SRI MEENAKSHI GOVT.ARTS COLLEGE FOR WOMEN (A), MADURAI - 625 002

DEPARTMENT OF PHYSICS

SYLLABUS

B.Sc. PHYSICS

FOR STUDENTS WHO ARE ADMITTED IN THE ACADEMIC YEAR 2023-2024

B.Sc., PHYSICS SYLLABUS

Preamble

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

The new curriculum offer courses in the core areas of mechanics, acoustics, optics and spectroscopy, electricity and magnetism, atomic and nuclear physics, solid state, electronics and other fields. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. In addition to the theoretical course work, the students also learn physics laboratory methods for different branches of physics, specialized measurement techniques, analysis of observational data, including error estimation and etc. The students will have deeper understanding of laws of nature through the subjects like classical mechanics, quantum mechanics, statistical physics etc. The problem solving ability of students will be enhanced. The students can apply principles in

physics to real life problems. The courses like integrated electronics and microprocessors will enhance the logical skills as well as employability skills. The numerical methods and mathematical physics provide analytical thinking and provides a better platform for higher level physics for research.

The restructured courses with well-defined objectives and learning outcomes, provide guidance to prospective students in choosing the elective courses to broaden their skills not only in the field of physics but also in interdisciplinary areas. The elective modules of the framework offer students choice to gain know2ledge and expertise in specialized domains of physics like astrophysics, medical physics, etc.

TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION	
Programme	**B.Sc., Physics**
Programme Code	UPHE1(EM) and UPHT1 (TM)
Duration	**3 years [UG]**
Programme Outcomes: (These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or the University for their Programme)	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally communicate with others using appropriate media; confidently share one‟s views and express herself/himself; demonstrate the ability to listen carefully; read and write analytically and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply the analytic thought to a body of knowledge; analyse and evaluate the proofs, arguments, claims, beliefs on the basis of empirical evidences; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach.

	PO4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one‟s learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one‟s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one‟s work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability

	issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/re skilling.

Programme Specific Outcomes: **(These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)**	**PSO1: Placement:** To prepare the students who will demonstrate respectful engagement with others" ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO2**: **Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations **PSO3**: **Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4**: **Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO5**: **Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

SRI MEENAKSHI GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), MADURAI-2

PROGRAMME : B.SC. PHYSICS
SEMESTER–I

Part	Course Type	SUB CODE	Title of the Course	Hrs / Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U231A1 /U231H1	Tamil/Hindi	6	3	3	25	75	100
II	ELC	U232A1	English	6	3	3	25	75	100
III	CC1 (T)	U23CP1	Properties of Matter and Acoustics	5	5	3	25	75	100

III	CC2 (P)	U23CP2P	Physics Practical 1	3	3	3	25	75	100
III	GEC 1(T)	U23GM11	Allied Mathematics - Paper I	4	4	3	25	75	100
III	GEC 2(P)	U23GM13	Allied Mathematics - Paper III	2	-	-	-	-	-
IV	S		Physics for Everyday Life	2	2	3	25	75	100
IV	Foundation Course	U23FP1	Introductory Physics	2	2	3	25	75	100
Total				**30**	**22**				**700**

SEMESTER–II

Part	Course Type	SUB CODE	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U231A2 /U231H2	Tamil/Hindi	6	3	3	25	75	100
II	ELC	U232A2	English	6	3	3	25	75	100
III	CC3 (T)	U23CP3	Heat, Thermodynamics and Statistical Physics	5	5	3	25	75	100
III	CC4 (P)	U23CP4P	Physics Practical 2	3	3	3	25	75	100
III		) U23GM12	Allied Mathematics - Paper II	4	4	3	25	75	100
III		) U23GM13	Allied Mathematics - Paper III	2	2	3	25	75	100
IV	SEC2	U23SEP2	Astrophysics	2	2	3	25	75	100
IV	SEC3/ NM	U23SEP3	Energy physics	2	2	3	25	75	100
Total				**30**	**24**				**800**

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SEMESTER–III

Part	Course Type	SUB CODE	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U231A3/ U231H3	Tamil/Hindi	6	3	3	25	75	100

II	ELC	U232A3	English	6	3	3	25	75	100
III	CC5 (T)	U23CP5	Mechanics	5	4	3	25	75	100
III	CC6 (P)	U23CP6P	Physics Practical 3	3	3	3	25	75	100
III	GEC 4(T)	U23GC20	Chemistry For Physical Science I	4	4	3	25	75	100
III	GEC 5(P)	U23GC21P	Chemistry Practical For Physical and Biological Sciences.	2	-	-	-	-	-
IV	SEC4	U23SEP4	Mobile Phone Servicing	1	1	3	25	75	100
IV		U23SEP5	C Programming	2	2	3	25	75	100
IV	E.V.S.	U23EVS1	E.V.S	1	--	--	--	--	--
Total				**30**	**20**				**700**

SEMESTER–IV

Part	Course Type	SUB CODE	Title of the Course	Hrs / Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U231A4/ U231H4	Tamil/Hindi	6	3	3	25	75	100
II	ELC	U232A4	English	6	3	3	25	75	100
III	CC7 (T) Core Industry Module	U23CP7	Optics and Laser Physics	4	4	3	25	75	100
III	CC8(P)	U23CP8P	Physics Practical 4	3	3	3	25	75	100
III	GEC 6(T)	U23GC22	Chemistry For Physical Science II	4	4	3	25	75	100
III	GEC 5(P)	U23GC21P	Chemistry Practical For Physical and Biological Sciences.	2	2	3	25	75	100
IV	SEC6	U23SEP6	Physics of Medical Instruments	2	2	3	25	75	100
IV	SEC7	U23SEP7	Home Electrical Installation	2	2	3	25	75	100
IV	E.V.S.	U23EVS1	E.V.S.	1	2	3	25	75	100

Total	**30**	**25**				**900**
SUMMER INTERNSHIP/INDUSTRIAL TRAINING ***Allied Courses are considered as GEC**						

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SEMESTER–V

Part	Course Type	SUB CODE	Title of the Course	Hrs / Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
III	CC9 (T)	U23CP9	Electricity, Magnetism and Electromagnetism	5	5	3	25	75	100
III	CC10 (T)	U23CP10	Atomic and Nuclear Physics	5	5	3	25	75	100
III	CC11 (P)	U23CP11P	Physics Practical 5	6	3	3	25	75	100
III	CC12 (T)	U23CP12	Analog and Communication Electronics	4	4	3	25	75	100
III	DSEC1	U23DP03	Advanced Mathematical Physics	4	3	3	25	75	100
III	DSEC2	U23DP05	Materials Science	4	3	3	25	75	100
IV		U23SIPI	Summer Internship/ Industry Training	--	2	--	--	--	100
V		U23VEI	Value Education	2	2	3	25	75	100
Total				**30**	**27**				**800**

SEMESTER–VI

Part	Course Type	SUB CODE	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
III	CC13(T)	U23CP13	Quantum Mechanics and Relativity	6	5	3	25	75	100
III	CC14(T)	U23CP14	Solid State Physics	6	5	3	25	75	100
III	CC15(P)	U23CP15P	Physics Practical 6	6	3	3	25	75	100
III	DSEC3	U23DP11	Digital Electronics and	5	3	3	25	75	100

			Microprocessor 8085						
III	DSEC4	U23DP08	Nano Science And Nano Technology	5	3	3	25	75	100
IV		U23EAP	Extension Activity	--	1	--	--	--	100
IV Professional Competency Skill		U23PCP1	Physics for Competitive examinations.	2	2	3	25	75	100
Total				**30**	**22**				**700**

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COURSE STRUCTURE ABSTRACT

Part	Course	Total No. of Papers	Hours	Credit	Marks
I	Tamil	4	24	12	400
II	English	4	24	12	400
III	Core Course -Major(CCM)	15	69	60	1500
III	GEC– Elective Course (Allied)	6	24	20	600
III	DSEC –Elective Course	4	18	12	400
IV	Internship	1	--	2	100
IV	Skill Enhancement Course	7	13	13	700
IV	Foundation Course	1	2	2	100
IV	E.V.S.	1	2	2	100
V	Value Education	1	2	2	100
IV	Extension Activity/NSS/NCC/SPORTS	1	-	1	100
IV	Professional Competency Skill	1	2	2	100
Total		**46**	**180**	**140**	**4600**

COURSES OFFERED BY DEPARTMENT OF PHYSICS
TO
II B.Sc., MATHEMATICS AND I B.Sc., CHEMISTRY

Part	Course Type	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
III	GEC	U23GP17	Allied Physics – I	4	4	3	25	75	100
III	GEC	U23GP19	Allied Physics – II	4	4	3	25	75	100
III	GEC	U23GP18P	Allied Physics Practical - I	2	2	3	25	75	100

QUESTION PAPER PATTERN

Section – A	Section-B	Section-C
(5 * 2 = 10)	**Answer ALL questions** **Either – Or pattern** **(5 * 5 = 25)**	**Answer ALL questions** **Either – Or pattern** **(5 * 8 = 40)**
I to V Units - equal distribution		

LIST of DSE Courses for B.Sc Physics 2023 -2024

S.NO	SUBJECT CODE	TITLE OF THE PAPER
1.	U23DP01	COMMUNICATION SYSTEMS
2.	U23DP02	MATHEMATICAL PHYSICS
3.	U23DP03	ADVANCED MATHEMATICAL PHYSICS
4.	U23DP04	NUMERICAL METHODS AND C PROGRAMMING

5.	U23DP05	MATERIALS SCIENCE
6.	U23DP06	LASERS AND FIBER OPTICS
7.	U23DP07	DIGITAL PHOTOGRAPHY
8.	U23DP08	NANO SCIENCE AND NANO TECHNOLOGY
9.	U23DP09	MEDICAL INSTRUMENTATION
10.	U23DP10	PHYSICS OF MUSIC
11.	U23DP11	DIGITAL ELECTRONICS AND MICROPROCESSOR 8085

List of **CORE** paper:

S.NO	SUBJECT CODE	TITLE OF THE PAPER
1.	U23CP1	PROPERTIES OF MATTER AND ACOUSTICS
2.	U23CP2P	PHYSICS PRACTICAL 1
3.	U23CP3	HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS
4.	U23CP4P	PHYSICS PRACTICAL 2
5.	U23CP5	MECHANICS
6.	U23CP6P	PHYSICS PRACTICAL 3
7.	U23CP7	OPTICS AND LASER PHYSICS
8.	U23CP8P	PHYSICS PRACTICAL 4
9.	U23CP9	ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM
10.	U23CP10	ATOMIC AND NUCLEAR PHYSICS
11.	U23CP11P	PHYSICS PRACTICAL 5
12.	U23CP12	ANALOG AND COMMUNICATION ELECTRONICS
13.	U23CP13	QUANTUM MECHANICS AND RELATIVITY
14.	U23CP14	SOLID STATE PHYSICS
15.	U23CP15P	PHYSICS PRACTICAL 6

