APPENDIX – AM

MADURAI KAMARAJ UNIVERSITY

(University with Potential for excellence)

B.SC., PHYSICS (SEMESTER)

CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS

(This will come into effect from the academic year 2023 onwards)

1.INTRODUCTION OF THE PROGRAMME:

Physics is often considered to be the most fundamental science. It is the basis of all other science subjects. It explains natural phenomena in the Universe. A bachelor degree in Physics is a great foundation for career in government jobs, industries, educational institutions, labs etc., Physics brings a broad perspective to any problem. This intensive thinking makes the Physicist desirable in any field. That's why Physics graduates can expect career salaries similar to those of computer science and engineering major.

2. QUALIFICATION FOR ADMISSION:

Candidates should have passed the higher secondary Examination conducted by the board of Higher Secondary Examination, Government of Tamilnadu or any other examination accepted by the syndicate of Madurai Kamaraj University as equivalent thereto with PHYSICS as one of the subjects along with MATHEMATICS in Higher Secondary Education.

3. DURATION OF THE COURSE:

The students shall undergo the prescribed course of study for a period of three academic years (six semesters).

4. MEDIUM OF INSTRUCTION: English / Tamil

5. OBJECTIVE OF THE PROGRAMME:

The UG course in Physics helps the students to understand the world around us, the world inside us and the world beyond us. Physics encompasses the study of the universe from the smallest sub atomic particles to the largest galaxies. Moreover it is the basis if many sciences like chemistry, oceanography, seismology and can be applied to a bachelor's degree in physics.

Physics challenges our imagination with concepts like relativity and string theory. It leads to great discoveries like computers and lasers that lead to technologies which change our lives – from healing joints to curing cancer and to develop sustainable energy solutions.

6. OUTCOME OF THE PROGRAMME:

The syllabus for B.Sc., Physics degree under semester system has been designed on the basis of Choice Based Credit System, (CBCS) which would focus on job oriented programmes and values added education. It will effect from June 2023 onwards. Duration of the course is three years. The students who are joining the B.Sc., (Physics) degree shall undergo a study period of three academic years - Six semesters.

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While preparing the syllabus, care is taken to provide the requirements of students who opt physics, for developing their skill and competence in their career. Hence after completion of the course, the student will be enriched with recent trends in Physics and be motivated towards higher studies and research activities. During the preparation of the syllabus and curriculum, the UGC model curriculum and syllabi of world best universities were considered.

8. UNITIZATION:

The important concepts of each subject is uniformly distributed in five units and properly required hours to teach are allotted.

9. PATTERN OF SEMESTER EXAMINATION:

The semester examination comprises of two parts i) internal assessment and ii) External examination. The maximum marks for the internal and external examinations are 25 and 75 respectively.

10. THE SCHEME FOR INTERNAL ASSESSMENT:

The Pattern for internal valuation

- Two tests will be conducted (10 mark each). The average of the two is taken – 10 marks
- 3rd test may be allowed for absentees of any one of the two tests.
- Group Discussion / Seminar / Quiz – 5 marks.
- For Quiz, 2 Quiz should be conducted.
- 2 Assignments : 5 mark each ; average 5 marks
- Peer team teaching and Peer group learning – 5 marks

(Students should be grouped into 5 or 6 members. 10% of each subject shall be taught through peer team teaching and learning method and appropriate hours should be allotted.

11. EXTERNAL EXAMINATION:

Student should appear for the external examination at the end of each semester. The University semester examinations will be conducted in the month of November and April for odd and even semesters respectively. He /she must satisfy the minimum attendance as prescribed by the University.

12. QUESTION PAPER PATTERN:

The pattern of Question paper will be as follows.

EXTERNAL

Time : 3 hours Max.Marks:75

SECTION A(10 X1 =10 Marks)

Question No. 1 to 10 (Multiple Choices)

- Two questions from each unit
- Four choices in each question
- No ‘ none of these ‘ choice.

SECTION B(5 X 7 = 35 marks)

- Answer all questions choosing either (a) or (b)
- Answer not exceeding two pages. (One question from each unit)

Question No : 11 – 15

11	(a)	or	11	(b)
12	(a)	or	11	(b)
13	(a)	or	11	(b)
14	(a)	or	11	(b)
15	(a)	or	11	(b)

SECTION C (3 X 10 = 30 marks)

- Answer not exceeding four pages.
- Answer any three out of five (1 Question from each unit)

Questions 16 -20

Section	Typesof questions	No. ofquestions	No. ofQuestions tobe answered	MarksForEach question	TotalMarks
A	Multiple Choice. Twoquestionsfromeach unit	10	1	1	10
B	Not exceeding 2. Pages(eitherortype)– Onefrom eachunit*	5	5	7	35
C	Notexceeding4 Pages (any three out of five – onefromeach unit*	5	3	10	30

There must be at least one problem in section B and section C

13. TherewillbeTwoAlliedsubjectstofulfillthecourseduringthreeyears.

Subject	Maximum marks	Credit	Yearofstudy
Mathematics	200	8	I
Chemistry	400	12	II

- ThesyllabusfortheancillarysubjectscanbegotfromtheAncillaryDepartmentofMathematics,Chemistry/ Applied electronics.

➢ Practical:Record NoteBook/Internal 5 +20 = 25
Examinationexternal = 75
Total 100

14.SCHEMEOFEVALUATION:

FortheUniversitytheoryexaminationthequestionpapersettershouldsubmittheschemeofvaluation alongwiththequestion paper foreachsubject.

15.PASSINGMINIMUM:

i) A candidate will be eligible for the B.Sc., degree by completing three years (sixsemesters)and passingall theprescribedexaminations.

ii) A candidate shall be declared as passed the course, if he/she scored a minimumof 35% marks in each paper of all the subjects. He/ She must score a minimum of 27marks out of 75 in the external examination and a minimum of 40 (internal + external)out of 100.

Classification

Sl.No	RangeofCCPA	Class
1	40 &abovebut below 50	III
2	50 &abovebut below 60	II
3	60 &Above	I

16 .MODELQUESTIONS:

Modelquestionpapersforafewcoresubject andskilledbasedpapersofPhysicsaregivenbelow.

MODEL QUESTION PAPERSMECHANICSAND PROPERTIESOFMATTER

(Forthosewho joined in June2023)

Time:Threehours Maximum:75 Marks

Section-A (10x1=10 Marks)

Answerall questions

Choosethecorrectanswer:

1. Inthe caseofelastic collision_____energyofthe particleis fullyconserved.

   (a)Potential (b) Kinetic (c)Thermal (d) Electrical

2. AccordingtoNewton'slaw_____

   $(a)\ F=\frac{d}{dt}(mv)$ (b) $F=\frac{d}{dt}(mp)$ (c) $F=\frac{dy}{dt}$ (d) $F=0$

3. Moment of inertia of circular disc about an axis through it's centre andperpendicularto its plane

   $(a)\ I=\frac{MR^2}{4}$ $(b)\ I=MR^2$ (c) $I=\frac{MR^2}{2}$ $(d)\ I=M^2R$

4. Thedimensions oftorqueis _____

(a) MLT^{-2} (b)ML^2T^{-2} (c)ML^2T^{-3} (d)ML^2T^{-1}

5. discoveredtheuniversallawof gravitation

(a) Newton (b)Planck (c)Curie (d)Kepler

6. Gravitationalfieldis a_____

(a) Vectorquantity (b)Scalarquantity
(c) Zeroat earthcrust (d) Infinityatearthcrust

7. substancesregaintheiroriginaldimensionaftertheremovalofforce

(a) Plastic (b)Elastic (c)Plasto elastic (d) Rigid

8. Maximum stress upto which the bodyexhibits thepropertyof elasticityis_____limit

(a)Elastic (b)Plastic (c)Tangent (d)Infinite

9. Excessofpressureina cylindrical dropis_____

(a) σ^r (b)σ/ 4r (c) σ.r (d)σ/r

10. Bernoulli'stheoremisapplicablein
(a) Bunsenburner (b)Filterpump
(c)Wingsof aeroplane (d)All of these

Section-B **(5x7=35Marks)**

AnswerALL questionschoosingeither(a)or (b)

11. (a)Whatiscollisionandexplainitstypes?

(or)

(b) Write short notes on Newton's law of motion and law of conservation of linearmomentum.

