B.Sc. PHYSICS

(Effective from the academic year 2024 - 2025)

Vision of the Department:

- To empower the young women by imparting quality education in physics that promotes interest and thirst for research in the field of physics to create competency and skills.

Objectives:

- To equip the knowledge and the skills needed to understand, improve and preserve the physical environment.
- To inculcate in them the scientific temper and spirit of inventiveness
- To identify the students talents and traits carefully and to provide adequate expression of their personalities
- To develop in the minds of the students a wide range of wholesome interests by providing opportunities for learning through co-operative work.

Eligibility for admission to B.Sc. PHYSICS:

- A pass in higher secondary with Mathematics, Physics, Chemistry and Biology (Category I).
- A pass in higher secondary with Mathematics, Physics, Chemistry and Computer Science (Category II)

Allied Subjects:

1. Mathematics
2. Chemistry

Eligibility to take Allied Subjects:

- Students who belong to category I and II are eligible to take Mathematics and Chemistry as one of the allied papers in their first and second years.

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application-oriented content wherever required.

- The Core subjects include latest developments in the education and scientific front, practical training, catering to the needs of stakeholders with research aptitude.

- The curriculum is designed to strengthen the industry-academia interface and provide more job opportunities for the students.

- The Internship during the second-year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.

- Project with viva-voce component in the fifth semester enables the students to apply their conceptual knowledge to practical situations. Such innovative provisions of the industrial training/project/internships will give students an edge over the counterparts in the job market.

- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective and Skill Enhancement Courses, covering conventional topics to the application oriented.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course in Physics** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning physics and its concepts.	• Instil confidence among students • Create interest for the subject

I, II, III & IV	**Skill Enhancement papers** (Discipline centric/ Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Skill training to girls leads to women empowerment
		• Discipline centric skill will improve the technical knowhow of solving real life problems
I, II, III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the state-of art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Emerging topics related to industry are introduced to facilitate advanced learning in the respective domains
III Year Vacation activity	Industrial Training	• Educational institutions, enable the students gain professional experience and become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• 'General Awareness for Competitive Examinations' caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

TANSCHE BASED PROGRAMME STRUCTURE FOR B.Sc. PHYSICS (For the candidates admitted from the academic year 2024-2025)									
Sem	**Part**	**Category**	**Paper Code**	**Title**	**Hours/ Week**	**Exam**		**Credits**	**Marks**
						Th	Pr		
I	I	Tamil/Language	ULTAA24	Tamil Paper – I	**5**	3	-	**3**	40 + 60
	II	English	UENGA24	English Paper – I	**6**	3	-	**3**	40 + 60
	III	Core Course 1	UCPHA24	Properties of Matter and Acoustics	**5**	4	-	**5**	40 + 60
		Core Practical 1	UCPHB24	Practical - I:	**3**	-	3	**3**	40 + 60
		Generic Elective 1	UAMAA24	Allied - I: Mathematics – I	**6**	3	-	**5**	40 + 60
	IV	Skill Enhancement Course SEC 1	USPHI24	SEC: Physics for everyday life	**2**	-	-	**2**	100
		Foundation Course FC	UFPH24	FC: Introductory Physics	**2**	2	-	**2**	40 + 60
		Value Education	UVEDA22*	Value Education	**1**	-	-	-	-
Total					**30**			**23**	**700/800**
II	I	Tamil/Language	ULTAB24	Tamil Paper – II	**6**	3	-	**3**	40+ 60
	II	English	UENGB24	English Paper – II	**5**	3	-	**3**	40 + 60
	III	Core Course 2	UCPHC24	Heat, Thermodynamics and Statistical Physics	**5**	4	-	**5**	40 + 60
		Core Practical 2	UCPHD24	Practical - II:	**3**	-	3	**3**	40 + 60
		Generic Elective 2	UAMAB24	Allied - II: Mathematics – II	**6**	3	-	**5**	40 + 60
	IV	Skill Enhancement Course SEC 2	USPH224	SEC: Home Electrical Installation	**2**	-	-	**2**	100
		Skill Enhancement Course SEC 3	USPH324	SEC: Mathematical Physics	**2**	-	-	**2**	100
		Value Education	UVEDA22**	Value Education	**1**	-	-	-	-
Total					**30**			**23**	**700/800**
III	I	Tamil/Language	ULTAC24	Tamil Paper – III	**5**	3	-	**3**	40+ 60
	II	English	UENGC24	English Paper – III	**6**	3	-	**3**	40 + 60
	III	Core Theory 3	UCPHE24	Mechanics	**5**	3	-	**5**	40 + 60
		Core Practical 3	UCPHF24	Practical - III:	**3**	-	3	**3**	40 + 60
		Generic Elective 3	UACHA324	Allied - III: Chemistry – I	**4**	3	-	**3**	40 + 60
			UACHB324	Allied Practical: Chemistry - I	**2**	-	3	**2**	40 + 60
	IV	Skill Enhancement Course SEC 4	USPH424	SEC: Energy Physics	**2**	-	-	**2**	100
		Skill Enhancement Course SEC 5	USPH524	SEC: Communication system	**2**	-	-	**2**	100
		EVS	UNEVS24*	Environmental Studies	**1**	-	-	-	-
		Value Education	UVEDA22**	Value Education	**1**	-	-	-	-
Total					**30**			**22**	**800**

Sem	Part	Category	Paper Code	Title	Hours/ Week	Exam		Credits	Marks
						Th	Pr		
IV	I	Tamil/Language	ULTAD24	Tamil Paper – IV	**6**	3	-	**3**	40+ 60
	II	English	UENGD24	English Paper – IV	**5**	3	-	**3**	40 + 60
	III	Core Course 4	UCPHG24	Optics and Laser Physics	**5**	3	-	**5**	40 + 60
		Core Practical 4	UCPHH24	Practical - IV:	**3**	-	3	**3**	40 + 60
		Generic Elective 4	UACHC424	Allied - IV: Chemistry – II	**4**	3	-	**4**	40 + 60
			UACHD424	Allied Practical: Chemistry Practical – II	**2**	-	3	**2**	40 + 60
	IV	Skill Enhancement Course SEC 6	USPH624	SEC: Astrophysics	**2**	-	-	**2**	100
		Skill Enhancement Course SEC 7	USPH724	SEC: Material Science	**1**	-	-	1	100
		EVS	UNEVS24	Environmental Studies	**1**	2	-	**2**	40 + 60
		Value Education	UVEDA22 ****	Value Education	**1**	-	-	-	-
Total					**30**			**25**	**900**
V	III	Core Course 5	UCPHI24	Electricity magnetism and electromagnetism	**5**	3	-	**5**	40 + 60
		Core Course 6	UCPHJ24	Atomic and Nuclear Physics	**5**	3	-	**4**	40 + 60
		Core Practical 5	UCPHK24	Practical -V	**3**	-	3	**3**	40 + 60
		Core Course (Group Project)	UCPHL24	Project	**5**	-	-	**4**	40 + 60
		Discipline Specific Elective 1	UEPHA24	Elective: Nanoscience and Nano Technology	**5**	3	-	**3**	40 + 60
			UEPHB24	Elective: Digital Photography					
		Discipline Specific Elective 2	UEPHC24	Elective: Analog and communication electronics	**5**	3	-	**3**	40 + 60
			UEPHD24	Elective: Advanced Mathematical Physics					
	IV	Value Education	UVEDA22 *****	Value Education	**1**	-	-	-	-
		Summer Internship/Industrial Training	UITPH24	Internship	**-**	-	-	**2**	40 + 60
Total					**30**			**24**	**700**
VI	III	Core Course 7	UCPHM24	Quantum mechanics and Relativity	**5**	3	-	4	40 + 60
		Core Course 8	UCPHN24	Solid State Physics	**5**	3	-	4	40 + 60
		Core Course 9	UCPHO24	Digital Electronics and Microprocessor	**5**	3	-	3	40 + 60
		Core Practical 6	UCPHP24	Practical – VI	**3**	-	3	2	40 + 60
		Discipline Specific Elective 3	UEPHE24	Laser and Fiber Optics	**4**	3	-	3	40 + 60
			UEPHF24	Medical Instrumentation					
		Discipline Specific Elective 4	UEPHG24	Numerical methods and C-Programming	**4**	3	-	3	40 + 60
			UEPHH24	Physics of Music					
	IV	Professional Competency SEC 8	UPPH24	Physics for Competitive Examinations	**2**	2	-	1	40 + 60
		Value Education	UVEDA22	Value Education	**1**	2	-	2	40 + 60
	V	Extension Activity	-	Extension Activity (90 hours)	-	-	-	1	-
Total					**30**			**23**	**800**
Grand Total					**180**			**140 +2***	**4800/ 4600**

- Any one course of the following to be completed during III semester (15 hours teaching and 15 hours activities):
  i) Fundamentals of Computer and MS Office (Computer Science & B.C.A)
    - Advanced Excel
    - Multimedia Using Flash
    - Photoshop
  ii) Health and Fitness (Physical Education)

Methods of Evaluation						
S. No.	**Category**	**Assessment Tool**	**Maximum Marks**	**Exam Theory**	**Weightage**	
1	Core Courses/Generic & Discipline Specific Electives	I Continuous Assessment (ICA)	50	1 ½ h	35	40
		II Continuous Assessment (IICA)	50	1 ½ h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	100	3 h		60
2	Foundation Course/Professional Competency SEC/	I Continuous Assessment (ICA)	30	1 h	35	40
		II Continuous Assessment (IICA)	30	1 h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	60	2 h		60
3	EVS	Continuous Assessment (IICA)	25	1 h		40
		Innovative Component (IC)	25	-		
		End Semester Examination	60	2 h		60

Activity-based Assessment for Skill Enhancement Courses:

Activity 1 for Unit I: (Nature of Activity) – 20 marks

Activity 2 for Unit II: (Nature of Activity) – 20 marks

Activity 3 for Unit III: (Nature of Activity) – 20 marks

Activity 4 for Unit IV: (Nature of Activity) – 20 marks

Activity 5 for Unit V: (Nature of Activity) – 20 marks

Nature of Activity – Field visit/Industrial visit/Project (individual or group)/Exhibits/Model making/Hands on training/Lab practice/Product making/Extempore/Block and Tackle/Debate/Report writing/Case study/Interpretation of data or results/Transcription/Quiz (LMS)/Problem solving/

Designing/Role play/Start-up proposal/Research proposal/Poster presentation/Oral presentation (live or video recorded)/Survey (Field or Online)/Group discussion/Problem solving/Problem formulation/Interviews/Concept mapping/Mind mapping /Promoting public awareness etc.

Record of Assessment will be maintained by the course instructors and verified by the Head of the department.

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

PROGRAMME OUTCOMES (PO)

On completion of the UG Programme, the students will be able to:

PO1: Attain knowledge and understand the principles and concepts in the respective discipline.

PO2: Acquire and apply analytical, critical and creative thinking, and problem-solving skills.

PO3: Effectively communicate general and discipline-specific information, ideas and opinions.

PO4: Appreciate biodiversity and enhance eco-consciousness for sustainable development of the society.

PO5: Emulate positive social values and exercise leadership qualities and team work.

PO6: Pursue higher knowledge, qualify professionally, enhance entrepreneurial skills and contribute towards the needs of the society.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of the UG Programme in Physics, the students will be able to:

PSO1: Students are expected to acquire knowledge in physics, including the major premises of Properties of matter and sound, Thermal Physics, Classical and quantum mechanics, electricity and Magnetism, electronics, optics, Relativity and modern physics.

PSO2: Students are also expected to develop skills in Physics for competitive Examinations.

PSO3: Analyze physical problems and develop correct solutions using natural laws.

PSO4: Students will develop the proficiency in the skill of data using a variety of laboratory instruments.

PSO5: Students will realize and develop an understanding of the impact of physics andscience on society.

PSO6: Prepare the student to successfully compete for employment and to offer awide range of applications.

PSO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
PSO1	H	M	H	M	H	H
PSO2	H	M	H	H	M	H
PSO3	H	L	H	H	M	M
PSO4	H	M	H	M	H	L
PSO5	L	M	M	H	L	H
PSO6	H	H	L	L	H	L

(HIGH - 3, MODERATE - 2, LOW - 1)

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	14	22	18	93
Part IV	4	4	3	5	2	4	22
Part V	-	-	-	-	-	1	1
Other	-	-	2	-	-	-	2
Total	23	23	24	25	24	23	**142**

*****Part I, II, and Part III components will be separately considered for CGPA calculation and classification for the undergraduate programme and the other components. IV, V must be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

<table>
<tr><td>Title of the Course</td><td colspan="7">PROPERTIES OF MATTER AND ACOUSTICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core -1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Course 1</td><td>Year</td><td>I</td><td>Credits</td><td>5</td><td>Course Code</td><td>UCPHA24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• 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.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
Elasticity
1.1 Stress-Strain diagram - Hooke’s law
1.2 Elastic constants –Poisson’s ratio
1.3 Relation between elastic constants and Poisson’s ratio
1.4 Work done in stretching and twisting a wire – twisting couple on a cylinder
1.5 Rigidity modulus by static torsion (Scale and telescope)
1.6 Determination of Rigidity modulus and moment of inertia using torsional pendulum (with and without masses) – q,n, σ by Searles method.</td></tr>
<tr><td colspan="7">Unit II (12 hours) (K1, K2, K3 & K4)
BENDING OF BEAMS
2.1 Bending of beam- Expression for Bending moment
2.2 Cantilever— Expression for depression at the loaded end of the cantilever– oscillations of a cantilever – Expression for time perio
2.3 Determination of Young’s Modulus by cantilever oscillations
2.4 Non-uniform bending– Experiment to determine Young’s modulus by Koenig’s method
2.5 Uniform bending – expression for elevation
2.6 Experiment to determine Young’s modulus using pin and microscope</td></tr>
<tr><td colspan="7">UNIT III: FLUID DYNAMICS: (15 hours) (K1, K2, K3 & K4)
Surface tension
3.1 Surface Tension: Definition and dimension of Surface tension – Molecular forces.
3.2 Excess pressure over curved surface - Its application to spherical, cylindrical</td></tr>
</table>

	drops, bubbles- synclastic and anticlastic surface. 3.3 Determination of surface tension by Jaegar's method–variation of surface tension with temperature 3.4 Viscosity: Viscosity definition, stream line flow, turbulent flow 3.5 Rate of flow of liquid in a capillary tube – Poiseuille's formula –corrections 3.6 Terminal velocity and Stoke's formula- variation of viscosity with temperature
	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **WAVES AND OSCILLATIONS** 4.1 Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM 4.2 Composition of two SHM in a straight line and at right angles – Lissajous's figures 4.3 Free, damped, forced vibrations –resonance and Sharpness of resonance. 4.4 Laws of transverse vibration in strings –sonometer 4.5 Determination of AC frequency using sonometer 4.6 Determination of frequency using Melde'sstring apparatus
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **ACOUSTICS OF BUILDINGS AND ULTRASONICS:** 5.1 Intensity of sound – decibel – loudness of sound –reverberation – 5.2 Sabine's reverberation formula – acoustic intensity 5.3 Factors affecting the acoustics of buildings. ***Ultrasonic waves*:** 5.4 Production of ultrasonic waves – Piezoelectric crystal method – 5.5 Magnetostriction effect 5.6 Application of ultrasonic waves
	UNIT VI **PROFESSIONAL COMPONENTS:** expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chand and Co. 2. BrijLaland N. Subrahmanyam, 2003, Properties of Matter, S.Chand and Co 3. D.R.Khanna andR.S.Bedi, 1969, Textbook of Sound, AtmaRamand sons 4. BrijLal and N.Subrahmanyam, 1995, A Text Book of Sound, Second revised edition,Vikas Publishing House. 5. R.Murugesan,2012, Properties of Matter, S.Chandand Co
Reference Books	1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publisher 2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition,R. Chand and Co. 3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.
Website and e-learning source	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-SuaSu1sandt=3s 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:

On completion of the course the students should be able to

CO1: Relate elastic behavior in terms of three modulii 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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	M	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	L
CO2	H	M	H	H	H	H
CO3	H	H	H	M	H	H
CO4	H	H	L	H	H	H
CO5	H	H	H	H	H	M

Title of theCourse	PRACTICAL - I						
Paper No.	Core Practical -I						
Category	Core	Year	I	Credits	3	Course Code	UCPHB24
		Semester	I				
Instructional hours perweek	Lecture	Tutorial	Lab Practice			Total	
	-	-	3			3	
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

Minimum of Eight Experiments from the 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 and 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 and 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.

