Department of Physics (Day)

ACADEMIC YEAR 2024-2025 onwards

1 to 6 Semesters

SCHEME AND SYLLABUS

CONTENTS

SCHEME

SYLLABUS

13. Non Major Electives

1. Physics in Everyday Life-1
2. Physics in Everyday Life-2
3. AstroPhysics
4. Non-Conventional Energy Sources
5. BioPhysics
6. Introduction to Numerical Methods
7. Contribution of India to Modern Science

14. Third Semester:

a) Core Paper III –Optics and Spectroscopy

b) Core Practical – II A

15. Fourth Semester:

a) Core Paper IV -Atomic Physics and Lasers
b) Core Practical – II B

16. Fifth Semester:

a) Core Paper V -Electricity and Electromagnetism

b) Core Paper VI- Mathematical methods in Physics

c) Core Paper VII -Solid State Physics

d) Core Paper VIII – Electronic Devices and Applications

e) Elective I (Any one of the below)

I a. Applied Electronics
I b. Problem Solving in Physics
I c. Numerical Methods

f) Core Practical-III A -- General experiments

g) Core Practical-IV A Basic electronics

h) Core Practical-V A Applied electronics

17. Sixth Semester:

a) Core Paper IX -Relativity and Quantum Mechanics

b) Core Paper X- Nuclear and Particle Physics

c) Elective II (Any one of the below)

II a. Digital Circuits and Design

II.b. GeoPhysics

II c. Medical Physics

d) Elective III (Any one of the below)

III a. . Microprocessors and

fundamentals of Microcontrollers

III b Fiber Optics

III c. Astrophysics

III d. Weather Forecasting

e) Core Practical-III B General experiments

f) Core Practical-IV B Basic electronics

g) Core Practical-V B. Applied electronics

18. Allied Physics Theory & Practicals

19. APPENDIX Graduate Attributes

Institution

VISION

To impart value based quality academia; to empower students with wisdom and to charge them with rich Indian traditions and culture; to invoke the self, to broaden the same towards nation building, harmony and Universal brotherhood.

MISSION

To ensure sustained progress and development in imparting quality education, to pioneer new avenues of teaching and research and to emerge as an institution with potential for excellence.

DEPARTMENT OF PHYSICS

VISION

To train the students to develop the scientific temper, achieve excellence in education in the field of Physics and related areas and equip them with skills, knowledge and become life- long learners.

MISSION

M1	To create an academic base that responds to the need of the students to understand the basics of Physics and it's ever evolving nature of applications in explaining all observed natural phenomenon as well as predicting the future applications to the new phenomenon with a global perspective.
M2	Apply one's knowledge and understanding relating to physics and skills to new/unfamiliar contexts and to identify and analyze problems and issues and seek solutions to real-life problems.
M3	To be a tool for transformation marching in the toad map of our country's vision towards Higher Education.

PROGRAME EDUCATION OBJECTIVES (PEOs)

PEO1	Create the facilities and environment in all the educational institutions to consolidate the knowledge acquired at +2 and to motivate and inspire the students to create deep interest in Physics, to develop broad and understanding of physical concepts, principles and theories of Physics.
PE02	Emphasize the discipline of Physics to be the most important branch of science for pursuing the interdisciplinary higher educations and/or research in interdisciplinary and multidisciplinary.
PEO3	Succeed in obtaining job opportunities appropriate to their interests, as well aspire for higher education and cultivate abilities.

E04	Imparting fundamental and 21st century skills and training to be life – long learners and demonstrate analytical skills and global competency.
E05	Improve leadership qualities in creating successful citizens with rational thinking and scientific temper.