12. (a)Explain brieflyaboutthe torque

(or)

(b)Deduceanexpressionformoment ofinertia ofa circulardisc.

13. (a).StateNewton's gravitationallawanddiscussitsapplications.

(or)

(b)How willyoudeterminethemass of Earth?

14. (a). Calculate the η =$8x10^{10}$ N/m^2 work done in twisting a steel wire

of radius 10^{-3} mandlength 0.25m through an angleof45^{o}

(or)

(b)Explainthe term Poisson's ratio anddiscuss its limitingvalues.

15. (a)Discussviscosity, Co-efficientofviscosityandstreamlinedand turbulentmotion.

(or)

(b)Whatisaventurimeter?Explainaboutitsoperation.

Section-C **(3x10=30Marks)**

AnsweranyTHREEquestions

16. When two smooth spheres undergo direct impact calculate the loss of energyinvolved?
17. (a) Deduce an expression for the moment of inertia of a solid sphere about thediameter.

    (b) Derivetherelationbetweenangularmomentumandtorque.

18. Calculatethe gravitationalpotentialatapointoutsidethesphericalshell.
19. Describetheexcess ofpressurein asynclasticandanticlasticsurface.
20. StateandexplainBernoulli'stheorem.

17.TEACHINGMETHODOLOGY:

Usual chalk and talk method may be followed.Apart from this seminar, GroupDiscussion, Peer Team Teaching and Peer Group Learning are practiced in the classroom.Teaching aids like Charts are also used in the classroom, Nowadays ComputerAidedTechnology,E-learning,SmartClassRoomPracticeswithPowerPointPresentationsare also followed.

18. TEXTBOOKS

Thelistoftextbooksprescribedforeachsubjectisgivenunderthesyllabusofconcernedsubject.

19. REFERENCEBOOKS

Thelistoftextbooksprescribedforeachsubjectisgivenunderthesyllabusofconcernedsubject.

20. RE-TOTALINGANDREVALUATIONPROVISION

Students may apply for re-totaling and revaluation after declaration of resultwithin7 days

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

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

TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION	
Programme	**B.Sc., Physics**
Programme Code	
Duration	**3 years [UG]**
Programme Outcomes: (These are mereguidelines. Faculty can create POs based on their curriculum or adopt from UGC or the University for their Programme)	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully; read and write analytically and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply the analytic thought to a body of knowledge; analyse and evaluate the proofs, arguments, claims, beliefs on the basis of empirical evidences; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach. **PO4: Problem solving:** Capacity to extrapolate from what one has learned and apply their

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

	PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes: **(These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)**	**PSO1: Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2**: **Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations **PSO3**: **Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4**: **Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5**: **Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

Credit Distribution for UG Programmes

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement -(Foundation Course)	2	2	2.7 Skill Enhancement Course –SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

3 –Year UG ProgrammeB.Sc., Physics Credit Distribution				
Part	**Details**	**No. of Papers**	**Total Credits**	**Part Credits**
Part-I	Language (3 Credits)	4	12	12
Part-II	English (3 Credits)	4	12	12
Part-III	Core Theory (4 Credits)	8	32	76
	Core Theory (3 Credits)	2	6	
	Allied Theory (4 Credits)	2	8	
	Allied Theory (3 Credits)	2	6	
	Core Practical (3 Credits)	6	18	
	Allied Practical (3 Credits)	2	6	
Part-IV	Foundation Course (2 Credits)	1	2	39
	Skills Enhancement Course (SEC) NME (2 Credits)	8	16	
	Ability Enhancement Compulsory Course (AECCC) Soft Skills (2 Credits)	4	8	
	Elective Core (2 Credits)	4	8	
	Summer Internship (1 Credits)	1	1	
	EVS (2 Credit)	1	2	
	Value Education (2 Credits)	1	2	
Part-V	Extension Activity (NSS/NCC/YRC/Physical Education) (1 Credit)	1	1	1
		51	**140**	**140**

ConsolidatedSemesterwiseandComponentwiseCreditDistribution

Parts	**Sem-I**	**Sem-II**	**Sem-III**	**Sem-IV**	**Sem-V**	**Sem-VI**	**Total Credits**
Part-I	3	3	3	3	-	-	12
Part-II	3	3	3	3	-	-	12
Part-III	11	11	13	13	18	18	84
Part-IV	6	6	6	8	1	4	31
Part-V	-	-	-	-	-	1	1
Total	**23**	**23**	**25**	**27**	**19**	**23**	**140**

Credit Distribution for B.Sc., Physics Programme, Courses with Laboratory Hours

First Year

Semester-I

Part	List of Courses	Credit	No. of Hours
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Theory 1 – Properties of Matter and Acoustics	4	5
	Core Practical 1 – Physics Practical 1	3	3
	Allied Theory 1 – Allied Mathematics 1	4	6
Part-IV	Skill Enhancement Course SEC-1 (NME)	2	2
	Foundation Course	2	2
	Ability Enhancement Compulsory Course (AECC) Soft Skill-1	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-I	Language and	3	6
Part-II	English	3	4
Part-III	Core Theory 2 – Heat, Thermodynamics and Statistical Physics	4	5
	Core Practical 2 – Physics Practical 2	3	3
	Allied Theory 2 – Allied Mathematics 2	4	6
Part-IV	Skill Enhancement Course -SEC-2 (NME)	2	2
	Skill Enhancement Course -SEC-3 (Discipline/Subject Specific)	2	2
	Ability Enhancement Compulsory Course (AECC) Soft Skill-2	2	2
		23	**30**

Second Year - Semester-III

Part	List of Courses	Credit	No. of Hours
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Theory 3 –Mechanics	4	4
	Core Practical 3 – Physics Practical 3	3	3
	Allied Theory 1 – Allied Chemistry 1	3	4
	Allied Practical 1 – Allied Chemistry Practical 1	3	3
Part-IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	2	2
	Skill Enhancement Course -SEC-5 (Discipline/Subject Specific)	2	2
	Ability Enhancement Compulsory Course (AECC) Soft Skill-3	2	1
	EVS	-	1
		25	**30**

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Theory 4 – Optics and Laser Physics	4	4
	Core Practical 4 – Physics Practical 4	3	3
	Allied Theory 2 – Allied Chemistry 2	3	4
	Allied Practical 1 – Allied Chemistry Practical 2	3	3
Part-IV	Skill Enhancement Course -SEC-6 (Discipline/Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline/Subject Specific)	2	2
	Ability Enhancement Compulsory Course (AECC) Soft Skill-4	2	1
	EVS	2	1
		27	**30**

Third Year

Semester-V

Part	List of Courses	Credit	No. of Hours
Part-III	Core Theory 5 – Electricity, Magnetism and Electromagnetism	4	5
	Core Theory 6 – Atomic and Nuclear Physics	4	5
	Core Theory 7 – Analog and Communication Electronics	3	5
	Core Practical 5 – Physics Practical 5	3	3
	Elective Course 1 (Generic/Discipline Specific) EC 1	2	5
	Elective Course 2 (Generic/Discipline Specific) EC 2	2	5
Part-IV	Internship / Industrial Training (Carried out in II Year Summer Vocation) (30 Hours)	1	-
	Value Education	-	2
		19	**30**

Semester – VI

Part	List of Courses	Credit	No. of Hours
Part-III	Core Theory 8 – Quantum Mechanics and	4	5
	Core Theory 9 – Solid State Physics	4	5
	Core Theory 10 – Digital Electronics and Microprocessor 8085	3	5
	Core Practical 6 –Physics Practical 6	3	3
	Elective Course 3 (Generic/Subject Specific) EC 3	2	4
	Elective Course 4 (Generic/Subject Specific) EC 4 (or) Project	2	4
Part-IV	Skill Enhancement Course -SEC-8 (Discipline/Subject Specific)	2	2
	Value Education	2	2
Part-V	Extension Activity, NSS/NCC/YRC/Physical Education (Outside College Hours)	1	-
		23	**30**

ELECTIVES COURSES (EC)

1. COMMUNICATION SYSTEMS
2. ENERGY PHYSICS
3. MATHEMATICAL PHYSICS
4. ADVANCED MATHEMATICAL PHYSICS
5. NUMERICAL METHODS AND C PROGRAMMING
6. MATERIALS SCIENCE
7. LASERS AND FIBER OPTICS
8. DIGITAL PHOTOGRAPHY
9. NANO SCIENCE
10. MEDICAL INSTRUMENTATION

