laws, Newton's law of gravitation – Determination of G by Boy's method -weightlessness – earth satellites – parking orbit – earth density -gravitational potential – escape velocity – potential and kinetic energy of satellite –Einstein's theory of gravitation – introduction –principle of equivalence.	15
2	**CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM:** conservation of linear and angular momentum – Internal forces and momentum conservation – center of mass-general elastic collision of particles of different masses – system with variable mass -conservation of angular momentum – torque due to internal forces – torque due to gravity.	15
3	**CONSERVATION LAWS OF ENERGY:** Introduction – significance of conservation laws – law of conservation of energy concepts of work- power – energy – conservative forces – potential energy and conservation of energy in gravitational and electric field- non-conservative forces – general law of conservation of energy.	15
4	**RIGID BODY DYNAMICS**: Translational and rotational motion – angular momentum – moment of inertia – general theorems of moment of inertia– rotation about fixed axis (solid and hollow sphere)– kinetic energy of rotation -body rolling along a plane surface – body rolling down an inclined plane – gyroscopic precision – gyrostatic applications.	15
5	**LAGRANGIAN MECHANICS**: generalized coordinates – degrees of freedom – constraints - principle of virtual work and D' Alembert's Principle –Lagrange's equation from D' Alembert's principle – application –simple pendulum – Atwood's machine.	15

CO	Course Outcomes Students will be able to
CO1	Apply the Newton's Law of motion, analyse general theory of relativity, Kepler's laws and realize the basic principles behind planetary motion.
CO2	Examine the conservation law of linear and angular momentum
CO3	Apply conservation law and calculate energy of various systems, understand and differentiate conservative and non-conservative forces
CO4	Examine rigid body dynamics and solve problems based on this concept
CO5	Appreciate Lagrangian system of mechanics, apply D' Alembert's principle
Textbooks:	
1	PJ.C.Upadhyaya, 2019, Classical Mechanics, Himalaya Publishing house, Mumbai.
2	P.DuraiPandian, LaxmiDuraiPandian, MuthamizhJayapragasam,2005, Mechanics, 6threvised edition, S.Chand& Co.
3	D. S. Mathur & P. S. Hemne, 2000, Mechanics, Revised Edition, S.Chand& Co.
4	Narayanamurthi, M.&Nagarathnam. N, 1998, Dynamics. The National Publishing,Chennai.
5	Narayanamurthi, M. and Nagarathnam, N, 1982, Statics, 18 Hydrostatics and Hydrodynamics, The National Publishers, Chennai.
Reference Books:	
1	Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesely.
2	Halliday, David & Robert, Resnick, 1995, Physics Vol.I. New Age, International, Chennai.
3	Halliday, David Robert Resnick and Walker Jearl, 2001, Fundamentals of Physics, John Wiley, New Delhi
Web resources:	
1	https://nptel.ac.in/courses/115103115
2	https://www.youtube.com/watch?v=p075LPq3Eas
3	https://onlinecourses.nptel.ac.in/noc22_me96/preview
4	https://onlinecourses.nptel.ac.in/noc21_me70/preview
5	https://www.youtube.com/watch?v=mH_pS6fruyg

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	2	3	3	3
CO2	3	3	3	3	3	2	3	2	3	3	3
CO3	2	3	3	2	3	2	3	2	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	2	3	2	3	3	3	3	3
Total	14	15	15	13	15	10	15	12	15	15	15
Average	**2.8**	**3**	**3**	**2.6**	**3**	**2**	**3**	**2.4**	**3**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHC32P	**PRACTICALS-III ELECTRICITY**	**Core**	0	0	4	0	2	4	25	75	100

Learning Objectives	
LO	To learn to construct circuits with concept of electricity, current, resistance in the path of current and different parameters.

Unit	Content	Hours
1	**Any eight experiments** 1. Calibration of low range and high range voltmeter using potentiometer 2. Calibration of ammeter using potentiometer. 3. Measurement of low resistances using potentiometer. 4. Determination of field along the axis of a current carrying circular coil. 5. Determination of earth's magnetic field using field along axis of current carrying coil. 6. Determination of specific resistance of the material of the wire using PO box. 7. Determination of resistance and specific resistance using Carey Foster's bridge. 8. Determination of internal resistance of a cell using potentiometer. 9. Determination of specific conductance of an electrolyte. 10. Determination of e.m.f of thermo couple using potentiometer 11. Determination of capacitance using Desauty's bridge and B.G./Spot galvanometer/head phone. 12. Determination of figure of merit of BG or spot galvanometer. 13. Comparison of EMF of two cells using BG. 14. Comparison of capacitance using BG.	60

CO	**Course Outcomes** Students will be able to
CO	Construct circuit and demonstrate the analysis of different parameter of electricity.

Textbooks:	
1	Dr. Srinivasan, Practical Physics Book, Chand & Co

2ND YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCHA31	**Allied Chemistry - I**	**EC-3**	**3**	**1**	**0**	**0**	**4**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To predict molecular properties using MO theory and analyze nuclear processes.
LO2	To classify and discuss fuel gases and silicone properties/applications.
LO3	To relate structure/bonding to properties using electronic effects.
LO4	To apply thermodynamic principles and interpret phase diagrams.
LO5	To perform volumetric calculations and select separation methods.

Unit	Content	Hours
1	**Chemical Bonding and Nuclear Chemistry**: Chemical Bonding: Molecular Orbital Theory - bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Applications of radioisotopes.	12
2	**Industrial Chemistry Fuels:** Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones.	12
3	**Fundamental Concepts in Organic Chemistry Hybridization:** Orbital overlap, hybridization and geometry of CH_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples.	12
4	**Thermodynamics and Phase Equilibria:** Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Phase Equilibria: Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).	12
5	**Analytical Chemistry:** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.	12

CO	Course Outcomes Students will be able to
CO1	Apply MO theory to predict molecular properties such as bond order and magnetism, and analyze nuclear processes including radioactive decay and nuclear reactions.
CO2	Classify various fuel gases and discuss the properties and applications of silicones in industrial and consumer contexts.
CO3	Correlate molecular structure and bonding with physical and chemical properties by analyzing electronic effects such as inductive, resonance, and hyperconjugation.
CO4	Utilize thermodynamic principles to analyze chemical systems and interpret phase diagrams to understand phase equilibria.
CO5	Conduct accurate volumetric calculations and select appropriate separation methods based on the physical and chemical properties of mixture components.
Textbooks:	
1.	F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus, "*Basic Inorganic Chemistry*", 3rd ed., Wiley, 1995.
2.	B.K. Sharma, "*Industrial Chemistry*", 16th ed., Goel Publishing House, 2017.
3.	Jonathan Clayden, Nick Greeves, Stuart Warren, Peter Wothers, "*Organic Chemistry*", 2nd ed., Oxford University Press, 2012.
4.	P.W. Atkins, J. de Paula, "*Atkins' Physical Chemistry*", 11th ed., Oxford University Press, 2017.
5.	Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, "*Fundamentals of Analytical Chemistry*", 9th ed., Cengage Learning, 2013.
Reference Books:	
1.	James E. Huheey, Ellen A. Keiter, Richard L. Keiter, "*Inorganic Chemistry: Principles of Structure and Reactivity*", 4th ed., Pearson, 1997.
2.	M.G. Fontana, "*Industrial Chemistry*", 3rd ed., McGraw-Hill, 2005.
3.	Paula Yurkanis Bruice, "*Organic Chemistry*", 8th ed., Pearson, 2016.
4.	J. Rajaram, J.C. Kuriacose, "*Thermodynamics for Chemists*", 1st ed., S Chand, 1999.
5.	Gary D. Christian, "*Analytical Chemistry*", 7th ed., Wiley, 2003.
Web resources:	
1.	www.khanacademy.org/science/chemistry
2.	https://chem.libretexts.org
3.	https://chem.libretexts.org/Bookshelves/Organic_Chemistry
4.	https://ocw.mit.edu/courses/chemistry/
5.	https://chem.libretexts.org/Bookshelves/Analytical_Chemistry