Determination of g using compound pendulum.

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: PHYSICS FOR EVERYDAY LIFE</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC-I</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td>USPHI24</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at
• 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</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I (6 hours)
MECHANICAL OBJECTS: spring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.</td></tr>
<tr><td></td><td colspan="7">UNIT-II (6 hours)
OPTICAL INSTRUMENTS AND LASER: vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.</td></tr>
<tr><td></td><td colspan="7">UNIT-III (6 hours)
PHYSICS OF HOME APPLIANCES: bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners</td></tr>
<tr><td></td><td colspan="7">UNIT-IV (6 hours)
SOLAR ENERGY: Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells</td></tr>
<tr><td></td><td colspan="7">UNIT-V (6 hours)
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.</td></tr>
</table>

Recommended Text	1. The Physics in our Daily Lives, UmmeAmmara, Gugucool Publishing, Hyderabad, 2019. 2. For the love of physics, Walter Lawin, Free Press, New York, 2011.

Course Outcomes:

On completion of the course the students should be able to

CO1: Appraise the importance of Physics in daily life.
CO2: Understand the importance about optical instruments and laser
CO3: Examine the working of basic household appliances
CO4: Recall the importance of conservation of energy.
CO5: Appraise the indian physicist and their contributions

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	M	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	M	H	H	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	H	H	H	M	H
CO2	H	H	H	H	H	H
CO3	H	M	H	H	H	M
CO4	H	H	H	H	H	H
CO5	H	H	H	M	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">INTRODUCTORY PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">FOUNDATION COURSE</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">FC -1</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td>Course Code</td><td>UFPH24</td></tr>
<tr><td>Semester</td><td>I</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>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">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</td></tr>
<tr><td></td><td colspan="7">UNIT II
Different types of forces–gravitational, electrostatic, magnetic, electromagnetic, nuclear – mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces</td></tr>
<tr><td></td><td colspan="7">UNIT-III:
Different forms of energy– conservation laws of momentum, energy – types of collisions –angular momentum– alternate energy sources–real life examples</td></tr>
<tr><td></td><td colspan="7">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.</td></tr>
<tr><td></td><td colspan="7">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</td></tr>
</table>

Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

PROFESSIONAL COMPONENTS: expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. D.S. Mathur, 2010, Elements of Properties of Matter, S.Chand and Co 2. BrijLaland N. Subrahmanyam, 2003, Properties of Matter, 3. S.Chand and Co.
Reference Books	1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S.Chand and Co.
Website and e-learning source	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:

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

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.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core -2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core -2</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td>Course Code</td><td>UCPHC24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• 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</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
CALORIMETRY & LOW TEMPERATURE PHYSICS
1.1 Specific heat capacity – specific heat capacity of gases C_P and C_V– Meyer’s relation
1.2 Joly’s method for determination of C_V – Regnault’s method for determination of C_P
1.3 Joule Thomson effect-Joule Kelvin Effect -Porous plug experiment – Theory
1.4 Boyle temperature – temperature of inversion- Liquefaction of gas by Linde’s Process
1.5 Kammerling Onne’s Method - Liquefaction of Hydrogen- Liquefaction of Helium
1.6 Production of low temperature - adiabatic demagnetization</td></tr>
<tr><td colspan="7">UNIT II (12 hours) (K1, K2, K3 & K4)
THERMODYNAMICS – I
2.1 Introduction – Thermodynamic system- Zeroth Law of Thermodynamics
2.2 Statement of First Law of Thermodynamics -Statement of Second Law
2.3 Heat Engines and Ideal Heat Engine - Concept of Entropy-Entropy of an Ideal GasReversible and Irreversible Process and their entropy
2.4 Carnot Theorem and Proof of Carnot Theorem
2.5 Construction and working of Internal Combustion Engine - Petrol and DieselEngines
2.6 First Latent Heat Equation – Clausis-Clapeyron equation and Second Latent HeatEquation</td></tr>
</table>

	UNIT III: THERMODYNAMICS – II: (15 hours) (K1, K2, K3 & K4) 3.1 Thermodynamic Scale of Temperature or Work Scale of Temperature and its Relation to Perfect Gas Scale 3.2 Entropy Temperature Diagram 3.3 Maxwell's Thermodynamic Equations and its Applications 3.4 Thermodynamic Potentials - Free Energy – Enthalpy- Internal energy – Helmholtz free energy – Significance of thermodynamic potentials 3.5 Gibbs function - Gibb's Helmholtz Equation - Third Law of Thermodynamics 3.6 Phase transition expression for the first order and second order transition
	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **HEAT TRANSFER & RADIATION** 4.1 Modes of heat transfer: conduction, convection and radiation. 4.2 Thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method 4.3 Determination of thermal conductivity of a bad conductor by Lee's disc method. 4.4 Stefan's Law -Laboratory determination of Stefan's Constant 4.5 Derivation of Newton's Law of Cooling from Stefan's Law 4.6 Planck's Quantum Theory of Radiation-Deduction of Wien's Law and Raleigh- Jeans Law from Planck's Law
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **STATISTICAL MECHANICS** 5.1 Definition of Phase-Space - Micro and Macro States 5.2 Different types of Ensembles- classical and quantum Statistics 5.3 Expression for Maxwell Boltzmann Statistics 5.4 Maxwell's law of Distribution energy 5.5 Expression for Fermi Dirac Statistics 5.6 Derivation for Bose Einstein Statistics - Comparison of Three Statistics
	Unit VI **PROFESSIONAL COMPONENTS:** expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Recommended Text	1. BrijlalandN. Subramaniam, 2000, Heat and Thermodynamics, S.Chandand Co. 2. NarayanamoorthyandKrishnaRao, 1969,Heat, Triveni Publishers, Chennai. 3. V.R.KhannaandR.S.Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish and Co, Meerut 4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations,Vikas Publishing House, New Delhi. 5. Ghosh, 1996, Text Book of Sound, S.ChandandCo. 6. BrijlalandN. Subramaniam, 2000, Heat and Thermodynamics, S.Chandand Co. 7. NarayanamoorthyandKrishnaRao, 1969,Heat, Triveni Publishers, Chennai. 8. V.R.KhannaandR.S.Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish and Co, Meerut 9. Brijlal and N. Subramanyam, 2001, Waves and Oscillations,Vikas Publishing House, New Delhi. 10. Ghosh, 1996, Text Book of Sound, S.ChandandCo.
Reference Books	1. J.B.Rajamand C.L.Arora, 1976, Heat and Thermodynamics, 8th edition, S.Chandand Co. Ltd. 2. D.S.Mathur, Heat and Thermodynamics, Sultan Chand and Sons. 3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand and Co. 4. Resnick, HallidayandWalker,2010, Fundamentals of Physics, 6th Edition. 5. Sears, Zemansky, Hugh D. Young,Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson.
WEB RESOURCES	1. https://youtu.be/M_5KYncYNyc 2. https://www.youtube.com/watch?v=4M72kQulGKkandvl=en 3. Lecture 1: Thermodynamics Part 1 | Video Lectures | Statistical Mechanics I: Statistical Mechanics of Particles | Physics | MIT OpenCourseWare 4. http://www.freebookcentre.net/Physics/Physics-Books-Online.html

Course Outcomes:

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

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 of the 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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	H	L	H
CO3	H	L	H	H	L	H
CO4	H	H	H	L	H	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	L	H	H	L	H
CO3	H	L	H	L	M	H
CO4	H	M	H	H	M	H
CO5	H	L	H	H	L	M

<table>
<tr><td>Title of theCourse</td><td colspan="7">PRACTICAL - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Practical -II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>UCPHD24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours perweek</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">3</td><td colspan="2">3</td></tr>
<tr><td>Course Objectives</td><td colspan="7">Apply their knowledge gained about the concept of heat and sound waves, resonance, calculate frequency of ac mains set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results</td></tr>
<tr><td colspan="8">HEAT, OSCILLATIONS, WAVES and SOUND</td></tr>
<tr><td colspan="8">Minimum of Eight Experiments from the 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.
Frequency of AC by using sonometer.</td></tr>
</table>

<table>
<tr><td>Title of the Course</td><td colspan="8">SKILL ENHANCEMENT COURSE: HOME ELECTRICAL INSTALLATION</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC-II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">USPH224</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• The students will get knowledge on electrical instruments, installations and domestic wiring techniques with safety precautions and servicing.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNIT - I
SIMPLE ELECTRICAL CIRCUITS: charge, current, potential difference, resistance – simple electrical circuits – DC ammeter, voltmeter, ohmmeter – Ohm’s law – difference between DC and AC – advantages of AC over DC – electromagnetic induction - transformers – inductors/chokes – capacitors/condensers – impedance – AC ammeter, voltmeter –symbols and nomenclature</td></tr>
<tr><td colspan="8">UNIT-II (6 hours)
TRANSMISSION OF ELECTRICITY: production and transmission of electricity – concept of power grid – Series and parallel connections – technicalities of junctions and loops in circuits –transmission losses (qualitative) – roles of step-up and step-down transformers – quality of connecting wires – characteristics of single and multicore wires</td></tr>
<tr><td colspan="8">UNIT-III (6 hours)
ELECTRICAL WIRING: different types of switches – installation of two way switch – role of sockets, plugs, sockets - installation of meters – basic switch board – electrical bell – indicator – fixing of tube lights and fans – heavy equipment like AC, fridge, washing machine, oven, geyser, jet pumps – provisions for inverter – gauge specifications of wires for various needs</td></tr>
<tr><td colspan="8">UNIT-IV (6 hours)
POWER RATING AND POWER DELIVERED: conversion of electrical energy in to different forms – work done by electrical energy – power rating of electrical appliances – energy consumption – electrical energy unit in kWh – calculation of EB bill – Joule’s heating – useful energy and energy loss – single and three phase connections – Measures to save electrical energy – energy audit</td></tr>
<tr><td colspan="8">UNIT-V (6 hours)
SAFETY MEASURES: insulation for wires – colour specification for mains, return and earth – Understanding of fuse and circuit breakers – types of fuse:</td></tr>
</table>

	kit-kat, HRC, cartridge, MCB, ELCB – purpose of earth line – lighting arrestors – short circuiting and over loading – electrical safety – tips to avoid electrical shock – first aid for electrical shock – fire safety for electric current

Books for Study and Reference:	1. Wiring a House: 5th Edition by Rex Cauldwell, (2014). 2. Black and 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).

Course Outcomes:

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

CO1: Understand the basic concepts, basic laws and methods of analysis of DC and AC networks.

CO2: Study about supply of electricity to homes.

CO3: Study the construction and working of domestic appliances.

CO4: Understand the conversion of electrical energy in to different forms.

CO5: Learn the effect of electric current and Safety precautions to be taken when working with electricity.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	M	H	H	L	L	H
CO3	H	H	M	M	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	M	M	L	L	H
CO4	H	L	H	H	M	H
CO5	H	M	H	M	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: MATHEMATICAL PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</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">USPH324</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="2">-</td><td colspan="3">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 at providing an overall view of the
• Higher mathematical concepts which are applied to solve problems in Physics and similar situations</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="7">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</td></tr>
<tr><td colspan="7">UNIT-II
VECTOR CALCULUS
Vector differentiation – directional derivatives –definitions and Physical significance of gradient, divergence, curl – vector identities – line, surface and volume integrals – statement, proof and simple problems for Gauss’s divergence theorem, Stoke’s theorem</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td colspan="7">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
FOURIER TRANSFORMS: Fourier Integral theorem(Statement only)– Fourier, Fourier sine and Fourier cosine transforms</td></tr>
</table>

	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.
Recommended Text	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. Mathematical Physics – H. K. Das, S. Chand and 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. Kusseand Erik A. Westwig, 2nd Ed, WILEY-VCH Verlag, 2006. 4. Vector space and Matrices – J. C. Jain, Narosa Publishing House Pvt Ltd

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	M	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	L
CO2	H	M	H	H	M	H
CO3	H	H	H	M	H	L
CO4	H	H	H	H	H	H
CO5	H	L	H	H	M	M

<table>
<tr><td>Title of the Course</td><td colspan="7">MECHANICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core - III</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>5</td><td>Course Code</td><td>UCPHE24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>III</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">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 everyday life;
• To visualize conservation laws;
• To apply Lagrangian equation to solve complex problems.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I
LAWS OF MOTION & GRAVITATION
1.1 Newton’s Laws – forces – equations of motion – frictional force
1.2 Motion of a particlein a uniform gravitational field – types of everyday forces in Physics.
1.3 Classical theory of gravitation–Kepler’s laws, Newton’s law of gravitation – Determination of G by Boy’s method
1.4 Earth-moon system – weightlessness – earth satellites – parking orbit – earth density – mass of the Sun
1.5 Gravitational potential – velocity of escape – satellite potential and kinetic energy –Einstein’s theory of gravitation
1.6 Introduction –principle of equivalence – experimental tests of general theory of relativity – gravitational red shift – bending of light – perihelion of mercury.</td></tr>
<tr><td></td><td colspan="7">UNIT-II
CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM
2.1 Conservation of linear and angular momentum
2.2 Internal forces and momentum conservation – center of mass – examples
2.3 General elastic collision of particles of different masses – system with variable mass – examples
2.4 Conservation of angular momentum – torque due to internal forces</td></tr>
</table>

	2.5 Torque due to gravity – angular momentum about center of mass 2.6 Proton scattering by heavy nucleus.
	UNIT-III **CONSERVATION LAWS OF ENERGY** 3.1 Introduction – significance of conservation laws 3.2 Law of conservation of energy concepts of work- power – energy 3.3 conservative forces 3.4 Potential energy and conservation of energy in gravitational and electric field – examples 3.5 Non-conservative forces 3.6 General Law of conservation of energy.
	UNIT-IV **RIGID BODY DYNAMICS** 4.1 Translational and rotational motion 4.2 Angular momentum – moment of inertia 4.3 General theorems of moment of inertia – examples 4.4 Rotation about fixed axis – kinetic energy of rotation – examples 4.5 Body rolling along a plane surface -Body rolling down an inclined plane 4.6 Gyroscopic precision – gyrostatic applications.
	UNIT-V **LAGRANGIAN MECHANICS** 5.1 Generalized coordinates 5.2 Degrees of freedom – constraints 5.3 Principle of virtual work and D' Alembert's Principle 5.4 Lagrange's equation from D' Alembert's principle 5.5 Application –simple pendulum , spherical pendulum 5.6 Atwood's machine.
	UNIT-VI PROFESSIONAL COMPONENTS:expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
Recommended Text	1. J.C.Upadhyaya, 2019, Classical Mechanics, Himalaya Publishing house, Mumbai. 2. P.DuraiPandian, LaxmiDuraiPandian, MuthamizhJayapragasam,2005, Mechanics, 6threvised edition, S.Chandand Co. 3. D. S.Mathur and P. S.Hemne, 2000, Mechanics, Revised Edition, S.Chandand Co. 4. Narayanamurthi, M.andNagarathnam. 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 and Robert, Resnick, 1995, Physics Vol.I. New Age, International, Chennai. 3. Halliday, David Robert Resnick and Walker Jearl, 2001, Fundamentals of Physics, John Wiley, New Delhi
WEB RESOURCES	1. https://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 7. 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, apply D' Alemberts principle

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	M	H
CO3	M	H	H	M	L	H
CO4	H	H	L	L	H	H
CO5	H	H	H	L	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	L	H
CO3	H	H	H	H	M	H
CO4	H	M	H	H	L	H
CO5	H	H	H	H	M	H

Title of theCourse	**PRACTICAL - III**						
Paper No.	**Core Practical -III**						
Category	**Core**	**Year**	II	**Credits**	3	**Course Code**	UCPHF24
		Semester	III				
Instructional hours perweek	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
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

Minimum of Eight Experiments from the list:

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

Comparison of capacitance using BG.