NON-MAJOR ELECTIVES (NME)

1. PHYSICS FOR EVERYDAY LIFE
2. ASTROPHYSICS
3. MEDICAL PHYSICS
4. HOME ELECTRICAL INSTALLATION
5. PHYSICS OF MUSIC

COURSE	**FIRST SEMESTER – FOUNDATION COURSE**
COURSE TITLE	**INTRODUCTORY PHYSICS**
CREDITS	2
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 vectorsfrom 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 lawsof momentum, energy – typesofcollisions –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 – comparisonoflight 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:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. D.S. Mathur, 2010, Elements of Properties of Matter, S.Chandand Co 2. BrijLaland N. Subrahmanyam, 2003, Properties of Matter, S.Chandand Co.
REFERENCE BOOKS	1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S.Chandand 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 InternalAssessment	End SemesterExamination	Total	Grade
25	**75**	**100**	

COURSEOUTCOMES:

Attheendofthecourse,thestudentwillbeableto:

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

MAPPINGWITHPROGRAMOUTCOMES:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**3**),MEDIUM(**2**)andLOW(**1**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

COURSE	**FIRST SEMESTER –CORE THEORY 1**
COURSETITLE	**PROPERTIES OF MATTER AND ACOUSTICS**
CREDITS	4
COURSE OBJECTIVES	Study of the properties of matter leads to information which is of practical value to both the physicist and the engineers.Itgives 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	**COURSEDETAILS**
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'sstringapparatus
UNIT-V	**ACOUSTICS OF BUILDINGS AND ULTRASONICS:** Intensity of sound – decibel – loudness of sound –reverberation – Sabine's reverberation formula – acoustic intensity – factors affecting the acoustics of buildings. *Ultrasonic waves*: production of ultrasonic waves – Piezoelectric crystal method –magnetostriction effect – application of ultrasonic waves

UNIT-VI	**PROFESSIONAL COMPONENTS:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chandand Co. 2. BrijLaland N. Subrahmanyam, 2003, Properties of Matter, S.Chandand Co 3. D.R.KhannaandR.S.Bedi, 1969, Textbook of Sound, AtmaRamand sons 4. BrijLal and N.Subrahmanyam, 1995, A Text Book of Sound, Second revised edition,Vikas Publishing House. 5. R.Murugesan,2012, Properties of Matter, S.Chandand Co.
REFERENCE BOOKS	1. C.J. Smith, 1960, General Properties of Matter, Orient Longman 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.
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 InternalAssessment	End Semester Examination	Total	Grade
25	75	100	

COURSE OUTCOMES:

Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

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

COURSE	**FIRST SEMESTER –CORE PRACTICAL 1**
COURSETITLE	**PRACTICAL 1**
CREDITS	3
COURSE OBJECTIVES	Apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Properties of Matter
Minimum of Eight Experiments from the list: 1. Determination of rigidity modulus without mass using Torsional pendulum. 2. Determination of rigidity modulus with masses using Torsional pendulum. 3. Determination of moment of inertia of an irregular body. 4. Verification of parallel axes theorem on moment of inertia. 5. Verification of perpendicular axes theorem on moment of inertia. 6. Determination of moment of inertia and g using Bifilar pendulum. 7. Determination of Young's modulus by stretching of wire with known masses. 8. Verification of Hook's law by stretching of wire method. 9. Determination of Young's modulus by uniform bending – load depression graph. 10. Determination of Young's modulus by non-uniform bending – scale and telescope. 11. Determination of Young's modulusby 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'sflow method. 21. Determinationradius of capillary tube by mercury pellet method. 22. Determinationof g using compound pendulum.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**SECOND SEMESTER – CORE THEORY 2**
COURSETITLE	**HEAT, THERMODYNAMICSandSTATISTICAL PHYSICS**
CREDITS	4
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:** specific heat capacity – specific heat capacity of gases $C_P$and C_V– Meyer's relation – Joly's method for determination of C_V – Regnault'smethodfordetermination of C_P **LOWTEMPERATUREPHYSICS:** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyletemperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.
UNIT-II	**THERMODYNAMICS-I:** zeroth law and first law of thermodynamics – P-V diagram – heat engine –efficiency of heat engine – 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 –thermodynamicalscale of temperature – Maxwell's thermodynamical relations –Clasius-Clapeyron'sequation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.
UNIT-IV	**HEATTRANSFER:** modes of heat transfer: conduction, convection and radiation. *Conduction*: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination ofthermal 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	**STATISTICALMECHANICS:** definition of phase-space – micro and macro states – ensembles –different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics – expression for distribution function – comparison of three statistics.
UNIT-VI	**PROFESSIONAL COMPONENTS:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

TEXT BOOKS	1. BrijlalandN. Subramaniam, 2000, Heat and Thermodynamics, S.Chandand Co. 2. NarayanamoorthyandKrishnaRao, 1969,Heat,Triveni Publishers, Chennai. 3. V.R.KhannaandR.S.Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish and Co, Meerut 4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations,Vikas Publishing House, New Delhi. 5. Ghosh, 1996, Text Book of Sound, S.ChandandCo. 6. R.MurugeshanandKiruthigaSivaprasath, Thermal Physics, S.Chandand Co.
REFERENCE BOOKS	1. J.B.RajamandC.L.Arora, 1976, Heat and Thermodynamics, 8th edition, S.Chandand Co. Ltd. 2. D.S.Mathur, Heat and Thermodynamics, Sultan Chand and Sons. 3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand and Co. 4. Resnick, HallidayandWalker,2010, Fundamentals of Physics, 6th Edition. 5. Sears, Zemansky, Hugh D. Young,Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson.
WEB RESOURCES	1. https://youtu.be/M_5KYncYNyc 2. https://www.youtube.com/watch?v=4M72kQulGKkandvl=en 3. Lecture 1: Thermodynamics Part 1 | Video Lectures | Statistical Mechanics I: Statistical Mechanics of Particles | Physics | MIT OpenCourseWare 4. http://www.freebookcentre.net/Physics/Physics-Books-Online.html

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**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, superfluidity 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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**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

COURSE	**SECOND SEMESTER – COREPRACTICAL 2**
COURSETITLE	**PRACTICAL 2**
CREDITS	3
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.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**THIRD SEMESTER - CORE**
COURSETITLE	**MECHANICS**
CREDITS	4
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 aparticlein a uniformgravitational 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 scatteringby 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 rollingalong 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.DuraiPandian, LaxmiDuraiPandian, MuthamizhJayapragasam,2005, Mechanics, 6th revised edition, S.Chandand Co. 3. D.S.Mathur and P.S.Hemne, 2000, Mechanics, Revised Edition, S.Chandand Co. 4. Narayanamurthi, M.andNagarathnam. N, 1998, Dynamics. The National Publishing,Chennai. 5. Narayanamurthi, M. and Nagarathnam, N, 1982, Statics, Hydrostatics and Hydrodynamics, The National Publishers, Chennai.
REFERENCE BOOKS	1. Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesely. 2. Halliday, David and Robert, Resnick, 1995, Physics Vol.I. New Age, International, Chennai. 3. Halliday, David Robert Resnick and Walker Jearl, 2001, Fundamentals of Physics, John Wiley, New Delhi
WEB RESOURCES	1. https://youtu.be/X4_K-XLUIB4 2. https://nptel.ac.in/courses/115103115 3. https://www.youtube.com/watch?v=p075LPq3Eas 4. https://www.youtube.com/watch?v=mH_pS6fruyg 5. https://onlinecourses.nptel.ac.in/noc22_me96/preview 6. https://www.youtube.com/watch?v=tdkFc88Fw-M 7. https://onlinecourses.nptel.ac.in/noc21_me70/preview

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

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

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

	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

COURSE	**THIRD SEMESTER - COREPRACTICAL 3**
COURSETITLE	**PRACTICAL 3**
CREDITS	3
COURSE OBJECTIVES	Construct circuits to learn about the concept of electricity, current, resistance in the path of current, different parameters that affect a circuit. Set up experiments, observe, analyse and assimilate the concept

ELECTRICITY

Minimum of Eight Experiments from the list:

1. Calibration of low range and high range voltmeter using potentiometer
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 wireusingPO 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 usingBG.
14. Comparison of capacitance using BG.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**FOURTH SEMESTER – CORE THEORY 4**
COURSETITLE	**OPTICS andLASER PHYSICS**
CREDITS	4
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,chromaticaberrations, 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 – circularlyandelliptically 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:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. Subramaniam. N andBrijlal, 2014, Optics, 25thEd,S.Chandand Co. 2. P.R.Sasikumar, 2012, Photonics, PHIPvt Ltd, New Delhi. 3. V.Rajendran, 2012, Engineering Physics, Tata McGraw Hill.
REFERENCE BOOKS	1. Sathyaprakash, 1990,Optics,VIIedition, RatanPrakashanMandhir, New Delhi. 2. AjoyGhatak, 2009,Optics, 4thedition, PHIPvt Ltd, New Delhi. 3. D.Halliday,R.Resnick and J. Walker, 2001, Fundamentals of Physics,6th edition, Willey, New York. 4. 7. JenkinsA.Francisand 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/gammarayburststs/imagine/index.html 5. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**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

COURSE	**FOURTH SEMESTER - CORE PRACTICAL 4**
COURSETITLE	**PRACTICAL 4**
CREDITS	3
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 LummerBrodhum Photometer.
10. Determination of range of motion using Searlesgoniometer.
11. Verification of Newton's formula for a lens separated by a distance.
12. Determination of refractive index of a given liquid by forming liquid lens
13. Determination of refractive index using Laser.
14. Determination of wavelengths, particle size using Laser/Monochromatic source.
15. Determination of resolving power of Diffraction grating using Laser
16. Determinationofwire using Laser.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**FIFTH SEMESTER – CORE THEORY 3**
COURSETITLE	**ELECTRICITY, MAGNETISM ANDELECTROMAGNETISM**
CREDITS	4
COURSE OBJECTIVES	To classify materials based on their electrical and magnetic properties. To analysethe 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:** capacitor – 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 – Anderson's method – mutual induction – coefficient of mutual inductance between two coaxial solenoids – coefficient of coupling - earth inductor- determination of angle of dip(Φ)
UNIT-IV	**TRANSIENT AND ALTERNATING CURRENTS:** growth and decay of current in a circuit containing resistance and inductance – growth and decay of charge in a circuit containing resistance and capacitor – growth and decay of charge in an LCR circuit (expressions for charge only) – peak, average and rms values of ac – LCR series and parallel circuits – resonance condition – Q factor – power factor.
UNIT-V	**MAXWELLS EQUATIONS AND ELECTROMAGNETIC WAVES:** Maxwell's equations in vacuum, material media– physical significance of Maxwell's equations –displacement current – plane electromagnetic waves in free space – velocity of light – Poynting vector–electromagnetic waves in a linear homogenous media – refractive index.

UNIT-VI	**PROFESSIONAL COMPONENTS:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. Murugeshan. R., - Electricity and Magnetism, 8thEdn, 2006, S.Chandand Co, New Delhi.\ 2. Sehgal D.L., Chopra K.L, Sehgal N.K., - Electricity and Magnetism, 3. Sultan Chand and Sons, New Delhi. 4. M. Narayanamurthy and N. Nagarathnam, Electricity and Magnetism, 4th Edition. 5. National Publishing Co., Meerut.
REFERENCE BOOKS	1. 1. Brijlal and Subramanian, Electricity and Magnetism, 6th Edn.,Ratanand Prakash, Agra. 2. Brijlal, N.Subramanyan and JivanSeshan, Mechanics and Electrodynamics (2005), 3. Eurasia Publishing House (Pvt.) Ltd., New Delhi. 4. David J. Griffiths, Introduction to Electrodynamics, 2ndEdn. 1997, Prentice Hall of 5. India Pvt. Ltd., New Delhi 6. D. Halliday, R. Resnik and J. Walker - Fundamentals of Physics, 6thEdn., Wiley, NY, 2001.
WEB RESOURCES	8. https://www.edx.org/course/electricity 9. https://www.udemy.com/courses/ electricity 10. https://www.edx.org/course/magnetism 11. http://www.hajim.rochester.edu/optics/undergraduate/courses.html

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade

25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**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

COURSE	**FIFTH SEMESTER - CORE**
COURSE TITLE	**ATOMIC and NUCLEAR PHYSICS**
CREDITS	4

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:** classification of elementary particles – fundamental interactions – elementary particle quantum numbers –iIsospin 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:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. R. Murugesan, Modern Physics, S. Chand and Co**. (**All units**)** (Units IandII-Problems) 2. Brijlaland N. Subrahmanyam, Atomic and Nuclear Physics, S. Chand and Co. (All units) 3. J. B. Rajam, Modern Physics, S. Chand and Co. 4. SehgalandChopra, Modern Physics, Sultan Chand, New Delhi 5. Arthur Beiser– Concept of Modern Physics, McGraw Hill

	Publication, 6th Edition.
REFERENCE BOOKS	1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill. 2. Modern Physics, S. Ramamoorthy, National Publishing and Co. 3. 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.
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 InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**CO1**	Listthe properties of electrons and positive rays, definespecific charge of positive rays and knowaboutdifferent mass spectrographs.
	CO2	Outlinephotoelectric effect and the terms related to it, Statelaws of photoelectric emission, Explain experiments and applications of photo electric effect, Solve problems based on photoelectric equation.
	CO3	Explain different atom models, Describedifferent quantum numbers and different coupling schemes.
	CO4	Differentiate between excitation and ionization potentials, Explain Davis and Goucher'sexperiment,Applyselection rule,AnalysePaschen-Back effect,CompareZeeman and Stark effect.
	CO5	Understand the condition for production of laser, Appreciate various properties and applications of lasers.

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

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

COURSE	**FIFTH SEMESTER – CORE**
COURSETITLE	**ANALOG AND COMMUNICATION ELECTRONICS**
CREDITS	3

COURSE OBJECTIVES	To studythe 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 FibreOptic Communications.

UNITS	**COURSE DETAILS**
UNIT-I	**DIODES:** diode 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 coupledCE amplifier –power amplifiers – classification of power amplifiers: A, B, C – push pull amplifiers – tuned amplifiers.
UNIT-III	**TRANSISTOR OSCILLATORS:** feedback 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:** differential amplifiers **–** OPAMP characteristics –IC 741 pin configuration **–** inverting and non-inverting amplifiers – unity follower –summing and difference amplifiers – differentiator and integrator – astablemultivibrator (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 – demodulation: 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.Chandand Co. Ltd., 2004. 2. V.Vijayendran - Integrated Electronics, S.Vishwanathan Publishers, Chennai. 3. B.L. Theraja - A Text Book of Electrical Technology. 4. John D. Ryder - Electronic fundamentals and Applications. 5. Malvino - Electronic Principles, Tata McGraw Hill.
REFERENCE BOOKS	1. B. Grob - Basic Electronics, 6th edition, McGraw Hill, NY, 1989. 2. Herbert Taub and Donald schilling - Digital Integrated Electronics, McGraw Hill, NY. 3. Ramakant A. – Op amp principles and linear integrated circuits, Gaykward

	4. Bagde and S. P. Singh - Elements of Electronics. 5. Millman and Halkias- Integrated Electronics, Tata McGraw Hill.
WEB RESOURCES	1. https://www.queenmaryscollege.edu.in/eresources/undergraduateprogram/py157 2. www.ocw.mit.edu>...> Circuits and Electronics 3. www.ocw.mit.edu>...> Introductory Analog Electronics Laboratory 4. https:// www.elprocus.com> semiconductor devices 5. https:// www.britannica.com>technology

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

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

COURSE	FIFTH SEMESTER – CORE PRACTICAL 5

COURSETITLE	PRACTICAL 5
CREDITS	3
COURSE OBJECTIVES	Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

GENERAL

Minimum of Eight Experiments from the list:

1. Diffraction grating Normal incidence.
2. Diffraction grating minimum deviation.
3. Diffraction at a wire.
4. Specific rotation of sugar solution.
5. Bi-prism – Determination of □ .
6. Thickness of a thin film of Bi-prism
7. Brewster's law – polarization
8. Double refraction (□ e and □ 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 InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**SIXTHSEMESTER – CORE**
COURSETITLE	**QUANTUM MECHANICS AND RELATIVITY**
CREDITS	4
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 – Eigenvalue – Hermitian operator – properties of Hermitian operator– observable – operators for position, linear Momentum, angular momentum components –commutatoralgebra –commutator between these operators –expectation values of position and momentum – Ehrenfesttheorem.
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, KiruthigaSivaprasath,S. Chand and Co.,17th Revised Edition, 2014. 2. Concepts of Modern Physics, A.Beiser, 6th Ed., McGraw-Hill, 2003. 3. Special Theory of Relativity,S.P.Puri, Pearson Education, India, 2013. 4. Quantum Mechanics, GhatakandLoganathan, Macmillan Publications. 5. Quantum mechanics – Satyaprakash and Swati Saluja. KedarNath Ram Nathand Co.
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, MathewsandVenkatesan, Tata McGraw Hill, New Delhi. 5. Introduction to Quantum Mechanics, Pauling and Wilson, McGraw Hill Co., NewYork.
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 InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

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

COURSE	**SIXTH SEMESTER – CORE**
COURSETITLE	**SOLID STATE PHYSICS**
CREDITS	4
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 – Van-der-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:** lattice vibrations and phonons: linear monoatomicanddiatomic chains. acoustical and optical phonons –qualitativedescription of the phonon spectrum in solids –Dulong and Petit's Law – Einstein and Debye theories ofspecific 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'squantum 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 – propertiesofdia, para,ferro, ferri and antiferromagnetism– Langevin'stheory of diamagnetism – Langevin'stheory 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:*experimentalresults –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:**expert 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, TataMcGraw Hill publishers (2014). 3. Solid State Physics , R L Singhal, Kedarnath Ram Nathand Co., Meerut (2003) 4. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India 5. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill 6. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning 7. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer 8. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India 9. Solid State Physics, M.A. Wahab, 2011, Narosa Publishing House, ND
REFERENCE BOOKS	1. PuriandBabber – Solid State Physics – S.ChandandCo. New Delhi. 2. Kittel - Introduction to solid state physics, Wiley and Sons, 7th edition. 3. Raghavan - Materials science and Engineering, PHI 4. Azaroff - Introduction to solids, TMH 5. S. O. Pillai - Solid State Physics, Narosa publication 6. A.J. Dekker - Solid State Physics, McMillan India Ltd. 7. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
WEB RESOURCES	1. https://nptel.ac.in/courses/115105099/ 2. https://nptel.ac.in/courses/115106061/

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**CO1**	Classify the bonding andcrystal 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:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**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

COURSE	**SIXTH SEMESTER – DISCIPLINE SPECIFIC ELECTIVE**
COURSETITLE	**DIGITAL ELECTRONICS AND MICROPROCESSOR 8085**
CREDITS	3
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	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 (Karnaughmap: 2, 3, 4 variables).
UNIT-II	adders,halfandfull adder –subtractors,halfandfullsubtractor –parallel binary adder – magnitude comparator – multiplexers (4:1) anddemultiplexers (1:4), encoder (8-line-to-3- line) and decoder (3-line-to-8-line), BCD to seven segment decoder.
UNIT-III	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 andring 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	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	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:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism

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

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

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

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**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

COURSE	**SIXTH SEMESTER – CORE PRACTICAL 6**
COURSETITLE	**PRACTICAL 6**
CREDITS	3
COURSE OBJECTIVES	To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators, counters, multivibrators. Perform fundamental experiments on microprocessor 8085 and learn to write programs by themselves.

Electronics

Minimum of Ten Experiments from the list:

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

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

ELECTIVE COURSES (EC)

STUDENTS CAN CHOOSE ANY OF THESES SUBJECTS IN SEM V AND VI

COMMUNICATION PHYSICS	
Learning Objective: To get a thorough knoowledge on transmission and reception of radio waves, the different types of communication like fibre optic, radar, satellite, cellular	
UNITS	**COURSE DETAILS**
UNIT-I	**RADIO TRANSMISSION AND RECEPTION:** transmitter – modulation types of modulation – amplitude modulation – limitations of amplitude modulation – frequency modulation – comparison of FM and AM – demodulation- essentials in demodulation – receivers: AM radio receivers – types of AM radio receivers – stages of superheterodyne radio receiver, advantages – FM receiver – difference between FM and AM receivers.
UNIT-II	**FIBER OPTIC COMMUNICATION:** introduction – basic principle of fiber optics – advantages – construction of optical fiber – classification based on the refractive index profile – classification based on the number of modes of propagation – losses in optical fibers – attenuation–advantages of fiberoptic communication
UNIT-III	**RADAR COMMUNICATION: i**ntroduction - basic radar system –radar range – antenna scanning –pulsed radar system – search radar –tracking radar – moving target indicator Doppler effect-MTI principle – CW Doppler radar
UNIT-IV	**SATELLITE COMMUNICATION:** introduction history of satellites – satellite communication system – satellite orbits – basic components of satellite communication system – commonly used frequency in satellite – communication –multiple access communication – satellite communication in India
UNIT-V	**MOBILE COMMUNICATION:** introduction – concept of cell – basic cellular mobile radio system – cellphone – facsimile – important features of fax machine – application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-4G (basic ideas)
TEXT BOOKS	1. V.K.Metha, Principles of Electronics, S. Chand andCoLtd., 2013 2. Anokh Singh and Chopra A.K., Principles of communication Engineering, S.Chandand Co, 2013
REFERENCE BOOKS	1. J.S. Chitode, Digital Communications, 2020, Unicorn publications 2. Senior John. M, Optical Fiber Communications: Principles and Practice, 2009, Pearson Education.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

ENERGY PHYSICS	
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:**solar energy Introduction – solar constant – solar radiation at the Earth's surface – solar radiation geometry – Solar radiation measurements – solar radiation data –solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of greenhouses – solar cells.
UNIT-III	**WIND ENERGY:**introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy
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:**importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.
TEXT BOOKS	1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4thEdn. 2. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rdEdn. 3. D P Kothari, K P Singal, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2ndEdn.
REFERENCE BOOKS	1. John Twidelland Tony Weir, Renewable Energy Resources, Taylor and Francis, 2005, 2ndEdn. 2. S.A. Abbasi and NasemaAbbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008. 3. M. P. Agarwal, Solar Energy, S. Chand and Co. Ltd., New Delhi,1982 4. H. C. Jain, Non-Conventional Sources of Energy, Sterling Publishers,1986.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

MATHEMATICAL PHYSICS

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

METHOD OF EVALUATION:

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

ADVANCED MATHEMATICAL PHYSICS

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 andanti 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 –Laplacianoperator – 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:**singularpoints of second order linear differential equations and importance –singularities of Bessels and Laguerre equations, Frobenius method and applications to differential equations: Legendre and Hermitedifferential equations – Legendre and Hermitepolynomials – Rodrigues formula –generating function – orthogonality
UNIT-V	**PARTIAL DIFFERENTIAL EQUATIONS:**solutions 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)
REFERENCE BOOKS	1. Mathematical MethodsorPhysicists,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 (SrikrishnaPrakashan)

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

NUMERICAL METHODS AND C PROGRAMMING	
Learning Objective: To understand the methods in numerical differentiation and integration andtodevelop the problem solving skills of the student. To introduce and explain the basic structure, rules of compiling and execution of C programming.	
UNITS	**COURSE DETAILS**
UNIT-I	**NUMERICAL SOLUTIONS:** determination of zeros of polynomials – roots of linear and nonlinear algebraic and transcendental equations – bisection and Newton-Raphson methods – convergence and divergence of solutions
UNIT-II	**NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING:** Newton's forward and backward interpolation – Lagrange's interpolation – Newton-Raphson method to find square root and cube roots – principle of least squares – fitting a straight line and exponential curve – trapezoidal rule – Simpson's 1/3 and 1/8 rule
UNIT-III	**ALGORITHM, FLOW CHART AND PROGRAM:** development of algorithm – flow chart for solving simple problems– average of set of numbers – greatest, smallest – conversion of Fahrenheit to Celsius and Celsius to Kelvin, miles to kilometer – sorting set of numbers in ascending and descending order – square matrix, addition, subtraction and multiplication of order (2x2) using arrays.
UNIT-IV	**INTRODUCTION TO C:** importance of C – basic structure of C programming – constants, variables and data types – character set, key words and identifiers – declaration of variables and data types – operators – expressions: arithmetic, relational, logical, assignment – increment and decrement – conditional – comma operators
UNIT-V	**CONTROL STRUCTURE:** decision making with if, if-else, nested if – switch –go to – break – continue –while, do while, for statements – arrays, one dimensional and two dimensional – declaring arrays – storing arrays in memory –initializing arrays – simple programs
TEXT BOOKS	1. Numerical methods,Singaravelu,Meenakshipublication,4th Edn., 1999. 2. Numerical methodsP.Kandasamy, K.Thilagavathy, K. Gunavathi, S.Chand, 2016 3. Programming in C, Balagurusamy, TMG, ND, 2012 4. Numerical Analysis,,M.K.Venkatraman, NPH, 2013 **5.** Numerical Analysis, B.D.Gupta, Konark Publishers, New Delhi, 2013
REFERENCE BOOKS	1. Schaum's outline series, Theory and Problems of programming in C, C.Byronand S. Gottfried, Tata McGraw Hill 2003 3. Numerical methods and C Programming, Veerarajan, 2015.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