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	2	2	3	3	3
CO2	3	3	3	2	3	1	2	3	2	3	3
CO3	3	3	3	2	2	1	2	2	3	3	3
CO4	3	3	3	2	2	1	2	2	3	2	3
CO5	3	3	3	2	3	1	2	3	2	3	2
Total	15	13	13	10	13	05	10	12	13	14	14
Average	**3.0**	**3.0**	**3.0**	**2.0**	**2.6**	**1.0**	**2.8**	**2.4**	**2.6**	**2.8**	**2.8**

3 – Strong, 2- Medium, 1- Low

2ND YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCHA32P	**Allied Chemistry Practical - I**	**EC-4**	**0**	**0**	**2**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To perform standard titration procedures accurately.
LO2	To demonstrate proficiency in using volumetric glassware (burette, pipette, volumetric flask) and other laboratory equipment essential for titrations safely.
LO3	To perform stoichiometric calculations to determine the concentration of an unknown solution using titration data.
LO4	To explain the underlying chemical principles of the specific type of titration being performed (acid-base, redox, or complexometric).
LO5	To analyze titration data, including identifying sources of error and evaluating the precision and accuracy of their results.

Unit	Content	Hours
1	**VOLUMETRIC ANALYSIS** 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid.	6
2	3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate.	6
3	5. Estimation of potassium permanganate using standard sodium hydroxide.	6
4	6. Estimation of magnesium using EDTA.	6
5	7. Estimation of calcium using EDTA. 8. Estimation of ferrous ion using diphenyl amine as indicator.	6

SCHEME OF VALUATION

ALLIED CHEMISTRY PRACTICAL-I

(For Physics – II year/III Semester)

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Volumetric Analysis: 60 Marks

Volumetric Analysis : 60 Marks (Maximum)

Short Procedure : 10 Marks

Error upto 2 % : 50 Marks

2 to 3 % : 40 Marks

3 to 4 % : 30 Marks

4 to 5 % : 20 Marks

> 5 % : 10 Marks

Arithmetic error : Deduct 1 mark

Wrong calculation : Deduct 20 % of marks scored

No calculation : Deduct 40 % of marks scored

CO	Course Outcomes Students will be able to
CO1	Design, carry out, record and interpret the results of volumetric titration.
CO2	Gain an understanding of the safe use of standard flask and volumetric pipettes, burette.
CO3	Perform stoichiometric calculations to determine the concentration of unknown solutions using data obtained from titration experiments.
CO4	Explain the underlying chemical principles governing various types of titrations, including acid-base, redox, and complexometric titrations, and their applications.
CO5	Analyze titration data, identify potential sources of error, and evaluate the precision and accuracy of experimental results.
Textbooks:	
1.	A.I. Vogel, "*A Textbook of Quantitative Inorganic Analysis"*, 4th ed., Longman, 1978.
2.	J. Mendham, R.C. Denney, J.D. Barnes, M. Thomas, "*Vogel's Textbook of Quantitative Chemical Analysis"*, 6th ed., Pearson, 2000.
3.	Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, "*Fundamentals of Analytical Chemistry"*, 9th ed., Cengage Learning, 2013.
4.	Daniel C. Harris, "*Quantitative Chemical Analysis"*, 9th ed., W. H. Freeman, 2015.
5.	Larry G. Hargis, "*Analytical Chemistry: Principles and Techniques"*, 1st ed., Prentice Hall, 1988.
Reference Books:	
1.	Gary D. Christian, "*Analytical Chemistry"*, 7th ed., Wiley, 2013.
2.	Douglas A. Skoog, F. James Holler, Stanley R. Crouch, "*Principles of Instrumental Analysis"*, 7th ed., Cengage Learning, 2017.
3.	G. Svehla, "*Vogel's Qualitative Inorganic Analysis"*, 7th ed., Pearson, 1996.
4.	Douglas A. Skoog, Donald M. West, F. James Holler, "*Analytical Chemistry: An Introduction"*, 7th ed., Saunders College Publishing, 2000.
5.	David Harvey, "*Modern Analytical Chemistry"*, 1st ed., McGraw-Hill, 2000.
Web resources:	
1.	https://www.wiredchemist.com/chemistry/instructional/laboratory-tutorials/volumetric-analysis?utm_source=chatgpt.com
2.	https://www.coursesidekick.com/chemistry/1516334?utm_source=chatgpt.com
3.	https://www.youtube.com/watch?v=INN9pdpHte0&utm_source=chatgpt.com
4.	https://en.wikipedia.org/wiki/Titration?utm_source=chatgpt.com
5.	https://geo1.tcu.edu/richards/Lab%204.pdf?utm_source=chatgpt.com

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2	2	2	3	3	3
CO2	3	3	3	2	2	2	2	3	2	3	3
CO3	3	3	3	2	3	2	2	3	3	2	3
CO4	3	3	3	2	3	2	2	2	3	3	3
CO5	3	3	3	2	2	2	2	2	3	3	3
Total	15	15	15	10	13	10	10	12	14	14	14
Average	**3.0**	**3.0**	**3.0**	**2.0**	**2.6**	**2.0**	**2.0**	**2.4**	**2.8**	**2.8**	**2.8**

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHS31	NANOSCIENCE AND NANOTECHNOLOGY	Skill	2	0	0	0	2	2	25	75	100

Learning Objectives	
LO1	To comprehend the fundamental principles of Nanoscience and Nanotechnology.
LO2	To understand the properties of Nano-materials.
LO3	To study the different types of fabrication methods of preparations.
LO4	To analyze and study the characterization techniques of nanomaterials.
LO5	To understand the applications of nanomaterials.