<table>
<tr><td>Title of the Course</td><td colspan="8">SKILL ENHANCEMENT COURSE: ENERGY PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC – IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">USPH424</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course allows the students:
• To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNIT-I
INTRODUCTION TO ENERGY SOURCES: energy consumption as a measure of prosperity – world energy future – energy sources and their availability – conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.</td></tr>
<tr><td colspan="8">UNIT-II
SOLAR ENERGY: solar energy Introduction – solar constant – solar radiation at the Earth’s surface – solar radiation geometry – Solar radiation measurements – solar radiation data –solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of greenhouses – solar cells.</td></tr>
<tr><td colspan="8">UNIT-III
WIND ENERGY: introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy</td></tr>
<tr><td colspan="8">UNIT-IV
BIOMASS ENERGY: introduction – classification – biomass conversion technologies –photosynthesis – fermentation - biogas generation –classification of biogas plants – anaerobic digestion for biogas – wood gasification – advantages and disadvantages.</td></tr>
<tr><td colspan="8">UNIT-V
ENERGY STORAGE: Importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.</td></tr>
<tr><td>Recommended Text</td><td colspan="8">1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4thEdn.</td></tr>
</table>

	2. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rdEdn. 3. D P Kothari, K P Singal, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2ndEdn
Reference Books	1. John Twidelland Tony Weir, Renewable Energy Resources, Taylor and Francis, 2005, 2ndEdn. 2. S.A. Abbasi and NasemaAbbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008. 3. M. P. Agarwal, Solar Energy, S. Chand and Co. Ltd., New Delhi,1982 4. H. C. Jain, Non-Conventional Sources of Energy, Sterling Publishers,1986.

Course Outcomes:

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

CO1: Understand the importance of conventional, non-conventional and renewable energy sources
CO2: Gain knowledge on of solar energy and solar cells
CO3: Understand basic principles of wind energy conversion and recognize their advantages and disadvantages
CO4: Understand the basic ideas of biomass energy and recognize their merits and demerits
CO5: Acquires knowledge on importance of energy storage ,batteries and fuel cells

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	H	H	H	H	H
CO3	H	M	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	L	H
CO2	H	H	H	H	H	H
CO3	H	M	H	H	H	H
CO4	H	H	H	M	H	H
CO5	H	H	H	H	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: COMMUNICATION PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>USPH524</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course allows the students:
• To get a thorough knowledge on transmission and reception of radio waves, the different types of communication like fibre optic, radar, satellite, cellular</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">UNIT-I
RADIO TRANSMISSION AND RECEPTION: transmitter – modulation types of modulation – amplitude modulation – limitations of amplitude modulation – frequency modulation – comparison of FM and AM – demodulation- essentials in demodulation – receivers: AM radio receivers – types of AM radio receivers – stages of superheterodyne radio receiver, advantages – FM receiver – difference between FM and AM receivers.</td></tr>
<tr><td colspan="7">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 fiberoptic communication</td></tr>
<tr><td colspan="7">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</td></tr>
<tr><td colspan="7">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</td></tr>
<tr><td colspan="7">UNIT-V
MOBILE COMMUNICATION: introduction – concept of cell –basic</td></tr>
</table>

	cellular mobile radio system – cellphone – facsimile – important features of fax machine – application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-4G (basic ideas)

Recommended Text	1. V.K.Metha, Principles of Electronics, S. Chand and CoLtd., 2013 2. Anokh Singh and Chopra A.K., Principles of communication Engineering, S.Chandand 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.

Course Outcomes:

On completion of the course the students should be able to

CO1: To understand the concept, working principle, block diagram and key applications of AM and FM receiving system

CO2: Explain about the fiber optics communications

CO3: Discuss fundamental concept of radar communication system.

CO4: To learn the information about satellite communication

CO5: To learn the cellular concept and techniques

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	M	H	M	H	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	M
CO2	H	H	H	M	H	H
CO3	H	H	H	H	H	H
CO4	H	L	H	H	H	H
CO5	H	H	H	L	H	H

<table>
<tr><td>Title of the Course</td><td colspan="8">OPTICS AND LASER PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core - 4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UCPHG24</td></tr>
<tr><td>Semester</td><td>IV</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="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at
• To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics in different media
• To study the aberrations in lenses, merits and limitations of prism, eyepieces and telescopes
• 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 working and applications of laser</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (K1, K2, K3 & K4)
LENS AND PRISMS
1.1 Fermat’s principle of least time – postulates of geometrical optics – thick and thin lenses
1.2 Focal length, critical thickness, power and cardinal points of a thick lens – narrow angled prisms
1.3 Lens: aberrations: spherical aberration, chromatic aberrations, coma, and astigmatism– curvature of the field – distortion – chromatic aberrations methods
1.4 Prism: dispersion, deviation, aberrations - applications rainbows and halos, constant deviation spectroscope
1.5 Eyepieces: advantage of an eyepiece over a simple lens – Huygen’s and Ramsden’s eyepieces, construction and working –merits and demerits of the eyepiece
1.6 Resolving power: Rayleigh’s criterion for resolution – limit of resolution for the eye – resolving power of, (i) Prism (ii) grating (iii) telescope</td></tr>
<tr><td></td><td colspan="8">UNIT II (K1, K2, K3 & K4)
INTERFERENCE
2.1 Division of wave front, Fresnel’s biprism – fringes with white light
2.2 Division of amplitude: interference in thin films due to (i) reflected light, (ii) transmitted light
2.3 Colours of thin films applications – air wedge – Newton’s rings
2.4 Interferometers: Michelson’s interferometer – applications determination of the wavelength of a monochromatic source of light</td></tr>
</table>

	2.5 Determination of the wavelength and separation D_1 and D_2 lines of sodium light, 2.6 Determination of a thickness of a mica sheet
	UNIT-III: (K1, K2, K3 & K4) **DIFFRACTION** 3.1 Fresnel's assumptions – zone plate – action of zone plate for an incident spherical wave front 3.2 Differences between a zone plate and a convex lens 3.3 Fresnel type of diffraction – diffraction pattern due to a straight edge 3.4 Positions of maximum and minimum intensities – diffraction due to a narrow slit –Fraunhofer type of diffraction 3.5 Fraunhofer diffraction at a single slit – plane diffraction grating 3.6 Experiment to determine wavelengths – width of principal maxima
	UNIT-IV: POLARIZATION (K1, K2, K3 & K4) 4.1 Optical activity – optically active crystals –polarizer and analyser– double refraction – optic axis, principal plane 4.2 Huygens's explanation of double refraction in uniaxial crystals – polaroids and applications 4.3 Circularly and elliptically polarized light –quarter wave plate – half wave plate 4.4 Production and detection of circularly and elliptically polarized lights 4.5 Fresnel's explanation – specific rotation 4.6 Laurent half shade polarimeter– experiment to determine specific rotatory power
	UNIT-V: (K1, K2, K3 & K4) **LASERS** 5.1 General principles of lasers – properties of lasers action 5.2 Spontaneous and stimulated emission – population inversion 5.3 Optical pumping – He-Ne laser (principle and working) 5.4 CO_2 laser (principle and working) semiconductor laser 5.5 Laser applications 5.6 Holography
Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. Subramaniam. N andBrijlal, 2014, Optics, 25th Ed,S.Chandand Co. 2. P.R.Sasikumar, 2012, Photonics, PHIPvt Ltd, New Delhi. 3. V.Rajendran, 2012, Engineering Physics, Tata McGraw Hill.
Reference Books	1. Sathyaprakash, 1990,Optics,VII edition, RatanPrakashanMandhir, New Delhi. 2. AjoyGhatak, 2009,Optics, 4th edition, PHIPvt Ltd, New Delhi. 3. D.Halliday,R.Resnick and J. Walker, 2001, Fundamentals of Physics,6th edition, Willey, New York. 4. JenkinsA.Francis and White, 2011, Fundamentals of Optics, 4th edition, McGraw Hill Inc., NewDelhi.
Website and e-learning source	1. https://science.nasa.gov/ems/ 2. https://www.youtube.com/watch?v=tL3rNc1G0qQandlist=RDCMUCzwo7UlGkb-8Pr6svxWo-LAandstart_radio=1andt=2472 3. https://science.nasa.gov/ems/ 4. https://imagine.gsfc.nasa.gov/educators/gammaraybursts/imagine/index.html 5. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/

Course Outcomes:

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

CO1: Outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces (K1, K2, K3, K4)

CO2: Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer (K1, K2, K3, K4)

CO3: Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyse the optical instruments (K1, K2, K3, K4)

CO4: Interpret basic formulation of polarization and gain knowledge about polarimeter, appraise its usage in industries (K1, K2, K3, K4)

CO5: Relate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	L	M
CO2	M	H	M	H	M	H
CO3	H	M	H	H	H	H
CO4	H	H	H	M	L	H
CO5	H	M	H	M	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	M	M
CO2	M	S	M	H	M	H
CO3	H	M	H	H	S	H
CO4	H	M	H	H	M	M
CO5	H	M	H	H	S	H

<table>
<tr><td>Title of theCourse</td><td colspan="7">PRACTICAL - IV</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Practical -IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td>UCPHH24</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Instructional hours perweek</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">3</td><td colspan="2">3</td></tr>
<tr><td>Course Objectives</td><td colspan="7">Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.</td></tr>
<tr><td colspan="8">LIGHT (any eight experiments)</td></tr>
<tr><td colspan="8">Minimum of Eight Experiments from the list:
1. Determination of refractive index of prism using spectrometer.
2. Determination of refractive index of liquid using hollow prism and spectrometer
3. Determination of dispersive power of a prism.
4. Determination of radius of curvature of lens by forming Newton’s rings.
5. Determination of thickness of a wire using air wedge.
6. Determination of Cauchy’s Constants.
7. Determination of resolving power of grating
8. Determination of resolving power of telescope
9. Comparison of intensities using Lummer Brodhum Photometer.
10. Determination of range of motion using Searle’s 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.</td></tr>
</table>

<table>
<tr><td>Title of the Course</td><td colspan="8">SKILL ENHANCEMENT COURSE: ASTROPHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC-6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">USPH624</td></tr>
<tr><td>Semester</td><td>IV</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="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course intends
• To introduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena and provide an understanding of the physical nature of celestial bodies along with the instrumentation and techniques used in astronomical research</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="8">UNIT I
TELESCOPES: Optical telescopes – magnifying power, brightness, resolving power and f/a ratio – types of reflecting and refracting telescopes – detectors and image processing – radio telescopes – Hubble space telescope.</td></tr>
<tr><td colspan="8">UNIT II
SOLAR SYSTEM:Bode’s law of planetary distances – meteors, meteorites, comets, asteroids – Kuiper belt – Oort cloud – detection of gravitational waves – recent advances in astrophysics.</td></tr>
<tr><td colspan="8">UNIT-III
ECLIPSES: types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse – transits.
THE SUN:physical and orbital data – solar atmosphere – photosphere– chromosphere – solar corona – prominences – sunspots – 11year solar cycle – solar flares.</td></tr>
<tr><td colspan="8">UNIT-IV:
STELLAR EVOLUTION: H-R diagram – birth and death of low mass, intermediate mass and massive stars – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes – supernovae.
GALAXIES: classification of galaxies – galaxy clusters –interactions of galaxies, dark matter and super clusters – evolving universe.</td></tr>
</table>

	UNIT-V: **ACTIVITIES IN ASTROPHYSICS:** (i) Basic construction of telescope (ii) Develop models to demonstrate eclipses/planetary motion (iii) Night sky observation (iv) Conduct case study pertaining to any topic in this paper (v) Visit to any one of the National Observatories. (Any three activities to be done compulsorily)
Recommended Text	1. BaidyanathBasu, (2001). An introduction to Astrophysics, Second printing, Prentice – Hall of India (P) Ltd, New Delhi 2. K.S.Krishnaswamy, (2002), Astrophysics – a modern perspective, New Age International (P) Ltd, New Delhi. 3. Shylaja, B.S. andMadhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play, Orient BlackSwan,

Course Outcomes:

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

CO1: Understand the basic function of telescope and its uses. (K1, K2, K3, K4)
CO2: Discuss about meteors, meteorites, comets, asteroids (K1, K2, K3, K4)
CO3: Learn the concept of physical and orbital data
CO4: Learn the key concepts in astronomy (K1, K2, K3, K4)
CO5: Explain the basic activities in astrophysics (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	M	L	H
CO3	H	H	H	L	M	H
CO4	H	H	M	L	L	H
CO5	H	M	H	H	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	H	H
CO3	H	M	L	H	H	H
CO4	H	M	L	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: MATERIALS SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td>Course Code</td><td>USPH724</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="2"></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>1</td><td>-</td><td colspan="3">-</td><td colspan="2">1</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• 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.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">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 andtwist boundaries,twin boundaries, stacking faults – volume defects – effect of imperfections.</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td></td><td colspan="7">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.</td></tr>
</table>

	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
Recommended Text	1. Material science and Engineering, Raghavan V, Prentice Hall of India, Sixth Edition, 2015 2. Materials science, V. Rajendran, McGraw Hill publications 2011
Reference Books	1. J.S. Chitode, Digital Communications, 2020, Unicorn publications 2. Senior John. M, Optical Fiber Communications: Principles and Practice, 2009, Pearson Education.

