SRI SARADA COLLEGE FOR WOMEN

(AUTONOMOUS),

Reaccredited with 'B++' Grade by NAAC

Affiliated to Periyar University

SALEM - 636 016

PG & RESEARCH DEPARTMENT OF PHYSICS

OUTCOME BASED SYLLABUS

B.Sc. Physics

(For the students admitted in *2025-26)*

(I, II, III , IV &VSemester)

B.Sc., PHYSICS SYLLABUS

Preamble

Physics is one of the basic and fundamental sciences. The curriculum for the graduate programme in Physics is revised as per the UGC guidelines on Learning Outcome based Course Framework. The learner-centric courses let the student progressively develop a deeper understanding of various aspects of physics.

The new curriculum offers courses in the core areas of mechanics, acoustics, optics and spectroscopy, electricity and magnetism, atomic and nuclear physics, solid state, electronics and other fields. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. In addition to the theoretical course work, the students also learn physics laboratory methods for different branches of physics, specialized measurement techniques, analysis of observational data, including error estimation and etc. The students will have deeper understanding of laws of nature through the subjects like classical mechanics, quantum mechanics, statistical physics etc. The problem solving ability of students will be enhanced. The students can apply principles in physics to real life problems. The courses like integrated electronics and microprocessors will enhance the logical skills as well as employability skills. The numerical methods and mathematical physics provide analytical thinking and provides a better platform for higher level physics for research.

The restructured courses with well-defined objectives and learning outcomes, provide guidance to prospective students in choosing the elective courses to broaden their skills not only in the field of physics but also in interdisciplinary areas. The elective modules of the framework offer students choice to gain knowledge and expertise in specialized domains of physics like astrophysics, medical physics, etc.

Programme	**B.Sc., Physics**
Programme Code	
Duration	**3 years [UG]**
Programme Outcomes: (These aremere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or the University for their Programme)	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully; read and write analytically and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply the analytic thought to a body of knowledge; analyse and evaluate the proofs, arguments, claims, beliefs on the basis of empirical evidences; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach. **PO4: Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation. **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team. **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/

	qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes: (These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)	**PSO1: Placement:** To prepare the students who will demonstrate respectful engagement withothers' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2**: **Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations. **PSO3**: **Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4**: **Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5**: **Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

METHOD OF EVALUATION:
Theory:

Continuous Internal Assessment	End Semester Examination	Total	Grade
30	70	100	

Practical:

Continuous Internal Assessment	End Semester Examination	Total	Grade
40	60	100	

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM –16
PG & RESEARCH DEPARTMENT OF PHYSICS
B.Sc PHYSICS
Programme Structure Under CBCS
(*For the Students Admitted in 2025-26)*
Total Credits: 141 + Extra credits (Maximum 28)

SEMESTER – I					
Part	**Course**	**Course Title**	**Code**	**No. of Hour**	**Credit**
I	Language	Tamil –I / Hindi-I / Sanskrit-I	25ULTC1/ 25ULHC1/ 25ULSC1	6	3
II	English	English-I	25ULEC1	6	3
III	Core Course -I	Properties of Matter and Sound	25UPHCC1	5	5
III	Core Course -II	Properties of Matter - Practical	25UPHCCQ1	4	3
III	Generic Elective-I	Chemistry-I	25UPHCGEC1	3	3
		Chemistry Practical-I	25UPHCGECQ1	2	2
IV	Skill Enhancement Course	NME: Physics for Everyday life	25UPHSEC1	2	2
IV	Skill Enhancement (Foundation Course)	Introductory Physics	25UPHSEFC	2	2
			Total	**30**	**23**
V	• Articulation and Idea Fixation skills • Physical Fitness Practice – 35 Hours per semester • Extra Credits are given for extra skills and courses qualified in MOOC/NPTEL				
	• Advanced diploma course in Renewable energy management and Audit Level- 1: Certificate Course 100 hours per year.				

SEMESTER – II					
Part	**Course**	**Course Title**	**Code**	**No. of**	**Credit**
I	Language	Tamil –II/ Hindi-II / Sanskrit-II	25ULTC2/ 25ULHC2/ 25ULSC2	6	3
II	English	English-II	25ULEC2	6	3
III	Core Course -III	Heat, Thermodynamics and Statistical Physics	25UPHCC2	5	5
III	Core Course -IV	Heat, Oscillations, Waves & Sound Experiments- Practical	25UPHCCQ2	4	3
III	Generic Elective –II	Chemistry-II	25UPHCGEC2	3	3
		Chemistry Practical-II	25UPHCGECQ2	2	2
IV	Skill Enhancement Course –II	NME: Home Electrical Installation	25UPHSEC2	2	2
IV	Skill Enhancement Course -III	IKS: Inherited Indian Knowledge in Astronomy	25UPHSEC3	2	2
			Total	**30**	**23**
V	• Articulation and Idea Fixation skills • Physical Fitness Practice – 35 Hours per semester • Extra Credits are given for extra skills and courses qualified in MOOC/NPTEL				
	• Advanced diploma course in Renewable energy management and Audit Level- 1: Certificate Course 100 hours per year				

SEMESTER – III					
Part	**Courses**	**Course Title**	**Code**	**No. of Hours**	**Credit**
I	Language	Tamil – III / Hindi – III / Sanskrit – III	25ULTC3 / 25ULHC3/ 25ULSC3	6	3
II	English	English – III	25ULEC3	6	3
III	Core Course – V	General Mechanics and Classical Mechanics	25UPHCC3	6	5
III	Core Course – VI	Electricity -Practical	25UPHCCQ3	3	3
III	Generic Elective - III	Theory of Equations & Differential Calculus	25UPHMGEC3	5	5
IV	Skill Enhancement Course – IV	Digital Photography (Entrepreneurial Skill)	25UPHSEC4	1	1
IV	Skill Enhancement Course – V	Computational methods and Programming in C	25UPHSEC5	2	2
IV	E.V.S	Environmental Studies	25UEVS	1	-
		Health and Wellness - 1	25UHAW		1
Total				**30**	**23**
V	• *Articulation and Idea Fixation skills* • *Physical Fitness Practice – 35 Hours per semester* • Extra Credits are given for extra skills and courses qualified in MOOC/NPTEL				
Advanced Diploma course in Renewable energy management and Audit Level – 2 Diploma Course 100 hours per year					

SEMESTER IV					
Part	**Course**	**Course Title**	**Code**	**No. of Hours**	**Credits**
I	Language	Tamil –IV/ Hindi-IV / Sanskrit-IV	25ULTC4/ 25ULHC4/ 25ULSC4	6	3
II	English	English-IV	25ULEC4	6	3
III	Core Course -VII	Optics and Spectroscopy	25UPHCC4	5	5
III	Core Course -VIII	Optics - Practical	25UPHCCQ4	3	3
III	Generic Elective-IV	Integral Calculus and Laplace Transform	25UPHMGEC4	3	3
		Theory of equations and Laplace Transform using sage math - Practical	25UPHMGECQ	2	2
IV	Skill Enhancement Course - VI	Electronic Devices	25UPHSEC6	2	2
IV	Skill Enhancement Course - VII	Communication Systems	25UPHSEC7	2	2
V	EVS	Environmental Studies	25UEVS	1	2
Total				**30**	**25**
V	• Articulation and Idea Fixation skills • Physical Fitness Practice – 35 Hours per semester • Extra Credits are given for extra skills and courses qualified in MOOC/NPTEL				
	• Advanced diploma course in Renewable energy management and Audit Level - 2: Diploma Course 100 hours per year				

SEMESTER V					
Part	**Course**	**Course Title**	**Code**	**No. of Hours**	**Credits**
III	Core Course – IX	Atomic Physics and Lasers	25UPHCC5	5	4
III	Core Course – X	Relativity and Quantum Mechanics	25UPHCC6	5	4
III	Core Course – XI	Electricity and Magnetism	25UPHCC7	5	4
III	Core Course - XII	Light and Magnetism - Practical	25UPPHCCQ5	3	3
III	Core Course(Project)	Project and viva - voce	25UPHPVV	5	4
III	Discipline Specific Elective - 1	Materials Science	25UPHDSEC1	5	3
IV	Value Education	Value Education	25UVEN	2	2
IV	Internship	Internship	25UPHI	-	2
Total				**30**	**26**
V	• Articulation and Idea Fixation skills • Physical Fitness Practice – 35 Hours per semester • Extra Credits are given for extra skills and courses qualified in MOOC/NPTEL				
	• Advanced diploma course in Renewable energy management and Audit Level - 3: Advanced Diploma Course 100 hours per year – 3 extra credits				
	The students should undergo compulsory 2 weeks internship programs during the IV Semester vacation. The students should submit the report at the end of the V semester.				

SEMESTER – I								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC1	**PROPERTIES OF MATTER AND SOUND**	**Core**	**4**	**1**	**-**	**5**	**5**	**70**
COURSE OBJECTIVES	Study of the properties of matter leads to information, which is of practical value to both the physicist and the engineers. It, gives us information about the internal forces which act between the constituent parts of the substance. Students who undergo this course are successfully bound to get a better insight and understanding of the subject.							

UNITS	COURSE DETAILS
UNIT-I	**ELASTICITY:** Hooke's law – stress-strain diagram – elastic constants – Poisson's ratio – relation between elastic constants and Poisson's ratio – work done in stretching and twisting a wire – twisting couple on a cylinder – rigidity modulus by static torsion– torsional pendulum (with and without masses)
UNIT-II	**BENDING OF BEAMS:** Cantilever – expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – expression for time period – experiment to find Young's modulus – non-uniform bending– experiment to determine Young's modulus by Koenig's method – uniform bending – expression for elevation – experiment to determine Young's modulus using microscope
UNIT-III	**FLUID DYNAMICS:** *Surface tension*: definition – molecular forces– excess pressure over curved surface – application to spherical and cylindrical drops and bubbles – determination of surface tension by Jaegar's method–variation of surface tension with temperature *Viscosity*: definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille's formula –corrections – terminal velocity and Stoke's formula– variation of viscosity with temperature.
UNIT-IV	**WAVES AND OSCILLATIONS:** Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM – composition of two SHM in a straight line and at right angles – Lissajous's figures- free, damped, forced vibrations –resonance and Sharpness of resonance. Laws of transverse vibration in strings –sonometer – determination of AC frequency using sonometer –determination of frequency using Melde's string Apparatus.