Unit	Content	Hours
1	**NANOSCIENCE AND NANOTECHNOLOGY:** Nanoscale– nature and nanostructures – nanostructures: 0D, 1D,2D– surface to volume ratio– size effect -quantum confinement– metal based nanoparticles – nanocomposites (non-polymer based) – carbon nanostructures.	6
2	**PROPERTIES OF NANO-MATERIALS:** Mechanical behavior –elastic properties – hardness and strength – ductility and toughness –superplastic behavior – optical properties – surface plasmon resonance – electrical properties – dielectric materials and properties – magnetic properties – super paramagnetism – electrochemical properties – properties of CNTs.	6
3	**FABRICATION METHODS AND VACUUM TECHNIQUES:** Top down and bottom-up approaches – electrochemical method – chemical & physical vapour depositions (CVD & PVD) – plasma arc discharge – sputtering – thermal evaporation – pulsed laser deposition – ball milling – sol-gel methods – synthesis of CNT.	6
4	**CHARACTERIZATION TECHNIQUES:** Atomic force microscopy – scanning electron microscopy – transmission electron microscopy –powder XRD method: determination of structure and grain size analysis – UV-visible and photoluminescence spectroscopy.	6
5	**APPLICATIONS OF NANOMATERIALS:** Medicine: drug delivery – photodynamic therapy – molecular motors –energy: fuel cells – rechargeable batteries – supercapacitors– photovoltaics. sensors: nanosensors based on optical and physical properties – electrochemical sensors-nanoelectronics: nanorobots.	6

CO	Course Outcomes Students will be able to
CO1	Explain the fundamental principles of Nanoscience and Nanotechnology.
CO2	Analyse the properties of nanomateials
CO3	Identify and describe the different types of fabrication methods of preparations.
CO4	Describe the different methods of characterization techniques
CO5	Evaluate the economic and environmental benefits of applications of Nano-materials
Textbooks:	
1	K.K.Chattopadhyay and A.N.Banerjee, (2012), Introduction to Nanoscience and Nanotechnology, PHI Learning Pvt. Ltd.,
2	M.A. Shah, Tokeer Ahmad (2010), Principles of Nanoscience and Nanotechnology, Narosa Publishing House Pvt Ltd.
3	Mick Wilson, et al (2005) Nanotechnology, Overseas Press.
Reference Books:	
1	Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA
2	J.H.Fendler (2007) Nano particles and nano structured films; Preparation, Characterization and Applications, John Wiley & Sons
3	B.S.Murty, et al (2012) Textbook of Nanoscience and Nanotechnology, Universities Press
Web resources:	
1	https://www.ijnnonline.net/
2	http://www.sapub.org/journal/aimsandscope.aspx?journalid=1014
3	https://www.shiksha.com/engineering/nanotechnology-chp
4	https://www.coursera.org/courses?query=nanotechnology
5	https://onlinecourses.swayam2.ac.in/cec24_cy03/preview

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	3	3	3	3	3
CO2	2	2	2	2	2	2	3	2	3	3	3
CO3	2	2	3	2	2	3	3	2	3	3	3
CO4	2	3	2	3	2	2	3	2	3	3	3
CO5	3	3	2	2	2	3	3	3	3	3	3
Total	14	13	12	11	10	12	15	12	15	15	15
Average	**2.8**	**2.6**	**2.4**	**2.2**	**2**	**2.4**	**3**	**2.4**	**3**	**3**	**3**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHS32	PHYSICS OF MEDICAL INSTRUMENTS	Skill	2	0	0	0	2	2	25	75	100

Learning Objectives	
LO1	To learn about the modern tools and equipment used in measuring bio-potentials in medical practice and research.
LO2	To gain in-depth knowledge about the principles of bio-potential recording systems, including the ECG, EEG, and EMG.
LO3	To gain knowledge about the concept of diathermy and its applications in the operation theatre also explore the various radiation safety devices
LO4	To understand the working principle of CT, MRI scanning, which is based on X-rays and to create cross-sectional images of the body.
LO5	To identify the different types of radiography techniques and how X-rays are used in various diagnostic scenarios.

Unit	Content	Hours
1	**BIO-POTENTIALS AND ELECTRODES**: transport of ions through cell membrane- resting and action potential - Characteristics of resting potential – bio-electric potential– components of bio-medical instrumentation – electrodes – electrode potential -types of electrodes – the pH electrode.	6
2	**BIO-POTENTIAL BASED INSTRUMENTATION**: Electrocardiography (ECG)-ECG lead configuration–block diagram of ECG recording set up - Electroencephalography (EEG) – origin of EEG – action and evoked potentials - block diagram of modern EEG set up – electromyography (EMG) – block diagram of EMG recording setup.	6
3	**OPERATION THEATRE AND SAFETY**: diathermy – block diagram of the electrosurgical diathermy– shortwave, microwave, ultrasonic diathermy – ventilators. **RADIATION SAFETY:** units of radiation - pocket dosimeter – pocket type radiation alarm – thermo-luminescence dosimeter.	6
4	**MEDICAL IMAGING**: nuclear imaging technique –computer tomography (CT) – principle -construction –block diagram of CT scanner – ultrasonic imaging systems – construction of transducer – display modes – MRI principle and instrumentation.	6
5	**DIAGNOSTICS AND SPECIALITIES**:X-rays in radiography – fluoroscopy – comparison– image intensifiers – angiography – applications of X-ray. **LASER IN MEDICINE:** laser interactions with biomolecules – advantages of laser surgery – endoscopy – types of endoscopes with their operation.	6

CO	Course Outcomes Students will be able to
CO1	Explain the concept of bio-potentials, including the transport of ions through cell membranes and the mechanisms of resting and action potentials.
CO2	Evaluate the modern tools and equipment used in measuring bio-potentials in medical practice and research.
CO3	Describe various types of diathermy techniques (shortwave, microwave, ultrasonic) and their applications in surgery.
CO4	Draw and analyze the block diagram of a MRI, CT scanner, identifying each component's role in the imaging process.
CO5	Explain the principles behind laser therapy, its interactions with biological tissues, and its specific applications in surgery.
Textbooks:	
1	Biomedical Instrumentation and measurement, Leslie Cromwell, PHI, 2015
2	Medical Instrumentation, M. Arumugam, Anuradha agencies, 1992
3	Medical Electronics, M.J.Kumar Doss, Prathibha Publishers, 1987
Reference Books:	
1	Medical Physics, John R. Cameron and James G. Skofronick, Thrift books, Atlanta, 1985
2	Electronic Instruments and Instrumentation Technology, M. M.M.Anand, PHI, 2015
Web resources:	
1	https://www.bing.com/ck/a?!&&p=f19d807c5befca2859194ecc8eed68b8357654840f53f35e984d5916e380fcc3JmltdHM9MTczODcxMzYwMA&ptn=3&ver=2&hsh=4&fclid=39e87f5f-7d46-6aea-0730-6d5d7c8a6be4&psq=PHYSICS+OF+MEDICAL+INSTRUMENTS&u=a1aHR0cHM6Ly96bGliLnB1Yi9ib29rL2hhbmRib29rLW9mLWJpb21lZGljYWwtaW5zdHJ1bWVudGF0aW9uLTJnMWUxNTlhdXBsZw&ntb=1