PEO TO MISSION STATEMENT MAPPING

MISSION STATEMENTS	PEO1	PEO2	PEO3	PEO4	PEO5
M1	2	3	3	3	3
M2	2	3	3	3	2
M3	3	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAM OUTCOMES (PO) IN RELATION TO GRADUATE ATTRIBUTES

PROGRAMME OUTCOMES

On completion of B.Sc. Physics program, the students of our Department will be able to:

S.No.	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
1.	**Disciplinary knowledge and skills**	Acquire a fundamental, systematic, coherent understanding of the academic field of Physics, its different learning areas applications in basic Physics as well its linkages with related disciplinary areas. **(PO1)**
2.	**Skilled communicator**	Demonstrate relevant problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, to develop communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner, to improve analytical skills, to construct logical arguments using correct technical language related to Physics, to develop ICT skills and personal skills such as the ability to work both independently and in a group. Gain necessary skills to communicate various concepts and applications of STEM to peer group and common man. **(PO2)**
3.	**Critical thinker and problem solver**	Plan and execute Physics-related experiments, analyze and interpret the acquired data using appropriate software and report the findings of the experiments while relating the findings to relevant theories of Physics. Develop systematic analysis by deduction analogy, argument and reasoning.**(PO3)**

4.	**Sense of inquiry**	Analyze Nature and laws of Physics by asking relevant questions in a sequential manner by inductive method. **(PO4)**
5.	**Team player/worker**	Collaborate effectively and gain the ability to work both independently and in group. **(PO5)**
6.	**Skilled project manager**	Understand the flow of Project/experimentation; gather men, method and means for its implementation. **(PO6)**
7.	**Digitally Efficient**	Seek e-resources and update Scientific information and skills through ICT tools. **(PO7)**
8.	**Ethical awareness / reasoning**	Demonstrate professional behavior such as being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; the ability to identify the potential ethical issues in work-related situations; appreciation of intellectual property, environmental and sustainability issues; and promoting safe learning and working environment. **(PO8)**
9.	**National and International perspective**	Participate in global citizen science projects using e-learning materials as well execute proposals of National and International importance. **(PO9)**
10.	**Lifelong learners**	Learn, Unlearn, Relearn as well seeks solution to real life problems. **(PO10)**

Mapping of POs TO PEOs

PEO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
PEO 1	3	3	3	3	3	3	3	3	3	3
PEO 2	3	3	2	3	3	3	2	3	3	3
PEO 3	3	3	3	3	3	3	3	3	3	3
PEO 4	3	3	3	3	3	2	3	3	3	3
PEO 5	3	3	3	3	3	3	2	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

PROGRAM SPECIFIC OUTCOMES

PSO1 - Understand, identify basic principles and concepts of various branches of Physics, correlate and solve the problems in the field of core and applied Physics.

PSO2 - Demonstrate the acquired knowledge of Physics on various scientific issues.

PSO3 - Design various experiments, electronic circuits investigate and become capable problem solver, using mathematical, conceptual and hands on skills.

PSO4 - Apply analytical abilities acquired from the class room / laboratory and promote scientific ideas, harness renewable and nonconventional energy resources.

PSO5 - Appreciate their experimental learning beyond the classroom; construct logical arguments, using technical language, develop programming skills, approach open-ended problems and innovate solutions.

Above 1 to 3 goals are foundational goals leading to fundamental understanding of Physics. All the courses and various modules on the courses are built on the foresaid goals. The goals 3 to 5 are realized through laboratory experiments, projects and e- learning resources.

DEPARTMENT OF PHYSICS

ELIGIBILITY FOR ADMISSION

A pass in the Higher Secondary Examination by the Govt. of Tamil Nadu or an Examination accepted as equivalent thereof by the Syndicate of the University of Madras with Physics and Mathematics as major subjects of study.

DURATION OF THE COURSE

Duration of the course is three academic years consisting of six semesters. And eachsemester comprises of not less than 90 working days.