UNIT-V	**ACOUSTICS OF BUILDINGS AND ULTRASONICS:** Intensity of sound – decibel – loudness of sound – reverberation – Sabine's reverberation formula – acoustic intensity – factors affecting the acoustics of buildings. *Ultrasonic waves*: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction effect – application of ultrasonic waves.
TEXT BOOKS	1. D.S. Mathur, 2010, Elements of Properties of Matter, S. Chand & Co. 2. BrijLal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co 3. D.R.Khanna & R.S.Bedi, 1969, Textbook of Sound, AtmaRam& sons 4. Brij Lal and N. Subrahmanyam, 1995, A Text Book of Sound, Second revised edition, Vikas Publishing House. 5. R. Murugesan, 2012, Properties of Matter, S. Chand &Co.
REFERENCE BOOKS	1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers 2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, R. Chand & Co. 3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.
WEBLINKS	1. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work 2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html 3. https://www.youtube.com/watch?v=gT8Nth9NWPM 4. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s 5. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work 6. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/ 7. http://www.sound-physics.com/ 8. http://nptel.ac.in/courses/112104026/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Relate elastic behavior in terms of three moduli of elasticity and working of torsion pendulum.
	CO2	Able to appreciate concept of bending of beams and analyze the expression, quantify and understand nature of materials.
	CO3	Explain the surface tension and viscosity of fluid and support the interesting phenomena associated with liquid surface; soap films provide an analogue solution to many engineering problems.

	CO4	Analyze simple harmonic motions mathematically and apply them. Understand the concept of resonance and use it to evaluate the frequency of vibration. Set up experiment to evaluate frequency of ac mains
	CO5	Understand the concept of acoustics, importance of constructing buildings with good acoustics. Able to apply their knowledge of ultrasonics in real life, especially in medical field and assimilate different methods of production of ultrasonic waves.

MAPPING WITH PROGRAM OUT COMES:

Map course out comes **(CO)** for each course with program out comes **(PO)** in the 3-point scale of STRONG(**S**), MEDIUM (**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	S	M	S
CO2	M	S	S	S	M	M	S	M	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	M	M	M
CO5	M	M	S	S	M	S	S	S	S	M

MAPPING WITH PROGRAM SPECIFIC OUT COMES:

Map Course Outcomes **(CO)** for each course with Program Specific Outcomes **(PSO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW(**L**).

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	M	M	S
CO2	S	M	S	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	S
CO5	M	M	S	M	S

SEMESTER: I								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCCQ1	**Properties of Matter - Practical**	**Core**	**1**	**-**	**3**	**3**	**4**	**60**

COURSE OBJECTIVES	Apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Properties of Matter -Practical
(Any 8 of the below list)

1. Determination of rigidity modulus without mass using Torsional pendulum.
2. Determination of rigidity modulus with masses using Torsional pendulum.
3. Determination of moment of inertia of an irregular body.
4. Verification of parallel axes theorem on moment of inertia.
5. Verification of perpendicular axes theorem on moment of inertia.
6. Determination of moment of inertia and g using Bifilar pendulum.
7. Determination of Young's modulus by stretching of wire with known masses.
8. Verification of Hook's law by stretching of wire method.
9. Determination of Young's modulus by uniform bending – load depression graph.
10. Determination of Young's modulus by non-uniform bending – scale & telescope.
11. Determination of Young's modulus by cantilever – load depression graph.
12. Determination of Young's modulus by cantilever – oscillation method
13. Determination of Young's modulus by Koenig's method – (or unknown load)
14. Determination of rigidity modulus by static torsion.
15. Determination of Y, n and K by Searle's double bar method.
16. Determination of surface tension & interfacial surface tension by drop weight method.
17. Determination of co-efficient of viscosity by Stokes' method – terminal velocity.
18. Determination of critical pressure for streamline flow.
19. Determination of Poisson's ratio of rubber tube.
20. Determination of viscosity by Poiseullie's flow method.
21. Determination radius of capillary tube by mercury pellet method.
22. Determination of g using compound pendulum.

BOOKS FOR STUDY	1. Practical Physics and Electronics - C.C. Ouseph, U. J. Rao, V. Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007). 2. A text book of Practical Physics - M.N. Srinivasan and others, Sultan Chand and Sons (2014).
REFERENCE BOOKS	B.Sc Practical Physics - C. L Arora, S. Chand (1995).

Outcomes: On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	**Recall** the concepts behind various physics experiments.	K_1
CO2	**Relate** various properties of matter with their behaviour and connect them with different physical parameters involved	K_2
CO3	**Determine** the elastic properties of materials through experimental procedures.	K_3
CO4	**Measure** different physical parameters with maximum Accuracy	K_3
CO5	**Apply** theoretical knowledge to analyze experimental data	K_4

MAPPING WITH PROGRAM OUT COMES:

Map course out comes **(CO)** for each course with program out comes **(PO)** in the 3-point scale of STRONG(**S**), MEDIUM (**M**) and LOW(**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	M	S	M	S
CO2	M	S	S	S	M	M	S	M	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	M	M	M
CO5	M	M	S	S	M	S	S	S	S	M

MAPPING WITH PROGRAM SPECIFIC OUT COMES:

Map Course Outcomes **(CO)** for each course with Program Specific Outcomes **(PSO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW(**L**).

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S
CO2	S	M	S	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	S
CO5	M	M	S	M	S

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY- I
(FOR PHYSICS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective - I</td></tr>
<tr><td>Category</td><td>Generic Course</td><td>Year
Semester</td><td>I
I</td><td>Credits</td><td>3</td><td>Course Code</td><td>25UPHCGEC1</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>-</td><td colspan="2">-</td><td colspan="3">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
• basics of atomic orbitals, chemical bonds, hybridization
• concepts of thermodynamics and its applications
• concepts of nuclear chemistry
• importance of chemical industries
• qualitative and analytical methods</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
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-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect – calculations; Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.</td></tr>
<tr><td></td><td colspan="7">UNIT II
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.
Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
<tr><td></td><td colspan="7">UNIT III
Fundamental Concepts in Organic Chemistry
Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on ka and kb of organic acids and bases, electromeric, mesomeric, hyperconjugation and steric-examples.
Reaction mechanisms: Types of reactions–aromaticity (Huckel’s rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft’s alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</td></tr>
</table>

	UNIT IV **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. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. 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).
	UNIT V **Analytical Chemistry** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and applications of column, paper and thin layer chromatography.

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours).
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Veeraiyan, V, *Text book of Ancillary Chemistry;* High mount publishing house, Chennai, 1st Ed., 2009. 2. Vaithyanathan, S, *Text book of Ancillary Chemistry*; Priya Publications, Karur, 2006. 3. Arun Bahl, S, Bahl, B.S, *Advanced Organic Chemistry;* S. Chand and Company, New Delhi, 23rd Ed., 2012. 4. Soni, P. L, Chawla, H, M, *Text Book of Organic Chemistry*; Sultan Chand & sons, New Delhi, 29th Ed., 2007.

Reference Books	5. Soni, P. L, Mohan Katyal, *Text book of Inorganic chemistry;* Sultan Chand and Company, New Delhi, 20th Ed., 2007. 6. Puri, B.R, Sharma, L.R, & Pathania, M.S, *Textbook Physical Chemistry;* Vishal Publishing Co., New Delhi, 47th Ed., 2018. 7. Sharma, B.K, *Industrial Chemistry*, GOEL publishing house, Meerut, 19th Ed., 2014.

Course Outcomes

On completion of the course the students should be able to

CO1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.

CO2: evaluate the efficiencies and uses of various fuels and fertilizers

CO3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

CO4: apply various thermodynamic principles, systems and phase rule.

CO5: explain various methods to identify an appropriate method for the separation of chemical components

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL- I
(Physics)</td></tr>
<tr><td>Paper Name</td><td colspan="7">Generic Elective-I – Chemistry Practical -I</td></tr>
<tr><td>Category</td><td>Generic Course</td><td>Year</td><td>I</td><td>Credit</td><td>2</td><td>Course Code</td><td>25UPHCGECQ1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td colspan="2">-</td><td colspan="2">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
● basics of preparation of solutions.
● principles and practical experience of volumetric analysis.</td></tr>
<tr><td>Course Outline</td><td colspan="7">Volumetric analysis
1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenyl amine as indicator.</td></tr>
<tr><td>Reference Book</td><td colspan="7">Venkateswaran, V, Veerasamy, R, Kulandaivelu, A.R, Basic Principles of Practical Chemistry; Sultan Chand & sons, 2nd Ed., 1997.</td></tr>
<tr><td colspan="8">Course Outcomes
On successful completion of the course the students should be able to

CO1: gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO2: design, carry out, record and interpret the results of volumetric titration.
CO3: apply their skill in the analysis of water /hardness.
CO4: analyze the chemical constituents in allied chemical products.</td></tr>
</table>

SEMESTER : I								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHSEC1	**NME: PHYSICS FOR EVERYDAY LIFE**	**Skill Enhancement Course**	**2**	**-**	**-**	**2**	**2**	**70**

PHYSICS FOR EVERYDAY LIFE	
Learning Objective: To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics	
UNITS	**COURSE DETAILS**
UNIT-I	**MECHANICS** Motion, Force and Newton's laws-momentum-Circular motion – Gravitation-Planetary motion –Rotational Motion –Earth Satellites – Communication Satellites
UNIT-II	**OPTICAL INSTRUMENTS AND LASER:** Vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.
UNIT-III	**PHYSICS OF HOME APPLIANCES:** bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners
UNIT-IV	**SOLAR ENERGY:** Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.
UNIT-V	**INDIAN PHYSICIST AND THEIR CONTRIBUTIONS:** C.V.Raman, Homi Jehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.
TEXT BOOKS	1. The Physics in our Daily Lives, Umme Ammara, Gugucool Publishing, Hyderabad, 2019. 2. For the love of physics, Walter Lawin, Free Press, New York, 2011.

SEMESTER - I								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHSEFC	**INTRODUCTORY PHYSICS**	**Foundation Course**	**2**	**-**	**-**	**2**	**2**	**70**
COURSE OBJECTIVES	To help students get an overview of Physics before learning their core courses. To serve as a bridge between the school curriculum and the degree programme.							
UNITS	**COURSE DETAILS**							
UNIT-I	vectors, scalars –examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants							
UNIT-II	different types of forces–gravitational, electrostatic, magnetic, electromagnetic, nuclear –mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces							
UNIT-III	different forms of energy– conservation laws of momentum, energy – types of collisions –angular momentum– alternate energy sources–real life examples							
UNIT-IV	types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – stream line and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations							
UNIT-V	surface tension – shape of liquid drop – angle of contact – viscosity – lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use- conductors, insulators – thermal and electric							
TEXT BOOKS	1. D.S. Mathur, 2010, Elements of Properties of Matter, S. Chand & Co 2. Brij Lal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co.							
REFERENCE BOOKS	1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S. Chand & Co.							
WEBLINKS	1. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://science.nasa.gov/ems/ 2. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/							

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Apply concept of vectors to understand concepts of Physics and solve problems
	CO2	Appreciate different forces present in Nature while learning about phenomena related to these different forces.
	CO3	Quantify energy in different process and relate momentum, velocity and energy
	CO4	Differentiate different types of motions they would encounter in various courses and understand their basis
	CO5	Relate various properties of matter with their behaviour and connect them with different physical parameters involved.

MAPPINGWITHPROGRAMOUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

MAPPING WITH PROGRAM SPECIFIC OUT COMES:

Map Course Outcomes **(CO)** for each course with Program Specific Outcomes **(PSO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	M	M	S
CO2	S	M	S	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	S
CO5	M	M	S	M	S

SEMESTER: II								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC2	**HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS**	**Core**	**4**	**1**	**-**	**5**	**5**	**70**
COURSE OBJECTIVES	The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation							

UNITS	COURSE DETAILS
UNIT-I	**CALORIMETRY:** specific heat capacity – specific heat capacity of gases C_P & C_V– Meyer's relation – Joly's method for determination of C_V – Regnault's method for determination of C_P **LOW TEMPERATURE PHYSICS:** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect – Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.
UNIT-II	**THERMODYNAMICS-I:** Zeroth law and first law of thermodynamics – P-V diagram – heat engine –efficiency of heat engine (problems)– Carnot's engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines.
UNIT-III	**THERMODYNAMICS-II:** second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram – thermodynamical scale of temperature – Maxwell's thermodynamical relations – Clasius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death- Entropy change in different phases – Problems.
UNIT-IV	**HEAT TRANSFER:** modes of heat transfer: conduction, convection and radiation. *Conduction*: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad conductor by Lee's disc method. *Radiation*: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law –Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.

UNIT-V	**STATISTICAL MECHANICS:** definition of phase-space – micro and macro states – ensembles –different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics –expression for distribution function – comparison of three statistics.
BOOKS FOR STUDY	1. Brijlal & N. Subramaniam, 2000, Heat and Thermodynamics, S. Chand& Co. 2. Narayanamoorthy & Krishna Rao, 1969, Heat, Triveni Publishers, Chennai. 3. V.R. Khanna & R.S. Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish & Co, Meerut 4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations, Vikas Publishing House, New Delhi. 5. Ghosh, 1996, Text Book of Sound, S. Chand & Co. 6. R. Murugeshan & Kiruthiga Sivaprasath, Thermal Physics, S. Chand& Co.
REFERENCE BOOKS	1. J.B. Rajam & C.L. Arora, 1976, Heat and Thermodynamics, 8th edition, S. Chand & Co. Ltd. 2. D.S. Mathur, Heat and Thermodynamics, Sultan Chand & Sons. 3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand & Co. 4. Resnick, Halliday & Walker, 2010, Fundamentals of Physics, 6th Edition. 5. Sears, Zemansky, Hugh D. Young, Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson.
WEBLINKS	1. https://youtu.be/M_5KYncYNyc 2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, super fluidity and Condensed Matter Physics.
	CO2	Derive the efficiency of Carnot's engine. Discuss the implications ofthe laws of Thermodynamics in diesel and petrol engines
	CO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an insight into thermodynamic properties like enthalpy, entropy

	CO4	Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyse them
	CO5	Interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law. Develop the statistical interpretation of Bose-Einstein and Fermi-Dirac. Apply to quantum particles such as photon and electron

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	S	M	S	S	S	M	M	S	M

SEMESTER: II								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCCQ2	**Heat, Oscillations, Waves & Sound -Practical**	**Core**	**1**	**-**	**3**	**3**	**4**	**60**

COURSE OBJECTIVES	Apply their knowledge gained about the concept of heat and sound waves, resonance to verify theories, quantify and analyse, able to do error analysis and correlate results.

(Any Eight of the below list)

1. Determination of specific heat by cooling – graphical method.
2. Determination of thermal conductivity of good conductor by Searle‟s method.
3. Determination of thermal conductivity of bad conductor by Lee‟s disc method.
4. Determination of thermal conductivity of bad conductor by Charlaton‟s method.
5. Determination of specific heat capacity of solid.
6. Determination of specific heat of liquid by Joule‟s electrical heating method (applying radiation correction by Barton‟s correction/graphical method),
7. Determination of Latent heat of a vaporization of a liquid.
8. Determination of Stefan‟s constant for Black body radiation.
9. Verification of Stefan‟s-Boltzmans law.
10. Determination of thermal conductivity of rubber tube.
11. Helmholtz resonator.
12. Velocity of sound through a wire using Sonometer.
13. Determination of velocity of sound using Kunds tube.
14. Determination of frequency of an electrically maintained tuning fork
15. To verify the laws of transverse vibration using sonometer.
16. To verify the laws of transverse vibration using Melde‟s apparatus.
17. To compare the mass per unit length of two strings using Melde‟s apparatus.
18. Frequency of AC by using sonometer.

BOOKS FOR STUDY	1. Practical Physics and Electronics - C.C. Ouseph, U. J. Rao, V. Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007). 2. A text book of Practical Physics - M.N. Srinivasan and others, Sultan Chand and Sons (2014).
REFERENCE BOOKS	B.Sc Practical Physics - C. L Arora, S. Chand (1995).

Course Outcomes: On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	**Determine** various physical quantities by applying the principles of physics	**K_1**
CO2	**Construct** basic digital circuits using discrete components	**K_2**
CO3	**Apply** knowledge of optics to explain the principles and applications of spectrometers.	**K_3**
CO4	**Gain** hands-on experience with equipment such as thermometers and calorimeters	**K_3**
CO5	**Examine** the properties of sound waves through laboratory experiments	**K_4**

MAPPINGWITHPROGRAMOUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scaleof STRONG (**S**), MEDIUM (**M**) and LOW(**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

MAPPING WITH PROGRAM SPECIFIC OUT COMES:

Map Course Outcomes **(CO)** for each course with Program Specific Outcomes **(PSO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW(**L**).

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S
CO2	S	M	S	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	S
CO5	M	M	S	M	S

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY-II
(FOR PHYSICS)</td></tr>
<tr><td>Course No.</td><td colspan="7">Elective -II (GE)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">25UPHCGEC2</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>-</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry for physical sciences -I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on the
● Co-ordination Chemistry and Water Technology
● Carbohydrates and Amino acids
● Basics and types of polymers
● Basics and applications of kinetics and catalysis
● Various photochemical phenomenon</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I 15 Hours

Co-ordination Chemistry and Water Technology
Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - 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.
Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-BOD, COD.</td></tr>
<tr><td></td><td colspan="7">UNIT II 15 Hours

Carbohydrates and Amino acids
Carbohydrates: 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, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).</td></tr>
</table>

	UNIT III **15 Hours** **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 cells-corrosion and its prevention.
	UNIT IV **15 Hours** **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.
	UNIT V **15 Hours** **Photochemistry** Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. Veeraiyan V., *Textbook of Ancillary Chemistry*; Highmount Publishing House, Chennai, 1st Ed.,2009. 2. Vaithyanathan S., *Text Book of Ancillary Chemistry*;Priya Publications, Karur,2006. 3. Arun Bahl, Bahl B.S., *Advanced Organic Chemistry*; S.Chandand Company, New Delhi, 23rd Ed., 2012. 4. Puri R., Sharma L. R., Pathania M. S., *Text Book Physical Chemistry*; Vishal Publishing Co., New Delhi, 47th Ed., 2018.
Reference Books	1. Soni P.L., Mohan Katyal, *Text book of Inorganic Chemistry*, Sultan Chand and Company, New Delhi, 20th Ed, 2007. 2. Sharma B.K., *Industrial Chemistry*, Meerut, 16th Ed, 2014. 3. Soni P.L., Chawla H.M., *Text Book of Organic Chemistry*, Sultan Chand & sons, New Delhi, 29th Ed., 2007.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology

CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids.

CO 3: apply the electrochemistry principles in corrosion, electroplating and fuel cells.

CO 4: identify the reaction rate, order for chemical reactions and explain the purpose of a catalyst.

CO 5: outline the various types of photochemical process.

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL-II
(Physics/ Home Science)</td></tr>
<tr><td>Course No.</td><td colspan="7">Elective-II (GE)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">25UPHCGECQ2</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
● identification of organic functional groups
● different types of organic compounds with respect to their properties.
● determination of elements in organic compounds.</td></tr>
<tr><td></td><td colspan="7">SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS
The analysis must be carried out as follows:
(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
(b) Detection of elements (N, S, Halogens).
(c) To distinguish between aliphatic and aromatic compounds.
(d) To distinguish – Saturated and unsaturated compounds.</td></tr>
<tr><td>Reference Books</td><td colspan="7">Venkateswaran V, Veerasamy R, Kulandaivelu A R, Basic Principles of Practical Chemistry; Sultan Chand & sons, 2nd Ed., 1997.</td></tr>
<tr><td colspan="8">Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: observe the physical state, odour, colour and solubility of the given organic compound.

CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.

CO3: analyze the given organic compound and explain the reactions behind it.</td></tr>
</table>

–

SEMESTER: II								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHSEC2	**NME: HOME ELECTRICAL INSTALLATION**	**Skill Enhancement Course**		**1**	**1**	**2**	**2**	**70**

Learning Objective: The students will get knowledge on electrical instruments, installations and domestic wiring techniques with safety precautions and servicing

UNITS	**COURSE DETAILS**
UNIT-I	**SIMPLE ELECTRICAL CIRCUITS:** Fundamentals of Electricity - Current, Volt, Resistance - Ohm's Law - Capacitance -Inductance - Electrical Charge -Electrical Energy-Electric Potential-Familiarizing Ammeter, Voltmeter and Multimeter- difference between DC and AC **Activity** **1. Construction of Simple circuits** **2. Continuity checking of electrical circuits using multimeter- Hands on training**
UNIT-II	**TRANSMISSION OF ELECTRICITY:** Production and transmission of electricity – concept of power grid – roles of step-up and step-down transformers-transmission losses (qualitative) – – Selecting Quality Cables and Wires- – characteristics of single and multicore wires
UNIT-III	**ELECTRICAL WIRING COMPONENTS AND ACCESSORIES:** Wiring materials-Wiring Accessories-(a) different types of switches -(b) Holders-(c) Ceiling rose-(d) Socket outlet/plug-(e) Main switch-(f) PVC casing-capping wiring-Conduit Wiring-Concealed Wiring- installation of Wiring Accessories on Board. **Activity** **Basic electrical wiring using web resources**
UNIT-IV	**POWER RATING AND POWER DELIVERED:** Conversion of electrical energy in to different forms – work done by electrical energy – power rating of electrical appliances –electrical energy unit in kWh – calculation of EB bill –single and three phase connections – Measures to save electrical energy –

	Activity **1. Power rating of home appliances** **2. Calculation of EB Bill of their Houses**
UNIT-V	**SAFETY MEASURES:** Insulation for wires – colour specification for mains, return and earth – Understanding of fuse and circuit breakers – purpose of earth line – lighting arrestors – short circuiting and over loading – electrical safety – tips to avoid electrical shock – first aid for electrical shock. **Activity** **1. Replacing fuse wire** **2. Protection of House from an electrical shock -Earthing**
TEXT BOOKS	1. Wiring a House: 5th Edition by Rex Cauldwell, (2014). 2. Black & Decker Advanced Home Wiring, 5th Edition: Backup Power - Panel Upgrades - AFCI Protection - "Smart" Thermostats, by Editors of Cool Springs Press, (2018). 3. Complete Beginners Guide to Rough in Electrical Wiring: by Kevin Ryan (2022).