UG COURSE 2023-2026

QUESTION PAPER PATTERN

Section – A	Section-B	Section-C

(5 * 2 = 10)	Answer ALL questions Either – Or pattern (5 * 5 = 25)	Answer ALL questions Either – Or pattern (5 * 8 = 40)
I to V units equal distribution		

Evaluation pattern for **Extension Activity** shall be as follows:

Attendance - **50** marks

Participation - **25** marks

Report - **25** marks

Evaluation pattern for **Internship** shall be as follows:

Attendance (mandatory) - **40** marks

Field work and performance - **40** marks

Report writing -**20** marks

SKILL ENHANCEMENT COURSE (SEC)

PART	SEMESTER	SUB CODE	COURSE TYPE	TITLE OF THE PAPER	HRS/ WEEK	CREDITS
IV	I	U23SEP1	SEC 1	Physics for Everyday Life	2	2
IV	II	U23SEP2	SEC 2	Astrophysics	2	2
IV	II	U23SEP3	SEC 3	Energy physics	2	2
IV	III	U23SEP	SEC 4	Mobile Phone Servicing	1	1

		4				
IV	**III**	**U23SEP 5**	**SEC 5**	C Programming	2	2
IV	**IV**	**U23SEP 6**	**SEC 6**	Physics of Medical Instruments	2	2
IV	**IV**	**U23SEP 7**	**SEC 7**	Home Electrical Installation	2	2

ELECTIVE PAPERS (DSEC)

PART		**SUB**	**COURSE TYPE**	**TITLE OF THE PAPER**	**HRS/ WEEK**	**CREDITS**
III	**V**	**U23DP03**	**DSEC 1**	Advanced Mathematical Physics	4	3
III	**V**	**U23DP05**	**DSEC 2**	Materials Science	4	3
III	**VI**	**U23DP11**	**DSEC 3**	Digital Electronics and Microprocessor 8085	5	3
III	**VI**	**U23DP08**	**DSEC 4**	Nano Science And Nano Technology	5	3

Programme :B.Sc Physics Part IV: FOUNDATION COURSE Semester :I Hours : 2Hrs/W (30Hrs P/S) Sub. Code : U23FP1 Credits: 2

TITLE OF THE PAPER: INTRODUCTORY PHYSICS

Nature of the Course

Relevant to Global need		Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need	(✓)	Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented		Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To help students get an overview of Physics before learning their core courses. To serve as a bridge between the school curriculum and the degree programme.

UNITS	COURSE DETAILS
UNIT-I	Vectors, scalars –examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants
UNIT-II	Different types of forces–gravitational, electrostatic, magnetic, electromagnetic, nuclear –mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces
UNIT-III	Different forms of energy– conservation laws of momentum, energy – types of collisions –angular momentum– alternate energy sources– real life examples
UNIT-IV	Types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – stream line and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations
UNIT-V	Surface tension – shape of liquid drop – angle of contact – viscosity –lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use-conductors, insulators – thermal and electric
UNIT-VI	**PROFESSIONAL COMPONENTS: E**xpert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. D.S. Mathur, 2010, Elements of Properties of Matter, S.Chand and Co 2. BrijLal and N. Subrahmanyam, 2003, Properties of Matter, S.Chand and Co.
REFERENCE BOOKS	1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S.Chand and Co.
WEB RESOURCES	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/

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

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

MAPPING WITH PROGRAM OUTCOMES:

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

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

Programme :B.Sc Physics Part III: CORE PAPER

Semester :I Hours : 5Hrs/W (75Hrs P/S) Sub. Code : U23CP1 Credits: 5

TITLE OF THE PAPER: PROPERTIES OF MATTER AND ACOUSTICS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need	( )	Skill Development Oriented	( )	Addresses Environment and Sustainability	

Relevant to Local need	( )			Addresses Human Values	

COURSE OBJECTIVES	Study of the properties of matter leads to information which is of practical value to both the physicist and the engineers. It gives us information about the internal forces which act between the constituent parts of the substance. Students who undergo this course are successfully bound to get a better insight and understanding of the subject.
UNITS	**COURSE DETAILS**
UNIT-I	**ELASTICITY:** Hooke‟s law – stress-strain diagram – elastic constants –Poisson‟s ratio – relation between elastic constants and Poisson‟s ratio – work done in stretching and twisting a wire – twisting couple on a cylinder – rigidity modulus by static torsion– torsional pendulum (with and without masses)
UNIT-II	**BENDING OF BEAMS:** Cantilever– expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – expression for time period – experiment to find Young‟s modulus – non-uniform bending– experiment to determine Young‟s modulus by Koenig‟s method – uniform bending – expression for elevation – experiment to determine Young‟s modulus using microscope
UNIT-III	**FLUID DYNAMICS:** *Surface tension*: Definition – molecular forces– excess pressure over curved surface – application to spherical and cylindrical drops and bubbles – determination of surface tension by Jaegar‟s method–variation of surface tension with temperature *Viscosity*: Definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille‟s formula –corrections – terminal velocity and Stoke‟s formula– variation of viscosity with temperature
UNIT-IV	**WAVES AND OSCILLATIONS:** Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM – composition of two SHM in a straight line and at right angles – Lissajous's figures- free, damped, forced vibrations –resonance and Sharpness of resonance. Laws of transverse vibration in strings –Sonometer – determination of AC frequency using Sonometer–determination of frequency using Melde‟s string apparatus

UNIT-V	**ACOUSTICS OF BUILDINGS AND ULTRASONICS:** Intensity of sound – decibel – loudness of sound –reverberation – Sabine‟s reverberation formula – acoustic intensity – factors affecting the acoustics of buildings. *Ultrasonic waves*: Production of ultrasonic waves – Piezoelectric crystal method –magneto restriction effect – application of

	ultrasonic waves
UNIT-VI	**PROFESSIONAL COMPONENTS:** Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. BrijLal and N.Subrahmanyam, 1995, A Text Book of Sound, Second revised edition, Vikas Publishing House. 2. R.Murugesan,2012, Properties of Matter, S.Chand and Co.
REFERENCE BOOKS	1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers 2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, R. Chand and Co. 3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold- Heinmann India. 4. D.S. Mathur, 2010, Elements of Properties of Matter, S.Chand and Co 5. BrijLal and N. Subrahmanyam, 2003, Properties of Matter, S.Chand and Co 6. D.R.Khanna and R.S.Bedi, 1969, Textbook of Sound, AtmaRam and sons
WEB RESOURCES	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 5. https://www.biolinscientific.com/blog/what-are-surfactants-and how-do-they-work 6. https://learningtechnologyofficial.com/category/fluid-mechanics lab/ 7. http://www.sound-physics.com/ 8. http://nptel.ac.in/courses/112104026/

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	75	100	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**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

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III: CORE PRATICAL-1 Semester : I Hours : 3Hrs/W (45Hrs P/S) Sub. Code :U23CP2P Credits: 3

TITLE OF THE PAPER: PHYSICS PRACTICAL 1 - Properties of Matter

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented	(✓)	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	(✓)

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. 22. Determination of g using compound pendulum.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Relate elastic behavior in terms of 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.

	CO4	Understand the theoretical principles of Matter.
	CO5	Improve the analytical and observations ability in Physics Experiments.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part IV: SEC Semester : I Hours : 2 Hrs/W (30Hrs P/S)
Sub. Code : U23SEP1 Credits: 2

TITLE OF THE PAPER: PHYSICS FOR EVERYDAY LIFE

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics
UNITS	**COURSE DETAILS**
UNIT-I	**MECHANICAL OBJECTS : S**pring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.

UNIT-II	**OPTICAL INSTRUMENTS AND LASER : V**ision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.
UNIT-III	**PHYSICS OF HOME APPLIANCES :B**ulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners
UNIT-IV	**SOLAR ENERGY:** Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.
UNIT-V	**INDIAN PHYSICIST AND THEIR CONTRIBUTIONS :** C.V.Raman, Homi Jehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.
TEXT BOOKS	1. The Physics in our Daily Lives, Umme Ammara, Gugucool Publishing, Hyderabad, 2019. 2. For the love of physics, Walter Lawin, Free Press, New York, 2011.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Know where all physics principles have been put to use in daily life.
	CO2	Appreciate the concepts with a better understanding.
	CO3	Understand the basic Principle behind the some Home Appliances.
	CO4	Apply Solar Energy in Domestic level.
	CO5	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

MAPPING WITH PROGRAM OUT COMES:

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

CO1	S	S	M	M	S	M	M	S	M	S
CO2	M	S	S	S	M	M	S	M	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	M	M	M
CO5	M	M	S	S	M	S	S	S	S	M

Programme : B.Sc Physics Part III: CORE PAPER Semester :II Hours : 5Hrs/W (75Hrs P/S) Sub. Code :U23CP3 Credits: 5

TITLE OF THE PAPER: HEAT, THERMODYNAMICS and STATISTICAL PHYSICS

Nature of the Course

Relevant to Global need	(🌲)	Employability Oriented	(🌲)	Addresses Professional Ethics	(🌲)
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(🌲)	Addresses Environment and Sustainability	(🌲)
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation	
UNITS	**COURSEDETAILS**	
UNIT-I	**CALORIMETRY: S**pecific heat capacity – specific heat capacity of gases C_P and C_V– Meyer‟s relation – Joly‟s method for determination of C_V – Regnault‟s method for determination of C_P **LOW TEMPERATURE PHYSICS:** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyle temperature – temperature of inversion – liquefaction of gas by Linde‟s Process – adiabatic demagnetisation.	
UNIT-II	**THERMODYNAMICS-I: Z**eroth law and first law of thermodynamics – P-V diagram – heat engine –efficiency of heat engine – Carnot‟s engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines.	

UNIT-III	**THERMODYNAMICS-II:** Second law of thermodynamics – entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermo dynamical scale of temperature – Maxwell‟s thermo dynamical relations –Clasius Clapeyron‟s equation (first latent heat equation) – third law of thermodynamics – un attainability of absolute zero – heat death.	
UNIT-IV	**HEAT TRANSFER: M**odes of heat transfer: conduction, convection and radiation. *Conduction*: Thermal conductivity – determination of thermal conductivity of a good conductor by Forbe‟s method – determination of thermal conductivity of a bad conductor by Lee‟s disc method. *Radiation*: Black body radiation (Ferry‟s method) – distribution of energy in black body radiation – Wien‟s law and Rayleigh Jean‟s law –Planck‟s law of radiation – Stefan‟s law – deduction of Newton‟s law of cooling from Stefan‟s law.	
UNIT-V	**STATISTICAL MECHANICS: D**efinition of phase-space – micro and macro states – ensembles –different types of ensembles – Classical and Quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics –	

	expression for distribution function – Fermi-Dirac statistics – expression for distribution function – comparison of three statistics.
UNIT-VI	**PROFESSIONAL COMPONENTS: E**xpert lectures –seminars – – webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. Brijlal and N. Subramaniam, 2000, Heat and Thermodynamics, S.Chand and Co. 2. Narayanamoorthy and Krishna Rao, 1969,Heat,Triveni Publishers, Chennai. 3. R.Murugeshan and Kiruthiga Sivaprasath, Thermal Physics, S.Chand and Co.