Course Outcomes:

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

CO1: Calculate the equilibrium concentration of point imperfections and understand their applications.K1
CO2: Understand the atomic model of elastic behaviour and the significance of modulus as a design parameter. K4
CO3: Interpret the tensile stress-strain curve and understand the mechanisms of plastic deformation by slip. K3
CO4: Investigate optical absorption properties in metals, semiconductors, and insulators. K5
CO5: Conduct and interpret results from destructive testing methods such as tensile, compression, and hardness tests K4, K5

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	L	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	M	H	H	H	H
CO4	H	L	H	H	M	H
CO5	H	M	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core -5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory 5</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">UCPHI24</td></tr>
<tr><td>Semester</td><td>V</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>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• To classify materials based on their electrical and magnetic properties.
• To analyse the working principles of electrical gadgets.
• To understand the behaviour of dc, ac and transient currents.
• To know about the communication by electromagnetic waves.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (18 hours) (K1, K2, K3 & K4)
CAPACITORS AND THERMO ELECTRICITY:
1.1 capacitor – principle – Energy of a charged capacitor – capacitance of spherical and cylindrical capacitors
1.2 Capacitance of a parallel plate capacitor (with and without dielectric slab) –
1.3 Effect of dielectric Carey Foster bridge – temperature coefficient of resistance
1.4 Seebeck effect – laws of thermo emf – Peltier effect – Thomson effect – thermoelectric diagrams – uses of thermoelectric diagrams
1.5 Thermodynamics of thermo couple - determination of Peltier and Thomson coefficients
1.6 Emf of Thermocouple using Potentiometer.</td></tr>
<tr><td></td><td colspan="7">UNIT II (18 hours) (K1, K2, K3 & K4)
MAGNETIC EFFECTS OF CURRENT:
2.1 Biot and Savart's law – magnetic induction due to circular coil – magnetic induction due to solenoid.
2.2 Helmholtz tangent galvanometer – Moving coil ballistic galvanometer construction and theory
2.3 Force on a current element by magnetic field – force between two infinitely long conductors – torque on a current loop in a field
2.4 Moving coil galvanometer – damping correction.
2.5 Ampere’s circuital law – differential form – divergence of magnetic field.
2.6 Magnetic induction due to toroid - Eddy current and its uses.</td></tr>
</table>

	UNIT-III: (18 hours) (K1, K2, K3 & K4) **MAGNETISM AND ELCTROMAGNETIC INDUCTION:** 3.1 Magnetic induction B – magnetization M - relation between B, H and M. 3.2 Magnetic susceptibility – magnetic permeability – experiment to draw B-H curve – energy loss due to hysteresis. 3.3 Importance of hysteresis curves –Properties of Para, dia and ferromagnetic materials. 3.3 Cycle of Magnetization - Faraday and Lenz laws –vector form – self-induction – coefficient of self-inductance of solenoid. 3.4 Anderson's method – mutual induction – coefficient of mutual inductance between two coaxial solenoids. 3.5 Coefficient of coupling - earth inductor 3.6 Determination of angle of dip(Φ).
	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **TRANSIENT AND ALTERNATING CURRENTS:** 4.1 Growth and decay of current in a circuit containing resistance and inductance. 4.2 Growth and decay of charge in a circuit containing resistance and capacitor. 4.3 Growth and decay of charge in an LCR circuit (expressions for charge only). 4.4 Peak, average and rms values of ac – LCR series and parallel circuits. 4.5 Resonance condition – Q factor – power factor. 4.6 Charging and discharging of capacitor through L and R.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **MAXWELLS EQUATIONS AND ELECTROMAGNETIC WAVES:** 5.1 Maxwell's equations in vacuum and in material media. 5.2 Physical significance of Maxwell's equations –displacement current. 5.3 Plane electromagnetic waves in free space. 5.4 Velocity of light – Poynting vector. 5.5 Electromagnetic waves in a linear homogenous media 5.6 Refractive index of the medium.
Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

Recommended Text	1. Murugeshan. R., - Electricity and Magnetism, 8th Edn, 2006, S.Chandand Co, New Delhi.\ 2. Sehgal D.L., Chopra K.L, Sehgal N.K., - Electricity and Magnetism, 3. Sultan Chand and Sons, New Delhi. 4. M. Narayanamurthy and N. Nagarathnam, Electricity and Magnetism, 4th Edition. 5. National Publishing Co., Meerut.
Reference Books	1. Brijlal and Subramanian, Electricity and Magnetism, 6th Edn.,Ratanand Prakash, Agra. 2. Brijlal, N.Subramanyan and JivanSeshan, Mechanics and Electrodynamics (2005), 3. Eurasia Publishing House (Pvt.) Ltd., New Delhi. 4. David J. Griffiths, Introduction to Electrodynamics, 2nd Edn. 1997, Prentice Hall of 5. India Pvt. Ltd., New Delhi 6. D. Halliday, R. Resnik and J. Walker - Fundamentals of Physics, 6th Edn., Wiley, NY, 2001.
Website and e-learning source	1. https://www.edx.org/course/electricity 2. https://www.udemy.com/courses/electricity 3. https://www.edx.org/course/magnetism 4. http://www.hajim.rochester.edu/optics/undergraduate/courses.html

Course Outcomes:
On completion of the course, the students should be able to
CO1 : Describe various thermo-electric effects and their properties.K2
CO2 : Apply Biot and Savart law to study the magnetic effect of electric current.K3
CO3 : Use Faraday and Lenz laws in explaining self and mutual inductance.K4, K5
CO4 : Analyze the time variation of current and potential difference in AC circuits.K3, K5
CO5 : Relate different physical quantities used to explain magnetic properties of materials.K1,K3

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	M	H	L	M	H
CO3	H	H	H	M	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	M	H	H	M	H
CO3	H	L	H	H	L	H
CO4	H	H	H	H	M	H
CO5	H	L	H	H	M	L

<table>
<tr><td>Title of the Course</td><td colspan="8">ATOMIC AND NUCLEAR PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core 6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory 6</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2">UCPHJ24</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="5"></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="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at
• 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 get knowledge on radioactive decay
• To know the concepts used in nuclear reaction
• To understand the quark model of classification of elementary particles</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (18 hours) (K1, K2, K3 & K4)
VECTOR ATOM MODEL
1.1 Introduction to atom model – vector atom model
1.2 Electron spin –spatial quantisation
1.3 Quantum numbers associated with vector atom model - L-S and J-J coupling
1.4 Pauli's exclusion principle
1.5 Magnetic dipole moment due to orbital motion and spin motion of the electron
1.6 Bohr magneton - Stern-Gerlach experiment – selection rules – intensity rule</td></tr>
<tr><td></td><td colspan="8">UNIT II (18 hours) (K1, K2, K3 & K4)
ATOMIC SPECTRA:
2.1 Origin of atomic spectra – excitation and ionization potentials
2.2 Davis and Goucher's method – spectral terms and notations
2.3 Fine structure of sodium D-lines – Zeeman effect
2.4 Larmor's theorem – quantum mechanical explanation of normal Zeeman effect
2.5 Anomalous Zeeman effect (qualitative explanation)
2.6 Paschen-Back effect – Stark effect</td></tr>
</table>

	UNIT-III: (18 hours) (K1, K2, K3 & K4) **RADIOACTIVITY:** 3.1 Discovery of radioactivity – natural radio activity 3.2 Properties of alpha rays, beta rays and gamma rays 3.3 Geiger-Nuttal law – alpha particle spectra 3.4 Gamow's theory of alpha decay (qualitative study) 3.5 General properties of nucleus and 3.6 Binding energy - Mass defect – Packing fraction - Nuclear stability
	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **NUCLEAR REACTIONS:** 4.1 Conservation laws of nuclear reaction – 4.2 Q-value equation for a nuclear reaction – threshold energy 4.3 Scattering cross section –-classification of neutrons 4.4 Models of nuclear structure 4.5 Liquid drop model 4.6 Shell model
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **ELEMENTARY PARTICLES:** 5.1 Classification of elementary particles – fundamental interactions **5.**2 Elementary particle quantum numbers – Isospin and strangeness quantum number 5.3 Conservation laws and symmetry – quarks – quark model (elementary ideas only) 5.4 Discovery of cosmic rays – primary and secondary cosmic rays 5.5 Latitude effect 5.6 Altitude effect
Extended Professional Component (isa part of internal component only, not to beincluded in the external examination question paper)	expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
Recommended Text	1. R. Murugesan, Modern Physics, S. Chand and Co**. (**All units**)** (Units IandII-Problems) 2. Brijlaland N. Subrahmanyam, Atomic and Nuclear Physics, S. Chand and Co. (All units) 3. SehgalandChopra, Modern Physics, Sultan Chand, New Delhi 4. Arthur Beiser– Concept of Modern Physics, McGraw Hill Publication, 6th Edition.

Reference Books	1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill. 2. Modern Physics, S. Ramamoorthy, National Publishing and Co. 3. Tayal, D.C.2000 – Nuclear Physics, Edition, Himalaya Publishing House, Mumbai. 4. Irving Kaplan (1962) Nuclear Physics, Second Edition, Oxford and IBH Publish and Co, New Delhi. **5.** Roy and Nigam, – Nuclear Physics (1967) First edition, Wiley Eastern Limited, New Delhi. 6. J. B. Rajam, Modern Physics, S. Chand and Co.
Website and e-learning source	1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html 2. https://makingphysicsfun.files.wordpress.com/2015/01/photoelectric-effect.pptx 3. https://www.khanacademy.org/science/physics/quantum-physics/in-in-nuclei/v/types-of-decay 4. https://www.khanacademy.org/science/in-in-class-12th-physics-india/nuclei

Course Outcomes:

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

CO1: List the properties of electrons and positive rays, define specific charge of positive rays and know about different mass spectrographs. (K1, K2, K3, K4)

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 (K1, K2, K3, K4)

CO3: Explain different atom models, Describe different quantum numbers and different coupling schemes (K1, K2, K3, K4)

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. (K1, K2, K3, K4)

CO5: Understand the condition for production of laser, Appreciate various properties and applications of lasers. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	M	H
CO3	H	H	L	M	L	H
CO4	H	L	H	L	M	H
CO5	H	H	H	M	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	M	H	H	L	H
CO4	H	L	H	H	M	H
CO5	H	H	H	L	M	H

Title of theCourse	PRACTICAL - V						
Paper No.	**Core Practical - V**						
Category	**Core**	**Year**	III	**Credits**	3	**Course Code**	UCPHK24
		Semester	V				
Instructional hours perweek	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
Course Objectives	Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.						

GENERAL

Minimum of Eight Experiments from the list:

1. Diffraction grating Normal incidence: Determination of wavelengths of Mercury spectral lines
2. Diffraction grating minimum deviation: To determine the wavelength of mercury spectral lines by keeping grating in minimum deviation
3. Diffraction at a wire: To determine the thickness of a wire
4. Specific rotation of sugar solution: To find the specific rotation of sugar solution by using a polarimeter
5. Bi-prism – Determination of the wavelength of Sodium light.
6. Thickness of a thin film by Bi-prism experiment
7. Brewster's law – polarization
8. Double refraction (□e and □o)
9. Y – by Corlus method. (Determination of Young's modulus of the material of a beam by Koenig's method)
10. Dispersive power of plane diffraction grating.
11. Diffraction a straight edge.
12. Kundt's tube – Velocity of sound, Adiabatic Young's modulus of the material of the rod.
13. Forbe's method – Thermal conductivity of a metal rod.
14. Spectrometer– Grating - Normal incidence - Wave length of Mercury spectral lines.
15. Spectrometer – Grating - Minimum deviation - Wave length of Mercury spectral lines.
16. Spectrometer – (i-d) curve.
17. Spectrometer – (i-i′) curve.
18. Spectrometer – Narrow angled prism.
19. Rydberg's constant
20. e/m Thomson method
21. h by photocell
22. Spectral response of photo conductor (LDR).
23. Potentiometer –Resistance and Specific resistance of the coil.
24. Potentiometer – E.M.F of a thermocouple.
25. Carey Foster's bridge - Temperature coefficient of resistance of the coil.
26. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and $B_H$using circular coil carrying current.
27. Vibration magnetometer - Determination of B_H using circular coil carrying current– Tan B position.
28. B.G – Figure of Merit – Charge Sensitivity

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: NANOSCIENCE AND NANO TECHNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective 1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">UEPHA24</td></tr>
<tr><td>Semester</td><td>V</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="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• This course aims to provide an overall understanding of Nanoscience and Nanotechnology and introduces different types of nanomaterials, their properties, fabrication methods, characterization techniques and a range of applications.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (18 hours) (K1, K2, K3 & K4)
NANOSCIENCE AND NANOTECHNOLOGY:
1.1. Nanoscale – nature and nanostructures – nanostructures: 0D, 1D, 2D.
1.2. Surface to volume ratio– size effect.
1.3. Excitons – quantum confinement.
1.4. Metal based nanoparticles (metal and metal oxide).
1.5. Nanocomposites (non-polymer based) –
1.6. Carbon nanostructures - Fullerene –SWCNT and MWCNT - Properties of CNTs.</td></tr>
<tr><td></td><td colspan="8">UNIT II (18 hours) (K1, K2, K3 & K4)
PROPERTIES OF NANOMATERIALS:
2.1 Introduction –mechanical behavior – Hardness and strength – Ductility and toughness - elastic properties-Super plastic behavior.
2.2 Optical properties (Change color of gold, quantum dots).
2.3 Surface Plasmon resonance
2.4 Electrical properties: dielectric materials and properties.
2.5 Magnetic properties – super paramagnetism
2.6 Electrochemical properties.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: (18 hours) (K1, K2, K3 & K4)
FABRICATION METHODS AND VACUUM TECHNIQUES:
3.1 Top-down and bottom-up approaches – electrochemical method.
3.2 Chemical and physical vapour depositions (CVD and PVD).
3.3 Plasma arc discharge – sputtering – thermal evaporation.
3.4 Pulsed laser deposition – ball milling.
3.5 Lithography: photolithography – e-beam lithography.
3.6 Sol-gel methods</td></tr>
</table>

	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **CHARACTERIZATION TECHNIQUES:** 4.1 Scanning probe microscopy – scanning tunneling microscopy. 4.2 Atomic force microscopy. 4.3 Scanning electron microscopy. 4.4 Transmission electron microscopy. 4.5 Powder XRD method: determination of structure and grain size analysis. 4.6 UV-visible and photoluminescence spectroscopy.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **APPLICATIONS OF NANOMATERIALS:** 5.1 Medicine: drug delivery – photodynamic therapy. 5.2 Molecular motors –energy: fuel cells –rechargeable batteries. 5.3 Supercapacitors– photovoltaics. sensors: nano sensors based on optical and physical properties. 5.4 electrochemical sensors – nano biosensors. nanoelectronics: CNTFET. 5.5 Display screens – GMR read/write heads 5.6 Nanorobots –applications of CNTs.
Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
Recommended Text	1. K.K.Chattopadhyay and A.N.Banerjee, (2012), Introduction to Nanoscience and Nanotechnology, PHI Learning Pvt. Ltd., 2. M.A. Shah, Tokeer Ahmad (2010), Principles of Nanoscience and Nanotechnology, Narosa Publishing House Pvt Ltd. 3. Mick Wilson, et al (2005) Nanotechnology, Overseas Press. 4. T. Pradeep, Nano: The essentials: Understanding Nanscience and Nanotechnology 1 July 2017, McGraw Hill Education
Reference Books	1. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA 2. J.H.Fendler (2007) Nano particles and nano structured films; Preparation, Characterization and Applications, John Wiley and Sons 3. B.S.Murty, et al (2012) Textbook of Nanoscience and Nanotechnology, Universities Press.