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	3	3	3	3	3
CO2	2	2	2	2	2	2	3	2	3	3	3
CO3	3	2	3	3	2	3	3	2	3	3	3
CO4	2	3	2	3	2	2	3	2	3	3	3
CO5	3	3	2	3	2	3	3	2	3	3	3
Total	13	13	12	13	10	12	15	11	15	15	15
Average	**2.6**	**2.6**	**2.4**	**2.6**	**2**	**2.4**	**3**	**2.2**	**3**	**3**	**3**

SECONDYEAR–
SEMESTER III

AEC– 2

HUMANVALUESANDINDIANKNOWLEDGESYSTEM

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAEC31	**AEC – 2: HUMAN VALUES AND INDIAN KNOWLEDGESYSTEM**	AEC-2	1	1	0	0	2	2	25	75	100

Learning Objectives	
LO1	Toidentifyanddescribeuniversalhumanvalues(Truth,Love,Peace,Righteousness,andNon-violence).
LO2	To interpret Indian ethical concepts like Dharma, Karma, and Nishkama Karma.
LO3	TodiscusscontributionsofAryabhata,Charaka,Sushruta,andChanakyatoscienceand governance.
LO4	To Analyze ethical and scientific insights from Bhagavad Gita, Yoga Sutras, and Arthashastra.
LO5	ToApplyleadershipandmanagementlessonsfromIndiantraditionsinprofessionallife.

Unit	Content	Hours
1	**Introduction to Human Values:** Meaning and importance of human values - Universal human values: Truth, Love, Peace, Righteousness, and Non-violence –Role of ethics and morality in personal and professional life Value-based education and character building.	6
2	**Ethics and Decision Making:** Ethical theories: Utilitarianism, Deontology, and Virtue Ethics - Indian ethical concepts: Dharma, Karma, and Nishkama Karma - Ethical dilemmas and decision-making models-Application of human values in business, governance, and social life.	6
3	**Overview of Indian Knowledge System(IKS):** Meaning and scope of IKS-Vedic and Upanishad wisdom: Science, Logic, and Spirituality Contributions of ancient Indian scholars:	6

	Aryabhata, Charaka, Sushruta, Chanakya-Relevance of traditional knowledge in modern times.	
4	**Science, Sustainability, and Indian Traditions:** Indigenous knowledge and environmental sustainability - Ayurveda and holistic health systems Traditional Indian education system: Gurukul and knowledge etrans mission-Ethical and scientific insights from Indian texts: Bhagavad Gita, Yoga Sutras, Arthashastra.	6
5	**Practical Applications and Contemporary Relevance:** Indian knowledge system in modern science and technology - Leadership and management lessons from Indian traditions - Role of Yoga, Meditation, and Mindfulness in human well-being-Case studies on Ethical leadership and sustainable development.	6

CO	Course Outcomes
CO1	Understand the fundamental human values and their role in personal and professional life.
CO2	AnalyzeethicaltheoriesandIndianphilosophicalconceptsforethicaldecision-making.
CO3	Explore the Indian Knowledge System(IKS)and its contributions to science, philosophy, and governance.
CO4	Evaluate the role of traditional knowledge in sustainability, health, and education.
CO5	Apply Indian ethical principles and leadership lessons in contemporary challenges.

Textbooks:	
1	R.R.Gaur,R.Sangal,andG.P.Bagaria–*AFoundationCourseinHumanValuesandProfessional Ethics*, Excel Books,2019.
2	IntroductiontoIndianKnowledgeSystem-conceptsandapplications,BMahadevan,VinayakRajat Bhat, Nagendra Pavana RN,2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-02.
3	AtextbookofAyurvediyaPhysiology-Prof.Dr.YogeshChandraMishra,ChaukhambhaPublication, edition2018.
Reference Books:	
1	Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
2	Dr.GirishNathJha,Dr.UmeshKumarSinghandDiwakarMishra,ScienceandTechnologyinAncient Indian Texts, DK Print World limited,
3	SriAurobindo–*TheLifeDivine*,SriAurobindoAshram,1990.
4	M.Hiriyanna –*Indian Conception of Values*, Motilal Banarsidass,2005.
5	N.S.Ramaswamy–*Management Concepts from Indian Epics*, Bharatiya Vidya Bhavan, 1992.
Web resources:	
1	https://fssai.gov.in/***FSSAIManual***

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	3	3	2	2	3
CO2	3	2	2	3	2	2	3	2	3	2	3
CO3	3	3	3	2	3	3	2	3	3	3	2
CO4	2	2	3	2	2	3	2	3	2	3	3
CO5	3	3	3	2	3	2	2	3	2	3	3
Total	14	13	13	12	12	13	12	14	12	13	14
Average	2.8	2.6	2.6	2.4	2.4	2.6	2.4	2.8	2.4	2.6	2.8

3–Strong,2- Medium,1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHC41	**Optics and Laser Physics**	Core	5	1	0	0	5	6	25	75	100

Learning Objectives	
LO1	To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics;
LO2	To explain the behaviour of light in interference,
LO3	To understand the different phenomena of diffraction
LO4	To learn about the polarizer, analyser and its applications
LO5	To understand the working and applications of laser

Unit	Content	Hours
1	**LENS AND PRISMS:** Postulates of geometrical optics – thick and thin lenses – focal length, critical thickness, power and cardinal points of a thick lens. Lens: lens makers formula (no derivation) – aberrations: spherical aberration, chromatic aberrations, coma, and astigmatism– curvature of the field – distortion – chromatic aberrations methods. Prism: dispersion, deviation, aberrations - applications rainbows and halos, constant deviation spectroscope. Eyepieces: Huygen's and Ramsden's eyepieces, construction and working – merits and demerits of the eyepiece. Resolving power: Rayleigh's criterion for resolution – limit of resolution for the eye.	15
2	**INTERFERENCE:** Types of wave front, Fresnel's biprism – fringes with white light- interference in thin films due to (i) reflected light, (ii) transmitted light – colours of thin films -applications – air wedge – Newton's rings. Interferometers : Michelson's interferometer – applications, (i) determination of the wavelength of a monochromatic source of light, (ii) determination of the wavelength and separation D1 and D2 lines of sodium light, (iii) determination of a thickness of a mica sheet.	15
3	**DIFFRACTION:** Fresnel's assumptions – zone plate– differences between a zone plate and a convex lens –Fresnel type of diffraction – diffraction pattern due to a straight edge – positions of maximum and minimum intensities – diffraction due to a narrow slit – Fraunhofer type of diffraction – Fraunhofer diffraction at a single slit – plane diffraction grating– experiment to determine wavelengths – width of principal maxima.	15
4	**POLARISATION:** optical activity – polarizer and analyser–double refraction – optic axis, principal plane – Huygens's explanation of double refraction in uniaxial crystals – polaroids and applications – circularly and elliptically polarized light –quarter wave plate – half wave plate – production and detection of circularly and elliptically polarized lights – Fresnel's explanation – specific rotation – Laurent half shade polarimeter – experiment to determine specific rotatory power	15