REFERENCE BOOKS	1. J.B.Rajam and C.L.Arora, 1976, Heat and Thermodynamics, 8th edition, S.Chand and 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, Halliday and Walker, 2010, Fundamentals of Physics, 6th Edition. 5. Sears, Zemansky, Hugh D. Young,Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson. 6. Ghosh, 1996, Text Book of Sound, S.Chand and Co. 7. V.R.Khanna and R.S.Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish and Co, Meerut. 8. Brijlal and N. Subramanyam, 2001, Waves and Oscillations, Vikas Publishing House, New Delhi.
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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, super fluidity and Condensed Matter Physics
	CO2	Derive the efficiency of Carnot‟s engine. Discuss the implications 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

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III: CORE PRACTICAL 2 Semester : II Hours : 3Hrs/W (45Hrs P/S) Sub. Code :U23CP4P Credits: 3

TITLE OF THE PAPER: PHYSICS PRACTICAL 2 -HEAT, OSCILLATIONS, WAVES and SOUND

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	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

HEAT, OSCILLATIONS, WAVES and SOUND

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. 18. Frequency of AC by using Sonometer.

25

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Apply their knowledge gained about the concept of heat and sound waves.
	CO2	Able to calculate the frequency of ac mains set up experimentation.
	CO3	Verify theories, quantify and analyse, in the basic Principle behind the Heat Experiments.
	CO4	Able to correlate the results.
	CO5	Know about the physics principles in heat experiments.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part IV: SEC Semester :II Hours : 2Hrs/W (30Hrs P/S)
Sub. Code :U23SEP2 Credits: 2

TITLE OF THE PAPER: ASTROPHYSICS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need	( )	Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need	( )	Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need	( )			Addresses Human Values	

ASTROPHYSICS	
Learning Objective: 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	
UNITS	**COURSE DETAILS**
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.
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.

UNIT-III	**ECLIPSES:** Types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse – transits. **THE SUN: P**hysical and orbital data – solar atmosphere – photosphere – chromosphere – solar corona – prominences – sunspots – 11year solar cycle – solar flares.
UNIT-IV	**STELLAR EVOLUTION:** H-R diagram – birth and death of low mass, intermediate mass and massive stars – Chandra Sekar 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.
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.

TEXT BOOKS	1. Dr.A.Mujiber Rahman ,(2018) Introduction to Astrophysics,1st Edition,KAMS Publications. 2. BaidyanathBasu, (2001). An introduction to Astrophysics, Second printing, Prentice – Hall of India (P) Ltd, New Delhi 3. K.S.Krishnaswamy, (2002), Astrophysics – a modern perspective, New Age International (P) Ltd, New Delhi. 4. Shylaja, B.S. andMadhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play, Orient BlackSwan,

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Understand the presently accepted formation theories of the solar system based upon the observational and physical constrains.
	CO2	Describe the features of objects in the Solar system giving details of similarities and differences between these objects. Understand the fundamental concepts of the sky, the stars and motion of planets.
	CO3	Understanding the basic properties of the Sun and other Stars.

	CO4	Understand the concept of stellar distance and magnitude of star light. Also students extend their understanding of physical concepts that apply to the study of block hole.
	CO5	Hands on training on basic constructs of telescope & night sky observation, visit the National observatory laboratory and conducting case study.

MAPPING WITH PROGRAM OUTCOMES:

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

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

Programme :B.Sc Physics Part IV: SEC Semester :II Hours : 2 Hrs/W (30Hrs P/S)
Sub. Code :U23SEP3 Credits: 2

TITLE OF THE PAPER: ENERGY PHYSICS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	( )
Relevant to Local need				Addresses Human Values	( )

Learning Objective: To get the understanding of the conventional and non conventional energy sources, their conservation and storage systems.	
UNITS	**COURSE DETAILS**

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.
UNIT-II	**SOLAR ENERGY :S**olar 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.
UNIT-III	**WIND ENERGY: I**ntroduction –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
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.
UNIT-V	**ENERGY STORAGE : I**mportance 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.
TEXT BOOKS	1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4th Edn. 2. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rd Edn. 3. D P Kothari, K P Singal, Rakesh Rajan, PHI Learning Pvt Ltd, 2011, 2nd Edn.

REFERENCE BOOKS	1. John Twidell and Tony Weir, Renewable Energy Resources, Taylor and Francis, 2005, 2nd Edn. 2. S.A. Abbasi and Nasema Abbasi, 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.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Get the understanding of the conventional and non conventional energy sources.
	CO2	Describe the features of their conservation of Energies.
	CO3	Understand the basic ideas of various types of Energy and their utilizations in daily life.
	CO4	Able to state the advantages and disadvantages of fuel devices.
	CO5	Acquired the knowledge of Energy Storage Devices.

MAPPING WITH PROGRAM OUTCOMES:

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

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

Programme :B.Sc Physics Part III: CORE PAPER Semester :III Hours : 5Hrs/W (75Hrs P/S) Sub. Code :U23CP5 Credits: 4

TITLE OF THE PAPER: MECHANICS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to		Skill Development	( )	Addresses	( )

Regional need		Oriented		Environment and Sustainability	)
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	This course allows the students: To have a basic understanding of the laws and principles of mechanics; To apply the concepts of forces existing in the system; To understand the forces of physics in everyday life; To visualize conservation laws; To apply Lagrangian equation to solve complex problems.

UNITS	**COURSEDETAILS**
UNIT-I	**LAWS OF MOTION:** Newton‟s Laws – forces – equations of motion – frictional force – motion of a particle in a uniform gravitational field – types of everyday forces in Physics. *Gravitation*: Classical theory of gravitation–Kepler‟s laws, Newton‟s law of gravitation – Determination of G by Boy‟s method – Earth-moon system – weightlessness – earth satellites – parking orbit – earth density – mass of the Sun – gravitational potential – velocity of escape – satellite potential and kinetic energy –Einstein‟s theory of gravitation – introduction –principle of equivalence – experimental tests of general theory of relativity – gravitational red shift – bending of light – perihelion of mercury.
UNIT-II	**CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM: C**onservation of linear and angular momentum – Internal forces and momentum conservation – center of mass – examples – general elastic collision of particles of different masses – system with variable mass – examples – conservation of angular momentum – torque due to internal forces – torque due to gravity – angular momentum about center of mass – proton scattering by heavy nucleus.
UNIT-III	**CONSERVATION LAWS OF ENERGY:** Introduction – significance of conservation laws – law of conservation of energy concepts of work- power – energy – conservative forces – potential energy and conservation of energy in gravitational and electric field – examples –non-conservative forces – general law of conservation of energy.

UNIT-IV	**RIGID BODY DYNAMICS: T**ranslational and rotational motion – angular momentum – moment of inertia – general theorems of moment of inertia – examples – rotation about fixed axis – kinetic energy of rotation – examples – body rolling along a plane surface – body rolling down an inclined plane – gyroscopic precision – gyrostatic applications.

UNIT-V	**LAGRANGIAN MECHANICS:** Generalized coordinates – degrees of freedom – constraints - principle of virtual work and D‟ Alembert‟s Principle – Lagrange‟s equation from D‟ Alembert‟s principle – application –simple pendulum – Atwood‟s machine.
UNIT-VI	**PROFESSIONAL COMPONENTS :** Expert lectures –seminars – – webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. J.C.Upadhyaya, 2019, Classical Mechanics, Himalaya Publishing house, Mumbai. 2. P.Durai Pandian, Laxmi Durai Pandian, Muthamizh Jayapragasam,2005, Mechanics, 6th revised edition, S.Chand and Co. 3. D.S.Mathur and P.S.Hemne, 2000, Mechanics, Revised Edition, S.Chandand Co. 4. Narayanamurthi, M. and Nagarathnam. N, 1998, Dynamics. The National Publishing, Chennai. 5. Narayanamurthi, M. and Nagarathnam, N, 1982, Statics, Hydrostatics and Hydrodynamics, The National Publishers, Chennai.
REFERENCE BOOKS	1. Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesely. 2. Halliday, David 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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**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‟ Alembert‟s principle.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III: CORE PRACTICAL 3 Semester : III Hours : 3Hrs/W (45Hrs P/S) Sub. Code : U23CP6P Credits: 3

TITLE OF THE PAPER: PHYSICS PRACTICAL 3 - ELECTRICITY

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented	(✓)	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	(✓)
Relevant to				Addresses Human	

Local need				Values	

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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Construct circuits to learn about the concept of electricity, current, resistance in the path of current.
	CO2	Able to calculate the different parameters that affect a circuit in Electrical experimentation.
	CO3	Verify theories, quantify and analyse, in the basic Principle behind the Electrical Experiments.
	CO4	Able to correlate the results.
	CO5	Able to set up the experiments, observe, analyse and assimilate the results in Electrical experiments.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part IV : SEC Semester :III Hours : 1Hr/W (15Hrs P/S)
Sub. Code :U23SEP4 Credits: 1

TITLE OF THE PAPER: MOBILE PHONE SERVICING

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need	( )	Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need	( )	Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need	( )			Addresses Human Values	

Learning Objective: To impart practical skill to develop self- employment to the students by covering all areas of Mobile Phone Servicing.	
UNITS	**COURSE DETAILS**
UNIT-I	**History of Mobile Phones:** Introduction - History of Mobile - From Analog cellular To Digital Mobile Phones.
UNIT-II	**Function of Mobile Phone:** The Principle – Features of a Mobile Phones – Familiarization of Circuit - Design with the Knowledge of Electronic Components And Their Characteristics - Major Function of Mobile phone.

UNIT-III	**Identification of Repairs:** Identification Of Faults – Rectification of Common Faults Like Faults In Battery, Call Drop Problem, Overheating, Sound Faults, Speaker Problem, Etc…
UNIT-IV	**Maintenance of Mobile Phones:** **7** Tips To Keep Your Phone Safe – Preventive Maintenance Scenario –Importance of Preventive Maintenance.
UNIT-V	**Practical Session:** Mobile Phone Repairing --- 1. Identify the proper tools and to have the ability to carry out the repairs. 2. To rectify the common problem like in audio speaker / audio microphones / audio Response in headsets - /voice problem. 3. Display problem 4. To rectify the problems in battery and their replacements.
TEXT BOOKS	Materials prepared by the Department.