SEMESTER: II

Course Code	Course Title	Category	L	T	P	Credits	Inst. Hours
25UPHSEC3	IKS: Inherited Indian Knowledge In Astronomy	Skill Enhancement Course	2	-	-	2	2

Learning Objective: To help students to trace, identify and acquire the significant Indian astronomical knowledge.

UNITS	COURSE DETAILS
UNIT-I	**Science of Astronomy** History of Indian Astronomy – Vedic Period and Vedāngajyotisa - Siddhanta – Aryabhata - Jyotiḥśāstra – three shandhas of Ganita (Astronomy), Horā (Horoscopic Astrology and Saṃhitā (Omens and Natural Phenomena) - Some of the prominent astronomers and their important contributions – Continuity in Astronomical tradition
UNIT-II	**Celestial Sphere** Diurnal motion of celestial bodies – Motion of celestial bodies relative to stars – Celestial horizon, meridian – Pole star and directions – Zodiac and Constellations – Equator and poles – Latitude at a place and Altitude of poleStar – Ecliptic and Equinoxes – Causes of Lunar and Solar Eclipses **Co-ordinate Systems** Celestial Longitude and Latitude – (Ecliptic System) – Right Ascension and declination (Equatorial System) -Azimuth and Altitude (Horizontal System) – hour Angle and declination (Meridian System) – Phenomenon of Precession of Equinoxes – Tropical (Sāyana) and Sideral (Nirayana) Longitudes
UNIT-III	**Time in Indian Astronomy** Introduction – Civil Day and sidereal day – Solar Year and Civil Calendar –Solar Month and Lunar Month – Luni – Solar Year (Lunar Year) – Adhikamāsa and Ksayamāsa – Yuga system – Indian Eras – Time on Microcosmic Scale.
UNIT-IV	**Calendar and Indian Pañcāṅga** Introduction – Gregorian Calendar – Hindu Calendar – Islamic calendar – Indian Calendar and Pañcāṅga – Thithi – Naksatra – Yoga – Karana – VāraRāśi and Nakṣatra Systems Zodiac and Rāśis – Naksatra System
UNIT-V	**Tripraśna – Direction, place and Time** Introduction – Determination of the North-South Line – Finding Latitude and Co – latitude of a place – Rising and setting points of the sun (Variationand declination) – Times of Sunrise and Sunset – Rising of Signs and Zodiac – intervals of rising of Sāyana Rāśis (or Signs) – Determination of Lagnaat a given time and place.

TEXT BOOKS	1. S. N. Sen and K. S. Shukla, History of Astronomy in India, 2nd Ed.,INSA, Delhi, 2001. 2. S. Balachandra Rao, Indian Astronomy An Introduction, UniversitiesPress, Hyderabad, 2000 3. History of Astronomy: A Handbook, Edited by K. Ramasubramanian, Aniket Sule and Mayank Vahia, SandHI, IIT Bombay, and T.I.F.R. Mumbai, 2016. 4. B.V. Subbarayappa and K.V. Sarma, Indian Astronomy: A Source Book, Nehru Centre, Bombay, 1985

SEMESTER: III								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC3	**GENERAL MECHANICS AND CLASSICAL MECHANICS**	**Core**	**5**	**1**	**-**	**5**	**6**	**70**

COURSE OBJECTIVES	This course allows the students: To have a basic understanding of the laws and principles of mechanics; To apply the concepts of forces existing in the system; To understand the forces of physics in everydaylife; To visualize conservation laws; To apply Lagrangian equation to solve complex problems.
UNIT-I	**LAWS OF MOTION:** Newton's Laws– Forces – Equations of Motion – Frictional Force – Motion of a particle in a Uniform Gravitational Field – Types of Everyday Forces in Physics. **Gravitation:** Classical Theory of Gravitation–Kepler's Laws, Newton's Law of Gravitation – Determination of G by Boy's Method – Earth- Moon System – Weightlessness – Earth Satellites – Parking Orbit – Earth Density – Mass of The Sun – Gravitational Potential– Velocity of Escape – Satellite Potential and Kinetic Energy – Einstein's Theory of Gravitation – Introduction –Principle of Equivalence – Experimental Tests of General Theory of Relativity – Gravitational Red Shift – Bending of Light – Perihelion of Mercury.
UNIT-II	**CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM:** Conservation of Linear and Angular Momentum – Internal Forces and momentum Conservation – Center of Mass – Examples – General Elastic Collision of Particles of Different Masses – System with Variable Mass – Examples – Conservation of Angular Momentum – Torque due to Internal Forces – Torque due to Gravity – Angular Momentum about Center of Mass – Proton Scattering by Heavy Nucleus.
UNIT-III	**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 – Examples –Non-Conservative Forces – General Law of Conservation of Energy.
UNIT-IV	**RIGID BODY DYNAMICS:** Translational and Rotational Motion – Angular Momentum – Moment of Inertia – General Theorems of Moment of Inertia – Examples – Rotation About Fixed Axis – Kinetic Energy of Rotation – Examples – Body Rolling along a Plane Surface – Body Rolling Down an Inclined Plane – Gyroscopic Precision – Gyrostatic Applications.
UNIT-V	**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.

TEXT BOOKS	1. J. C. Upadhyaya, 2019, Classical Mechanics, Himalaya Publishing house, Mumbai. 2. P. Durai Pandian, Laxmi Durai Pandian, Muthamizh Jayapragasam, 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, 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
WEBLINKS	1. https://youtu.be/X4_K-XLUIB4 2. https://nptel.ac.in/courses/115103115 3. https://www.youtube.com/watch?v=p075LPq3Eas 4. https://www.youtube.com/watch?v=mH_pS6fruyg 5. https://onlinecourses.nptel.ac.in/noc22_me96/preview 6. https://www.youtube.com/watch?v=tdkFc88Fw-M https://onlinecourses.nptel.ac.in/noc21_me70/preview

COURSE OUTCOMES

On completion of the course the students should be able to

CO1	Understand the Newton's Law of motion, understand general theory of relativity, Kepler's laws and realize the basic principles behind planetary motion
CO2	Acquire the knowledge on the conservation laws
CO3	Apply conservation law and calculate energy of various systems, understand and differentiate conservative and non-conservative forces
CO4	Gain knowledge on rigid body dynamics and solve problems based on this concept
CO5	Appreciate Lagrangian system of mechanics, applyD‟ Alemberts principle.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	S	S	M	S	S
CO2	S	S	S	M	S	M	S	S	S	M
CO3	S	S	S	S	S	S	M	S	M	S
CO4	M	S	S	S	M	S	S	M	S	S
CO5	S	S	M	S	S	M	S	S	S	M

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	3	2
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	3	3	3	3	3

SEMESTER – III								
Course Code	**COURSE TITLE**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCCQ3	**ELECTRICITY – PRACTICAL**	**Core**	**-**	**-**	**3**	**3**	**3**	**60**

COURSE OBJECTIVES	Construct circuits to learn about the concept of electricity, current, resistance in the path of current, different parameters that affect a circuit. Set up experiments, observe, analyse and assimilate the concept.

Electricity – Practical
(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

BOOKS FOR STUDY	1. Practical Physics and Electronics - C.C. Ouseph, U. J. Rao, V. Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007). 2. A Text Book of Practical Physics - M.N. Srinivasan and others, Sultan Chand and Sons (2014).
REFERENCE BOOKS	1. B.Sc Practical Physics - C. L Arora, S. Chand (1995).

Course Outcomes:	
At the end of the course the student should be able to:	
CO1	Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
CO2	Apply theoretical knowledge to analyze experimental data and draw conclusions.
CO3	Gain proficiency in performing measurements of electric and magnetic fields.
CO4	Enhance critical thinking skills by designing and conducting experiments to investigate specific phenomena in light, electricity and magnetism.

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	3	2	2	2	2	3	3	2
CO2	3	2	3	2	3	2	3	3	3	3
CO3	3	3	3	2	3	2	3	3	2	3
CO4	2	3	2	3	3	3	2	2	2	3

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	2	2
CO2	3	2	3	2	3
CO3	3	3	3	2	3
CO4	2	2	2	2	2

Title of the Course	**THEORY OF EQUATIONS AND DIFFERENTIAL CALCULUS (II B.Sc. Physics)**						
Course No.	**Elective – III (GE)**						
ELECTIVE COURSE	**Year**	**II**	**Credits**	**5**	**Course Code**	**24UPHMGEC3**	
	Semester	**III**					
Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**			
	5	**-**	**-**	**5**			
Pre-requisite	12th Standard Mathematics						
Objectives of the Course	1. To acquire knowledge in a theory of equations, Differential calculus, and Differential equations. 2.To understand the method of solving algebraic equations using the transformation of equations. 3.To promote problem-solving ability in differential equations.						

Course Outcomes:

Students will be able to

CO1: Learn the concepts of theory of equations, differential calculus, ordinary and partial differential equations

CO2: Analyze various methods to find roots of polynomial equations and inspect Horner's method and Newton's method to find approximate real roots

CO3: Understand the concept of the angle between the radius vector and the tangent, radius of curvature, pedal equation, and Descartes rule of signs and solve related problems

CO4: Solve specific types of ordinary and partial differential equations.