Course Outcomes:

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

CO1: Grasp the fundamental concepts of nanoscale science, including the nature and types of nanostructures (0D, 1D, 2D)

CO2: Identify and describe various nanomaterials, including metal-based nanoparticles, non-polymer nanocomposites, carbon nanostructures K3

CO3: Evaluate the mechanical behaviors such as elasticity, hardness, strength, ductility, toughness, and superplasticity, along with optical, electrical properties

CO4: Apply top-down and bottom-up synthesis approaches, including electrochemical methods, CVD, PVD, plasma arc discharge. K4

CO5: Employ advanced characterization techniques like scanning probe microscopy, electron microscopy, XRD, and spectroscopy. K2, K3

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	M	L	H
CO3	H	H	H	L	M	L
CO4	H	H	H	L	L	H
CO5	H	M	H	H	L	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	M	H	H	M	H
CO3	M	L	H	M	H	H
CO4	H	M	H	H	M	H
CO5	H	L	H	H	L	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: DIGITAL PHOTOGRAPHY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective 1A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">UEPHB24</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="5"></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="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at giving an overall view of the
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I
PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION
1.1 Principle –chemical route and digital route –light, wavelengths
1.2 Colours – shadows – light intensity and distance
1.3 Making light form images –pin-hole images
1.4 Practical limitations to pin-hole images
1.5 Lens instead of pin-hole – focal length and image size
1.6 Imaging of closer subjects.</td></tr>
<tr><td></td><td colspan="8">UNIT II
LENSES – CONTROLLING THE IMAGES
2.1 Photographic lens
2.2 Focal length and angle of view (problems)
2.3 Focusing movement – aperture and f-numbers (problems)
2.4 Depth of field– depth of focus
2.5 Image stabilization
2.6 Lenses for digital cameras – lens and camera care</td></tr>
<tr><td></td><td colspan="8">UNIT-III:
CAMERA USING FILMS AND ITS TYPES
3.1 Camera and its essential components
3.2 Shutter – aperture – light measurement
3.3 Film housing
3.4 Camera types: view camera– view finder camera
3.5 Reflex camera
3.6 Single lens reflex (SLR) camera</td></tr>
</table>

	UNIT-IV: **DIGITAL CAMERAS PRINCIPLE AND TYPES:** 4.1 Principle of digital image capturing –comparison of digital and analog picture information 4.2 Megapixel – grain, noise and pixel density 4.3 Optical and digital zooming – image stabilizer – bit depth – white balance-colour modes – 4.4 File formats (TIFF, RAW and JPEG) – storage cards and types 4.5 Digital cameras: camera phones – compact camera 4.6 Hybrid camera – digital SLR.
	UNIT-V: **THE DIGITAL IMAGE – POSTPRODUCTION** 5.1 Hardware: computer and its peripherals 5.2 Software: saving digital file – basic editing: navigating the image undo/redo/history – crop – rotate – brightness and contrast 5.3 Colour balance – hue/saturation – dodge/burn – cloning and retouching – removing an element in an image 5.4 Advanced editing: histogram/levels – curves – selection tools: magic wand 5.5 Printing digital images: inkjet printer – laser printer 5.6 Dye sub printer – lambda/light jet printers.
Recommended Text	1. Michel J.Langford , Anna Fox and 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
Reference Books	1. Mark Galer, Digital Photography in Available Light essential skills, 2006, Focal press, London 2. Paul Harcourt Davies, The Photographer's practical handbook, 2005, UK PRESS

Course Outcomes:

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

CO1: They will learn to select the appropriate settings for various photographic scenarios to achieve desired.

CO2: They will be able to create well-composed and aesthetically pleasing images with effective use of light

CO3: They will learn techniques for color correction, retouching, cropping and creating special effects

CO4: They will learn to adapt their techniques and creative approaches to suit different styles and subjects

CO5: This portfolio will reflect their technical skills, artistic vision, and versatility as photographers, suitable for presenting to potential clients or employers

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	M	L	H
CO3	H	L	H	L	L	H
CO4	H	L	H	M	M	H
CO5	H	H	H	M	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	L	H
CO2	H	M	H	H	M	H
CO3	H	L	H	M	L	L
CO4	H	M	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: ANALOG AND COMMUNICATION ELECTRONICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective 2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UEPHC24</td></tr>
<tr><td>Semester</td><td>V</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="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at
• To study the design, working and applications of semiconducting devices.
• To construct various electronic circuits.
• To study them in details.
• To study the basis of audio and video communication systems and the aspects of satellite and Fibre Optic Communications.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I
DIODES
1.1 PN junction diode -V-I characteristics
1.2 Rectifiers- Half wave rectifier -expression for efficiency
1.3 Full wave rectifier –Centre tapped - Bridge rectifiers- expression for efficiency and ripple factor for half wave and full wave rectifiers
1.4 Filters-Types of filter circuits -Action of filter circuits
1.5 Clipping and Clamping circuits
1.6 Zener diode -Zener diode as a voltage regulator</td></tr>
<tr><td></td><td colspan="8">UNIT II
TRANSISTOR AMPLIFIER
2.1 Junction transistors- CB, CE , CC modes configuration
2.2 Relationship between current amplification factors of a transistor
2.3 Transistor amplifier- Methods of transistor biasing -voltage divider Method
2.4 Two-port representation of a transistor -h-parameters -AC equivalent circuit of a transistor amplifier (common emitter only), expressions for current gain, voltage gain,input, impedance, output admittance and power gain
2.5 RC coupled amplifier -Frequency response curve
2.6 Power amplifiers- Classification of amplifiers: A, B, C, class A power amplifier- Push -pull amplifiers, class B power amplifier-Emitter follower.</td></tr>
</table>

	UNIT-III: **TRANSISTOR OSCILLATORS** 3.1 Feedback in amplifier-Positive and negative Feedback-Advantages of negative feedback 3.2 Oscillators -Oscillations in tank circuit 3.3 Barkhausen Criterion 3.4 Hartley and Colpitts oscillators 3.5 Phase shift and Wien Bridge oscillators 3.6 Expressions for the frequency of oscillation and conditions for oscillations in h parameters
	UNIT-IV: **OPERATIONAL AMPLIFIERS** 4.1 Differential amplifier-Differential gain 4.2 OPAMP characteristics –IC 741 pin configuration 4.3 Expression of voltage gain for inverting and non-inverting amplifier 4.4 Voltage follower, summing and difference amplifier 4.5 Differentiator, Integrator 4.6 Multivibrators, astable multivibrator (square wave generator), monostable vibrator using op-amp
	UNIT-V: **MODULATION AND DEMODULATION** 5.1 Theory of amplitude modulation - frequency modulation 5.2 Comparison of AM and FM – phase modulation 5.3 Pulse width modulation – pulse modulation systems: PAM, PPM, and PCM 5.4 Demodulation: AM and FM detection 5.5 Block diagram of AM transmitting system- AM receiver: Principle of Superhetrodyne receiver (block diagram) 5.6 Block diagram of FM transmitting & receiving system
Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. V.K.Mehta - Principles of Electronics, S.Chand and Co. Ltd., 2004. 2. V.Vijayendran - Integrated Electronics, S.Vishwanathan Publishers, Chennai. 3. B.L. Theraja - A Text Book of Electrical Technology. 4. John D. Ryder - Electronic fundamentals and Applications. 5. Malvino - Electronic Principles, Tata McGraw Hill.
Reference Books	1. B. Grob - Basic Electronics, 6th edition, McGraw Hill, NY, 1989. 2. Herbert Taub and Donald schilling - Digital Integrated Electronics, McGraw Hill, NY. 3. Ramakant A. – Op amp principles and linear integrated circuits, Gaykward 4. Bagde and S. P. Singh - Elements of Electronics. 5. Millman and Halkias- Integrated Electronics, Tata McGraw Hill.
Website and e-learning source	1. https://www.queenmaryscollege.edu.in/eresources/undergraduateprogram/py157 2. www.ocw.mit.edu>...> Circuits and Electronics 3. www.ocw.mit.edu>...> Introductory Analog Electronics Laboratory 4. https:// www.elprocus.com> semiconductor devices 5. https:// www.britannica.com>technology

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: ADVANCED MATHEMATICAL PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective 2A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UEPHD24</td></tr>
<tr><td>Semester</td><td>V</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="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at giving an overall view of the
• The fundamentals of matrices
• Vector calculus learnt in earlier course will enable students to learn advanced topics
• Special theorems
• The special functions
• Applications of partial differential equations will be of use in research at a later stage.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I
MATRICES
1.1 Introduction – special types of matrices – transpose
1.2 conjugate– conjugate transpose– symmetric and anti symmetric
1.3 Hermitian and skew Hermitian
1.4 orthogonal and unitary – properties –
1.5 characteristic equation – roots and characteristic vectors diagonalization–
1.6 Cayley–Hamilton theorem –simple problems.</td></tr>
<tr><td></td><td colspan="8">UNIT II
VECTOR CALCULUS
2.1 ∇operator – divergence – second derivative of vector functions or fields
2.2 Laplacian operator – curl of a vector –
2.3 line integral – line Integral of a vector field around an infinitesimal rectangle –
2.4 curl of conservative field – surface integral – volume integral (without problem) –
2.5 Gauss’s divergence theorem and proof
2.6 Stroke’s theorem and proof –simple problems.</td></tr>
</table>

	UNIT-III: **SPECIAL FUNCTIONS** 3.1 Definition –Beta function – Gamma function 3.2 Evaluation of Beta function 3.3 Other forms of Beta function 3.4 Evaluation of Gamma function 3.5 Other forms of Gamma function 3.6 Relation between Beta and Gamma functions – simple problems.
	UNIT-IV: **FROBENIUS METHOD AND SPECIAL FUNCTIONS:** 4.1 Singular points of second order linear differential equations and importance 4.2 Singularities of Bessels and Laguerre equations 4.3 Frobenius method and applications to differential equations. 4.4 Legendre and Hermite polynomials 4.5 Rodrigues formula –generating function 4.6 Orthogonality
	UNIT-V: **PARTIAL DIFFERENTIAL EQUATIONS** 5.1 Solutions to partial differential equations using separation of variables 5.2 Laplace's equation in problems of rectangular symmetry 5.3 Cylindrical symmetry 5.4 Spherical symmetry 5.5 Conducting and dielectric sphere in an external uniform electric field 5.6 Wave equation and its solution for vibrational modes of a stretched string
Recommended Text	1. Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4 th Edition (2006) 2. Mathematical Physics, SatyaPrakash (Sultan Chand)
Reference Books	1. Lang, Kenneth R., and Owen Gingerich, eds. A source book in astronomy and astrophysics, 1900–1975. Harvard University Press, 1979. 2. Duric, Nebojsa. Advanced astrophysics. Cambridge University Press, 2004. 3. Carroll, Bradley W., and Dale A. Ostlie. An introduction to modern astrophysics. Cambridge University Press, 2017.

Course Outcomes:

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

CO1: Learn about matrices, Hermitian operator and cayley – Hamilton theorem and its application

CO2: Learn about gradients, divergence and curl in orthogonal curvilinear and their typical applications in physics.

CO3: Learn about special type of matrices that are relevant in physics and get introduced to special functions like gamma function, beta function, delta function, dirac delta function, Bessel functions and their recurrence relations (K1, K2, K3, K4)

CO4: Analyse Frobenius method and its differential equations, Legendre and Hermite polynomials (K1, K2, K3, K4)

CO5: To acquire the mathematical skills in solving the basic partial differential equations (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	M	L	H
CO3	H	H	H	L	L	H
CO4	H	L	H	L	M	H
CO5	H	H	H	M	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	L	H
CO2	H	M	H	H	M	H
CO3	H	L	H	H	L	L
CO4	H	M	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">QUANTUM MECHANICS AND RELATIVITY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course 7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory 7</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>UCPHM24</td></tr>
<tr><td>Semester</td><td>V</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>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (18 hours) (K1, K2, K3 & K4)
SPECIAL THEORY OF RELATIVITY:
1.1 Michelson-Morley experiment–frames of reference – Galilean Relativity – postulates of special theory of relativity.
1.2 Lorentz transformation – consequences – time dilation–concept of simultaneity.
1.3 Doppler effect – length contraction – variation of mass with velocity.
1.4 Relativity of simultaneity and Addition of velocities.
1.5 Einstein’s mass-energy relation– relativistic momentum.
1.6 Energy relation – Minkowski’s four dimensional space.</td></tr>
<tr><td></td><td colspan="7">UNIT II (18 hours) (K1, K2, K3 & K4)
TRANSFORMATION RELATIONS & GENERAL THEORY OF RELATIVITY:

2.1 Transformation of velocity, mass, energy and momentum – four vectors.
2.2 Invariance under transformation.
2.3 Lorentz transformation and velocity addition equations in terms of hyperbolic functions.
2.4 Inertial and Gravitational mass – Principle of equivalence.
2.5 Experimental evidences for General theory of Relativity.
2.6 Elementary ideas of general theory of relativity and its significance.</td></tr>
</table>

	UNIT-III: (18 hours) (K1, K2, K3 & K4) **PHOTONS AND MATTER WAVES:** 3.1 Wave Nature of Particles – Matter Waves – Wave Packet 3.2 Difficulties of classical physics and origin of quantum theory – black body radiation 3.3 Planck's law – Einstein's photoelectric equation – Compton effect – pair production 3.4 De Broglie waves – phase velocity and group velocity 3.5 Davisson and Germer's experiment – uncertainty principle – consequences 3.6 Illustration of Gamma ray microscope- determination of angle of dip(Φ).
	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **OPERATORS AND SCHRÖDINGER EQUATION:** 4.1 Postulates of quantum mechanics – Wave function and its interpretation. 4.2 Schrödinger 's equation – linear operators – Eigenvalue. 4.3 Hermitian operator – properties of Hermitian operator. 4.4 Simultaneous Measurability of observables – operators for position, linear Momentum, angular momentum components. 4.5 Commutator algebra –commutator between these operators 4.6 Ladder Operators –expectation values of position and momentum – Ehrenfest theorem.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS:** 5.1 One-dimensional problems: (i) particle in a box, (ii) barrier penetration problem 5.2 Quantum mechanical tunneling, 5.3 linear harmonic oscillator (Series) 5.4 Free Particle for a Schrodinger equation. 5.5 Higher dimensional problems: (i) Rigid rotator (qualitative) 5.6 Hydrogen atom (qualitative).
Extended Professional Component (isa part of internal component only, not to be included in theexternal examination question paper)	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