REFERENCE BOOKS	To Understand Circuit Diagrams And The Electronic Components-- 1. Theraja, B.L., & Sedha, R.S. (2009). – Principals Of Electronic Devices And Circuits : Analog And Digital In S.I. Units. New Delhi: S.Chand and Company Ltd. 2. Tokhein, A. (2005). Digital Electronics: Principals And Applications, (6th edn.) New Delhi: Tata McGraw Hill. **3.** https://www.mobilerepairingonline.com **- free e-book 4.** https://www.computer-pdf.com **- free e-book** **5.** Mobile Repairing Course Book - Basic to Advance by Marcos Lynch **– e-book.**

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Achieve the importance of embarking on self-employment and has developed the confidence and personal skill for the same.
	CO2	Understand the fundamentals of electronic components and functions.

	CO3	Test and identify the faults.
	CO4	Acquire the knowledge of maintenance and servicing
	CO5	To become a self-secured, and job satisfied in servicing Mobile Phone Servicing.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part IV : SEC
Semester : III Hours : 2Hrs/W (30Hrs P/S) Sub. Code : U23SEP5 Credits: 2

TITLE OF THE PAPER : **C PROGRAMMING**

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To understand the basics and concepts involved in programming language. To emphasize logical thinking and to develop programming skill.
UNITS	**COURSE DETAILS**

UNIT-I	**CONSTANTS, VARIABLES, DATA TYPES AND OPERATORS:** Basic structure of C Program - Character Set – C tokens-Keywords and identifiers, Constants, Variables, Data types - Declaration of Variables - Assigning values to variables -Defining Symbolic Constants - Arithmetic Operators - Relational, Logical, Assignment, Increment and Decrement, and Conditional operators - Arithmetic Expressions - Precedence of Arithmetic operators. Program for temperature conversion - From °C to ^{o}F or ^{o}F to °C or to use any scientific formula – Simple type.
UNIT-II	**MANAGING INPUT AND OUTPUT OPERATIONS:** Managing input and output Operations- Reading a character-Writing a character- Formatted input- formatted output. To reverse the digits of the given number.
UNIT-III	**DECISION MAKING AND BRANCHING:** Decision making with IF statement- Simple IF, IF-ELSE statements - ELSE - IF Ladder - Switch statement. To find the solution of a quadratic equation (Else-if ladder). To find the largest of given three numbers (Nested if else) To find the grade of the students (Switch statement) To find the sum of digits of a given number (While).
UNIT-IV	**DECISION MAKING AND LOOPING:** Introduction - WHILE, DO and FOR Statements - Jumps in Loops. To find the multiplication table (Do - While) To find the factorial of a given number (For)
UNIT-V	**ARRAYS AND STRINGS:** Arrays - One dimension & Two dimensions - Declaration and initialization of one and two dimensional arrays -Declaring and initializing string

	variables - String handling functions. To sort the given numbers in ascending or descending order (1D – Array) To find addition and subtraction of matrices (2D – Array).
UNIT-VI	**PROFESSIONAL COMPONENTS:** Expert lectures-seminars-webinars-industry inputs-social accountability patriotism
TEXT BOOKS	Programming in ANSI C - E.Balagurusamy, 6th Edition – 2012, Tata Mc Graw Hill Education Pvt. Ltd.
REFERENCE BOOKS	1.Programming Language C with Practicals – Ananthi Sheshasaayee& G.Sheshasaayee, Edition - 2001 (2nd Print) 2.Programming in C – Kamthane Ashok.N, 2nd Edition – 2013, Pearson Education

	3.Programming in C - P. Radha Ganesan &S.Ramasamy – Edition - 2004, Sci tech Publications
WEB RESOURCES	1.https://codeforwin.org/ 2.https://www.cprogramming.com/ 3.http://en.cpreference.com/w/c

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	define the basics of programming language
	CO2	understand the concept of input and output operations
	CO3	describe decision making and branching
	CO4	discuss the use decision making and looping
	CO5	describe arrays and strings

MAPPING WITH PROGRAM OUTCOMES:

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

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

Programme : B.Sc Physics Part III : CORE Paper Semester :IV Hours : 4Hrs/W (60Hrs P/S) Sub. Code : U23CP7 Credits: 4

TITLE OF THE PAPER: OPTICS and LASER PHYSICS Nature of the Course

Relevant to	(🌲	Employability Oriented		Addresses	

Global need	)			Professional Ethics	
Relevant to National need		Entrepreneurship Oriented	(🌲)	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(🌲)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics; To explain the behaviour of light in different mediums; To understand the differences in the important phenomena namely interference, diffraction and Polarization and apply the knowledge in day to day life; To understand the design of optical systems and methods to minims aberrations; To understand the working and applications of laser

UNITS	**COURSEDETAILS**
UNIT-I	**LENS AND PRISMS:** Fermat‟s principle of least time – postulates of geometrical optics – thick and thin lenses – focal length, critical thickness, power and cardinal points of a thick lens – narrow angled prisms. *Lens*: Aberrations: spherical aberration, chromatic aberrations, coma, and astigmatism– curvature of the field – distortion – chromatic aberrations methods. *Prism*: Dispersion, deviation, aberrations - applications rainbows and halos, constant deviation spectroscope. *Eyepieces*: Advantage of an eyepiece over a simple lens – Huygen‟s and Ramsden‟s eyepieces, construction and working –merits and demerits of the eyepiece. *Resolving power*: Rayleigh‟s criterion for resolution – limit of resolution for the eye – resolving power of, (i) Prism (ii) grating (iii) telescope
UNIT-II	**INTERFERENCE:** Division of wave front, Fresnel‟s biprism – fringes with white light – division of amplitude: interference in thin films due to, (i) reflected light, (ii) transmitted light – colours of thin films applications – air wedge – Newton‟s rings. *Interferometers* : Michelson‟s interferometer – applications, (i) determination of the wavelength of a monochromatic source of light, (ii) determination of the wavelength and separation D_1 and D_2 lines of sodium light, (iii) determination of a thickness of a mica sheet.

UNIT-III	**DIFFRACTION:** Fresnel‟s assumptions – zone plate – action of zone plate for an incident spherical wave front – differences between a zone plate and a convex lens –Fresnel type of diffraction – diffraction pattern due to a straight edge – positions of maximum and minimum intensities – diffraction due to a narrow slit –Fraunhofer

	type of diffraction – Fraunhofer diffraction at a single slit – plane diffraction grating– experiment to determine wavelengths – width of principal maxima.
UNIT-IV	**POLARISATION:** Optical activity – optically active crystals – polarizer and analyser –double refraction – optic axis, principal plane – Huygens‟s explanation of double refraction in uniaxial crystals – polaroids and applications – circularly and elliptically polarized light –quarter wave plate – half wave plate – production and detection of circularly and elliptically polarized lights – Fresnel‟s explanation – specific rotation – Laurent half shade polarimeter– experiment to determine specific rotatory power.
UNIT-V	**LASERS:** general principles of lasers – properties of lasers action – spontaneous and stimulated emission – population inversion – optical pumping – He-Ne laser (principle and working) – CO_2 laser (principle and working) semiconductor laser – laser applications – holography.
UNIT-VI	**PROFESSIONAL COMPONENTS: E**xpert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. Subramaniam. N and Brijlal, 2014, Optics, 25thEd, S.Chand and Co. 2. P.R.Sasikumar, 2012, Photonics, PHI Pvt Ltd, New Delhi. 3. V.Rajendran, 2012, Engineering Physics, Tata McGraw Hill.
REFERENCE BOOKS	1. Sathyaprakash, 1990,Optics,VII edition, Ratan Prakashan Mandhir, New Delhi. 2. Ajoy Ghatak, 2009,Optics, 4thedition, PHI Pvt Ltd, New Delhi. 3. D.Halliday, R.Resnick and J. Walker, 2001, Fundamentals of Physics, 6th edition, Willey, New York. 4. 7. Jenkins. A. Francis and White, 2011, Fundamentals of Optics, 4th edition, McGraw Hill Inc., NewDelhi.
WEB RESOURCES	1. https://science.nasa.gov/ems/ 2. https://www.youtube.com/watch?v=tL3rNc1G0qQandlist=RDCMUCzwo7UlGkb-8Pr6svxWo-LAandstart_radio=1andt=2472 3. https://science.nasa.gov/ems/ 4. https://imagine.gsfc.nasa.gov/educators/gammarabursts/imagine/ index.html 5. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord rayleigh-sir-raman-scattering/

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces
	CO2	Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer
	CO3	Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyse the optical instruments
	CO4	Interpret basic formulation of polarization and gain knowledge about Polarimeter, appraise its usage in industries
	CO5	Relate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III : CORE PRACTICAL 4 Semester : IV Hours : 3Hrs/W (45Hrs P/S) Sub. Code : U23CP8P Credits: 3

TITLE OF THE PAPER: PHYSICS PRACTICAL 4 - LIGHT

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

LIGHT (any Eight experiments)

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 Searles goniometer.
11. Verification of Newton‟s formula for a lens separated by a distance.
12. Determination of refractive index of a given liquid by forming liquid lens 13. Determination of refractive index using Laser.
14. Determination of wavelengths, particle size using Laser/Monochromatic source. 15. Determination of resolving power of Diffraction grating using Laser
16. Determination of wire using Laser.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Able to set the apparatus and learn about the concept of various optical phenomena.
	CO2	Able to understand and Demonstrate, the working principles behind, various Optical experimentation.
	CO3	Apply and calculate different parameters by the basic Principle behind the Optical Experiments.
	CO4	Able to correlate and interpret the results.
	CO5	Able to set up the experiments, observe, analyse and assimilate the results in Optical experiments.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part IV : SEC

Semester : IV Hours : 2Hrs/W (30Hrs P/S) Sub. Code : U23SEP6 Credits: 2

TITLE OF THE PAPER: PHYSICS OF MEDICAL INSTRUMENTS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	( )
Relevant to Local need				Addresses Human Values	( )

Learning Objective: The students will be exposed to instruments like ECG, EEG, EMG, medical imaging, diagnostic specialties, operation theater and its safety which will kindle interest to specialize in instrument servicing.	
UNITS	**COURSE DETAILS**
UNIT-I	**BIO-POTENTIALS AND ELECTRODES: T**ransport of ions through cell membrane- resting and action potential - Characteristics of resting potential – bio-electric potential – design of medical instruments – components of bio-medical instrumentation – electrodes – electrode potential – metal microelectrode – depth and needle electrodes – types of surface electrode – the pH electrode.
UNIT-II	**Bio-potential based Instrumentation:** Electrocardiography (ECG) – origin of cardiac action potential - ECG lead configuration –block diagram of ECG recording set up (qualitative) – Electroencephalography (EEG) – origin of EEG – action and evoked potentials - brain waves – block diagram of modern EEG set up – electromyography (EMG) – block diagram of EMG recording setup.
UNIT-III	**OPERATION THEATRE AND SAFETY:** Diathermy – block diagram of the electrosurgical diathermy– shortwave, microwave, ultrasonic diathermy – ventilators – servo controlled systems – **RADIATION SAFETY:** units of radiation - pocket dosimeter – pocket type radiation alarm – thermo-luminescence dosimeter.
UNIT-IV	**MEDICAL IMAGING: N**uclear imaging technique –computer tomography (CT) – principle – mathematical basis of image construction –block diagram of CT scanner – ultrasonic imaging systems – construction of transducer – display modes – MRI principle and instrumentation.
UNIT-V	**DIAGNOSTICS AND SPECIALITIES:** X-rays in radiography – fluoroscopy – comparison– image intensifiers – angiography – applications of X-ray examination (*problems*). **LASER IN MEDICINE: L**aser interactions with bio molecules – advantages of laser surgery – endoscopy – types of endoscopes with their operation (qualitative).