CO5: AnalyzethemethodofVariationofparameterstosolveordinarydifferential equations, Lagrange's method to solve partial differential equations

Course Outline	**Unit – I**
	Theory of Equations **15 Hours** Relation between the roots and coefficients of an equation, Imaginary and irrational roots, Symmetric functions of the roots of an equation in terms of its coefficients (up to cubic equations), and Reciprocal equation. **Chapter 6 (Page No: 6.2 - 6.37)**

	Unit – II **Theory of Equations** **15 Hours** **Transformation** of equation (Definition only), Multiplication of roots by m (Definition only), Diminishing the roots of an equation, Removal of a term, Descartes' rule of sign, Descartes's rule of signs for negative roots of an equation, Horner's method, Newton's method of evaluating a real root correct to given decimal places. **Chapter 6 (PageNo: 6.38 - 6.67)**
	Unit - III **Differential Calculus** **15 Hours** The angle between the radius vector and the tangent, Angle of the intersection of two curves, the Length of a perpendicular from the pole to the Tangent, Pedal equation, The Cartesian formula for the radius of curvature, and the Parametric formula for the radius of curvature. **Chapter 10 & 11(Page No.: 10.1 - 10.23, 11.1 - 11.2)**
	Unit – IV **Ordinary Differential Equations** **15 Hours** Second order differential equations with constant coefficients, finding particular integral for the function $f(x)$ a , cosax, sin ax,e sinhax, coshax, xm, $eaxv$ where v is any function of x, Linear homogeneous equation and Variation of parameter. **Chapter 23 & 24 (Page No: 23.1 - 23.32, 24.1 - 24.23)**
	Unit – V **Partial Differential Equations** **15 Hours** Elimination of arbitrary constants, Elimination of arbitrary functions, Definitions - complete solution, singular solutions, General solutions, Standard types, Lagrange's linear partial differential equations (Charpit's method to be excluded). **Chapter 26 (Page No: 26.1 - 26.40, 26.44 - 26.58)**
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	P.R. Vittal - Allied Mathematics**,** Margham Publications, Chennai-17
Reference Books	T.K. Manicavachagam Pillai, Natarajan & K.S. Ganapathy - Algebra Volume-I, Viswanathan Publishers, Pvt. Ltd, 2004.

Web Resources	1. http://www.universityofcalicut.info/SDE/VI%20Sem.%20B.Sc%20Maths%20%20Additional%20Course%20in%20lie%20of%20Pro ject%20-Theory%20of%20equations%20&%20fuzzy%20set.pdf. 2. https://sol.du.ac.in/pluginfile.php/4111/mod_resource/content/1/B.A. 3. %20st%20m%204_1-7_.pdf

SEMESTER – III

Course Code	COURSE TITLE	Category	L	T	P	Credits	Inst. Hour	Marks
25UPHSEC4	**Digital Photography (Entrepreneurial Skill)**	**Skill Enhancement Course**	**1**	**-**	**-**	**1**	**1**	**70**

Learning Objective: To understand the principles of photography and image formation and the science and arts behind it. To understand the essential components of conventional and digital cameras and also the different image processing techniques

UNITS	COURSE DETAILS
UNIT-I	**DIGITAL CAMERAS PRINCIPLE** Principle of Digital Image Capturing –Comparison of Digital and Analog Picture Information – Megapixel – Grain, Noise and Pixel Density – Optical and Digital Zooming – Image Stabilizer – Bit Depth- White Balance
UNIT-II	**DIGITAL CAMERAS AND TYPES:** Colour Modes – File Formats (TIFF, RAW &JPEG) Storage Cards and Types – Digital Cameras: Camera Phones –Compact Camera – Hybrid Camera – Digital SLR
UNIT-III	**THE DIGITAL IMAGE – PRODUCTION:** Hardware: Computer and its Peripherals – Software: Saving Digital File – Basic Editing: Navigating the Image – Undo/Redo/History – Crop – Rotate – Brightness &Contrast – Colour Balance – Hue/Saturation – Dodge/Burn – Cloning & Retouching – Removing An Element In An Image – Advanced Editing: Histogram/Levels – Curves **Activity: Hands on Training in Photo Editing**
UNIT-IV	**THE DIGITAL IMAGE-SELECTION TOOLS** Selection Tools: Magic Wand – Printing Digital Images: Inkjet Printer – Laser Printer – Dye Sub Printer – Lambda/Light Jet Printers **Activity: To edit an image using any one editing tool**
UNIT-V	**THE DIGITAL IMAGE – POSTPRODUCTION** Editing: Histogram/Levels – Curves Selection Tools: Magic Wand – Printing Digital Images: Inkjet Printer – Laser Printer – Dye Sub Printer – Lambda/Light Jet Printers

TEXT BOOKS	1. Michel J. Langford , Anna Fox & Richard Sawdon Smith, Basic photography, 9th Edition, , 2010-NL, Focal press, London 2. Henry Carroll, Read this if you want to take great photographs of people, Laurence King Publishing
REFEREN CE BOOKS	3.Mark Galer, Digital Photography in Available Light Paul Harcourt Davies, The Photographe's practical handbook,2005, UKPRESS

SEMESTER: III								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHSEC5	**Computational methods and Programming in C**	**Skill Enhancement Course**	**1**	**1**	**-**	**2**	**2**	**70**

LEARNING OBJECTIVES	This course will provide the necessary basic concepts of errors in computing and a few numerical methods for finding zeros of non- linear functions. Further, will provide the basics of the C programming language.
UNITS	**COURSE DETAILS**
UNIT-I	**ERRORS IN COMPUTING:** Significant digits – Inherent Errors – Numerical Errors – Modelling Errors – Absolute and Relative Errors – Error Propagation – Conditioning and stability – Convergence of iterative process.
UNIT-II	**ROOTS OF EQUATIONS:** Algebraic, Polynomial, Transcendental equations – Methods of the solution – Iterative methods – Starting and stopping iterative process – Evaluation of polynomials – Bisection method – False Position method-Related problems.
UNIT-III	**C-FUNDAMENTALS:** Character set – Keywords - data types – variable types - constants – identifiers – keywords – operators and expressions – Input and Output functions.
UNIT-IV	**CONTROL STATEMENTS** (Syntax and examples for each) If – else, Nested if-else, Switch – Case,Break, While Loop, for loop, Do-While statement, go to.
UNIT-V	**FUNCTIONS AND ARRAYS** Declaration and definition of a function– accessing a function – passing parameters to a function Defining an array – processing an array – single dimensional array – multidimensional array - simple programs (Addition, Subtraction, Multiplication of two matrices - Ascending and Descending order).
TEXT BOOKS	1. E. Balagurusamy, Numerical Methods, McGraw Hill Publishers, 2017. 2. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 2012
REFERENCE BOOKS	1. E. Balagurusamy, Programming in ANSIC, McGraw Hill Publishers, 2019, 8thEdn. 2. B. Gottfried, Schaum's Outline of Programming with C, McGraw Hill Publishers, 1996.

WEBLINKS	1. https://beginnersbook.com/2014/01/c-tutorial-for- beginners-with-examples/ 2. https://onlinecourses.swayam2.ac.in/cec20_cs02/preview

Semester IV								
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC4	**OPTICS AND SPECTROSCOPY**	**Core**	**4**	**1**	**-**	**5**	**5**	**70**

COURSE OBJECTIVES	To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics; To explain the behavior of light in different mediums; To understand the differences in the important phenomena namely interference, diffraction and Polarization and apply the knowledge in day to day life; To understand the design of optical systems and methods to minims aberrations; To solve problems in optics by selecting the appropriate equations and performing numerical or analytical calculations.
UNITS	**COURSE DETAILS**
UNIT-I	**LENS AND PRISMS:** Fermat‟s Principle Of Least Time – Postulates of Geometrical Optics – Thick and Thin Lenses – Focal Length, Critical Thickness, Power and Cardinal Points of a Thick Lens – Narrow Angled Prisms. **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:** Advantage of an Eyepiece over a Simple Lens – 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 – Resolving Power of, (I) Prism (II) Grating (III) Telescope
UNIT-II	**INTERFERENCE:** Division of Wave Front, Fresnel's Biprism – Fringes with White Light – Division of Amplitude: 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 D2Lines of Sodium Light, (iii) Determination of a Thickness of a Mica Sheet.
UNIT-III	**DIFFRACTION:** Fresnel‟s assumptions – zone plate – action of zone plate for an incident spherical wave front – 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.

UNIT-IV	**POLARISATION:** Optical Activity – Optically Active Crystals –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.
UNIT-V	**SPECTROSCOPY:** Infra-Red Spectroscopy Near Infra-Red and Far Infra-Red – Properties – Origin of IR spectra – IR Spectrophotometer – Applications Interpretation of IR Spectra – CH, CO, CN Bending and Stretching Vibrational Modes Only – Scattering of Light – Raman Effect –Classical Theory –Quantum Theory –Mutual Exclusion Principle – Raman Spectrometer- Characteristics of Raman Lines –Applications – Ultraviolet and Visible Spectroscopy –Properties – Spectrophotometer.
TEXT BOOKS	1. Subramaniam. N & Brijlal, 2014, Optics, 25 th edition, S.Chand & Co. 2. S.L. Gupta, V. Kumar & R.C.Sharma, 1997, Elements of Spectroscopy, 13th Edition, Pragati Prakashan, Meerut. 3. G.Aruldhass, 2000, Molecular Structure and Spectroscopy, II edition PHIPvt Ltd, New Delhi. 4. P.R. Sasikumar, 2012, Photonics, PHIPvt Ltd, New Delhi. 5. K. Rajagopal, 2008, Engineering Physics, PHIPvt Ltd, New Delhi. 6. V. Rajendran, 2012, Engineering Physics, Tata McGraw Hill.
REFERENCE BOOKS	1. Agarwal B.S, 2011, Optics, Kedernath Ramnath Publishers, Meerut. 2. Sathyaprakash, 1990, Optics, VII edition, Ratan Prakashan Mandhir, New Delhi. 3.C.N.Banewell, 2006, Introduction to Molecular Spectroscopy, IV edition, TMH Publishing Co, New Delhi. 4. AjoyGhatak, 2009, Optics, 4th edition, PHIPvt Ltd, New Delhi. 5. Singh & Agarwal,2002,Optics and Atomic Physics, 9th edition, Pragati Prakashan Meerut. 6. D.Halliday, R.Resnick and J. Walker, 2001, Fundamentals of Physics,6th edition, Willey, New York. Jenkins A.Francis & White, 2011, Fundamentals of Optics, 4th edition, McGraw Hill Inc., NewDelhi.
WEBLINKS	1. https://science.nasa.gov/ems/ 2. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUC z wo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472 3. https://science.nasa.gov/ems/ 4. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUC z wo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472 5. https://imagine.gsfc.nasa.gov/educators/gammarabursts/imagine/in d ex.html 6. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh- sir-raman-scattering/ 7. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh- sir-raman-scattering/

COURSE OUTCOMES:

At the end of the course, the student 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 analyse the optical instruments
CO4	Interpret basic formulation of polarization and gain knowledge about polarimeter, appraise its usage in industries
CO5	Relate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes**(CO)**for each course with program outcomes**(PO)** in the3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	M	M	S	S	M	M
CO2	M	S	M	S	M	S	M	M	S	S
CO3	S	M	S	S	S	M	S	S	M	M
CO4	S	M	S	M	M	S	M	M	S	M
CO5	S	M	S	M	S	S	M	S	S	S

Semester IV

Course Code	Course Title	Category	L	T	P	Credits	Inst. Hours	Marks
25UPHCCQ4	**Optics - Practical**	**Core**	**-**	**-**	**3**	**3**	**3**	**60**
COURSE OBJECTIVES	Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results..							