5	**LASERS:** General principles of lasers – properties of lasers – spontaneous and stimulated emission – population inversion – optical pumping – Principle and working of He-Ne laser – CO_2 laser semiconductor laser – laser applications – holography.	15
CO	**Course Outcomes** Students will be able to	
CO1	Outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces	
CO2	Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer	
CO3	Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyze the optical instruments	
CO4	Interpret basic formulation of polarization and gain knowledge about polarimeter, appraise its usage in industries	
CO5	Understand the principle and various types of lasers and its applications in industries.	
Textbooks:		
1	Subramaniam. N & Brijlal, 2014,Optics, 25th edition, S.Chand &Co.	
2	R. Murugeshan and Kiruthiga Sivaprasath, 2003, Optics and Spectroscopy, S.Chand & Co.	
3	P.R.Sasikumar, 2012, Photonics, PHI Pvt Ltd, New Delhi.	
4	K.Rajagopal, 2008, Engineering Physics, PHI Pvt Ltd, New Delhi	
5	Sathya prakash, 1990, Optics, VII edition, Ratan Prakashan Mandhir, New Delhi.	
Reference Books:		
1	Agarwal B.S, 2011, Optics, Kedernath Ramnath Publishers, Meerut.	
2	Singh &Agarwal, 2002, Optics and Atomic Physics, 9th edition, Pragati Prakashan Meerut	
Web resources:		
1	https://science.nasa.gov/ems/	
2	https://www.youtube.com/watch?v=tL3rNc1G0qQandlist=RDCMUCzwo7UlGkb-8Pr6svxWo-LAandstart_radio=1andt=2472	
3	https://science.nasa.gov/ems/	
4	https://imagine.gsfc.nasa.gov/educators/gammarabursts/imagine/index.html	
5	http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/	

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	2	3	3	3	3
CO2	2	2	2	2	2	2	2	3	2	2	3
CO3	2	3	2	2	2	2	2	2	3	2	3
CO4	2	2	2	2	2	2	2	3	2	3	3
CO5	2	2	2	2	3	2	2	3	2	3	3
Total	11	12	10	10	11	10	10	14	12	13	15
Average	**2.2**	**2.4**	**2**	**2**	**2.2**	**2**	**2**	**2.8**	**2.4**	**2.6**	**3**

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHC41P	**Practical IV- Light Experiments**	Core	0	0	4	0	2	4	25	75	100

Learning Objectives	
LO1	To demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

Unit	Content (Any Eight Experiments)	Hours
1	1. Determination of refractive index of prism using spectrometer. 2. Determination of refractive index of liquid using hollow prism and spectrometer 3. Determination of dispersive power of a prism. 4. Determination of radius of curvature of lens by forming Newton's rings. 5. Determination of thickness of a wire using air wedge. 6. Determination of Cauchy's Constants. 7. Determination of resolving power of grating 8. Determination of resolving power of telescope 9. Comparison of intensities using Lummer Brodhum Photometer. 10. Determination of range of motion using Searlesgoniometer. 11. Verification of Newton's formula for a lens separated by a distance. 12. Determination of refractive index of a given liquid by forming liquid lens 13. Determination of refractive index using Laser. 14. Determination of wavelengths, particle size using Laser/Monochromatic source. 15. Determination of resolving power of Diffraction grating using Laser 16. Determination of wire using Laser. 17. Bi-prism – Determination of refractive index.	60

CO	Course Outcomes Students will be able to
CO1	Understand and demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.
Textbooks:	
1	Practical Physics by Srinivasan by Chand & Co Publication

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCHA41	**Allied Chemistry – II**	Elective	3	1	0	0	4	4	25	75	100

Learning Objectives	
LO1	To apply IUPAC nomenclature and theories of coordination chemistry, and experimentally determine the hardness of water using the EDTA or Zeolite methods.
LO2	To classify and illustrate the structures of carbohydrates and understand the properties of amino acids and the roles of DNA and RNA.
LO3	To explain the principles of galvanic cells and use them for conductometric titrations and pH determination, while also understanding buffer solutions and electroplating.
LO4	To determine the order of a reaction, calculate its half-life, and explain the role of catalysts and the Arrhenius equation.
LO5	To explain the core principles of photochemistry and the laws governing it, and describe the various processes of light absorption and emission.

Unit	Content	Hours
1	**Co-ordination Chemistry and Water Technology:** Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], [Ni(CN)4]2-, [Co(CN)6]3- Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis. Hardness of water, determination of hardness of water using EDTA method, zeolite method	12
2	**Carbohydrates and Amino acids:** Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose – fructose interconversion. Properties of starch and cellulose. Amino acids: Classification - preparation and properties of alanine. RNA and DNA (elementary idea only).	12
3	**Electrochemistry**: Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials – electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cellscorrosion and its prevention.	12
4	**Kinetics and Catalysis:** Order and molecularity. Integrated rate expression for I and II (2A Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.	12
5	**Photochemistry:** Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-Chloride and Hydroge-Bromide reaction. Jablonski Diagram - Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).	12

CO	Course Outcomes Students will be able to
CO1	To apply coordination chemistry principles to name complex compounds and to analyze the role of complexation in determining the hardness of water using volumetric methods.
CO2	To differentiate between major classes of carbohydrates and amino acids, illustrate their structures, and describe the fundamental biological functions of DNA and RNA.
CO3	To demonstrate an understanding of electrochemical cells and their applications, including the practical use of conductometric titrations and pH determination, as well as the principles of electroplating.
CO4	To experimentally determine reaction kinetics, predict reaction rates using the half-life and Arrhenius equation, and explain the function of different types of catalysis.
CO5	To explain the fundamental laws of photochemistry and apply them to describe processes of light absorption and emission, such as fluorescence and phosphorescence.
Textbooks:	
1	F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus, "Basic Inorganic Chemistry", 3rd ed., Wiley, 1995.
2	V.Veeraiyan, "Textbook of Ancillary Chemistry", High mount publishing house, Chennai, 1st ed., 2009
3	S.Vaithyanathan, "Text book of Ancillary Chemistry", Priya Publications, Karur, 2006.
4	Arun Bahl, B.S.Bahl, "Advanced Organic Chemistry", S.Chand and Company, New Delhi, 23rd ed., 2012.
5	P. W. Atkins, J. de Paula, J. Keeler, "Atkins' Physical Chemistry", Oxford University Press, Oxford, 11th ed., 2018.
Reference Books:	
1	James E. Huheey, Ellen A. Keiter, Richard L. Keiter, "Inorganic Chemistry: Principles of Structure and Reactivity", 4th ed., Pearson, 1997.
2	P.L.Soni, Mohan Katyal, "Text book of Inorganic Chemistry", Sultan Chand and Company, New Delhi, 20th ed., 2007.
3	Paula Yurkanis Bruice, "*Organic Chemistry*", 8th ed., Pearson, 2016.
4	P.L.Soni, H.M.Chawla, "Text Book of Organic Chemistry", Sultan Chand & Sons, New Delhi, 29th ed., 2007.
5	R.Puri, L.R.Sharma, M.S.Pathania, "Text book Physical Chemistry", Vishal Publishing Co., New Delhi, 47th ed., 2018.
Web resources:	
1	https://nou.edu.ng/coursewarecontent/CHM%20423%20MARCH%202021_0.pdf
2	https://byjus.com/chemistry/carbohydrates/
3	https://www.nagwa.com/en/explainers/269168626823/