TEXT BOOKS	1. Biomedical Instrumentation and measurement, Leslie Cromwell, PHI, 2015 2. Medical Instrumentation, M. Arumugam, Anuradha agencies, 1992 3. Medical Electronics, M.J.Kumar Doss, Prathibha Publishers, 1987 4. Medical Physics, John R. Cameron and James G. Sko fronick, Thrift books, Atlanta, 1985 5. Electronic Instruments and Instrumentation Technology, M. M.M.Anand, PHI, 2015

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	List the electrode material and types of electrodes.
	CO2	Understand the characteristics of the recording system.
	CO3	Explain the safety measures in operation theatre.
	CO4	Acquire the knowledge about medical imaging techniques.
	CO5	Understand the working of medical equipments.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part IV : SEC
Semester :IV Hours : 2Hrs/W (30Hrs P/S) Sub. Code : U23SEP7
Credits: 2

TITLE OF THE PAPER: HOME ELECTRICAL INSTALLATION

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional		Skill Development Oriented	( )	Addresses Environment and	( )

need				Sustainability	
Relevant to Local need				Addresses Human Values	

Learning Objective: The students will get knowledge on electrical instruments, installations and domestic wiring techniques with safety precautions and servicing.	
UNITS	**COURSE DETAILS**
UNIT-I	**SIMPLE ELECTRICAL CIRCUITS: C**harge, 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.
UNIT-II	**TRANSMISSION OF ELECTRICITY: P**roduction 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 multi-core wires.
UNIT-III	**ELECTRICAL WIRING: D**ifferent 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
UNIT-IV	**POWER RATING AND POWER DELIVERED: C**onversion 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.
UNIT-V	**SAFETY MEASURES: I**nsulation for wires – colour specification for mains, return and earth – Understanding of fuse and circuit breakers – types of fuse: 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.
TEXT BOOKS	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).

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Get knowledge on electrical instruments and circuits
	CO2	Learn about production and transmission of electricity
	CO3	Get knowledge on domestic electrical wiring techniques
	CO4	Learn about get power rating and power delivered
	CO5	Know about safety precautions and servicing.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part III : CORE PAPER Semester :V Hours : 5Hrs/W (75Hrs P/S) Sub. Code : U23CP9 Credits: 5

TITLE OF THE PAPER: ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to		Entrepreneurship		Addresses Gender	

National need		Oriented		Sensitization	
Relevant to Regional need		Skill Development Oriented	()	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	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.

UNITS	**COURSE DETAILS**
UNIT-I	**CAPACITORS AND THERMO ELECTRICITY: C**apacitor – principle – capacitance of spherical and cylindrical capacitors – capacitance of a parallel plate capacitor (with and without dielectric slab) – effect of dielectric –Carey Foster bridge – temperature coefficient of resistance – Seebeck effect – laws of thermo emf – Peltier effect – Thomson effect – thermoelectric diagrams –uses of thermoelectric diagrams – thermodynamics of thermo couple - determination of Peltier and Thomson coefficients.
UNIT-II	**MAGNETIC EFFECTS OF CURRENT:** Biot and Savart's law – Magnetic induction due to circular coil – magnetic induction due to solenoid – Helmholtz tangent galvanometer –force on a current element by magnetic field – force between two infinitely long conductors – torque on a current loop in a field - moving coil galvanometer – damping correction – Ampere‟s circuital law – differential form – divergence of magnetic field – magnetic induction due to toroid.
UNIT-III	**MAGNETISM AND ELCTROMAGNETIC INDUCTION:** Magnetic induction B – magnetization M - relation between B, H and M – magnetic susceptibility – magnetic permeability – experiment to draw B-H curve – energy loss due to hysteresis - Importance of hysteresis curves – Faraday and Lenz laws –vector form – self-induction – coefficient of self-inductance of solenoid –

UNIT-IV	**TRANSIENT AND ALTERNATI** and decay of current in a circui inductance – growth and decay of c resistance and capacitor – growth an circuit (expressions for charge only values of ac – LCR series and p condition – Q factor – power factor.
UNIT-V	**MAXWELLS EQUATIONS AND WAVES:** Maxwell‟s equations in physical significance of Maxwell‟ current – plane electromagnetic wave light – Poynting vector–electroma homogenous media – refractive index
UNIT-VI	**PROFESSIONAL COMPONENTS** –seminars – – webinars – industry inp – patriotism
TEXT BOOKS	1. Murugeshan. R., - Electricity and M S.Chandand Co, New Delhi. 2. M. Narayanamurthy and N. Nagara Magnetism, 4th Edition. National
REFEREN CE BOOKS	1. Brijlal and Subramanian, Electri Edn., Ratan and Prakash, Agra. 2. Brijlal, N.Subramanyan and J Electrodynamics (2005), Eura Ltd., New Delhi. 3. David J. Griffiths, Introduction t 1997, Prentice Hall of India Pv 4. D. Halliday, R. Resnik and J. Wa Physics, 6th Edn., Wiley, NY, 20 5. Sehgal D.L., Chopra K.L, Sehga Magnetism,Sultan Chand and S
WEB RESOURCES	1. https://www.edx.org/course/ele 2. https://www.udemy.com/course 3. https://www.edx.org/course/mag 4.http://www.hajim.rochester.edu/o ht ml

	Anderson‟s method - inductance between coupling - earth induc

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES		
	CO1	Describe various thermo-electric effects and their properties.
	CO2	Apply Biot and Savart law to study the magnetic effect of electric current.
	CO3	Use Faraday and Lenz laws in explaining self and mutual inductance.
	CO4	Analyze the time variation of current and potential difference in AC circuits.
	CO5	Relate different physical quantities used to explain magnetic properties of materials.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III : CORE PAPER Semester : V Hours : 5Hrs/W (75Hrs P/S) Sub. Code : U23CP10 Credits: 5

TITLE OF THE PAPER : ATOMIC and NUCLEAR PHYSICS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	

Relevant to Regional need		Skill Development Oriented	()	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	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.

UNITS	COURSE DETAILS
UNIT-I	**VECTOR ATOM MODEL:** Introduction to atom model – vector atom model – electron spin –spatial quantisation– quantum numbers associated with vector atom model – L-S and J-J coupling – Pauli's exclusion principle – magnetic dipole moment due to orbital motion and spin motion of the electron – Bohr magnetron – Stern-Gerlach experiment – selection rules – intensity rule.
UNIT-II	**ATOMIC SPECTRA:** Origin of atomic spectra – excitation and ionization potentials – Davis and Goucher's method – spectral terms and notations – fine structure of sodium D-lines – Zeeman effect –Larmor's theorem – quantum mechanical explanation of normal Zeeman effect – anomalous Zeeman effect (qualitative explanation) –Paschen-Back effect – Stark effect.
UNIT-III	**RADIOACTIVITY:** Discovery of radioactivity – natural radio activity – properties of alpha rays, beta rays and gamma rays – Geiger-Nuttal law – alpha particle spectra –Gammow's theory of alpha decay (qualitative study) – beta ray spectra – neutrino theory of beta decay – nuclear isomerism – internal conversion – non conservation of parity in weak interactions.

UNIT-IV	**NUCLEAR REACTIONS:** Conservation laws of nuclear reaction – Q-value equation for a nuclear reaction – threshold energy – scattering cross section – artificial radio activity – application of radio isotopes – classification of neutrons – models of nuclear structure – liquid drop model – shell model.

UNIT-V	**ELEMENTARY PARTICLES: C**lassification of elementary particles – fundamental interactions – elementary particle quantum numbers –I Isospin and strangness quantum number – Conservation laws and symmetry – quarks – quark model (elementary ideas only) – discovery of cosmic rays – primary and secondary cosmic rays – latitude effect– altitude effect.
UNIT-VI	**PROFESSIONAL COMPONENTS: E**xpert lectures –seminars – – webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. R. Murugesan, Modern Physics, S. Chand and Co**. (**All units**)** (Units I and II-Problems)
REFEREN CE BOOKS	1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill. 2. Modern Physics, S. Ramamoorthy, National Publishing and Co. 3. Laser and Non-Linear Optics by B.B.Laud, Wiley Easter Ltd.,NewYork,1985. 4. Tayal, D.C.2000 – Nuclear Physics, Edition, Himalaya Publishing House, Mumbai. 5. Irving Kaplan (1962) Nuclear Physics, Second Edition, Oxford and IBH Publish and Co, New Delhi. 6. J.B. Rajam– Atomic Physics, S. Chand Publication, 7th Edition. 7. Roy and Nigam, – Nuclear Physics (1967) First edition, Wiley Eastern Limited, New Delhi. 8. Brijlal and N. Subrahmanyam, Atomic and Nuclear Physics, S. Chand and Co. (All units) 9. J. B. Rajam, Modern Physics, S. Chand and Co. 10.Sehgal and Chopra, Modern Physics, Sultan Chand, New Delhi 11.Arthur Beiser– Concept of Modern Physics, McGraw Hill Publication, 6th Edition.
WEB RESOURCES	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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	List the properties of electrons and positive rays, define specific charge of positive rays and know about different mass spectrographs.
	CO2	Outline photoelectric effect and the terms related to it, State laws of photoelectric emission, Explain experiments and applications of photo electric effect, Solve problems based on photoelectric equation.
	CO3	Explain different atom models, Describe different quantum numbers and different coupling schemes.