Optics - Practical

(Any Eight Experiments)

. 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 Searles goniometer.

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.

Title of the Course	INTEGRAL CALCULUS AND LAPLACE TRANSFORM (for II B.Sc., PHYSICS)									
Paper Number			**EC II (GENERIC)**							
Category	ELECTIVE		**Year**	**I**	**Credits**		**3**	**Course Code**		**25UPHMGEC4**
			Semester	**IV**						
Instructional Hours per week			**Lecture**	**Tutorial**		**Lab Practice**			**Total**	
			3	**-**		**-**			3	
Pre-requisite			12th Standard Mathematics							

Objectives of the Course	1.To acquire the knowledge in integral calculus, Fourier series and Laplace transform 2. To understand the method of doing problems using the above concepts. 3. To analysis the different methods of solving differential equations using the Laplace transform

Course Outcomes:

Students will be able to

CO1: learn the notions of multiple integrals and Laplace transforms

CO2: Understand the change of order of integration, Fourier coefficients, odd and even functions and solved related problems.

CO3: analyse the properties of integration to evaluate double and triple integrals and Fourier series.

CO4: interpret the properties of Laplace transform, inverse Laplace transform and solve the related problems.

ACO CO5: apply Laplace transform and inverse Laplace transform to solve the differential equations

Course Outline

Unit – I (Hours : 9)

Integral Calculus

Multiple Integrals Evaluation of double integrals, Double integral in polar co- ordinates.

Chapter 20 (sections20.1-20.17)

Unit – II (Hours : 9)

Triple integrals, Change of order of integration. applications of double and triple integrals to area volume and centroid.

Chapter 20(sections20.18 -20.44)

Unit – III (Hours : 9)

Fourier Series

Definition, Finding Fourier series for a given periodic function with period 2π, Fourier series for odd and even functions.

Chapter 21 (sections 21.1-21.40)

Unit – IV(Hours : 9)

Laplace Transform

Definition, Laplace transform of elementary functions, Linearity property, Shifting property, Change of Scale property, Laplace transform of derivatives.

Chapter 27 (sections 27.1-27.20)

Unit – V(Hours : 9)
Inverse Laplace transform, Solving differential equations using Laplace transform. (Simultaneous equations are to be excluded).
Chapter 27 (sections 27.23-27.57)
(Section 5: Examples1-10 only, Exercise 4:1-26 only)

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	P.R.Vittal,AlliedMathematics**,**MarghamPublications,Chennai-1
Reference Books	S. Narayanan and T. K. Manicavachagam Pillay, Calculus-Volume III, S. Viswanathan (Printers and Publishers), Pvt., Ltd, 2011.
Web resources	https://nptel.ac.in

Title of the Course	THEORY OF EQUATIONS AND LAPLACE TRANSFORM USING SAGE MATH- PRACTICAL (for II B.Sc., PHYSICS)								
Paper Number	EC – PRACTICAL								
Category	ELECTIVE	Year	I	Credits		2	Course Code	25UPHM GECQ	
		Semester	IV						
Instructional Hours per week		Lecture	Tutorial		Lab Practice			Total	
		-	-		2			2	

Pre-requisite

Basic knowledge in data and representations

Objectives of the Course

The main objectives of this course are:

1. To work with interpolation and approximation methods in finding roots using Sage Math.
2. To utilize Sage Math to perform symbolic and numerical integration. and Laplace Transforms

Course Outcomes:

Students will be able to

CO1: learn the notions of approximation of solutions, Laplace transforms, inverse Laplace transform and basic operations, commands within SageMath

CO2: understand the fundamental principles of ordinary differential equations and numerical integrations using SageMath to solve them accurately

CO3: apply the Laplace, Inverse Laplace Transforms to solve linear differential equations in SageMath.

CO4: analyze the application of SageMath in solving differential equations in simplifying and solving complex problems.

CO5: evaluate multiple integrals, and non-linear equations with accuracy using SageMath while demonstrating critical thinking skills

Course Outline

Unit I: Theory of Equations

Problems on Finding the roots of the equations using the SageMath.

(Page No: 139-140)

Unit II: Non-Linear Equations

Numerical Solution: Location of solutions of Algebraic equations and Iterative Approximation Methods using SageMath.

(Page No: 263-278)

Unit III: Multiple integral

Available Integration Functions, Multiple Integrals using SageMath

(Page No: 305-317)

Unit IV: Laplace Equations

Solving problems on Laplace transforms using SageMath

(Page No: 225)

Unit V: Inverse Laplace Transforms

Solving problems on Inverse Laplace transformations using SageMath (Page No: 226)

Skills acquired from the course Computational Mathematics with Sage Math
Web Resources https://archive.nptel.ac.in/courses/111/106/111106149/

Semester IV								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHSEC6	**ELECTRONIC DEVICES**	**Skill Enhancement Course**	**1**	**1**	**-**	**2**	**2**	**70**

COURSE OBJECTIVES	Providing an overview of the principles, operation and applications of special diodes. Introducing transistor and transistor biasing. Providing an overview of the principles, operation and applications of special devices. Providing an overview of amplifiers, oscillators and their applications in different electronic fields. To make students acquire knowledge about Boolean algebra, logic circuits, designing counters and the basic concepts of memory and programmable logic device.
UNIT-I	**SPECIAL DIODES:** Spectral response of human eye - Light Emitting Diode (LED)– advantages and its applications – photo transistor -- characteristics and applications – Tunnel diode and its characteristics – Tunnel diode as an Oscillator.
UNIT-II	**SPECIAL TRANSISTORS:** JFET construction - JFET characteristics – parameters - Common source JFET amplifier UJT construction - working – equivalent circuit - characteristics – Relaxation oscillator – SCR Construction – working – equivalent circuit - V-I characteristics and their application.
UNIT-III	**OPERATIONAL AMPLIFIERS:** Op-amp - characteristics – Inverting and non-inverting amplifier - CMRR – Frequency response-Slew rate-Differential Amplifier-Applications: Sign changer and scale changer – adder – subtractor – integrator – differentiator.
UNIT-IV	**AMPLIFIERS:** Principle of Amplifier- Performance analysis of single-stage transistor amplifer-class A power amplifier- class B push pull power amplifier- characteristics of Amplifier-Appliciaton.
UNIT-V	**OSCILLATORS:** Principles of Oscillators- Types of Oscillators-Colpitt's oscillator - Hartley oscillator. Principle of multivibrator - Astable – monostable – bistable multivibrator using transistors – Applications.
TEXT BOOKS	1. Metha V. K. Principles of Electronics, New Delhi, S. Chand & Co. Ltd., 2003. 2. Atul P. Godse, Deepali A. Godse, Electronic Circuits, Pune, Technical Publications, 2009. 3. B. L. Theraja, Basic electronics, S. Chand, New Delhi, 2010. 4. D Leach, Albert Malvino, Digital Principles and Applications, CMc-Graw Hill Inc., US (1994).

Semester IV								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHSEC7	**Communication Systems**	**Skill Enhancement Course**	**2**	**-**	**-**	**2**	**2**	**70**

COURSE OBJECTIVES	To enable the students to understand the different types of communications and make them appreciate the flavour of physics in communication
UNIT-I	**RADIO TRANSMISSION AND RECEPTION:** Introduction-types of modulation –comparison of FM and AM – demodulation – receivers: AM radio receivers – types of AM radio receivers – stages of superheterodyne radio receiver, advantages – disadvantages.
UNIT-II	**FIBER OPTIC COMMUNICATION:** Introduction – Basic Principle of Fiber Optics – Advantages – Construction of Optical Fiber – Classification Based on The Refractive Index Profile – Classification Based On The Number of Modes of Propagation – Losses in Optical Fibers – Attenuation–Advantages of Fiber optic Communication
UNIT-III	**RADAR COMMUNICATION:** Introduction - Basic Radar System –Radar Range – Antenna Scanning –Pulsed Radar System – Search Radar –Tracking Radar – Moving Target Indicator Doppler Effect-MTI Principle – CW Doppler Radar
UNIT-IV	**SATELLITE COMMUNICATION:** Introduction –History of Satellites – Satellite Communication System – Satellite Orbits – Basic Components of Satellite Communication System – Commonly used Frequency In Satellite – Communication – Multiple Access Communication – Satellite Communication in India
UNIT-V	**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)
TEXT BOOKS	1. V.K.Metha, Principles of Electronics, S. Chand &CoLtd., 2013 2. Anokh Singh and Chopra A.K., Principles of communication Engineering, S.Chand& Co, 2013.
REFERENCE BOOKS	1. J.S. Chitode, Digital Communications, 2020, Unicorn publications 2. Senior John. M, Optical Fiber Communications: Principles and Practice, 2009, Pearson Education.

SEMESTER – V								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC5	**ATOMIC PHYSICS AND LASERS**	**Core**	**4**	**1**	**-**	**4**	**5**	**70**
COURSE OBJECTIVES	To study about electric charges, their properties through experiments; To gain knowledge on photoelectric effect; To solve problems based on Einstein′s photoelectric equation; To make students understand the development of atom models, quantum numbers, coupling schemes and analysis of magnetic moments of an electrons; To gain knowledge on excitation and ionization potentials, splitting of spectral lines in magnetic and electric fields; To understand the principle, production and applications of lasers.							