Recommended Text	1. Modern Physics, R. Murugeshan, KiruthigaSivaprasath,S. Chand and Co.,17th Revised Edition, 2014. 2. Concepts of Modern Physics, A.Beiser, 6th Ed., McGraw-Hill, 2003. 3. *Special Theory of Relativity,S. P.Puri*, Pearson Education, India, 2013. 4. Quantum Mechanics, GhatakandLoganathan, Macmillan Publications. 5. Quantum mechanics – Satyaprakash and Swati Saluja. KedarNath Ram Nathand Co. 6. Quantum mechanics by Gupta Kumar and Sharma 7. Quantum Mechanics by Aruldoss
Reference Books	1. Fundamentals of Modern Physics, Peter J. Nolan, 1stEdition, 2014, by Physics 2. Quantum Mechanics, V. Devanathan, Narosa Pub. House, Chennai, 2005. 3. Quantum Mechanics, V.K. Thangappan, New Age International, New Delhi. 4. A Text Book of Quantum Mechanics, Mathews andVenkatesan, Tata McGraw Hill, New Delhi. **5.** Introduction to Quantum Mechanics, Pauling and Wilson, McGraw Hill Co., NewYork.
Website and e-learning source	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 4. https://www.khanacademy.org/science/physics/special-relativity/minkowski-spacetime/v/introduction-to-special-relativity-and-minkowski-spacetime-diagrams

Course Outcomes:

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

CO1: To understand the theory of relativity, its postulates and the consequences.K1
CO2: To learn the importance of transformation equations and also to differentiate between special and general theory of relativity.K3
CO3: To interpret the wave theory of matter with various theoretical and experimental evidences.K3, K4
CO4: To derive and use Schrodinger's wave equation and also learn about various operators. K2, K5
CO5: To solve Schrodinger's wave equation for simple problems and analyse to understand the solutions.K1, K4

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	L	L	H	H
CO3	H	H	H	L	L	H
CO4	M	H	H	M	L	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	L	H	H	H	H
CO3	H	H	H	L	M	H
CO4	H	L	H	H	H	H
CO5	H	M	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SOLID STATE PHYSICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course - 8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>UCPHN24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></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>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• To understand constituents, properties and models of nucleus.
• To give reason for radioactivity and study their properties.
• To learn about the principles of various particle detectors and accelerators.
• To acquire knowledge on different types of nuclear reactions and their applications.
• To know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (18 hours) (K1, K2, K3 & K4)
BONDING IN SOLIDS, CRYSTAL STRUCTURE
1.1 Types of bonding – ionic bonding – bond energy of NaCl molecule – covalent bonding – metallic bonding – hydrogen bonding – Van-der-Waals bonding
1.2 Crystal lattice – lattice translational vectors – lattice with basis – unit cell – Bravais' lattices - Bravais lattices of Cubic system – Miller indices – procedure for finding them
1.3 Packing of BCC and FCC structures – structures of NaCl and diamond crystals
1.4 Reciprocal lattice – reciprocal lattice vectors – properties – reciprocal lattices to SC, BCC and FCC structures
1.5 Brillouin zones – X-rays – Bragg's law (simple problems)
1.6 Experimental methods: Laue method, powder method and rotating crystal method</td></tr>
<tr><td></td><td colspan="7">UNIT II (18 hours) (K1, K2, K3 & K4)
ELEMENTARY LATTICE DYNAMICS
2.1 Lattice vibrations and phonons: linear monoatomic chain- Dulong and Petit's Law
2.2 Einstein and Debye theories of specific heat of solids – T^3 law (qualitative only)
2.3 Properties of metals – Classical free electron theory of metals (Drude-Lorentz)
2.4 Ohm's law – electrical and thermal conductivities - Weidemann-Franz' law
2.5 Sommerfeld's quantum free electron theory (qualitative only)
2.6 Einstein's theory of specific heat capacity</td></tr>
</table>

	UNIT-III: (14 hours) (K1, K2, K3 & K4) **MAGNETIC PROPERTIES OF SOLIDS** 3.1 Permeability, susceptibility, relation between them. 3.2 Classification of magnetic materials – properties of dia, para, ferro, ferri and antiferromagnetism 3.3 Langevin's theory of diamagnetism – Langevin's theory of paramagnetism- Curie – Weiss law 3.4 Weiss theory of ferromagnetism (qualitative only) – Heisenberg's quantum theory of ferromagnetism. 3.5 Domains – discussion of B-H curve –hysteresis and energy loss 3.6 Soft and hard magnets – magnetic alloys
	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **DIELECTRIC PROPERTIES OF MATERIALS** 4.1 Polarization and electric susceptibility – local electric field of an atom 4.2 Dielectric constant and polarizability – Polarization processes 4.3 Electronic polarization – calculation of polarizability- ionic, orientational and space charge polarization 4.4 Internal field – Clausius – Mosotti relation – frequency dependence of dielectric constant 4.5 Dielectric loss – effect of temperature on dielectric constant – dielectric breakdown and its types 4.6 Classical theory of electric polarizability – normal and anomalous dispersion
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **FERROELECTRIC AND SUPERCONDUCTING PROPERTIES OF MATERIALS** 5.1 Ferroelectric effect: Curie- Weiss Law- ferroelectric domains, P-E hysteresis loop 5.2 Elementary band theory: Kronig-Penny model - band gap (no derivation) – conductor, semiconductor (P and N type) and insulator 5.3 Conductivity of semiconductor - mobility- Hall effect - measurement of conductivity (four probe method) - Hall coefficient 5.4 **Superconductivity:** experimental results – critical temperature –critical magnetic field 5.5 Meissner effect –type-I and type-II superconductors 5.6 Idea of BCS theory (no derivation)
Extended Professional Component (isa part of internal component only, not to be included in theexternal examination question paper)	Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. Introduction to Solid State Physics,Kittel, Willey Eastern Ltd (2003). 2. Solid state Physics, Rita John,1st edition, TataMcGraw Hill publishers (2014). 3. Solid State Physics , R L Singhal, Kedarnath Ram Nathand Co., Meerut (2003) 4. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India 5. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill 6. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning 7. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer 8. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India 9. Solid State Physics, M.A. Wahab, 2011, Narosa Publishing House, ND
Reference Books	1. PuriandBabber – Solid State Physics – S.ChandandCo. New Delhi. 2. Kittel - Introduction to solid state physics, Wiley and Sons, 7th edition. 3. Raghavan - Materials science and Engineering, PHI 4. Azaroff - Introduction to solids, TMH 5. S. O. Pillai - Solid State Physics, Narosa publication 6. A.J. Dekker - Solid State Physics, McMillan India Ltd. 7. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
Website and e-learning source	1. https://nptel.ac.in/courses/115105099/ 2. https://nptel.ac.in/courses/115106061/

Course Outcomes:

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

CO1: Classify the bonding andcrystal structure also learn about the crystal structure analysis using X ray diffraction (K1, K2, K3, K4)

CO2: Understand the lattice dynamics and thus learn the electrical and thermal properties of materials. (K1, K2, K3, K4)

CO3: Give reason for classifying magnetic material on the basis of their behaviour. (K1, K2, K3, K4)

CO4: Comprehend the dielectric behavior of materials (K1, K2, K3, K4)

CO5: Appreciate the ferroelectric and super conducting properties of materials. (K1, K2, K3)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	H	L	M	M	H
CO3	H	H	H	L	L	H
CO4	H	H	H	M	L	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	M	H	H	L	H
CO4	H	H	H	L	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">DIGITAL ELECTRONICS AND MICROPROCESSOR 8085</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course - 10</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core
Theory</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UCPHO24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></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>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view
• To learn all types of number systems, Boolean algebra and identities, digital circuits for addition and subtraction, flip-flops, registers, counters.
• To get the knowledge on fundamentals of 8085 architecture, instruction sets and simple programs.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (18 hours) (K1, K2, K3 & K4)
BOOLEAN ALGEBRA AND LOGIC GATES
1.1 Decimal, Binary, Octal,Hexadecimal number systems and their conversions- Codes: BCD,gray and excess-3codes-code conversions-Complements(1’s, 2’s, 9’s and 10’s)
1.2 Binary addition, binary subtraction using 1’s and 2’s complement methods
1.3 Boolean operations, logic expressions, rules and laws of Boolean algebra
1.4 DeMorgan’s theorems -Simplification of Boolean expressions using Boolean algebraTechniques
1.5 Fundamental products-Sum of products - Karnaugh map-pair, quads and octet
1.6 AND gate - OR gate - NOT gate - NAND gate - NOR gate -EX – OR and EX – NOR gates – NAND and NOR as universal gates</td></tr>
<tr><td></td><td colspan="7">UNIT II (18 hours) (K1, K2, K3 & K4)
ARITHMETIC CIRCUITS
2.1 Introduction of Arithmetic circuits
2.2 Adders- Half Adder - Full Adder
2.3 Subtractor - Half Subtractor
2.4 Parallel binary adders- BCD adder
2.5 Multiplexers(4:1) and De-Multiplexers (1:4)
2.6 Encoder(8 line to 3-line) and Decoder(3 line to 8 line)- BCD to seven segment decoder</td></tr>
</table>

	UNIT-III: (14 hours) (K1, K2, K3 & K4) **FLIP FLOPS** 3.1 Flip-flops: S-R Flip-flop , J-K Flip-flop, T and D type flip-flops, master-slave flip-flop 3.2 Asynchronous counter- mod-8, mod-10 3.3 Synchronous counters- 4 bit and ring counter 3.4 General memory operations, ROM, RAM (static and dynamic), PROM, EPROM, EEPROM. 3.5 Digital logic family- RTL NOR gate-DTL NAND gate- TTL logic, CMOS NAND and NOR gates 3.6 Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL).
	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **MICROPROESSOR 8085** 4.1 Introduction to Microprocessor 8085-Pin configuration of 8085-Block diagram of Architecture of 8085 4.2 Data transfer instructions I – Arithmetic, logic and special instructions 4.3 Assembly language to Hex code – Data transfer instruction II -Addressing modes of 8085 4.4 Simple programs- code conversion- 8 bit addition, subtraction 4.5 Multiplication and division 4.6 Arranging number in ascending and descending orders
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **I/O INTERFACES** 5.1 Serial communication interface (8251-USART) 5.2 Programmable peripheral interface (8255-PPI) 5.3 Programmable interval timers (8253) 5.4 keyboard and display (8279) 5.5 Programmable Peripheral Interface (8255) 5.6 DMA controller (8237)
Extended Professional Component (isa part of internal component only, not to be included in theexternal examination question paper)	Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. M.Morris Mano, "Digital Design "3rd Edition, PHI, NewDelhi. 2. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV) 3. S.Salivahanaand S. Arivazhagan-Digital circuits and design 4. Microprocessor Architecture, Programming and Applications with the 8085 – Penram International Publishing, Mumbai.- Ramesh S.Gaonakar 5. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and GlenSA
Reference Books	1. Herbert Taub and Donald Schilling. "Digital Integrated Electronics" . McGraw Hill. 1985. 2. S.K. Bose. "Digital Systems". 2/e. New Age International.1992. 3. D.K. Anvekar and B.S. Sonade. "Electronic Data Converters: Fundamentals andApplications". TMH.1994. 4. Malvino and Leach. "Digital Principles and Applications". TMG HillEdition 5. Microprocessors and Interfacing – Douglas V.Hall 6. Microprocessor and Digital Systems – Douglas V.Hall
Website and e-learning source	1. https://youtu.be/-paFaxtTCkI 2. https://youtu.be/s1DSZEaCX_g

Course Outcomes:

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

CO1: Learn about number systems, Boolean algebra, logical operation and logic gates
CO2: Understand the working of adder, subractors, multiplexers and demultiplexers.
CO3: Get knowledge on flip-flops and storage devices.
CO4: Gain inputs on architecture of microprocessor 8085.
CO5: Develop program writing skills .on microprocessor 8085.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	L	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	L	H
CO4	H	H	H	M	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	L	H
CO2	H	L	H	H	M	L
CO3	H	H	H	H	M	H
CO4	H	L	H	H	L	H
CO5	H	H	H	H	M	L

Title of theCourse	PRACTICAL - VI						
Paper No.	Core Practical -VI						
Category	Core	Year	III	Credits	2	Course Code	UCPHP24
		Semester	VI				
Instructional hours perweek	Lecture	Tutorial	Lab Practice			Total	
	-	-	3			3	
Course Objectives	To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators, counters, multivibrators. Perform fundamental experiments on microprocessor 8085 and learn to write programs by themselves.						

Electronics

Minimum of Ten Experiments from the list:

1. Zener diode – voltage regulations
2. Bride rectifier using diodes
3. Clipping and clamping circuits using diodes.
4. Characteristics of a transistor – (CE mode)
5. Characteristics of a transistor – (CB mode).
6. Frequency response of a RC coupled CE transistor amplifier - single stage.
7. Transistor Emitter follower.
8. Colpitt's oscillator -transistor.
9. Hartley oscillator - transistor.
10. Astablemultivibrator - transistor.
11. Bistablemultivibrator - transistor.
12. FET - characteristics.
13. FET - amplifier (common drain)
14. UJT -characteristics
15. AC circuits with L,C,R -Series resonance.
16. AC circuits with L,C,R - Parallel resonance.
17. Operational amplifier - inverting amplifier and summing.
18. Operational amplifier - non-inverting amplifier and summing.
19. Operational amplifier – differential amplifier
20. Operational amplifier - differentiator and integrator.
21. Operational amplifier - D/A converter by binary resistor method.
22. 5V, IC Regulated power supply.
23. Construction of seven segment display.
24. Study of gate ICs – NOT, OR, AND, NOR, NAND, XOR, XNOR
25. Verification of De Morgan's theorem using ICs –NOT, OR, AND
26. NAND as universal building block.
27. NOR as universal building block.
28. Half adder / Half subtractor using basic logic gate ICs
29. Microprocessor 8085 – addition (8 bit only)
30. Microprocessor 8085 – subtraction (8 bit only)
31. Microprocessor 8085 – multiplication (8 bit only)
32. Microprocessor 8085 – division (8 bit only)
33. Microprocessor 8085 – square (8 bit only)
34. Microprocessor 8085 – square root (8 bit only)
35. Microprocessor 8085 – largest/smallest of numbers (8 bit only)
36. Microprocessor 8085 –ascending/descending order
37. Microprocessor 8085 – Fibonacci series

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: LASERS AND FIBER OPTICS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective 3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UEPHE24</td></tr>
<tr><td>Semester</td><td>VI</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>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at
• To learn the fundamentals, types of lasers
• To learn the laser instrumentation and their applications, also the interconnect between optics with lasers</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I
FUNDAMENTALS OF LASER
1.1 Basic principles: spontaneous and stimulated emission
1.2 Einstein’s coefficient – pumping mechanism: optical, electrical and laser pumping
1.3 Population inversion – two and three level laser system
1.4 Resonator configuration – quality factor
1.5 Threshold condition – concept of Q switching
1.6 Theory of mode locking– cavity dumping.</td></tr>
<tr><td></td><td colspan="8">UNIT II
TYPES OF LASER
2.1 Solid state laser: ruby laser, Nd:YAG laser, Nd:Glass laser
2.2 Semiconductor laser: intrinsic semiconductor laser, doped semiconductorlaser,
2.3 injection laser – dye laser – chemical laser: HCL laser, DF-
2.4 CO_2, CO chemical laser.
2.5 Gas laser: neutral atom gas laser (He-Ne laser),
2.6 CO_2laser, Copper vapour laser.</td></tr>
</table>

	UNIT-III **APPLICATIONS OF LASER** 3.2 application of laser in metrology 3.3 optical communication 3.4 material processing: laser instrumentation of material processing, powder feeder 3.5 laser heating, laser welding, laser melting 3.6 medical application – Laser instrumentation for surgeries– 3.7 laser in astronomy
	UNIT-IV **FIBER OPTICS** 4.1 Basic components of optical fiber communication – 4.2 Principles of light propagation through fiber – total internal reflection 4.3 Optical fiber – coherent bundle – numerical aperture and skew mode 4.4 Phase shift and attenuation during total internal reflection 4.5 Types of fiber: single mode and multi-mode fiber – step index and graded index fiber 4.6 Fiber optic sensors – application of fiber optics.
	UNIT-V **CHARACTERISTICS AND FABRICATION OF OPTICALFIBER** 5.1 Fiber characteristics: mechanical and transmission characteristics 5.2 Absorption loss and scattering loss measurements – 5.3 Dispersion – connectors and splicers – fiber termination – 5.4 Optical time domain reflectometer (OTDR) and its uses – 5.5 Fiber material – fiber fabrication (Single & Double crucible technique) 5.6 Fiber optic cables design.
Recommended Text	1. B.B. Laud - Laser and Non-linear Optics, New Age International Publications Third Edition, New Delhi. 2. An Introduction to laser, theory and applications by Avadhunulu, M.N.S.,Chand and Co, New Delhi 3. Laser Fundamentals by William Silfvast, Second edition, Cambridge 4. J. Wilson and J.F.B. Hawkes. 'Introduction to Opto Electronics', Pearson Education, 2018. 5. Optical Fiber Communication, John M. Senior, Third Edition, Pearson

Reference Books	1. A.Sennaroglu,"PhotonicsandLaserEngineering:Principles,DevicesandApplications"McGraw-HillEducation,2010. 2. K.R.Nambiar, "Lasers: Principles, Typesand Applications", New Age International, 2004. 3. Optic, AjoyGhatak, McGraw-Hill Education (India) Pvt, Ltd, 6th Edn., 2017.