	CO4	Differentiate between excitation and ionization potentials, Explain Davis and Goucher‟s experiment**,** Apply selection rule, Analyse Paschen -Back effect ,Compare Zeeman and Stark effect.
	CO 5	Understand the condition for production of laser, Appreciate various properties and applications of lasers.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III : CORE PRACTICAL 5 Semester : V Hours : 6 Hrs/W (90Hrs P/S) Sub. Code : U23CP11P Credits: 3

TITLE OF THE PAPER: PHYSICS PRACTICAL 5 – GENERAL

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

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.
2. Diffraction grating minimum deviation.
3. Diffraction at a wire.
4. Specific rotation of sugar solution.
5. Bi-prism – Determination of λ.
6. Thickness of a thin film of Bi-prism
7. Brewster‟s law – polarization
8. Double refraction (λ_e and λ_o)
9. Y – by Corlus 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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Able to set the apparatus and learn about the concept of various optical principles and its phenomena.
	CO2	Able to understand and Demonstrate, the working principles behind, various physics experimentation.
	CO3	Apply and calculate different parameters in physics Experiments.
	CO4	Able to correlate and interpret the results.

	CO5	Able to set up the experiments, observe, analyse and assimilate the results in Optical experiments.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III : CORE PAPER Semester :V Hours : 4Hrs/W (60Hrs P/S) Sub. Code :U23CP12 Credits: 4

TITLE OF THE PAPER: ANALOG AND COMMUNICATION ELECTRONICS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	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.

UNITS	**COURSE DETAILS**

UNIT-I	**DIODES: D**iode characteristics – rectifiers - clipper circuits, clamping circuits. half wave rectifier, center tapped and bridge fullwave rectifiers, calculation of efficiency and ripple factor. DC power supply: Block diagram of a power supply, qualitative description of shunt capacitor filter, Zener diode as voltage regulator, temperature coefficient of Zener diode.
UNIT-II	**TRANSISTOR AMPLIFIERS:** Transistor configurations: CB, CE CC modes – I-V characteristics and hybrid parameters – DC load line – Q point self-bias – RC coupled CE amplifier –power amplifiers – classification of power amplifiers: A, B, C – push pull amplifiers – tuned amplifiers.
UNIT-III	**TRANSISTOR OSCILLATORS: F**eedback amplifier - principle of feedback, positive and negative feedback of voltage and current gain, advantages of negative feedback - Barkhausen‟s criterion. Transistor oscillators: Hartely, Colpitt, Phase shift oscillators with mathematical analysis.
UNIT-IV	**OPERATIONAL AMPLIFIERS: D**ifferential amplifiers – OPAMP characteristics –IC 741 pin configuration – inverting and non-inverting amplifiers – unity follower –summing and difference amplifiers – differentiator and integrator – astable multivibrator (square wave generator) – monostable vibrator

UNIT-V	**MODULATION AND DEMODULATION : T**heory of amplitude modulation - frequency modulation – comparison of AM and FM – phase modulation – sampling theorem – pulse width modulation – pulse modulation systems: PAM, PPM, and PCM – d**emodulation**: AM and FM detection - duper heterodyne receiver (block diagram)
UNIT-VI	**PROFESSIONAL COMPONENTS:** Expert lectures –seminars – – webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. V.K.Mehta - Principles of Electronics, S.Chand and Co. Ltd., 2004..
REFEREN CE 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. 6. V.Vijayendran - Integrated Electronics, S.Vishwanathan Publishers, Chennai. 7. B.L. Theraja - A Text Book of Electrical Technology. 8. John D. Ryder - Electronic fundamentals and Applications

	9. Malvino - Electronic Principles, Tata McGraw Hill.
WEB RESOURCES	1. https://www.queenmaryscollege.edu.in/eresources/undergraduat eprogram/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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Explain the basic concepts of semiconductors devices.
	CO2	know and classify the basic principles of biasing and transistor amplifiers
	CO3	Acquire the fundamental concepts of oscillators.
	CO4	Understand the working of operational amplifiers
	CO5	Learn and analyze the operations of sequential and combinational digital circuits

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III : DSEC

Semester : V Hours : 4Hrs/W (60 Hrs P/S) Sub. Code : U23DP04 Credits: 3

TITLE OF THE PAPER: ADVANCED MATHEMATICAL PHYSICS

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

Learning Objective: The fundamentals of matrices and vector calculus learnt in earlier course will enable students to learn advanced topics and theorems. The special functions and applications of partial differential equations will be of use in research at a later stage.

UNITS	COURSE DETAILS
UNIT-I	**MATRICES: I**ntroduction – special types of matrices – transpose – conjugate– conjugate transpose– symmetric and anti symmetric – Hermitian and skew Hermitian – orthogonal and unitary – properties – characteristic equation – roots and characteristic vectors – diagonalization– Cayley–Hamilton theorem –simple problems
UNIT-II	**VECTOR CALCULUS:** ∇ operator – divergence – second derivative of vector functions or fields –Laplacian operator – curl of a vector – line integral – line Integral of a vector field around an infinitesimal rectangle – curl of conservative field – surface integral – volume integral (without problem) – Gauss‟s divergence theorem and proof – Stroke‟s theorem and proof –simple problems.
UNIT-III	**SPECIAL FUNCTIONS:** Definition –Beta function – Gamma function – evaluation of Beta function – other forms of Beta function – evaluation of Gamma function – other forms of Gamma function – relation between Beta and Gamma functions – simple problems.
UNIT-IV	**FROBENIUS METHOD AND SPECIAL FUNCTIONS: S**ingular points of second order linear differential equations and importance – singularities of Bessels and Laguerre equations, Frobenius method and applications to differential equations: Legendre and Hermite differential equations – Legendre and Hermite polynomials – Rodrigues formula –generating function – orthogonality

UNIT-V	**PARTIAL DIFFERENTIAL EQUATIONS: S**olutions to partial differential equations using separation of variables - Laplace‟s equation in problems of rectangular – cylindrical and spherical symmetry – conducting and dielectric sphere in an external uniform electric field – wave equation and its solution for vibrational modes of a stretched string.

TEXT BOOKS	1. Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4 th Edition (2006) 2. Mathematical Physics, SatyaPrakash (Sultan Chand)
REFEREN CE BOOKS	1. Mathematical Methods for Physicists,G.B.Arfken,H.J.Weber,F.E.Harris (2013, 7th Edn., Elsevier) 2. Mathematical Physics–H. K. Dass, Dr. Rama Verma (S. Chand Publishing) 3. Advanced Engineering Mathematics, Erwin Kreyszig (Wiley India) 4. Mathematical Physics and Special Relativity, M. Das, P.K. Jena and B.K. Dash (Srikrishna Prakashan)

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Learnt the advance level in Mathematical Physics with the understanding of fundamentals of matrices and vector calculus
	CO2	Learnt the advanced topics and theorems.
	CO3	Acquire the advanced level in mathematical physics.
	CO4	Understand the concepts of partial differential equations
	CO5	Able to apply the special functions and partial differential equations in research at a later stage.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part III : DSEC
Semester :V Hours : 4Hrs/W (60Hrs P/S) Sub. Code : U23DP06 Credits: 3

TITLE OF THE PAPER: MATERIALS SCIENCE

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

Learning Objective: To learn imperfections in crystals, deformation of materials and testing of materials. To get knowledge on behavior of a material, under the action of light and their applications. To know the applications of crystal defects.

UNITS	COURSE DETAILS
UNIT-I	**CRYSTAL IMPERFECTIONS:** Introduction – point defects: vacancies **(***problems***)**, interstitials, impurities, electronic defects – equilibrium concentration of point imperfections **(***problems***)**– application of point defects –line defects: edge dislocation **(***problems***)**, screw dislocation – surface defects: extrinsic defects – intrinsic defects: grain boundaries, tilt and twist boundaries, twin boundaries, stacking faults – volume defects – effect of imperfections.

UNIT-II	**MATERIAL DEFORMATION: I**ntroduction – elastic behavior of materials – atomic model of elastic behavior –modulus as a parameter in design – rubber like elasticity – inelastic behavior of materials – relaxation process – visco elastic behavior of materials – spring-Dash pot models of visco elastic behavior of materials.
UNIT-III	**PERMANENT DEFORMATION AND STRENGTHENING METHODS OF MATERIALS:** Introduction –plastic deformation: tensile stress-strain curve – plastic deformation by slip – creep: mechanism of creep – creep resistant materials – strengthening methods: strain hardening, grain refinement – solid solution strengthening – precipitation strengthening.
UNIT-IV	**OPTICAL MATERIALS: I**ntroduction – optical absorption in metals, semiconductors and insulators – NLO materials and their applications – display devices and display materials: fluorescence and phosphorescence – light emitting diodes –liquid crystal displays.

UNIT-V	**MECHANICAL TESTING: D**estructive testing: tensile test, compression test, hardness test – nondestructive testing (NDT): radiographic methods, ultrasonic methods – thermal methods of NDT: thermography – equipment used for NDT: metallurgical microscope.
TEXT BOOKS	1. Material science and Engineering, Raghavan V, Prentice Hall of India, Sixth Edition, 2015. 2. Materials science, V. Rajendran, McGraw Hill publications 2011. 3. Materials science, M. Arumugam, Revised 1st edn, Reprint 2002, Madras Classic Print.
REFERENCE BOOKS	1. William D. Callister, Jr., Material Science and Engineering – An Introduction, 8th Edition, John Wiley and Sons, Inc., 2007 2. W. Bolton, "Engineering materials technology", 3rd Edition, Butterworth and Heinemann, 2001. 3. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", 5th Edition, Thomson Learning, First Indian Reprint, 2007. 12.William F. Smith, "Structure and Properties of Engineering Alloys", Mc Graw-Hill Inc., U.S.A, 2nd edition, 1993.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE	**CO1**	Learn imperfections in crystals, deformation of materials and testing of materials.

OUTCOMES	**CO2**	Learn elastic behavior of materials.
	CO3	Learn about deformation and strengthening methods.
	CO4	Get knowledge on behavior of a material, under the action of light and their applications.
	CO5	Know the applications of crystal defects.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme : B.Sc Physics Part III : CORE PAPER Semester : VI Hours : 6Hrs/W (90Hrs P/S) Sub. Code : U23CP13 Credits: 5

TITLE OF THE PAPER: QUANTUM MECHANICS AND RELATIVITY

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To understand the theory of relativity, its postulates and the consequences. To learn the importance of transformation equations and also to differentiate between special and general theory of relativity. To interpret the wave theory of matter with various theoretical and experimental evidences. To derive and use Schrodinger‟s wave equation and also learn about various operators. To solve Schrodinger‟s wave equation for simple problems and analyse to understand the solutions.

UNITS	COURSE DETAILS
UNIT-I	**SPECIAL THEORY OF RELATIVITY:** Michelson-Morley experiment–frames of reference – Galilean Relativity – postulates of special theory of relativity – Lorentz transformation – consequences – time dilation–concept of simultaneity – Doppler effect – length contraction–variation of mass with velocity – Einstein‟s mass-energy relation– relativistic momentum – energy relation
UNIT-II	**TRANSFORMATION RELATIONS:** Transformation of velocity, mass, energy and momentum – four vector – invariance under transformation – Lorentz transformation and velocity addition equations in terms of hyperbolic functions. **GENERAL THEORY OF RELATIVITY:** Inertial and Gravitational mass – Principle of equivalence – Experimental evidences for General theory of Relativity
UNIT-III	**PHOTONS AND MATTER WAVES:** Difficulties of classical physics and origin of quantum theory – black body radiation – Planck‟s law – Einstein‟s photoelectric equation – Compton effect – pair production – De Broglie waves – phase velocity and group velocity – Davisson and Germer‟s experiment – uncertainty principle – consequences – illustration of Gamma ray microscope.