UNITS	COURSE DETAILS
UNIT-I	**THE ELECTRON AND POSITIVE RAYS:** e/m of electron by Dunnington's method –charge of electron by Millikan‟s oil drop method – properties of positive rays –e/m of positive rays by Thomson's parabola method (problems calculation of e/m ratio of positive rays)–mass spectrographs and uses– Bainbridge and Dempster‟s mass spectrographs
UNIT-II	**PHOTOELECTRIC EFFECT:** Photoelectric Emission – Leonard's Experiment – Richardson and Compton Experiment – Laws of Photoelectric Emission – Einstein's Photoelectric Equation (Problems using Einstein's Photoelectric Equation) –Experimental Verification by Millikan‟s Method – Photoelectric Cell– Photo Emissive Cell –Photovoltaic Cell – Photo Conducting Cell – Applications of Photoelectric Cells –Photomultiplier.
UNIT-III	**ATOMIC STRUCTURE:** Sommerfield’s relativistic atom model –vector atom model –various quantum numbers – L-S and J-J coupling – Pauli's exclusion principle – magnetic dipole moment of an electron due to orbital and spin motion – Bohr magneton - Stern and Gerlach experiment – Lande ‘g’ factor.
UNIT-IV	**SPLITTING OF SPECTRAL LINES:** Excitation, Ionisation and Critical Potentials – Davis and Goucher’s Method – Optical Spectra – Spectral Notation and Selection Rules – Fine Structure of Sodium D-Line – Zeeman Effect – Experimental Arrangement and Classical Theory of Normal Zeeman Effect – Larmor's Theorem –Quantum Theory of Normal Zeeman Effect –Anomalous Zeeman Effect –Explanation of Splitting of D1 And D2lines of Sodium – Paschen Back Effect - Stark Effect (Qualitative Only).
UNIT-V	**LASERS:** General Principles of Lasers – Properties of Lasers Action – Spontaneous and Stimulated

	Emission – Population Inversion – Optical Pumping – HeNe Laser (Principle and Working) – Semiconductor Laser –Laser Applications–Holography.
TEXT BOOKS	1. R. Murugesan, Modern Physics, S. Chand & Co. (All units) (Units I&II-Problems) 2. Brijlal & N. Subrahmanyam, Atomic & Nuclear Physics, S. Chand & Co. (All units) 3. J. B. Rajam, Modern Physics, S. Chand & Co. 4. Sehgal & Chopra, Modern Physics, Sultan Chand, New Delhi 5. Avadhahnulu, An Introduction to Lasers - Theory and Applications, M.N., S.Chand & Co., New Delhi, 2001.
REFERENCE BOOKS	1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill. 2. Modern Physics, S. Ramamoorthy, National Publishing & Co. 3. Laser and Non-Linear Optics by B.B.Laud, Wiley Easter Ltd., New York,1985.
WEBLINKS	1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html 2. https://makingphysicsfun.files.wordpress.com/2015/01/photoelec t ric-effect.pptx 3. https://www.khanacademy.org/science/physics/quantum - physics/in-in-nuclei/v/types-of-decay https://www.khanacademy.org/science/in-in-class-12th-physics- india/nuclei

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	List the properties of electrons and positive rays, define specific charge of positive rays, know different mass spectrographs.
CO2	Outline photoelectric effect and the terms related to it, State laws of photoelectric emission, Explain experiments and applications of photo electric effect, Solve problems based on photoelectric equation.
CO3	Explain different atom models, Describe different quantum numbers and different coupling schemes.
CO4	Differentiate between excitation and ionization potentials, Explain Davis and Goucher‟s experiment, Apply selection rule, Analyse Paschen-Back effect, Compare Zeeman and Stark effect.
CO5	Understand the condition for production of laser, Appreciate various properties and applications of lasers.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes**(CO)**for each course with program outcomes**(PO)** in the 3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	M	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	M	S	S	S
CO4	M	S	S	S	S	M	S	M	M	M
CO5	S	M	S	S	M	S	S	M	M	S

SEMESTER – V								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC6	**RELATIVITY AND QUANTUM MECHANICS**	**Core**	**4**	**1**	**-**	**4**	**5**	**70**
COURSE OBJECTIVES	To understand the theory of relativity, its postulates and the consequences. To learn the importance of transformation equations and also to differentiate between special and general theory of relativity. To interpret the wave theory of matter with various theoretical and experimental evidences. To derive and use Schrodinger's wave equation and also learn about various operators. To solve Schrodinger's wave equation for simple problems and analyse to understand the solutions.							

UNITS	COURSE DETAILS
UNIT-I	**SPECIAL THEORY OF RELATIVITY:** Michelson-Morley Experiment–Frames of Reference – Galilean Relativity – Postulates of Special Theory of Relativity – Lorentz Transformation – Consequences – Time Dilation– Concept of Simultaneity – Doppler Effect – Length Contraction–Variation Of Mass with Velocity – Einstein‟s Mass-Energy Relation– Relativistic Momentum – Energy Relation
UNIT-II	**TRANSFORMATION RELATIONS:** Transformation of velocity, mass, energy and momentum – four vector – invariance under transformation – Lorentz transformation and velocity addition equations in terms of hyperbolic functions. **ENERAL THEORY OF RELATIVITY:** Inertial and Gravitational mass – Principle of equivalence – Experimental evidences for General theory of Relativity
UNIT-III	**PHOTONS AND MATTER WAVES:** Difficulties of classical physics and origin of quantum theory –black body radiation – Planck‟s law – Einstein‟s photoelectric equation – Compton effect –pair production – De Broglie waves – phase velocity and group velocity– Davisson and Germer‟s experiment –uncertainty principle – consequences –illustration of Gamma ray microscope.
UNIT-IV	**OPERATORS AND SCHRÖDINGER EQUATION:** Postulates of quantum mechanics – Eigenvalue - linear operators - operators for position, linear Momentum, angular momentum components - observable - commutator algebra – commutator between these operators - Hermitian operator – properties of Hermitian operator– expectation values of position and momentum - Ehrenfest theorem - Schrödinger's equation - Wave function and its interpretation.

UNIT-V	**SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS:** One-dimensional problems: (i) particle in a box, (ii) barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. Higher dimensional problems: (i) Rigid rotator (qualitative), (ii) Hydrogen atom (qualitative).
TEXT BOOKS	1. Special Theory of Relativity,S. P. Puri, Pearson Education, India, 2013. 2. Concepts of Modern Physics, A.Beiser, 6th Ed., McGrawHill, 2003. 3. Modern Physics, R. Murugeshan, Kiruthiga Sivaprasath, S. Chand & Co.,17th Revised Edition, 2014. 4. Quantum Mechanics, S.P.Singh, M.K.Bagde, S.Chand& Co., New Delhi, 2000. 5. Quantum Mechanics in Physics and Chemistry with Applications to Biology, Rabi Majumdar, PHI, 2011. 6. Modern Physics, R. Murugesan, S.Chand& Co., New Delhi. (Quantum Mechanics, Gupta, Kumar and Sharma. Jai Prakash Nath & Co Meerut 7. Quantum mechanics – Satyaprakash and Swati Saluja. KedarNath Ram Nath& Co.
REFERENCE BOOKS	1. Fundamentals of Modern Physics, Peter J. Nolan, 1stEdition, 2014, by Physics 2. Quantum Mechanics, V.Murugan, Pearson Education, India, 2014. 3. Quantum Mechanics, Alastair I. M. Rae and Jim Napolitano, 6th Edition, CRC Press:Taylor& Francis, 2010. 4. Quantum Physics:A Fundamental Approach to Modern Physics, John S. Townsend, University Science Books, Sausalito, California, 2010. 5. Quantum Mechanics: Theory and Applications, Ajoy Ghatak and S. Lokanathan, Springer ScienceB usiness Media, Dordrecht, Netherlands, 2004. 6. Physics ofthe Atom,Editor(s): M. R. Wehr, J. A. Richards, T. W. Adair, 4th Edition, Narosa, 2013. 7. Quantum Mechanics, V.Devanathan, Narosa Pub. House, Chennai, 2005. 8. Quantum Mechanics, V.K. Thangappan, New Age International, New Delhi. 9. AText Book of Quantum Mechanics, Mathews &Venkatesan, Tata McGraw Hill, New Delhi. 10. Quantum Mechanics, Ghatak & Loganathan, Macmillan Publications. 11. Introduction to Quantum Mechanics, Pauling &Wilson, McGraw Hill Co., New York. 12. Quantum Mechanics, Gupta, Kumar and Sharma. JaiPrakashNath&Co Meerut
WEBLINKS	1. http://hyperphysics.phy-astr.gsu.edu/hbase/qapp.html 2. https://swayam.gov.in/nd2_arp19_ap83/preview 3. https://swayam.gov.in/nd1_noc20_ph05/preview https://www.khanacademy.org/science/physics/special-relativity/minkowski-spacetime/v/introduction-tohttps://www.khanacademy.org/science/physics/special-relativity/minkowski-spacetime/v/introduction-to-special-relativity-and-minkowski-spacetime-diagramsspecial- relativity-and-minkowski-spacetime-diagrams

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand various postulates of special theory of relativity.
CO2	Appreciate the importance of transformation equations and also the general theory of relativity.
CO3	Realise the wave nature of matter and understand its importance
CO4	Derive Schrodinger equation and also realize the use of operators.
CO5	Apply Schrödinger equation to simple problems.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes**(CO)**for each course with program outcomes**(PO)** in the3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	M	S	M	M	S	M	M	M
CO3	M	M	S	M	S	S	M	S	S	S
CO4	M	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	M	M	S	M	M	S

Semester V								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHCC7	**ELECTRICITY AND MAGNETISM**	**Core**	**4**	**1**	**-**	**4**	**5**	**70**

COURSE OBJECTIVES	To acquire in-depth knowledge of measuring instruments involving electric and magnetic fields. To study various magnetic properties of materials and their applications. To give an idea of the fundamentals of electromagnetic induction and alternating currents. On the successful completion of the course, students will be able to recognize basic principles and applications of electrometers. Effectively formulate the electrical circuit problem into a mathematical problem using circuits, laws and theorems.

UNITS	**COURSE DETAILS**
UNIT-I	**CAPACITORS AND ELECTROMETERS:** Spherical Capacitors - Cylindrical capacitors– Parallel plate capacitor – Effect of dielectric - the force of attraction between plates of a charged parallel plate capacitor – Guard Ring capacitor – Mica capacitor – uses of capacitors - Quadrant electrometer – measurement of potential, ionization current and dielectric constant.
UNIT-II	**ELECTRICAL MEASUREMENTS AND THERMOELECTRICITY:** Carey–Foster Bridge – theory – temperature coefficient of resistance –potentiometer – calibration of ammeter and high range voltmeter – thermoelectricity – laws of thermos e.m.f.– measurement of thermos e.m.f. using potentiometer–Peltier effect and Peltier coefficient – Thomson effect and Thomson coefficient – relation between π and σ – thermoelectric diagrams and their uses.
UNIT-III	**MAGNETIC PROPERTIES OF MATERIALS:** Relation between three magnetic vectors B, H and M- Intensity of magnetization - Susceptibility – Permeability – Properties, Electron theory and Langevin's theory of dia, para and ferromagnetic materials - magnetic hysteresis – Experiment to draw B-H curve – Ballistic method – Energy loss - determination of susceptibility: Gouy's method.
UNIT-IV	**ELECTROMAGNETIC INDUCTION:** Magnetic induction due to a straight conductor carrying current – Moving coil ballistic galvanometer – damping correction –absolute capacity of a condenser using B.G – Ampere's circuital Law- Faradays Laws of electromagnetic induction – vector form - self – inductance by Anderson's Bridge method – Mutual inductance – Experimental determination - coefficient of coupling
UNIT-V	**ALTERNATING CURRENT:** Peak, average and RMS value of current and voltage– form factor – ac circuit containing resistance and inductance – ac circuit containing resistance and capacitance – series and parallel resonance circuits –Q factor – power in an ac circuit containing LCR – Wattless

	current – choke coil - Transformer – construction, theory and uses – energy loss – skin effect.
TEXT BOOKS	1. Brij Lal and Subrahmanyam, Electricity and Magnetism, S. Chand & Co, New Delhi (2016) 2. R. Murugesan, Electricity and Magnetism, S. Chand & Co, New Delhi(2016)
REFERENCE BOOKS	1. D. N. Vasudeva, Electricity and Magnetism, S. Chand & Co, New Delhi(2016) 2. K. K. Tewari, Electricity and Magnetism, S. Chand & Co, New Delhi (2016) 3. Fundamentals of Electricity and Magnetism – B.D.Duggal and C.L. Chhabra, Vishal Publishing Co(2004)
WEBLINKS	1. https://www.askiitians.com/revision-notes/physics/current- electricity.html https://www.askiitians.com/revision- notes/physics/electromagnetic-induction-and alternating- current/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts of capacitors and types.
CO2	Apply electrical techniques and thermoelectric principles for precise measurements.
CO3	Apply the magnetic properties of materials for characterizing and understanding material behavior
CO4	Gain a comprehensive understanding of electromagnetic induction principles and develop practical skills.
CO5	Analyze resistance, inductance, and capacitance in AC circuits