Course Outcomes:

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

CO1: To learn the basics of emission, pumping mechanism and Q switching (K1, K2, K3, K4)
CO2: To learn the different types of lasers Solid lasers and Gas lasers (K1, K2, K3, K4)
CO3: To acquire the applications of laser in different field (K1, K2, K3, K4)
CO4: To learn fiber optics, total internal reflection and optic sensors applications (K1, K2, K3, K4)
CO5: To learn fiber characteristics absorption loss, scattering loss and fiber material fabrication process (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	M	L	H
CO3	H	H	H	L	M	H
CO4	H	H	M	L	L	H
CO5	H	M	H	H	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	H	H
CO3	H	M	L	H	H	H
CO4	H	M	L	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: MEDICAL INSTRUMENTATION</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective 3A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td>UEPHF24</td></tr>
<tr><td>Semester</td><td>V</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>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• This course aims to provide background of the Physics principles inmedical instrumentation technologies through theoretical and practical learning.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
1.1 BIOMETRICS: introduction to man-instrument system and its component
1.2 Problems encountered in measuring living systems –
1.3 Transducers– force, motion, pressure transducers.
1.4 AUDIOMETRY: mechanism of hearing – air and bone conduction – threshold of hearing –
1.5 Audiometer – masking in audiometry – pure tone and speech audiometer –
1.6 Evoked response audiometry – hearing aids.</td></tr>
<tr><td></td><td colspan="7">UNIT II
2.1 BIOELECTRIC POTENTIALS AND ELECTRODES: biomedical signals
2.2 Sources of bioelectric potentials – resting, action and propagation of bioelectric potentials
2.3 Bio-potential electrodes – skin surface, needle electrodes.
2.4 BIOMEDICAL RECORDERS: electro-conduction system of heart – electro cardiogram (ECG) – Einthoven’s triangle
2.5 Electro encephalogram (EEG) –brain waves – EEG instrumentation – recording of evoked potentials
2.6 Electro myogram (EMG)–pulse oximeter.</td></tr>
</table>

	UNIT-III: 3.1 **DIAGNOSTIC RADIOLOGY:** radiography – primary radiological image – contrast agents, 3.2 Filters – beam restrictor, grid – image quality 3.3 **COMPUTED TOMOGRAPHY:** linear tomography – computed tomography 3.4 Helical and multi slice – image quality– radiation dose. 3.5 **RADIOISOTOPES AND NUCLEAR MEDICINE:** radioisotopes – radiopharmaceuticals – technetium generator 3.6 Gamma camera – positron emission tomography – disposal of radioactive waste.
	UNIT-IV: 4.1 **ULTRASOUND IMAGING:** ultrasound transducer – ultrasound imaging 4.2 Doppler ultrasound – ultrasound image quality and bio-effects. 4.3 **MAGNETIC RESONANCE IMAGING:** proton and external magnetic field – precession 4.4 Radiofrequency and resonance – MRI signal – relaxation time 4.5 MRI instrumentation – imaging sequences 4.6 Biosafety
	UNIT-V: **PROJECT ASSIGNMENT :** 5.1 Clinical practice of one of the following: electro cardiogram, 5.2 Electro encephalogram, 5.3 Electro myogram, 5.4 Electro oculogram, computed tomography, 5.5 Positron emission tomography, 5.6 Ultrasound
Extended Professional Component (isa part of internal component only, not to be included in theexternal examination question paper)	Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

Recommended Text	1. Leslie Cromwell, Fred Weibell, Erich Pfieffer (2002) Biomedical Instrumentation and Measurements Prentice Hall of India, New Delhi. 2. R. S. Khandpur (2003) Handbook of Biomedical Instrumentation 2nd Edn. Tata McGraw Hill, New Delhi. 3. Kuppusamy Thayalan (2017), Basic Radiological Physics 2nd Edn. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
Reference Books	1. John Webster (2004) Bioinstrumentation John Wiley and Sons, Singapore. 2. John Enderle, Susan Blanchard, Joseph Bronzino (2005) Introduction to Biomedical Engineering, 2nd ed. Elsevier, San Deigo 3. William Hendee, Geoffrey Ibbott, Eric Hendee (2005) Radiation therapy Physics 3rd ed. Wiley-Liss, New Jersey

Course Outcomes:

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

CO1: To learn the principles, operation and applications of various biomedical devices (K1, K2, K3, K4)

CO2: To engage the innovative thinking and development of new medical devices and technologies (K1, K2, K3, K4)

CO3: To acquire technical skills necessary to design, calibrate and maintain medical instrumentation. (K1, K2, K3, K4)

CO4 : To learn about the regulatory requirements and safety standards governing uses of medical instrumentation. (K1, K2, K3, K4)

CO5: To develop the ability to analyze and solve complex problems related to medical instrumentation (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	H	L	L	M	H
CO2	M	L	M	M	L	M
CO3	H	M	H	L	M	H
CO4	M	H	M	H	L	M
CO5	H	M	M	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	H	H	M	H
CO2	L	L	H	L	M	M
CO3	H	H	M	H	H	L
CO4	M	M	L	M	H	M
CO5	H	L	M	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: NUMERICAL METHODS AND C PROGRAMMING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective 4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UEPHG24</td></tr>
<tr><td>Semester</td><td>VI</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>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• To understand the methods in numerical differentiation and integration and to develop the problem solving skills of the student.
• To introduce and explain the basic structure, rules of compiling and execution of C programming.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (18 hours) (K1, K2, K3 & K4)
NUMERICAL SOLUTIONS:
1.1 Determination of zeros of polynomials
1.2 Roots of linear and nonlinear algebraic
1.3 Transcendental equations
1.4 Bisection and Newton-Raphson methods
1.5 Euler’s method
1.6 Convergence and divergence of solutions</td></tr>
<tr><td></td><td colspan="7">UNIT II (18 hours) (K1, K2, K3 & K4)
NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING:
2.1 Newton’s forward and backward interpolation.
2.2 Lagrange’s interpolation.
2.3 Newton- Raphson method to find square root and cube roots.
2.4 Principle of least squares – fitting a straight line and exponential curve.
2.5 Trapezoidal rule.
2.6 Simpson’s 1/3 and 1/8 rule.</td></tr>
</table>

	UNIT-III: (14 hours) (K1, K2, K3 & K4) **ALGORITHM, FLOW CHART AND PROGRAM:** 3.1 Development of algorithm. 3.2 Flow chart for solving simple problems. 3.3 Average of set of numbers – greatest, smallest. 3.4 Conversion of Fahrenheit to Celsius and Celsius to Kelvin. 3.5 Miles to kilometer – sorting set of numbers in ascending and descending order. 3.6 Square matrix, addition, subtraction and multiplication of order (2x2) using arrays.
	UNIT-IV: (18 hours) (K1, K2, K3 & K4) **INTRODUCTION TO C:** 4.1 Importance of C – basic structure of C programming 4.2 Constants, variables and data types 4.3 Character set, key words and identifiers 4.4 Declaration of variables and data types 4.5 Operators – expressions: arithmetic, relational, logical, assignment 4.6 Increment and decrement – conditional – comma operators.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **CONTROL STRUCTURE:** 5.1 Decision making with if, if-else, nested if 5.2 Switch –go to – break – continue –while, do while, for statements 5.3 Arrays, one dimensional and two dimensional 5.4 Declaring arrays 5.5 Storing arrays in memory 5.6 Initializing arrays – simple programs
Recommended Text	1. Numerical methods,Singaravelu,Meenakshipublication,4th Edn., 1999. 2. Numerical methodsP.Kandasamy, K.Thilagavathy, K. Gunavathi, S.Chand, 2016 3. Programming in C, Balagurusamy, TMG, ND, 2012 4. Numerical Analysis,,M.K.Venkatraman, NPH, 2013 Numerical Analysis, B.D.Gupta, Konark Publishers, New Delhi, 2013

Reference Books	1. Schaum's outline series, Theory and Problems of programming in C, C.Byronand S. Gottfried, Tata McGraw Hill 2003 2. Numerical methods and C Programming, Veerarajan, 2015.

Course Outcomes:

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

CO1: Determine the zeros of polynomials and find the roots of linear and nonlinear algebraic.(K1)
CO2: Apply the Newton-Raphson method to compute square roots and cube roots.(K2,K3)
CO3: Develop algorithms and create flowcharts for solving basic computational problems.(K3)
CO4: Explain the importance and basic structure of C programming.(K4)
CO5: Utilize decision-making statements such as if, if-else, nested if, switch, go to, break.(K5)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	L	L	H
CO3	H	H	H	H	M	H
CO4	H	H	H	L	L	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	M	H	H	L	M
CO4	H	L	H	H	M	H
CO5	H	M	H	H	H	M

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: PHYSICS OF MUSIC</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective 4A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UEPHH24</td></tr>
<tr><td>Semester</td><td>V</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>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• To apprise and train students on the role of Physics in music and get the knowledge on the musical notes and instruments.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
SCIENTIFIC STUDY OF MUSIC:
1.1 Vibrations of atoms of matter– vibrations coupling to air
1.2 Propagation of sound waves in air, other media, fluids and solids velocity, frequency, wavelength, time period, intensity:
1.3 Definition and unit fs
1.4 Classification of sound on frequency and velocity
1.5 Human and animal sound perception– mechanism of ear and hearing
1.6 psychoacoustics</td></tr>
<tr><td></td><td colspan="7">Unit II
SIMPLE VIBRATING SYSTEMS:
2.1 Simple harmonic motion – tuning fork
2.2 Amplitude, phase, energy, energy loss/damping/ dissipation – power
2.3 Travelling waves and standing waves– laws of vibration in stretched strings– one-dimensional medium
2.4 Open and closed organ pipes – over tones, harmonics
2.5 Quality of sound: pitch, timber, loudness
2.6 Octaves, musical notes</td></tr>
</table>

	UNIT-III: **MUSICAL TONE:** 3.1 Pure/simple tones – sine/cosine waves– well-defined frequencies. 3.2 Wavelengths, amplitudes and phases 3.3 Partial tones – assembly of pure tones– mix of different frequencies and amplitudes 3.4 Complex tone – superposition of simple tones 3.5 Complex waveform– periodic complex waveform 3.6 Formants – resonances– sound envelope
	UNIT-IV: PRODUCTION OF MUSICAL SOUNDS: 4.1 human voice, mechanism of vocal sound production – larynx (sound box) – stringed 4.2 Instruments: plucked and bowed, guitar, mandolin, violin, piano, etc. 4.3 Wind instruments: whistles, flute, saxophone, pipe organ, bagpipes, etc 4.4 Percussion instruments: plates, membranes, drums, cymbals, xylophone etc. 4.5 Electronic instruments: keyboards, electric guitars, rhythm pads, etc. analog and digital sound synthesizers 4.6 MIDI instrument– computer generated music
	UNIT-V: **RECORDING OF MUSIC and SOUND:** 5.1 Edison phonograph – cylinder and disk records 5.2 Magnetic wire and tape recorders – digital recording (e.g. to CD, DVD, etc.) 5.3 Analog transducers, condenser, dynamic microphones, loudspeaker 5.4 Complex sound fields – near and far fields of acoustic 5.5 Spectral analysis techniques – continuous and discrete Fourier transforms, digital signal processing – digital filtering 5.6 Specifications of recording studios
Recommended Text	1. Physics and Music: The Science of Musical Sound by Harvey White (2014) 2. Good Vibrations – The Physics of Music by Barry Parker, (2009) 3. The History of Musical Instruments by Curt Sachs, (2006) 4. Physics and Music: Essential Connections and Illuminating Excursions by Kinko Tsuji and Stefan C. Müller(2021)

Course Outcomes:

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

CO1: Explores the science behind sound and music
CO2: Understands wave generation, harmonics
CO3: Acquire the fundamental concepts of musical tone
CO4: Learn about different types of instruments.
CO5: Learn and acquire knowledge about recording sound and music

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	H	L	L	M	H
CO2	M	L	M	M	L	M
CO3	L	M	H	L	M	H
CO4	M	H	L	H	L	M
CO5	H	M	M	H	H	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	H	H	M	L
CO2	L	L	H	L	M	M
CO3	H	H	M	H	H	L
CO4	M	L	L	M	H	M
CO5	H	L	M	H	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICS FOR COMPETITIVE EXAMINATIONS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Professional Competency SEC-8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>III</td><td>Credits</td><td>1</td><td>Course Code</td><td>UPPH24</td></tr>
<tr><td>Semester</td><td>VI</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>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• To make the students familiar with problems in Physics.
• To prepare the students for various Entrance examinations.
• To know the various applications of physics.
• To summarize important topics in physics.</td></tr>
<tr><td>Course Outline</td><td colspan="7">Unit I:
Mechanics and Waves
1.1 Newton’s laws of motion and its application Conservative forces and frictional forces -Centrifugal and Coriolis forces
1.2 Kepler’s laws – Escape velocity and artificial satellite - Gravitational Law and field.
1.3 Motion under a central force - Moments of Inertia and products of Inertia - Principalmoments and axes
1.4 Rigid body motion, fixed axis rotations - Bernoulli’s theorem – Elasticity
1.5 Waves and Simple Harmonic motion – Lissajous figures- Damped and Undampedoscillators
1.6 Wave equation -Resonance – Doppler effect in sound- Ultrasonics and applications.</td></tr>
<tr><td></td><td colspan="7">UNIT II :
Light
2.1 Thick lens formulae - power of a lens - Fermat’s Principle – Rayleigh criterion.
2.2 Resolving power of a prism and grating - Conditions for constructive and destructiveinterferences.
2.3 Newton’s rings - Calculation of radius of curvature – Air wedge – Calculation ofbandwidth.
2.4 Fresnel and Fraunhofer diffraction
2.5 Linear, circular and elliptic polarization - double refraction and optical rotation
2.6 Specific rotatory power of an optically active substance</td></tr>
</table>