UNIT-IV	**OPERATORS AND SCHRÖDINGER EQUATION:** Postulates of quantum mechanics – Wave function and its interpretation – Schrödinger,,s equation – linear operators – Eigen value – Hermitian operator – properties of Hermitian operator– observable – operators for position, linear Momentum, angular momentum components – commutator algebra – commutator between these operators –expectation values of position and momentum – Ehrenfest theorem.
UNIT-V	**SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS:** *one-dimensional problems*: (i) Particle in a box, (ii) barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. *higher dimensional problems*: (i) Rigid rotator (qualitative), (ii) Hydrogen atom (qualitative).

UNIT-VI	**PROFESSIONAL COMPONENTS:** Expert lectures –seminars – – webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. Modern Physics, R. Murugeshan, Kiruthiga Sivaprasath,S. Chand and Co.,17th Revised Edition, 2014. 2. Quantum mechanics – Satyaprakash and Swati Saluja. Kedar Nath Ram Nath and Co.
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 and Venkatesan, Tata McGraw Hill, New Delhi. 5. Introduction to Quantum Mechanics, Pauling and Wilson, McGraw Hill Co., NewYork. 6. Concepts of Modern Physics, A.Beiser, 6th Ed., McGraw-Hill, 2003. 7. *Special Theory of Relativity, S.P.Puri,* Pearson Education, India, 2013. 8. Quantum Mechanics, Ghatak and Loganathan, Macmillan Publications
WEB RESOURCES	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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Understand various postulates of special theory of relativity.
	CO2	Appreciate the importance of transformation equations and also the general theory of relativity.
	CO3	Realise the wave nature of matter and understand its importance

	CO4	Derive Schrodinger equation and also realize the use of operators.
	CO5	Apply Schrödinger equation to simple problems.

MAPPING WITH PROGRAM OUT COMES:

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO 1	S	S	S	S	S	S	S	M	S	M
CO 2	S	S	M	S	M	M	S	M	M	M
CO 3	M	M	S	M	S	S	M	S	S	S
CO 4	M	S	S	S	S	S	S	M	M	M
CO 5	S	M	S	S	M	M	S	M	M	S

Programme :B.Sc Physics Part III : CORE PAPER Semester :VI Hours : 6Hrs/W (60Hrs P/S) Sub. Code : U23CP14 Credits: 5

TITLE OF THE PAPER: SOLID STATE PHYSICS

Nature of the Course

Relevant to Global need	(🌲)	Employability Oriented	(🌲)	Addresses Professional Ethics	(🌲)
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(🌲)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	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.

UNITS	COURSE DETAILS
UNIT-I	**BONDING IN SOLIDS, CRYSTAL STRUCTURE:** Types of bonding –ionic bonding – bond energy of NaCl molecule –covalent bonding – metallic bonding – hydrogen bonding – Vander-Waals bonding – crystal lattice – lattice translational vectors – lattice with basis – unit cell – Bravais‟ lattices – Miller indices – procedure for finding them –packing of BCC and FCC structures – structures of NaCl and diamond crystals –reciprocal lattice – reciprocal lattice vectors – properties – reciprocal lattices to SC, BCC and FCC structures – Brillouin zones – X-rays – Bragg's law(simple problems) – experimental methods: Laue method, powder method and rotating crystal method.
UNIT-II	**ELEMENTARY LATTICE DYNAMICS: L**attice vibrations and phonons: linear mono atomic and diatomic chains. acoustical and optical phonons –qualitative description of the phonon spectrum in solids –Dulong and Petit‟s Law – Einstein and Debye theories of specific heat of solids – T^3 law (qualitative only)–properties of metals – classical free electron theory of metals (Drude-Lorentz) – Ohm‟s law – electrical and thermal conductivities – Weidemann Franz‟ law – Sommerfeld‟s quantum free electron theory (qualitative only) – Einstein‟s theory of specific heat capacity.

UNIT-III	**MAGNETIC PROPERTIES OF SOLIDS:** Permeability, susceptibility, relation between them – classification of magnetic materials – properties of dia, para, ferro, ferri and anti ferromagnetism–Langevin‟s theory of diamagnetism – Langevin‟s theory of paramagnetism– Curie-Weiss law – Weiss theory of ferromagnetism(qualitative only) – Heisenberg‟s quantum theory of ferromagnetism – domains – discussion of B-H curve –hysteresis and energy loss – soft and hard magnets – magnetic alloys.

UNIT-IV	**DIELECTRIC PROPERTIES OF MATERIALS:** Polarization and electric susceptibility –local electric field of an atom – dielectric constant and polarisability – polarization processes: electronic polarization– calculation of polarisability – ionic, orientational and space charge polarization –internal field –Clausius- Mosotti relation –frequency dependence of dielectric constant –dielectric loss – effect of temperature on dielectric constant – dielectric breakdown and its types – classical theory of electric polarisability –normal and anomalous dispersion – Cauchy and Sellmeir relations –Langevin Debye equation – complex dielectric constant -optical phenomena. Application – plasma oscillations – plasma frequency – plasmons.
UNIT-V	**FERROELECTRIC and SUPERCONDUCTING PROPERTIES OF MATERIALS:** *Ferroelectric effect*: Curie-Weiss Law – ferroelectric domains, P-E hysteresis loop – *elementary band theory:* Kronig-Penny model – band gap(no derivation) – conductor, semiconductor (P and N type) and insulator –conductivity of semiconductor – mobility – Hall effect – measurement of conductivity (four probe method) - Hall coefficient. *Superconductivity :* experimental results –critical temperature – critical magnetic field – Meissner effect –type-I and type-II superconductors – London‟s equation and penetration depth – isotope effect – idea of BCS theory (no derivation).
UNIT-VI	**PROFESSIONAL COMPONENTS : E**xpert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. Introduction to Solid State Physics, Kittel, Willey Eastern Ltd (2003). 2. Solid state Physics, Rita John, 1st edition, Tata McGraw Hill publishers (2014).
REFEREN CE BOOKS	1. Puri and Babber – Solid State Physics – S.Chand and Co. New Delhi. 2. Kittel - Introduction to solid state physics, Wiley and Sons, 7^{th}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. 8. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India 9. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill 10. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning.

	11. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer. 12. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India. 13. Solid State Physics, M.A. Wahab, 2011, Narosa Publishing House, ND
WEB RESOURCES	1. https://nptel.ac.in/courses/115105099/ 2. https://nptel.ac.in/courses/115106061/

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Classify the bonding and crystal structure also learn about the crystal structure analysis using X ray diffraction.
	CO2	Understand the lattice dynamics and thus learn the electrical and thermal properties of materials.
	CO3	Give reason for classifying magnetic material on the basis of their behaviour.
	CO4	Comprehend the dielectric behavior of materials.

	CO5	Appreciate the ferroelectric and super conducting properties of materials.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part III : CORE PRACTICAL 6 Semester :VI Hours : 6Hrs/W (90Hrs P/S) Sub. Code : U23CP15P Credits: 3

TITLE OF THE PAPER : PHYSICS PRACTICAL 6 - Electronics

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators, counters, multi-vibrators. 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. RC coupled CE transistor amplifier - single stage.
7. Transistor Emitter follower.
8. Colpitt‟s oscillator -transistor.
9. Hartley oscillator - transistor.
10. A stable multi-vibrator - transistor.
11. Bi stable multi-vibrator - 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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Able to perform basic experiments on characteristics of electronic devices.
	CO2	Able to understand and Demonstrate, the various Electronics experimentation with the knowledge of its working principles and its phenomena behind it.
	CO3	Able to get into the applications such as amplifiers, oscillators, counters, multi-vibrators and calculate different parameters in the Experiments.
	CO4	Able to Perform fundamental experiments on microprocessor 8085 and correlate and interpret the results.
	CO5	Learn to write programs by themselves.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part III : DSEC Semester :VI Hours : 5Hrs/W (75 Hrs P/S) Sub. Code : U23DP17 Credits: 3

TITLE OF THE PAPER: DIGITAL ELECTRONICS AND MICROPROCESSOR 8085

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented	(✓)	Addresses Professional Ethics	(✓)
Relevant to National need		Entrepreneurship Oriented	(✓)	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	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.

UNITS	COURSE DETAILS
UNIT-I	**Digital Logic and Combinational Logic Circuits** : Decimal, binary, octal, hexadecimal numbers systems and their conversions – codes: BCD, gray and excess-3 codes –code conversions – complements (1"s, 2"s, 9"s and 10"s) –binary addition, binary subtraction using 1"s and 2"s complement methods – Boolean laws – De-Morgan"s theorem –basic logic gates -universal logic gates (NAND and NOR) –standard representation of logic functions (SOP and POS) – minimization techniques (Karnaugh map: 2, 3, 4 variables).
UNIT-II	**Arithmatic and Data Processing Circuits** : Adders, half and full adder – Subtractors, half and full Subtractor –parallel binary adder – magnitude comparator – multiplexers (4:1) and de multiplexers (1:4), encoder (8-line-to-3- line) and decoder (3-line-to-8-line), BCD to seven segment decoder.
UNIT-III	**Flip – Flops, Registers, Counters and Memory** : Flip-flops: S-R Flip-flop , J-K Flip-flop, T and D type flip-flops, master-slave flip flop, truth tables, registers:- serial in serial out and parallel in and parallel out – counters asynchronous:-mod-8, mod-10, synchronous - 4-bit and ring counter – general memory operations, ROM, RAM (static and dynamic), PROM, EPROM, EEPROM, EAROM. IC – logic families: RTL, DTL, TTL logic, CMOS NAND and NOR Gates, CMOS Inverter, Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL).
UNIT-IV	**Microprocessors Architecture and Programming** : 8085 Microprocessor: introduction to microprocessor – INTEL 8085 architecture – register organization –pin configuration of 8085,

	interrupts and its priority – Program Status Word (PSW) –instruction set of 8085 –addressing modes of 8085 –assembly language programming using 8085 – programmes for addition (8-Bit and 16- Bit), subtraction (8-Bit and 16-Bit), multiplication (8- Bit), division (8- Bit) – largest and smallest number in an array – BCD to ASCII and ASCII to BCD.
UNIT-V	**Microprocessor Interfacing** : I/O Interfaces: serial communication interface (8251-USART) – programmable peripheral interface (8255-PPI) –programmable interval timers (8253) – keyboard and display (8279), DMA controller (8237).