MATERIALS SCIENCE	
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 andtwistboundaries,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 – viscoelastic behavior of materials – spring-Dash pot models of viscoelastic behavior of materials.
UNIT-III	**PERMANENT DEFORMATION AND STRENGTHENING METHODS OF MATERIALS:** introduction –plastic deformation: tensile stress-strain curve – plastic deformation by slip – creep: mechanism of creep – creep resistant materials – strengthening methods: strain hardening, grain refinement – solid solution strengthening – precipitation strengthening.
UNIT-IV	**OPTICAL MATERIALS:** introduction – optical absorption in metals, semiconductors and insulators – NLO materials and their applications – display devices and display materials: fluorescence and phosphorescence – light emitting diodes –liquid crystal displays.
UNIT-V	**MECHANICAL TESTING:** destructive testing: tensile test,compression test, hardness test – nondestructive testing (NDT): radiographic methods, ultrasonic methods – thermal methods of NDT: thermography – equipment used for NDT: metallurgical microscope
TEXT BOOKS	1. Material science and Engineering, Raghavan V, Prentice Hall of India, Sixth Edition, 2015 2. Materials science, V. Rajendran, McGraw Hill publications 2011
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. 8. William F. Smith, "Structure and Properties of Engineering Alloys", Mc-Graw-Hill Inc., U.S.A, 2nd edition, 1993.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

LASERSANDFIBEROPTICS	
Learning Objective: The students will learn the fundamentals, types of lasers, laser instrumentation and their applications also the interconnectbetweenoptics with lasers.	
UNITS	**COURSE DETAILS**
UNIT-I	**FUNDAMENTALSOFLASER:** basic principles: spontaneous and stimulated emission – Einstein'scoefficient – pumping mechanism: optical, electrical and laser pumping – population inversion – two and three level laser system – resonatorconfiguration – quality factor – threshold condition – concept of Qswitching–Theoryofmodelocking– cavitydumping.
UNIT-II	**TYPESOFLASER: s**olidstatelaser:rubylaser, Nd:YAGlaser,Nd:Glasslaser– semiconductor laser: intrinsic semiconductor laser, doped semiconductorlaser, injection laser – dye laser – chemical laser: HCL laser, DF- CO_2, COchemicallaser. Gaslaser:neutral atom gas laser (He-Ne laser), CO_2laser, Copper vapour laser.
UNIT-III	**APPLICATIONSOFLASER:** application of laser in metrology – optical communication – materialprocessing: laser instrumentation of material processing, powder feeder, laser heating, laser welding, laser melting – medical application – Laserinstrumentationforsurgeries– laserinastronomy
UNIT-IV	**FIBEROPTICS:** basic components of optical fiber communication – principles of lightpropagation through fiber – total internal reflection – optical fiber – coherent bundle – numerical aperture and skew mode – phase shift andattenuation during total internal reflection – types of fiber: single mode andmulti-mode fiber – step index and graded index fiber – fiber optic sensors –applicationoffiberoptics.
UNIT-V	**CHARACTERISTICSANDFABRICATIONOFOPTICALFIBER:** fiber characteristics: mechanical and transmission characteristics – absorption loss and scattering loss measurements – dispersion – connectorsandsplicers – fiber termination – optical time domain reflectometer(OTDR) and its uses – fiber material – fiber fabrication – fiber optic cablesdesign.
TEXT BOOKS	1. B.B. Laud - Laser and Non-linear Optics, New Age International Publications Third Edition, New Delhi. 2. An Introduction to laser, theory and applications by Avadhunulu, M.N.S.,Chand and Co, New Delhi 3. J. Wilson and J.F.B. Hawkes. 'Introduction to Opto Electronics', Pearson Education, 2018.
REFERENCE BOOKS	1. A.Sennaroglu,"PhotonicsandLaserEngineering:Principles,Devicesand Applications"McGraw-HillEducation,2010. 2. K.R.Nambiar, "Lasers: Principles, Typesand Applications", New Age International, 2004. 3. Optic, AjoyGhatak, McGraw-Hill Education (India) Pvt, Ltd, 6th Edn., 2017.

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade

25	**75**	**100**	

DIGITAL PHOTOGRAPHY	
Learning Objective: To understand the principles of photography and image formation and the science and arts behind it. To understand the essential components ofconventionaland digital cameras and also the different image processing techniques.	
UNITS	**COURSE DETAILS**
UNIT-I	**PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION:** principle –chemical route and digital route –light, wavelengths,colours – shadows – light intensity and distance – making light form images –pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole – focal length and image size – imaging of closer subjects.
UNIT-II	**LENSES – CONTROLLING THE IMAGES:** photographic lens – focal length and angle of view **(***problems***)** – focusing movement – aperture and f-numbers **(***problems***)** – depth of field– depth of focus – image stabilization – lenses for digital cameras – lens and camera care
UNIT-III	**CAMERA USING FILMS AND ITS TYPES:** camera and its essential components– shutter – aperture – light measurement – film housing – camera types: view camera– view finder camera – Reflex camera– single lens reflex (SLR) camera
UNIT-IV	**DIGITAL CAMERAS PRINCIPLE AND TYPES:** principle of digital image capturing –comparison of digital and analog picture information – megapixel – grain, noise and pixel density – optical and digital zooming – image stabilizer – bit depth – white balance – colour modes – file formats (TIFF, RAW and JPEG) – storage cards and types – digital cameras: camera phones – compact camera – hybrid camera – digital SLR.
UNIT-V	**THE DIGITAL IMAGE – POSTPRODUCTION:** hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness andcontrast – colourbalance – hue/saturation – dodge/burn – cloning andretouching – removing an element in an image – advanced editing: histogram/levels – curves – selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/light jet printers.
TEXT BOOKS	1. Michel J.Langford , Anna Fox and Richard Sawdon Smith, Basic photography, 9th Edition, , 2010-NL, Focal press, London **2.** Henry Carroll, Read this if you want to take great photographs of people, Laurence King Publishing
REFERENCE BOOKS	1. Mark Galer, Digital Photography in Available Light essential skills, 2006, Focal press, London **2.** Paul Harcourt Davies, The Photographer's practical handbook, 2005, UK PRESS

METHOD OF EVALUATION:

Continuous InternalAssessment	**End Semester Examination**	**Total**	**Grade**

25	**75**	**100**	

NANOSCIENCE AND NANO TECHNOLOGY	
Learning Objective: This course aims to provide an overall understanding of Nanoscience and Nanotechnology and introduces different types of nanomaterials, their properties, fabrication methods, characterization techniques and a range of applications.	
UNITS	**COURSE DETAILS**
UNIT-I	**NANOSCIENCE AND NANOTECHNOLOGY:** nanoscale– nature and nanostructures – nanostructures: 0D, 1D,2D– surface to volume ratio– size effect –excitons– quantum confinement– metal based nanoparticles (metal and metal oxide) – nanocomposites (non-polymer based) – carbon nanostructures – fullerene –SWCNT and MWCNT
UNIT-II	**PROPERTIES OF NANOMATERIALS:**introduction–mechanical behavior –elastic properties – hardness and strength – ductility and toughness –superplastic behavior – optical properties – surface plasmon resonance – electrical properties – dielectric materials and properties – magnetic properties – super paramagnetism – electrochemical properties – properties of CNTs.
UNIT-III	**FABRICATION METHODS AND VACUUM TECHNIQUES:**top-down and bottom-up approaches – electrochemical method – chemical and physical vapour 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:**scanning 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:**medicine: drug delivery – photodynamic therapy – molecular motors –energy: fuel cells – rechargeable batteries – supercapacitors– photovoltaics. sensors: nanosensors based on optical and physical properties – electrochemical sensors – nanobiosensors. nanoelectronics: CNTFET – display screens – GMR read/write heads – nanorobots –applications of CNTs
TEXT BOOKS	1. K.K.Chattopadhyay and A.N.Banerjee, (2012), Introduction to Nanoscience and Nanotechnology, PHI Learning Pvt. Ltd., 2. M.A. Shah, Tokeer Ahmad (2010), Principles of Nanoscience and Nanotechnology, Narosa Publishing House Pvt Ltd. 3. Mick Wilson, et al (2005) Nanotechnology, Overseas Press.
REFERENCE BOOKS	1. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA 2. J.H.Fendler (2007) Nano particles and nano structured films; Preparation, Characterization and Applications, John Wiley and Sons 3. B.S.Murty, et al (2012) Textbook of Nanoscience and Nanotechnology, Universities Press.