4	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Kinetics
5	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Photochemistry

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	2	2	3	3	3
CO2	3	3	3	2	3	1	2	3	2	3	3
CO3	3	3	3	2	2	1	2	2	3	3	3
CO4	3	3	3	2	2	1	2	2	3	2	3
CO5	3	3	3	2	3	1	2	3	2	3	2
Total	15	15	15	10	13	5	10	12	13	14	14
Average	**3**	**3**	**3**	**2**	**2.6**	**1**	**2**	**2.4**	**2.6**	**2.8**	**2.8**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHA42	Numerical Methods and Programming in C	Elective	3	1	0	0	4	4	25	75	100

Learning Objectives	
LO1	Apply root-finding algorithms like Bisection, Newton-Raphson.
LO2	Use interpolation methods such as Lagrange and Newton's forward/backward formulas
LO3	To learn the basics of C programming
LO4	To learn about control structure in C
LO5	Analysis the convergence and efficiency of algorithms

Unit	Content	Hours
1	**NUMERICAL SOLUTIONS:** Determination of zeros of polynomials – roots of linear and nonlinear algebraic and transcendental equations – bisection and Newton-Raphson methods.	12
2	**NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING:** Newton's forward and backward interpolation – Lagrange's interpolation – principle of least squares – fitting a straight line and exponential curve – trapezoidal rule – Simpson's 1/3 and 1/8 rule.	12
3	**INTRODUCTION TO C:** Importance of C – basic structure of C programming – constants, variables and data types – character set, key words and identifiers – declaration of variables and data types – operators – expressions: arithmetic, relational, logical, assignment – increment and decrement – conditional – comma operators.	12
4	**CONTROL STRUCTURE:** decision making with if, if-else, nested if – switch – go to – break – continue –while, do while, for statements – arrays, one dimensional and two dimensional – declaring arrays simple programs.	12
5	**ALGORITHM, FLOW CHART AND PROGRAM:** Development of algorithm – flow chart for solving simple problems–conversion of Fahrenheit to Celsius and Celsius to Kelvin, miles to kilometre – sorting set of numbers in ascending and descending order – square matrix, addition, subtraction and multiplication of order (2x2) using arrays.	12

CO	Course Outcomes Students will be able to
CO1	Understand numerical method.
CO2	Learn about numerical differentiation and curve fittings. /
CO3	Know about the basic C programming structures.
CO4	Implement in control structure in C
CO5	Interpret the algebraic form of conversions.
Textbooks:	
1	Numerical methods, Singaravelu, Meenakshipublication,4th Edn., 1999.
2	Numerical methods P.Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand, 2016
3	Programming in C. Balagurusamy, TMG, ND, 2012
4	Numerical Analysis, M.K. Venkatraman, NPH, 2013
5	Numerical Analysis, B.D. Gupta, Konark Publishers, New Delhi, 2013
Reference Books	
1	Schaum's outline series, Theory and Problems of programming in C, C. Byron& S. Gottfried, Tata McGraw Hill 2003
2	Numerical methods and C Programming, Veera Rajan, 2015.
Web resources:	
1.	https://madasmaths.com/archive/maths_booklets/standard_topics/various/numerical_solutions_of_equations.pdf
2.	https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200403225057191 2siddharth_bhatt_engg_Numerical_Differentation_and_Integration.pdf
3.	https://www.geeksforgeeks.org/c/c-language-introduction/
4.	https://www.geeksforgeeks.org/dsa/control-structures-in-programming-languages/
5.	https://courses.minia.edu.eg/Attach/16036flowchart-algorithm-manual.pdf

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	3	3	3	3
CO2	2	3	3	2	2	1	2	3	3	3	3
CO3	3	3	3	2	2	2	2	3	3	3	3
CO4	3	3	3	2	2	2	2	3	3	3	3
CO5	2	3	3	2	2	2	2	3	3	3	3
Total	13	15	15	10	10	9	10	15	15	15	15
Average	**2.6**	**3**	**3**	**2**	**2**	**1.8**	**2**	**3**	**3**	**3**	**3**

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCHA41P	**Chemistry Practical for Physical and Biological Sciences - II**	**Elective**	0	0	2	0	2	2	25	75	100

Learning Objectives	
LO1	Different types of organic compounds with respect to their properties.
LO2	Determination of elements in organic compounds.
LO3	Identification of organic functional groups.
LO4	Identify the components and structure of an unknown organic molecule.
LO5	Skills to solve problems related to the identification of organic molecules through a series of tests and observations

Unit	Content	Hours
1	**Systematic Analysis of Organic Compounds** **The analysis must be carried out as follows:** **Preliminary Tests** 1**.** To distinguish between aliphatic and aromatic compounds.	6
2	To distinguish – Saturated and unsaturated compounds	6
3	Detection of special elements (N, S, Halogens).	6
4	Identification of Functional group tests (Absence of special elements) - Phenol, Acids (mono & di), Aldehyde and Carbohydrate	6
5	Identification of Functional group tests (Presence of special elements) - Presence aromatic primary amine, Amides (mono & di).	6

CO	Course Outcomes Students will be able to
CO1	To demonstrate a comprehensive understanding of laboratory safety practices, including the ability to identify and respond appropriately to potential hazards.
CO2	To accurately identify the functional groups present in unknown organic compounds using a variety of chemical tests.
CO3	To effectively differentiate between aromatic and aliphatic compounds, as well as saturated and unsaturated compounds.
CO4	To competently analyze the special elements like nitrogen, sulphur and halogens in the given compounds.
CO5	To successfully prepare the specific functional groups to confirm their presence in organic compounds.