UNIT-VI	**PROFESSIONAL COMPONENTS: E**xpert lectures –seminars — webinars – industry inputs – social accountability – patriotism.
TEXT BOOKS	1. Malvino and Leach. “Digital Principles and Applications”. TMG Hill 7th Edition 2. Microprocessor Architecture, Programming and Applications with the 8085 – Penram International Publishing, Mumbai.- Ramesh S.Gaonakar
REFEREN CE 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 and Applications”. TMH.1994. 4. Microprocessors and Interfacing – Douglas V. Hall 5. Microprocessor and Digital Systems – Douglas V. Hall 6. M. Morris Mano, “Digital Design “3rd Edition, PHI, New Delhi 7. Ronald J. Tocci. “Digital Systems-Principles and Applications” 6/e. PHI. New Delhi. 1999.(UNITS I to IV) 8. S. Salivahana and S. Arivazhagan -Digital circuits and design 9. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and Glen SA
WEB RESOURCES	1. https://youtu.be/-paFaxtTCkI 2. https://youtu.be/s1DSZEaCX_g

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Learn about number systems, Boolean algebra, logical operation and logic gates
	CO2	Understand the working of adder, subractors, multiplexers and de multiplexers.
	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.

MAPPING WITH PROGRAM OUT COMES:

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

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

Programme :B.Sc Physics Part III : DSEC Semester :VI Hours : 5Hrs/W (75Hrs P/S) Sub. Code : U23DP09 Credits: 3

TITLE OF THE PAPER: NANO SCIENCE AND NANO TECHNOLOGY

Nature of the Course

Relevant to Global need	( )	Employability Oriented		Addresses Professional Ethics	
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented		Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

Learning Objective: This course aims to provide an overall understanding of Nano science and Nanotechnology and introduces different types of nano materials, their properties, fabrication methods, characterization techniques and a range of applications.

UNITS	**COURSE DETAILS**
UNIT-I	**NANOSCIENCE AND NANOTECHNOLOGY: N**anoscale– nature and nanostructures – nanostructures: 0D, 1D,2D– surface to volume ratio– size effect – excitons – quantum confinement– metal based nano particles (metal and metal oxide) – nano composites (non polymer based) – carbon nanostructures – fullerene –SWCNT and MWCNT .

UNIT-II	**PROPERTIES OF NANOMATERIALS : I**ntroduction–mechanical behavior –elastic properties – hardness and strength – ductility and toughness –super plastic behavior – optical properties – surface plasmon resonance – electrical properties – dielectric materials and properties – magnetic properties – super paramagnetism – electrochemical properties – properties of CNTs.
UNIT-III	**FABRICATION METHODS AND VACUUM TECHNIQUES : T**op-down and bottom-up approaches – electrochemical method – chemical and physical vapor depositions (CVD and PVD) – plasma arc discharge – sputtering – thermal evaporation – pulsed laser deposition – ball milling – lithography: photolithography – e-beam lithography – sol-gel methods – synthesis of CNT.
UNIT-IV	**CHARACTERIZATION TECHNIQUES : S**canning probe microscopy – scanning tunneling microscopy – atomic force microscopy – scanning electron microscopy – transmission electron microscopy –powder XRD method: determination of structure and grain size analysis – UV-visible and photoluminescence spectroscopy.
UNIT-V	**APPLICATIONS OF NANOMATERIALS : M**edicine: drug delivery – photodynamic therapy – molecular motors –energy: fuel cells –rechargeable batteries – super capacitors– photo voltaics. Sensors: nano sensors based on optical and physical properties –

	electrochemical sensors – nano biosensors. Nano electronics: CNTFET – display screens – GMR read/write heads – nano robots –applications of CNTs.
TEXT BOOKS	1. K.K. Chattopadhyay and A.N. Banerjee, (2012), Introduction to Nano science and Nanotechnology, PHI Learning Pvt. Ltd., 2. M.A. Shah, Tokeer Ahmad (2010), Principles of Nano science and Nanotechnology, Narosa Publishing House Pvt Ltd. 3. Mick Wilson, et al (2005) Nanotechnology: Basic Science and Emerging Technology,1st edn. Overseas Press. Pvt. Ltd., New Delhi , 2005
REFEREN CE 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.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Understand the basic of nanoscience and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials.
	CO2	Explore various physical, mechanical, optical, electrical and magnetic properties nanomaterials.
	CO3	Understand the process and mechanism of synthesis and fabrication of nanomaterials.
	CO4	Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques.
	CO5	Apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.

MAPPING WITH PROGRAM OUTCOMES:

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

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

Semester : VI Hours : 2 hrs/W (30 Hrs P/S) Sub. Code : U23PCP1 Credits: 2

TITLE OF THE PAPER: PHYSICS FOR COMPETITIVE EXAMINATIONS

Nature of the Course

Relevant to Global need	( )	Employability Oriented	( )	Addresses Professional Ethics	( )
Relevant to National need		Entrepreneurship Oriented	( )	Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	( )	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To Learn the skill of time management in solving problems and answering multiple choice questions. To apply the knowledge of physics in answering multiple choice questions and solving problems in physics.

UNITS	COURSE DETAILS
UNIT-I	**Mechanics and properties of matter :** Laws of motion – friction – work, power, energy – conservation of energy and momentum – elastic and inelastic collisions – projectile motion – circular motion – centripetal and centrifugal forces – mechanics of rigid bodies – moment of iner – conservation of angular momentum – gravitation – planets and satellites - cosmic rays & the universe- elasticity. Hydrostatics – principles of buoyancy and pressure in fluid – surface tension –flow of liquids – viscosity.
UNIT-II	**Heat and sound :** Thermal expansion – calorimetry and change of state – thermodynamics – isothermal, adiabatic, isobaric, isochoric processes – laws of thermodynamics – reversible and irreversible processes – entropy – transmission of heat – conduction, convection and radiation – body radiations – J-K effect – liquefaction of gases. Simple harmonic motion – damped and forced oscillations – progressive waves – beats-stationary waves in a string – Doppler effect – acoustics – ultrasonic waves.
UNIT-III	**Electricity and electromagnetism** : Electric field and potential – capacitors and dielectrics – current and circuits – thermo electricity – magnetic effect of current. Magnetic materials – hysteresis – energy loss – electromagnetic induction – self and mutual inductances – AC circuits series and parallel resonances – transformer.
UNIT-IV	**Optics and Electronics :** Reflection, refraction and dispersion – aberration and optical instrumer interference of light – interference in thin films- Fresnel and Fraunhofer diffraction – resolving power – polarization – double refraction – optical activity – principle of fiber optic communicati – NA – step index and graded index fibers – characteristics of laser.

black

electric

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	Intrinsic and extrinsic semiconductors – junction diodes – PNP and NPN transistors – FET, JFET,MOSFET- rectifiers – amplifiers – oscillators – modulation and demodulation – OP – AMPS Boolean identities – De Morgan‟s laws – logic gates.
UNIT-V	**Modern Physics :** Electron – band theory of solids – structure of atom – X-rays – photoelectric effect – wave mechanics – nuclear structure – nuclear radiations – particle accelerators – radioactivity – nuclear fission and fusion – nuclear reactors. Different crystal systems – bonding crystals - crystal imperfections – classification of super conductors - applications. Relativity – reference systems – Galilean invariance and conservation laws – Michelson – Morley experiment postulates of special theory of relativity – Lorentz transformation – length contraction – time dilation – variation of mass with velocity – mass – energy equivalence.
UNIT-VI	**Professional Components: E**xpert lectures –seminars — webinars – industry inputs – social accountability – patriotism.
Book For Study :	Material: Prepared by the Department of Physics

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METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	75	100	

COURSE OUTCOMES:

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

COURSE OUTCOMES	**CO1**	Develop the method of attending multiple choice questions in mechanics, properties of matter
	CO2	Enhance the skill in solving problems and answering multiple choice questions in physics
	CO3	Understand and analyze the tricks in attending more questions (multiple choice) in a short interval of time.
	CO4	Apply the knowledge of physics in solving problems.
	CO5	Develop the confidence of attending competitive exams.

MAPPING WITH PROGRAM OUT COMES:

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

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

TITLE OF THE PAPER: ALLIED PHYSICS – I

Nature of the Course

Relevant to Global need	(✓)	Employability Oriented		Addresses Professional Ethics	
Relevant to National need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to Regional need		Skill Development Oriented	(✓)	Addresses Environment and Sustainability	
Relevant to Local need				Addresses Human Values	

COURSE OBJECTIVES	To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

UNITS	COURSE DETAILS
UNIT-I	**WAVES, OSCILLATIONS AND ULTRASONICS:** Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultra sonography –ultrasonoics imaging- ultrasonics in dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry.
UNIT-II	**PROPERTIES OF MATTER:** *Elasticity*: Elastic constants – bending of beam – theory of non- uniform bending – determination of Young‟s modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum *Viscosity*: Streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille‟s formula – comparison of viscosities – burette method, *Surface tension*: Definition – molecular theory – droplets formation– shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.

UNIT-III	**HEAT AND THERMODYNAMICS:** Joule-Kelvin effect – Joule Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde‟s process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryo coolers– thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot‟s cycle – efficiency – entropy – change of entropy in reversible and irreversible process.

UNIT-IV	**ELECTRICITY AND MAGNETISM:** Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot- Savart‟s law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart Wi Fi switches fuses and circuit breakers in houses
UNIT-V	**DIGITAL ELECTRONICS AND DIGITAL INDIA:** Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan‟s theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT- semiconductor laboratories under Dept. of Space – an introduction to Digital India
UNIT-VI	**PROFESSIONAL COMPONENTS :** Expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. R. Murugesan, (2001), Allied Physics, S. Chand and Co, New Delhi.
REFERENCE BOOKS	1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11th edition) , John Willey and Sons, Asia Pvt. Ltd., Singapore. 2. V.R. Khanna and R.S.Bedi (1998), Textbook of Sound, 1st Edn. Kedhar naath Publish and Co, Meerut. 3. N.S. Khare and S. S. Srivastava (1983), Electricity and Magnetism 10th Edn., Atma Ram and Sons, New Delhi. 4. D.R.Khanna and H.R. Gulati (1979). Optics, S.Chand and Co. Ltd., New Delhi. 5. V.K.Metha (2004). Principles of Electronics 6th Edn. S.Chand and company. 6. Brijlal and N.Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, New Delhi. 7. Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand and Co., New Delhi. 8. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8th edition), S.Chand and Co., New Delhi. 9. R.Murugesan (2005), Optics and Spectroscopy, S.Chand and Co, NewDelhi. 10. A.Subramaniyam, Applied Electronics 2nd E dn., National Publishing Co., Chennai.

WEB RESOURCES	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=gT8 Nth9NWPMhttps://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