METHOD OF EVALUATION:

Continuous InternalAssessment	**End Semester Examination**	**Total**	**Grade**

25	**75**	**100**	

MEDICAL INSTRUMENTATION	
Learning Objective: This course aims to provide background of the Physics principles inmedical instrumentation technologies through theoretical and practical learning.	
UNITS	**COURSE DETAILS**
UNIT-I	**BIOMETRICS:**introduction to man-instrument system and its components – problems encountered in measuring living systems – transducers– force, motion, pressure transducers. **AUDIOMETRY:** mechanism of hearing – air and bone conduction – threshold of hearing – audiometer – masking in audiometry – pure tone and speech audiometer – evoked response audiometry – hearing aids
UNIT-II	**BIOELECTRIC POTENTIALS AND ELECTRODES:** biomedical signals – sources of bioelectric potentials – resting, action and propagation of bioelectric potentials –bio-potential electrodes – skin surface, needle electrodes. **BIOMEDICAL RECORDERS:** electro-conduction system of heart – electro cardiogram (ECG) – Einthoven's triangle — electro encephalogram (EEG) –brain waves – EEG instrumentation – recording of evoked potentials – electro myogram (EMG)–pulse oximeter.
UNIT-III	**DIAGNOSTIC RADIOLOGY:** radiography – primary radiological image – contrast agents, filters – beam restrictor, grid – image quality **COMPUTED TOMOGRAPHY:** linear tomography – computed tomography – helical and multi slice – image quality– radiation dose. **RADIOISOTOPES AND NUCLEAR MEDICINE:** radioisotopes – radiopharmaceuticals – technetium generator – gamma camera – positron emission tomography – disposal of radioactive waste.
UNIT-IV	**ULTRASOUND IMAGING:** ultrasound transducer – ultrasound imaging– Doppler ultrasound – ultrasound image quality and bio-effects. **MAGNETIC RESONANCE IMAGING:**protonand external magnetic field – precession – radiofrequency and resonance – MRI signal – relaxation time – MRI instrumentation – imaging sequences – biosafety
UNIT-V	**PROJECT ASSIGNMENT:** clinical practice of *one* of the following: electro cardiogram, electro encephalogram, electro myogram, electro oculogram, computed tomography, positron emission tomography, ultrasound
TEXT BOOKS	1. Leslie Cromwell, Fred Weibell, Erich Pfieffer (2002) Biomedical Instrumentation and Measurements Prentice Hall of India, New Delhi. 2. R. S. Khandpur (2003) Handbook of Biomedical Instrumentation 2nd Edn. Tata McGraw Hill, New Delhi. 3. KuppusamyThayalan (2017), Basic Radiological Physics 2nd Edn. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
REFERENCE BOOKS	1. John Webster (2004) Bioinstrumentation John Wiley and Sons, Singapore. 2. John Enderle, Susan Blanchard, Joseph Bronzino (2005) Introduction to Biomedical Engineering, 2nd ed. Elsevier, San Deigo 3. William Hendee, Geoffrey Ibbott, Eric Hendee (2005) Radiation therapy Physics 3rd ed. Wiley-Liss, New Jersey

METHOD OF EVALUATION:

Continuous InternalAssessment	**End Semester Examination**	**Total**	**Grade**

25	**75**	**100**	

NON MAJOR ELECTIVES (NME)

PHYSICS FOR EVERYDAY LIFE	
Learning Objective: To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics	
UNITS	**COURSE DETAILS**
UNIT-I	**MECHANICAL OBJECTS: s**pring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.
UNIT-II	**OPTICAL INSTRUMENTS AND LASER:**vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.
UNIT-III	**PHYSICS OF HOME APPLIANCES:** bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners
UNIT-IV	**SOLAR ENERGY:** Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.
UNIT-V	**INDIAN PHYSICIST AND THEIR CONTRIBUTIONS:**C.V.Raman, HomiJehangirBhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, VenkatramanRamakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.
TEXT BOOKS	1. The Physics in our Daily Lives, UmmeAmmara, GugucoolPublishing, Hyderabad, 2019. 2. For the love of physics, Walter Lawin, Free Press, New York, 2011.

METHOD OF EVALUATION:

Continuous InternalAssessment	**End Semester Examination**	**Total**	**Grade**
25	**75**	**100**	

ASTROPHYSICS	
Learning Objective: This course intends tointroduceprinciples 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 celestialbodies 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:**physical 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 – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes – supernovae. **GALAXIES:** classification of galaxies – galaxy clusters –interactions of galaxies, dark matter and super clusters – evolving universe.
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. BaidyanathBasu, (2001). An introduction to Astrophysics, Second printing, Prentice – Hall of India (P) Ltd, New Delhi 2. K.S.Krishnaswamy, (2002), Astrophysics – a modern perspective, New Age International (P) Ltd, New Delhi. 3. Shylaja, B.S. andMadhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play, Orient BlackSwan,

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

PHYSICS OF MEDICAL INSTRUMENTS	
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:** transport 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:** nuclear 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:**laser interactions with biomolecules – 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. Skofronick, Thrift books, Atlanta, 1985 5. Electronic Instruments and Instrumentation Technology, M. M.M.Anand, PHI, 2015

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

HOME ELECTRICAL INSTALLATION	
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:** production and transmission of electricity – concept of power grid – Series and parallel connections – technicalities of junctions and loops in circuits –transmission losses (qualitative) – roles of step-up and step-down transformers – quality of connecting wires – characteristicsof single and multicore wires
UNIT-III	**ELECTRICAL WIRING:** different types of switches – installation of two way switch – role of sockets, plugs, sockets - installation of meters – basic switch board – electrical bell – indicator – fixing of tube lights and fans – heavy equipment like AC, fridge, washing machine, oven, geyser, jet pumps – provisions for inverter – gauge specifications of wires for various needs
UNIT-IV	**POWER RATING AND POWER DELIVERED:** conversion of electrical energy in to different forms – work done by electrical energy

	– power rating of electrical appliances – 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:** insulation 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 InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