APPING WITH PROGRAM OUT COMES:

Map course outcomes**(CO)**for each course with program outcomes**(PO)** in the3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	M	S	S	M	M	S
CO2	S	M	M	M	S	M	M	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	M	M	M	M	S	M	M	S	S	M
CO5	S	S	M	M	S	M	M	S	S	M

Semester V

Course Code	Course Name	Category	L	T	P	Credits	Inst. Hours	Marks
25UPHCCQ5	**General Experiments Practical**	**Core**	**-**	**-**	**3**	**3**	**3**	**60**

COURSE OBJECTIVES	Demonstrate physics principles using various experiments and interpret the results.

(ANY EIGHT EXPERIMENTS)

1. Diffraction at a wire and straight edge
2. Specific rotation of a sugar solution
3. Brewster's law- p0larization
4. Biprism – determination of refractive index 5. Dispersive power of plane diffraction grating.
6. Y- by Corlus Method
7. e/m Thomson Method.
8. Kundt's tube – Velocity of sound, Adiabatic Young's modulus of the material of the rod.
9. Forbe's method – Thermal conductivity of a metal rod.
10. Spectrometer– Grating - Normal incidence - Wave length of Mercury spectral lines.
11. Spectrometer – Grating - Minimum deviation - Wave length of Mercury spectral lines.
12. Spectrometer – (i-d) curve.
13. Spectrometer – (i-i′) curve.
14. Spectrometer – Narrow angled prism.
15. Rydberg's constant
16. Spectral response of photo conductor (LDR).
17. Potentiometer –Resistance and Specific resistance of the coil.
18. Potentiometer – E.M.F of a thermocouple.
19. Carey Foster's bridge - Temperature coefficient of resistance of the coil.
20. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and BH using circular coil carrying current.
21. Vibration magnetometer - Determination of BH using circular coil carrying current– Tan B position.
22. B.G – Figure of Merit – Charge Sensitivity

BOOKS FOR STUDY	1. Practical Physics and Electronics - C.C. Ouseph, U. J. Rao, V.Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007). 2. A text book of Practical Physics - M.N. Srinivasan and others, Sultan Chand and Sons (2014).
REFERENCE BOOKS	1. B.Sc Practical Physics - C. L Arora, S. Chand (1995).

Semester V								
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
25UPHDSEC1	**MATERIALS SCIENCE**	**Discipline Specific Elective**	**4**	**1**	**-**	**3**	**5**	**70**

COURSE OBJECTIVES	To learn imperfections in crystals, deformation of materials and testing of materials. To get knowledge on behavior of a material, under the action of light and their applications. To know the applications of crystal defects
UNITS	**COURSE DETAILS**
UNIT-I	**CRYSTAL IMPERFECTIONS:** Introduction – Point Defects: Vacancies**(**Problems**)**, Interstitials, Impurities, Electronic Defects – Equilibrium Concentration of Point Imperfections **(**Problems**)**–Application of Point Defects –Line Defects: Edge Dislocation**(**Problems**)**, Screw Dislocation – Surface Defects: Extrinsic Defects – Intrinsic Defects: Grain Boundaries, Tilt &Twist Boundaries, Twin Boundaries, Stacking Faults – Volume Defects – Effect of Imperfections.
UNIT-II	**MATERIAL DEFORMATION:** Introduction – Elastic Behavior of Materials – Atomic Model of Elastic Behavior – Modulus as a Parameter in Design – Rubber Like Elasticity – Inelastic Behavior of Materials – Relaxation Process – Viscoelastic Behavior of Materials – Spring- Dash Pot Models of Viscoelastic Behavior of Materials.
UNIT-III	**PERMANENT DEFORMATION AND STRENGTHENING METHODS OF MATERIALS:** Introduction –Plastic Deformation: Tensile Stress-Strain Curve – Plastic Deformation by Slip – Creep: Mechanism of Creep – Creep Resistant Materials – Strengthening Methods: Strain Hardening, Grain Refinement – Solid Solution Strengthening – Precipitation Strengthening.
UNIT-IV	**OPTICAL MATERIALS:** Introduction – Optical Absorption in Metals, Semiconductors and Insulators – NLO Materials and their Applications – Display Devices and Display Materials: Fluorescence and Phosphorescence – Light Emitting Diodes –Liquid Crystal Displays.

UNIT-V	**MECHANICAL TESTING:** Destructive Testing: Tensile Test, Compression Test, Hardness Test – Nondestructive Testing (NDT): Radiographic Methods, Ultrasonic Methods – Thermal Methods of NDT: Thermography – Equipment Used for NDT: Metallurgical Microscope
TEXT BOOKS	1. Material science and Engineering, Raghavan V, Prentice Hall of India, Sixth Edition, 2015 2. Materials science, V. Rajendran, McGraw Hillpublications2011.
REFERENCE BOOKS	1. William D. Callister, Jr., Material Science & Engineering – An Introduction, 8th Edition, John Wiley & Sons, Inc., 2007 2. W. Bolton, "Engine ring materials technology", 3rd Edition, Butterworth & Heinemann, 2001. 3. Donald R. Askeland, Prade p P. Phule, "The Science and Engine ring of Materials", 5thEdition, Thomson Learning, First Indian Reprint, 2007. 4. William F. Smith, "Structure and Properties of Engine ring Aloys", Mc-Graw-Hill Inc., U.S.A, 2nd edition, 1993.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand Crystal Imperfections including point, line, and surface defects
CO2	Analyze Deformation Mechanisms under mechanical stress, including elastic and plastic deformation.
CO3	Evaluate and gain knowledge of various material testing techniques, including tensile, hardness, impact, and fatigue tests
CO4	Examine this knowledge in optical applications such as photonics, lasers, and fiber optics.
CO5	Apply the knowledge of crystal defects on electrical, optical, and mechanical properties.

MAPPING WITH PROGRAM OUTCOMES

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	M	S	S	M	M	S	M	M	M
CO3	S	S	S	M	S	M	M	S	M	M
CO4	S	M	S	S	S	M	S	M	S	S
CO5	S	M	S	M	S	S	M	M	M	S

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
25UPHDSEC1B	**MATHEMATICAL PHYSICS**	**Discipline Specific Elective - 1**	**4**	**1**	**-**	**3**	**5**	**70**

COURSE OBJECTIVES	To understand higher mathematical concepts which are applied to solve problems in Physics and similar situations
UNITS	**COURSE DETAILS**
UNIT-I	**MATRICES:** types of matrices – symmetric, Hermitian, unitary and orthogonal matrices– characteristic equation of a matrix – Eigen values and Eigen vectors of a matrix – Cayley-Hamilton theorem – inverse of matrix by Cayley-Hamilton theorem – similarity transformations – diagonalization of 2x2 real symmetric matrices.
UNIT-II	**VECTOR CALCULUS:** vector differentiation – directional derivatives –definitions & Physical significance of gradient, divergence, curl – Laplace operators– vector identities – line, surface and volume integrals – statement, proof and simple problems for Gauss's divergence theorem, Stoke's theorem, Green's theorem.
UNIT-III	**ORTHOGONAL CURVILINEAR COORDINATES:** tangent basis vectors – scale factors – unit vectors in cylindrical and spherical coordinate systems –gradient of a scalar –divergence and curl of a vector – Laplacian in these coordinate systems.
UNIT-IV	**FOURIER SERIES:** periodic functions – Dirichlet's conditions – general Fourier series – even and odd functions and their Fourier expansions – Fourier cosine and sine – half range series – change of length of interval. Fourier analysis of square wave, saw-tooth wave, half wave/full wave rectifier wave forms. **FOURIER TRANSFORMS**: Fourier Integral theorem (Statement only)–Fourier, Fourier sine and Fourier cosine transforms,– Fourier transform of single pulse – trigonometric, exponential and Gaussian functions – inverse Fourier transform – convolution theorem.
UNIT-V	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (PDE):** PDE for transverse vibrations in elastic strings (one dimensional wave equation) –one dimensional heat flow equation – solutions to these PDE's by method of separation of variables – problems based on boundary conditions and initial conditions.
TEXT BOOKS	1. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India. 2. Mathematical Physics – P. K. Chattopadhyay, New Age International Publishers. 3. Mathematical Physics – B. D. Gupta. 4. Mathematical Physics – H. K. Das, S. Chand & Co, New Delhi.
REFERENCE BOOKS	1. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill. 2. Engineering Mathematics III- B, M. K. Venkataraman, 3. Applied Mathematics for Scientists and Engineers, Bruce R. Kusse & Erik A. Westwig, 2nd Ed, WILEY-VCH Verlag, 2006. 4. Vector space & Matrices – J. C. Jain, Narosa Publishing House Pvt. Ltd.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the basic concepts of matrices and its applications
CO2	Apply vectors in various fields like physics and engineering.
CO3	Implement vectors to solve problems involving vector calculus in different coordinate systems.
CO4	Analyse Fourier series and transforms to solve problems using them, and understand their applications in various fields
CO5	Apply their knowledge of PDEs to diverse situations in physics

MAPPING WITH PROGRAM OUTCOMES

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	M	S	S	M	M	S	M	M	M
CO3	S	S	S	M	S	M	M	S	M	M
CO4	S	M	S	S	S	M	S	M	S	S
CO5	S	M	S	M	S	S	M	M	M	S