Textbooks:	
1	Venkateswaran V, Veerasamy R and Kulandaivelu A. R, "Basic Principles of Practical Chemistry", Sultan Chand & Sons, 2nd ed., 1997.
2	J. Mendham, R.C. Denney, J.D. Barnes, M. Thomas, "Vogel's Textbook of Quantitative Chemical Analysis", Pearson, 6th ed., 2000.
3	Donald L. Pavia, Gary M. Lampman, George S. Engel & Roger G. Gries, "*Experimental Organic Chemistry*", Cengage Learning, 2005.
4	Jerry Mohrig, Craig Hammond & Paul F. Snyder, "Techniques in Organic Chemistry", Macmillan Learning, 4th ed., 2014.
5	Mann F. G and Saunders B. C, "Practical Organic Chemistry", Pearson Education, 4th ed., 1975.
Reference Books:	
1	Ralph J. Fessenden and Joan S. Fessenden, "Organic Chemistry Laboratory Manual", Brooks/Cole, 3rd ed., 1982.
2	Middleton H, "Organic Qualitative Analysis", Longmans, Green and Co., 1st ed., 1951.
3	Bansal R. K, "Laboratory Manual of Organic Chemistry", New Age International Publishers, 5th ed., 2010.
4	John Leonard, Barry Lygo and Garry Procter, "Advanced Practical Organic Chemistry", CRC Press, 3rd ed., 2013.
5	Lisa Nichols, "Organic Chemistry Laboratory Techniques", LibreTexts, 1st ed., 2016.
Web resources	
1	https://www.scribd.com/document/22912118/systematic-organic-analysis
2	https://celqusb.files.wordpress.com/2018/04/kupdf-com_systematic-identification-oforganic-compounds-wiley-shrinerhermannmorrillcurtinfuson.pdf
3	https://ncert.nic.in/pdf/publication/sciencelaboratorymanuals/classXI/chemistry/kelm207.pdf
4	https://archive.org/details/dli.ernet.288570
5	https://www.scribd.com/document/29184298/systematic-qualitative-organic-analysis

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	2	3	2
CO2	2	3	3	3	2	3	3	2	3	3	3
CO3	3	3	2	2	3	3	3	2	3	3	3
CO4	3	3	2	3	2	3	3	2	2	3	3
CO5	2	3	3	3	3	3	3	2	3	2	3
Total	13	15	13	14	13	15	15	10	13	14	14
Average	**2.6**	**3**	**2.6**	**2.8**	**2.6**	**3**	**3**	**2**	**2.6**	**2.8**	**2.8**

SCHEME OF VALUATION
CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES - II
(For Mathematics / Physics – II year/IV Semester)

Internal assessment : 25 Marks

External assessment : 75 Marks

Total : 100 Marks

Max. Marks : 75 Marks

Record : 10 Marks

Viva voce : 5 Marks

Organic Analysis : 60 Marks

Organic Analysis : 60 Marks

Preliminary Test : 10 Marks

Aliphatic or Aromatic : 5 Marks

Saturated or Unsaturated : 5 Marks

Tests for Special Elements : 10 Marks

Confirmation Tests : 15 Marks

Functional groups Tests : 15 Marks

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHA42P	**Practical - Numerical Methods and Programming in C**	**Elective**	0	0	2	0	2	2	25	75	100

Learning Objectives	
LO	To equip the computational skill using various mathematical tools. To apply the software tools to explore the concepts of physical science. To approach the real time activities using physics and mathematical formulations..

Unit	Content (Any Eight Experiments)	Hours
1	1. Lagrange's interpolation with Algorithm, Flow chart and output. 2. Fitting a straight line with Algorithm, Flow chart and output. 3. Numerical integration by the trapezoidal rule with Algorithm, Flow chart and output. 4. Newton's forward interpolation with Algorithm, Flow chart and output. 5. Newton's backward interpolation with Algorithm, Flow chart and output. 6. Numerical integration by Simpson's 1/8 rule with Algorithm, Flow chart and output. 7. Numerical integration by Simpson's 3/8 rule with Algorithm, Flow chart and output. 8. Finding Roots of a Polynomial - Newton Raphson Method. 9. Finding Roots of a Polynomial - Bisection Method. 10. Solution of Simultaneous Linear Equation by Gauss elimination method. 11. Matrix Multiplication. 12. Matrix Addition. 13. Sorting a List of Numbers (Ascending & Descending). 14. Write a program to calculate the factorial of a number. 15. Conversion of Fahrenheit to Celsius and vice versa	30

CO	Course Outcomes Students will be able to
CO	Understand the computational skill using various mathematical tools, to apply the softwares to explore the concepts of physical science.

Textbooks:	
1	Numerical Methods by G. Balaji

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHS41	Physics Workshop Skills	Skill	1	1	0	0	2	2	25	75	100

Learning Objectives	
LO1	To identify the components and interpret specifications.
LO2	To know the functions and working of different power supply system
LO3	To know the principle and working of different electrical and electronics appliances
LO4	To learn the concept of mass and media communications
LO5	Explain the Identification, classification, and working principle of various Biomedical Instruments and application of these instruments in diagnosis, therapeutic treatment and imaging fields

Unit	Content	Hours
1	**TESTING OF DISCRETE COMPONENTS** Resistors- types - Characteristics -Colour coding -resistors in series and parallel - Capacitors - types -Capacitor in Series and Parallel – Digital Multimeter - How to Use a Multimeter - Continuity Testing of Voltage - Current - Resistance -Diode and Transistor-Design of Bread board-Soldering Technique used in PCBs.	6
2	**POWER SUPPLY** Power Supply Unit - Regulated power supply- Zener diode voltage regulator-Inverter-Uninterrupted power supply (UPS) - Switched mode power supply (SMPS)-Cathode Ray Oscilloscope (CRO) and measurement of time period and frequency - Function generator.	6
3	**ELECTRICAL & ELECTRONICS APPLIANCES** Construction and Working of Electric iron Box - fans- Water Heater - Grinder-Microwave Oven-Washing Machine – Refrigerator-Air Conditioner.	6
4	**MASS AND MEDIA COMMUNICATION** Mobile Communication (GSM) -Android version- USB - Various Types of USB-C Port- Cable and Connectors - VGA- AV port - HDMI- DVI - S Video and Display port- Bluetooth - Wi-fi and Li-fi - Direct broadcast satellite (DBS)- DTH-Radar Communication System.	6
5	**BIO-MEDICAL INSTRUMENTATION** Principle, description, function and recording of ECG, and EEG -artificial pace maker- simulators -Heart lung machine –ventilators and nebulizers-Kidney dialysis machine- pH meter - Laser blood flow meter–Thermal scanner and pulse oximeter.	6

CO	Course Outcomes Students will be able to
CO1	Test the instruments with specific skills
CO2	Express the functions and working of linear power supply
CO3	Know the basics of analytical instruments and its calibration techniques.
CO4	Explain mobile communication and radar communication system
CO5	Demonstrate the principle and working of various biomedical equipment.
Textbooks:	
1	B.L. Theraja, A Text book of Electrical Technology, S.Chand& Co., New Delhi, 2007.
2	Robert A. Mammano, Power Supply Design Seminars, , Texas Instruments, 2017.
3	Basic Electrical Engineering -Vocational Theory-Plus One Text Book-TN State Board.
4	V.K. Metha, Principles of Electronics, V K Metha, S Chnd&Co.,New Delhi, 2001.
5	M.Arumugam M, Biomedical Instrumention, Anuradha Publications, Kumbakonam, 2011.
Reference Books:	
1	I.J. Nagrath and D. P. Kothari, Electrical Machines,Tata McGraw Hill, 1997.
2	M. D. Singh, K. B.Khanchandani Power Electronics, Tata McGraw Hill, 2006.
3	V. JeyasriArokiasamy, Mobile Communications,Technical Publications, 2009.
Web resources:	
1	https://www.electronicsforu.com/
2	https://www.electronics-tutorials.ws/supplies/power-supplies-for-beginners-part-1.html
3	https://lecturenotes.in/subject/199/analytical-instrumentation-ai
4	http://electrotel.com.ar/handbook-of-analytical-instruments-r-s-khandpur-downloadfull-version.pdf
5	https://www.youtube.com/watch?v=YbBSf8bnYgw