	UNIT-III: **ELECTRICITY AND MAGNETISM** 3.1 Electric Charge - Coulomb law – Gauss law – Electric potential 3.2 Capacitors –Energy stored in a capacitor – Dielectric 3.3 Ampere's law - BiotSavart law – Faraday's laws of electromagnetic induction 3.4 Self-inductance – Mutual inductance – Alternating currents. 3.5 Growth and decay of current and charge in LR circuit – RC circuit – LCR circuit **3.6** Magnetic permeability and susceptibility, Dia, para and ferromagnetism,Measurement of susceptibility, Hysteresis loop.
	UNIT-IV: **ATOMIC AND NUCLEAR PHYSICS** 4.1 Atomic physics: X-ray spectrum – Compton Effect 4.2 Compton wavelength Photoelectric effect 4.3 Calculation of DeBroglie wavelength of electrons 4.4 Wave velocity and group velocity for DeBroglie waves 4.5 Uncertainty principle - Pauli Exclusion Principle 4.6 Mass defect - Binding energy – Radioactive disintegration law – half life – Q valueof nuclear reactions – Nuclear fission and fusion
	UNIT-V: **ELECTRONICS** 5.1 Semiconductors - Rectifiers 5.2 Zener diode as voltage regulator 5.3 Transistor as an Amplifiers – Relation between α and β 5.4 Feedback amplifier – Oscillators 5.5 Amplitude and frequency modulation 5.6 OR, AND, NOR and NAND gates – OP amps
Recommended Text	1. D S Mathur – Mechanics – S. Chand Publication, 2001. 2. Brijlal Subramaniyam - Properties of Matter (Unit I) – Eurasia Publication House Pvt. Ltd.,2001 3. Nelkan and Parker – Advanced Level Physics – Heinemann Longmann Education International Publication, 1995. (Unit II) 4. C.L Arora - Simplified Course in B.Sc Physics – S.Chand, 1999. (Unit III) 5. S.L.Kakani – Objective Physics – S.Chand and co. Ltd., New Delhi, 2001. (Unit IV)

	6. R.S.Sedha – Basic Electronics – S.Chand Publications, New Delhi, 2006 (Unit V) 7. Dr.N.K.Nayyar - Unique Quintessence of physics – Unique Publishers, 2010. 8. Principles of Electronics by V.K. Metha, S.Chand
Reference Books	1. Dr.Surekha Singh – UGC CSIR/NET/JRF/SLET – UpkarPrakashan Publishers. 2. Karen Cummings, Priscilla Laws, Edward Redish, Patrick Cooney - UnderstandingPhysics, 6th Edition – Wiley Student Education, 2005. 3. The Pearson Guide to Objective Physics – S.Chand Publishing House, 2007. 4. Sathya Prakash Arya – Objective Physics – MTG Books Publishers, 2007. 5. S.L.Kakani - Objective Physics, 10th Edition - S.Chand Publishing House, 2007. 6. K.C.Jain, C.LArora – Numerical Problems in Physics - S.Chand Publishing House,2005

Course Outcomes:

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

CO1 : To know the basic laws in Physics and its applications
CO2: To learn the principle of optics and study the light experiments like Newton's ring and Air wedge.
CO3: To study and evaluate the problems in Electricity and magnetism**.**
CO4: To give an extended knowledge in atomic physics and nuclear physics to solve the problems.
CO5: To know the application of semiconductor materials in various electronic circuits.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	L	H
CO2	H	H	H	H	M	H
CO3	H	H	H	L	L	H
CO4	H	H	M	H	L	H
CO5	H	M	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	M	H	H	M	H
CO3	H	L	H	M	H	H
CO4	H	M	H	L	M	H
CO5	H	L	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED PHYSICS – I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Allied I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td rowspan="2">UAPHA24</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td>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>3</td><td>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at
• To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
WAVES, OSCILLATIONS AND ULTRASONICS:
1.1 Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1)
1.2 Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) .
1.3 Ultrasound – production – piezoelectric method
1.4 Application of ultrasonics: medical field – lithotripsy, ultrasonography – ultrasonoimaging
1.5 Ultrasonics in dentistry – physiotheraphy, opthalmology
1.6 Advantages of noninvasive surgery – ultrasonics in green chemistry.</td></tr>
<tr><td></td><td colspan="7">Unit II (12 hours) (K1, K2, K3 & K4)
PROPERTIES OF MATTER:
2.1 Elasticity: elastic constants – bending of beam – theory of non- uniform bending – determination of Young’s modulus by non-uniform bending –
2.2 energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum
2.3 Viscosity: streamline and turbulent motion – critical velocity
2.4 coefficient of viscosity – Poiseuille’s formula – comparison of viscosities – burette method,
2.5 Surface tension: definition – molecular theory – droplets formation– shape, size and lifetime
2.6 Determination of surface tension through drop weight method – interfacial surface tension.</td></tr>
</table>

	UNIT-III: (12 hours) (K1, K2, K3 & K4) **HEAT AND THERMODYNAMICS:** 3.2 Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion 3.3 liquefaction of Oxygen– Linde's process of liquefaction of air 3.4 Liquid Oxygen for medical purpose– importance of cryocoolers 3.5 Thermodynamic system – thermodynamic equilibrium – laws of thermodynamics 3.6 Heat engine – Carnot's cycle – efficiency 3.7 Entropy – change of entropy in reversible and irreversible process.
	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **ELECTRICITY AND MAGNETISM:** 4.1 Transient current (DC) – Growth and decay of current in a circuit containinginductance and resistance (LR) – time constant 4.2 Growth and decay of charge in a circuit containing capacitance and resistance(CR) – time constant - Determination of high resistance by leakage (K3,K4) 4.3 Peak, average and RMS values of ac current and voltage - power factor and current values in an AC circuit 4.4 Types of switches in household and factories - Smart wifi switches- Fuses and circuit breakers in houses 4.5 Biot-Savart's law – field along the axis of the coil carrying current 4.6 Potentiometer –magnetic field due to a current carrying conductor
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **DIGITAL ELECTRONICS AND DIGITAL INDIA:** 5.1 Decimal and binary systems - Decimal to binary and binary to decimal conversion 5.2 Boolean operations, logic expressions, rules and laws of Boolean algebra 5.3 Fundamental products-Sum of products - Karnaugh map- pair, quads and octet 5.4 Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates 5.5 Universal building blocks – Boolean algebra 5.6 De Morgan's theorem – verification

Extended Professional Component (isa part of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Recommended Text	1.R.Murugesan (2001), Allied Physics,S. Chand and Co, NewDelhi. 2.BrijlalandN.Subramanyam (1994), Waves and Oscillations, Vikas Publishing House,NewDelhi. 3. BrijlalandN.Subramaniam (1994), Properties of Matter, S.Chand and Co., NewDelhi. 4.J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8th edition), S.ChandandCo.,New Delhi. 5.R.Murugesan(2005), Optics and Spectroscopy,S.ChandandCo,NewDelhi. 6.A.Subramaniyam, AppliedElectronics2ndEdn.,NationalPublishingCo.,Chennai.
Reference Books	1.ResnickHallidayandWalker(2018).FundamentalsofPhysics(11thedition),JohnWilleyand Sons, Asia Pvt.Ltd., Singapore. 2.V.R.KhannaandR.S.Bedi (1998), TextbookofSound1stEdn. KedharnaathPublishandCo, Meerut. 3.N.S.KhareandS.S.Srivastava (1983), ElectricityandMagnetism10thEdn.,AtmaRamandSons, New Delhi. 4.D.R.KhannaandH.R. Gulati(1979). Optics,S. Chand andCo.Ltd.,New Delhi. 5.V.K.Metha(2004).Principlesofelectronics6thEdn. S.Chandandcompany.
Website and e-learning source	1. https://youtu.be/M_5KYncYNyc 2. https://youtu.be/ljJLJgIvaHY 3. https://youtu.be/7mGqd9HQ_AU 4. https://youtu.be/h5jOAw57OXM 5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/ 6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://www.youtube.com/watch?v=gT8Nth9NWPMhttps://www.youtube.com/watch?v=9mXOMzUruMQandt=1shttps://www.youtube.com/watch?v=m4u-SuaSu1sandt=3shttps://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

Course Outcomes:

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

CO1: Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field.

CO2: Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.

CO3: Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.

CO4: Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze the mathematically verify circuits and apply the concepts to construct circuits and study them.

CO5: Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. Acquire information about various Govt. programs/ institutions in this field.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	L	L	H
CO3	H	L	H	M	H	H
CO4	H	H	H	L	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	M	H	H	M	H
CO3	H	M	H	H	L	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	L	H

<table>
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<tr><td>Paper No.</td><td colspan="7">Allied Practical -I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2"></td><td>Year</td><td>I/ II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UAPHB24</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
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<tr><td>Course Objectives</td><td colspan="7">Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results</td></tr>
</table>

Minimum of Eight Experiments from the list:

1. Young’s modulus by non-uniform bending using pin and microscope
2. Young’s modulus by non-uniform bending using optic lever,scale and telescope
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass
2. Surface tension and interfacial Surface tension – drop weight method
3. Comparison of viscosities of two liquids – burette method
4. Specific heat capacity of a liquid – half time correction
5. Verification of laws of transverse vibrations using sonometer
6. Calibration of low range voltmeter using potentiometer
7. Determination of thermo emf using potentiometer
8. Verification of truth tables of basic logic gates using ICs
9. Verification of De Morgan’s theorems using logic gate ICs.
10. Use of NAND as universal building block.

Note : Use of digital balance permitted

<table>
<tr><td>Title of the Course</td><td colspan="8">ALLIED PHYSICS – II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Allied II</td></tr>
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<tr><td>Semester</td><td>II/IV</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="3">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Physics</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at
• To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3 & K4)
OPTICS
1.1 Interference – interference in thin films –colors of thin films
1.2 Air wedge – determination of diameter of a thin wire by air wedge
1.3 Diffraction – diffraction of light vs sound – normal incidence
1.4 Experimental determination of wavelength using diffraction grating (no theory) –
1.5 Polarization – polarization by double reflection – Brewster’s law
1.6 Optical activity – application in sugar industries</td></tr>
<tr><td></td><td colspan="8">Unit II (12 hours) (K1, K2, K3 & K4)
ATOMIC PHYSICS:
2.1 Atom models – Bohr atom model – mass number – atomic number
2.2 Nucleons – vector atom model – various quantum numbers – Pauli’s exclusion principle
2.3 Electronic configuration – periodic classification of elements – Bohr Magneton
2.4 Stark effect –Zeeman effect (elementary ideas only)
2.5 Photo electric effect- Einstein’s photoelectric equation
2.6 Applications of photoelectric effect: solar cells, solar panels, optoelectronic devices</td></tr>
</table>

	UNIT-III: (12 hours) (K1, K2, K3 & K4) **NUCLEAR PHYSICS:** 3.1 Nuclear models – liquid drop model, Shell model, magic numbers 3.2 Nuclear energy – mass defect – binding energy 3.3 Artificial transmutation – Rutherford's experiment –Types of nuclear reactions Energy balance in nuclear reactions and the Q-value – Q value equation for a nuclear reaction 3.4 Radioactivity – uses – half life – mean life - radio isotopes and uses – controlled and uncontrolled chain reaction 3.5 Nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor 3.6 Nuclear fusion – thermonuclear reactions – differences between fission and fusion.
	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES**: 4.1 Frame of reference – postulates of special theory of relativity 4.2 Galilean transformation equations 4.3 Lorentz transformation equations- Derivation 4.4 Length contraction – time dilation – twin paradox 4.5 Relativity of simultaneity and Addition of velocities 4.6 Mass-energy equivalence –introduction on gravitational waves
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **SEMICONDUCTOR PHYSICS:** 5.1 Semiconductors -P-type and N-type- PN junction diode 5.2 Characteristic of diode (I-V) – forward and reverse biasing 5.3 Zener diode – characteristic of zener diode- Voltage regulator 5.4 Full wave bridge rectifier – construction and working – advantages (no mathematical treatment) 5.5 Filters-Types of filter circuits -Action of filter circuits -π section filter 5.6 USB cell phone charger
Extended Professional Component (isa part of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. R.Murugesan (2005), AlliedPhysics,S.ChandandCo,NewDelhi. 2. K.ThangarajandD.Jayaraman(2004), AlliedPhysics,PopularBookDepot,Chennai. 3. BrijlalandN.Subramanyam(2002), TextbookofOptics,S.ChandandCo,NewDelhi. 4. R.Murugesan (2005), ModernPhysics,S.ChandandCo,NewDelhi. 5. A.SubramaniyamAppliedElectronics, 2nd Edn.,NationalPublishingCo.,Chennai.
Reference Books	1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn.,John Willeyand Sons, Asia Pvt. Ltd., Singapore. 2. D.R.KhannaandH.R. Gulati (1979).Optics, S.Chandand Co.Ltd.,New Delhi. 3. A.Beiser (1997), Concepts of Modern Physics,Tata McGraw HillPublication,NewDelhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, NewDelhi. 5. V.K.Metha (2004), Principles of electronics, 6th Edn. ,S.Chandand Company, New Delhi.
Website and e-learning source	1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318andv=D38BjgUdL5Uandfeature=emb_logo 2. https://www.youtube.com/watch?v=JrRrp5F-Qu4 3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/ 4. https://www.atoptics.co.uk/atoptics/blsky.htm - 5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

Course Outcomes:

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

CO1: Explain the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns

CO2: Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance ofinterpretingimprovingtheoreticalmodelsbasedonobservation.Appreciateinterdisciplinarynatureofscience and in solar energy related applications.

CO3: Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt. agencies like DAE guiding the country in the nuclear field.

CO4: To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.

CO5: Summarize the working of semiconductor devices like junction diode, Zener diode, transistors and practical devices we daily use like USB chargers and EV charging stations.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	M	L	H
CO3	H	H	H	H	M	H
CO4	H	H	H	M	L	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	M	H	H	H	H
CO3	H	L	M	H	H	H
CO4	H	M	H	H	M	H
CO5	H	L	H	L	H	H

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<tr><td>Paper No.</td><td colspan="7">Allied Practical -II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2"></td><td>Year</td><td>I/ II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UAPHD24</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
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<tr><td>Course Objectives</td><td colspan="7">Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results</td></tr>
</table>

Minimum of Eight Experiments from the list:

1. Radius of curvature of lens by forming Newton’s rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistanceof a wire using PO box
8. Thermal conductivity of poor conductor using Lee’s disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth’s magnetic field using field along the axis of a coil
11. Characterisation of Zener diode
12. Construction of Zerner/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block