PHYSICS OF MUSIC	
Learning Objective: To apprise and train students on the role of Physics in music and get the knowledge on the musical notes and instruments.	
UNITS	**COURSE DETAILS**
UNIT-I	**SCIENTIFIC STUDY OF MUSIC:** vibrations of atoms of matter– vibrations coupling to air – propagation of sound waves in air, other media, fluids and solids – velocity, frequency, wavelength, time period, intensity: definition and unit fs – classification of sound on frequency and velocity– human and animal sound perception– mechanism of ear and hearing – psychoacoustics
UNIT-II	**SIMPLE VIBRATING SYSTEMS:** simple harmonic motion – tuning fork– amplitude, phase, energy,energy loss/damping/ dissipation – power – travelling waves and standing waves– laws of vibration in stretched strings– one-dimensional medium – open and closed organ pipes – over tones, harmonics – quality of sound: pitch, timber, loudness – octaves, musical notes
UNIT-III	**MUSICAL TONE:** pure/simple tones – sine/cosine waves– well-defined frequencies, wavelengths, amplitudes and phases– partial tones – assembly of pure tones– mix of different frequencies and amplitudes– complex tone – superposition of simple tones – complex waveform– periodic complex waveform – formants – resonances– sound envelope
UNIT-IV	**PRODUCTION OF MUSICAL SOUNDS:** human voice,mechanism of vocal sound production – larynx (sound box) – *stringed Instruments*:pluckedandbowed, guitar, mandolin, violin, piano, etc. – *wind instruments*: whistles, flute, saxophone, pipe organ, bagpipes,etc–

	percussion instruments:plates, membranes,drums, cymbals, xylophone etc. – *electronic instruments*: keyboards, electric guitars, rhythm pads, etc. – analog and digital sound synthesizers,–MIDI instrument– computer generated music
UNIT-V	**RECORDING OF MUSIC and SOUND:** Edison phonograph – cylinder and disk records – magnetic wire and tape recorders – digital recording (e.g. to CD, DVD, etc.)– analog transducers, condenser, dynamic microphones, loudspeaker – complex sound fields – near and far fields of acoustic– spectral analysis techniques – continuous and discrete Fourier transforms, digital signal processing – digital filtering – specifications of recording studios
TEXT BOOKS	1. Physics and Music: The Science of Musical Sound by Harvey White (2014) 2. Good Vibrations – The Physics of Music by Barry Parker, (2009) 3. The History of Musical Instruments by Curt Sachs, (2006) 4. Physics and Music: Essential Connections and Illuminating Excursions byKinko Tsuji and Stefan C. Müller(2021)

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**ALLIED PAPER**
COURSETITLE	**ALLIED PHYSICS – I**
CREDITS	3
COURSE OBJECTIVES	To impart basicprinciplesof 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, ultrasonography –ultrasonoimaging- 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 cryocoolers– 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 wifi 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), AlliedPhysics,S. ChandandCo,NewDelhi. 2. BrijlalandN.Subramanyam (1994), WavesandOscillations,VikasPublishingHouse,NewDelhi. 3. BrijlalandN.Subramaniam (1994), PropertiesofMatter,S.ChandandCo.,NewDelhi. 4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8^{th} edition), S.ChandandCo.,New Delhi. 5. R.Murugesan(2005), OpticsandSpectroscopy,S.ChandandCo,NewDelhi. 6. A.Subramaniyam, AppliedElectronics2^{nd}Edn.,NationalPublishingCo.,Chennai.
REFERENCE BOOKS	1. ResnickHallidayandWalker(2018).FundamentalsofPhysics(11^{th}edition),JohnWilleyand Sons, Asia Pvt.Ltd., Singapore. 2. V.R.KhannaandR.S.Bedi (1998), TextbookofSound1^{st}Edn. KedharnaathPublishandCo, Meerut. 3. N.S.KhareandS.S.Srivastava (1983), ElectricityandMagnetism10^{th}Edn.,AtmaRamandSons, New Delhi. 4. D.R.KhannaandH.R. Gulati(1979). Optics,S. Chand andCo.Ltd.,New Delhi. **5.** V.K.Metha(2004).Principlesofelectronics6^{th}Edn. S.Chandandcompany.
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=gT8Nth9NWPMhttps://www.youtube.com/watch?v=9mXOMzUruMQandt=1shttps://www.youtube.com/watch?v=m4u-SuaSu1sandt=3shttps://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**CO1**	Explain types of motion andextend their knowledge in the study of variousdynamicmotionsanalyzeand demonstrate mathematically. Relate theory with practical applications in medical field.
	CO2	Explaintheirknowledgeofunderstandingaboutmaterialsandtheir behaviorsandapplyittovarioussituationsinlaboratoryandreal life. Connect droplet theory with Corona transmission.
	CO3	Comprehend basic concept of thermodynamics concept of entropyand associated theorems able to interpret the process of flowtemperaturephysicsinthebackgroundofgrowthof this technology.
	CO4	Articulate the knowledge about electric current resistance,capacitance in terms of potential electric field and electric correlatetheconnectionbetweenelectricfieldandmagneticfieldan danalyzethemmathematicallyverifycircuitsandapplytheconcepts toconstructcircuitsandstudythem.
	CO5	Interpret the real life solutions using AND, OR, NOT basiclogicgatesandintendtheirideastouniversalbuildingblocks. InferoperationsusingBooleanalgebraandacquireelementaryidea sofICcircuits.Acquire information about various Govt. programs/ institutions in this field.

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

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

COURSE	**ODD SEMESTER - CORE**
COURSETITLE	**ALLIED PRACTICAL– I**
CREDITS	3
COURSE OBJECTIVES	Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Minimum of Eight Experiments from the list:

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

Note : Use of digital balance permitted

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE	**ALLIED PAPER**
COURSETITLE	**ALLIED PHYSICS –II**
CREDITS	3
COURSE OBJECTIVES	To understand the basic concepts of optics, modern Physics, concepts of relativity and quantumphysics, semiconductorphysics, and electronics.

UNITS	COURSE DETAILS
UNIT-I	**OPTICS: i**nterference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries
UNIT-II	**ATOMIC PHYSICS:** atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – applications of photoelectric effect: solar cells, solar panels, optoelectric devices
UNIT-III	**NUCLEAR PHYSICS:** nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.
UNIT-IV	**INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES**:frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence –introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences
UNIT-V	**SEMICONDUCTOR PHYSICS:** p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations

UNIT-VI	**PROFESSIONAL COMPONENTS:**expert lectures –seminars — webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	1. R.Murugesan (2005), AlliedPhysics,S.ChandandCo,NewDelhi. 2. K.ThangarajandD.Jayaraman(2004), AlliedPhysics,PopularBookDepot,Chennai. 3. BrijlalandN.Subramanyam(2002), TextbookofOptics,S.ChandandCo,NewDelhi. 4. R.Murugesan (2005), ModernPhysics,S.ChandandCo,NewDelhi. 5. A.SubramaniyamAppliedElectronics, 2nd Edn.,NationalPublishingCo.,Chennai.
REFERENCE BOOKS	1. ResnickHallidayandWalker (2018), FundamentalsofPhysics, 11th Edn.,JohnWilleyandSons, Asia Pvt.Ltd.,Singapore. 2. D.R.KhannaandH.R. Gulati (1979).Optics, S.ChandandCo.Ltd.,New Delhi. 3. A.Beiser (1997), ConceptsofModernPhysics,TataMcGrawHillPublication,NewDelhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, NewDelhi. 5. V.K.Metha(2004), Principlesofelectronics, 6th Edn. ,S.ChandandCompany, New Delhi.
WEB RESOURCES	1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318andv=D38BjgUdL5Uandfeature=emb_logo 2. https://www.youtube.com/watch?v=JrRrp5F-Qu4 3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/ 4. https://www.atoptics.co.uk/atoptics/blsky.htm - 5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthecourse,thestudentwillbeableto:

COURSEOUTCOMES	**CO1**	Explaintheconceptsofinterferencediffractionusingprinciplesofsuperpositionofwaves and rephrase the concept of polarization based on wave patterns
	CO2	Outline the basic foundation of different atom models and variousexperiments establishing quantum concepts. Relate the importance ofinterpretingimprovingtheoreticalmodelsbasedonobservation. Appreciateinterdisciplinarynatureofscience and in solar energy related applications.
	CO3	Summarizethepropertiesofnuclei, nuclearforcesstructureofatomicnucleusandnuclear models. Solveproblems on delayratehalf-lifeand mean-life.Interpret nuclear processes likefission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt.agencies like DAE guiding the country in the nuclear field.
	CO4	Todescribethebasicconceptsofrelativitylikeequivalenceprinciple, inertialframes and Lorentz transformation. Extend their knowledge on concepts ofrelativityandviceversa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.
	CO5	Summarize the working of semiconductor devices like junction diode, Zenerdiode, transistors and practical devices we daily use like USB chargers and EV charging stations.

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes**(CO)**foreachcoursewithprogramoutcomes**(PO)**inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

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

CO4	S	S	S	S	S	S	S	M	S	S
CO5	M	S	S	S	S	S	S	S	S	S

COURSE	**EVEN SEMESTER - CORE**
COURSETITLE	**ALLIED PRACTICAL– II**
CREDITS	3
COURSE OBJECTIVES	Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Minimum of Eight Experiments from the list:

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

METHOD OF EVALUATION:

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