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	2	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3
Total	15	15	15	15	15	11	11	15	15	15	15
Average	**3**	**3**	**3**	**3**	**3**	**2.2**	**2.2**	**3**	**3**	**3**	**3**

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UPHS42	Communication System	Skill	1	1	0	0	2	2	25	75	100

Learning Objectives	
LO1	Understand the **basic components** of communication systems: transmitter and receiver
LO2	Apply the concepts of fiber optics in communication systems.
LO3	Explain key concepts of radar communications
LO4	To learn the basics of satellite communications.
LO5	Understand modern communication technology

Unit	Content	Hours
1	**RADIO TRANSMISSION AND RECEPTION**: Basic Principals of Transmitter – modulation – amplitude modulation – limitations of amplitude modulation – frequency modulation – comparison of FM and AM – demodulation essentials in demodulation. Receivers: AM radio receivers – radio receiver, advantages – FM receiver – difference between FM and AM receivers.	6
2	**FIBER OPTIC COMMUNICATION:** Basic, types and applications of fiber optics – construction of optical fiber – classification based on the refractive index and modes of propagation – losses in optical fibers – attenuation–advantages of fiber optic communication.	6
3	**RADAR COMMUNICATION:** Basics, Types & Applications-radar range equation – antenna scanning –pulsed radar system – search radar –tracking radar – MTI Radar -Advantages, Limitations, Applications of MTI radar- Doppler effect– CW Doppler radar-CW radar Advantages, Limitations, Applications-Difference between MTI and Pulse Doppler Radar	6
4	**SATELLITE COMMUNICATION:** Elements of orbital mechanics (Kepler's laws)-Equations of motion- Need of Satellite Communication-Working -Types – Advantage and disadvantages - Application of Satellite Communication- Benefits of Satellite Communication for India	6
5	**MOBILE COMMUNICATION:** Introduction – concept of cell basic cellular mobile radio system – cell phone – facsimile – important features of fax machine – application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-4G/5G (basic ideas)	6

CO	Course Outcomes Students will be able to
CO1	Understand the Radio Transmission and Reception concepts.
CO2	Analysis the Fiber-Optics and to apply the concept in Communication system.
CO3	Know the Radar Communication for signal processing
CO4	Study the orbital trajectory to apply the concepts in Satellite Communication
CO5	Understand the Mobile Communication for today's fastest-growing and most impactful engineering domain.
Textbooks:	
1	V.K.Metha, Principles of Electronics, S. Chand & Co Ltd., 2013
2	Anokh Singh and Chopra A.K., Principles of communication Engineering, S.Chand& Co, 2013
Reference Books:	
1	1. J.S. Chitode, Digital Communications, 2020, Unicorn publications
2	Senior John. M, Optical Fiber Communications: Principles and Practice, 2009, Pearson Education.
Web resources:	
1	https://www.etsi.org/deliver/etsi_gts/05/0505/05.02.00_60/gsmts_0505v050200p.pdf
2	https://www.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf
3	https://www.elprocus.com/radar-basics-types-and-applications/
4	https://www.tutorialspoint.com/satellite_communication/satellite_communication_introduction.htm
5	https://www.bfs.de/EN/topics/emf/mobile-communication/basics/basics_node.html

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3
Total	15	15	15	15	15	15	10	15	15	15	15
Average	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**

SECOND YEAR FOURTH SEMESTER

AEC – 3 – ENVIRONMENTAL STUDIES & DISASTER MANAGEMENT

Course Code	Course name	Category	L	T	P	S	Credit	Hours	Marks		
									CIA	External	Total
24UAEC41	ENVIRONMENTAL STUDIES & DISASTER MANAGEMENT	AEC - 3	2	0	0	0	2	2	25	75	100

Learning Objectives		
LO1	To provide basic knowledge of Environmental Science and Sustainability	
LO2	To understand the Fundamentals of Disaster Management	
LO3	To create awareness about Natural Disaster and Management	
LO4	To familiarize students with Manmade Disaster and Management	
LO5	To promote community participation and technological applications in disaster risk reduction	
Unit	**Contents**	**Hour**
I	**Environmental Science and Sustainability** Ecosystem: structure, types, and functions - Biodiversity: importance and conservation strategies - Environmental pollution: types (Air & Water), causes, effects, and control measures - Climate change and global warming	5
II	**Fundamentals of Disaster Management** Concepts: disaster, hazard, vulnerability, risk, resilience - Types of disasters: natural and man-made - Disaster management cycle: prevention, mitigation, preparedness, response, recovery**.**	5
III	**Natural Disasters and Management** Earthquakes, floods, Oil spill disaster, cyclones, Tsunami, droughts, landslides, Heat wave - Causes, consequences, and case studies - Community and government measures for preparedness and mitigation. Role of Government in Disaster Management – NDMA, SDMA & DDMA. Community Based Disaster Management	8
IV	**Man-Made Disasters and Management** Industrial accidents, fires, chemical and nuclear hazards, Biological hazards, transport accidents - Impacts on society, economy, and environment - Disaster preparedness and management strategies - Case studies: Bhopal Gas Tragedy, Vizag Gas Leak, urban disasters.	7
V	**Sustainable Development and Disaster Risk Reduction** Principles of sustainable development and Sustainable Development Goals (SDGs) -	5

	Climate change and disaster interlinkages - Disaster risk reduction strategies: early warning systems, resilient infrastructure, policy framework. Role of technology, education, and media in environmental sustainability and disaster management	

Course Outcomes **The students will be able to**	
CO1	Describe the importance of ecosystems, biodiversity, and methods of controlling pollution.
CO2	Understand the basic concepts of disaster management, hazards, risks, and resilience.
CO3	Explain the causes, effects, and control measures of major natural disasters.
CO4	Identify different types of man-made disasters and suggest safety and preparedness measures.
CO5	Recognize the role of sustainable development and disaster risk reduction strategies in protecting environment and society.
Textbooks	
1	Government of India – Disaster Management Act, 2005
2	P.C. Mishra – Disaster Management and Mitigation
Reference Book	
1	Erach Bharucha – Textbook of Environmental Studies
2	IGNOU Study Material – Disaster Management

Web Resources:

1	https://ndma.gov.in/

Mapping Programme Outcomes and Programme Specific Outcomes with Course Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	2	2	3	3	3	3
CO2	3	3	3	3	3	2	3	3	3	3	2
CO3	3	3	3	3	3	2	3	3	3	3	2
CO4	3	2	3	3	3	2	3	3	3	3	2
CO5	3	2	3	3	3	2	3	3	3	3	2
Total	15	13	15	15	15	10	14	15	15	15	11
Average	3	2.6	3	3	3	2	2.8	3	3	3	2.2

3 – Strong, 2- Medium, 1- Low