B.Sc. Physics Curriculum

Physics is one of the basic and fundamental sciences. The curriculum for the Graduate programme in physics is revised as per the UGC guidelines on Learning Outcome based education criteria course framework and integrated common regulations under CBCS of University of Madras. The learner-centric courses let the student progressively develop a deeper understanding of various aspects of physics. 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, students also learn Physics Laboratory methods for different branches of physics, specialized measurement techniques, analysis of observational data, including error estimation. Students will have deeper understanding of laws of nature through the subjects like classical Mechanics, quantummechanics, statistical physics etc. Students' ability of problem Solving will be enhanced. Students can apply principles in physics to real life problems. Subjects like integrated electronics and microprocessors will enhance the logical skills as well as employability skills. Numerical methods and mathematical Physics provides analytical thinking and provides a better platform for higher level Physics and research. The restructured courses with well defined objectives and learning outcomes, provides guidance to prospective students in choosing the elective courses to broaden their skills in the field of physics and interdisciplinary areas. Elective modules of the framework offer students choice to gain knowledge and expertise in specialized domains of physics like astrophysics, medical physics, etc.

ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the degree only if she/he has undergone prescribed course of study for a period of not less than three academic years and passed the

examination of all the six semesters prescribed earning a minimum of 140 credits as per the distribution given for Part I, II, III, IV & V and also fulfilled such other conditions as have been prescribed thereof.

SCHEME OF EXAMINATIONS

As per the university regulation the following split up of marks for theory and practical are to be followed.

(i) SPLIT UP FOR INTERNAL AND EXTERNAL MARKS FOR THEORY AND PRATICAL PAPER:

S.No.	Paper	Internal	External	Total
1.	Theory	50	50	100
2.	Practical	50	50	100

(ii) SPLIT UP FOR INTERNAL ASSESSMENT MARKS (50) FOR THEORY:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Attendance	Quizzes, Assignments, Seminars, etc	Current Affairs, Hands-on activities, etc
Marks (out of 50)	**30**	**5**	**5**	**10**
Remember			5	
Understand	10	5		
Apply	10			10
Analyze	5			
Evaluate	5			
Create				

(iii) SPLIT UP FOR INTERNAL ASSESSMENT MARKS (50) FOR PRACTICALS:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests**	**Attendance**	**Record**
Marks (out of 50)	**30**	**5**	**5**
Remember			5
Understand		5	
Apply	10		
Analyze	5		
Evaluate	5		
Create	10		

iv) ESE- Semester End Examination - THEORY (Exam for 100 Marks; weightage 50%)

Bloom's Category	**Weightage %**
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

v) ESE- Semester End Examination – PRACTICALS (Exam for 100 Marks; weightage 50%)

Bloom's Category	**Weightage %**
Remember	5
Understand	20
Apply	15
Analyse	20
Evaluate	20
Create	20

COURSE STRUCTRURE

Scheme of First Semester

S.No.	Course Components	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	PART I	Language Paper I	4	3	3	50	50	100
2	PART II	English Paper I	4	3	3	50	50	100
3	PART III	**Core Paper I** Waves, Mechanics and Properties of Matter	6	5	3	50	50	100
		Core Practical I A	3	2	3	50	50	100
4		Allied Mathematics 1	9	5	3	50	50	100
5	Part IV	Non-Major Elective NME / Basic Tamil	2	2	3	50	50	100
6		Soft Skill I	2	2	3	50	50	100
	Total		30	22		300	300	600

Scheme of Second Semester

S.No.	Course Components	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	PART I	Language Paper II	4	3	3	50	50	100

2	PART II	English Paper II	4	3	3	50	50	100
3	PART III	**Core Paper II** Thermal and Statistical Physics	6	5	3	50	50	100
		Core Practical IB	3	2	3	50	50	100
4		Allied Mathematics II	9	5	3	50	50	100
5	Part IV	Non-Major Elective/ Basic Tamil	2	2	3	50	50	100
6		Soft Skill II	2	2	3	50	50	100
	Total		30	22		420	280	700

Scheme of Third Semester

S.No.	Course Components	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	PART I	Language Paper III	6	3	3	50	50	100
2	PART II	English Paper III	4	3	3	50	50	100
3	PART III	**Core Paper III** Optics and Spectroscopy	6	5	3	50	50	100
		Core Practical II A	3	2	3	50	50	100
4		Allied Chemsitry I	6	5	3	50	50	100

5		Allied Chemistry Practicals	3	Practical examination at the end of Even Semester				
6	Part IV	Environmental Studies EVS	2	Examination at the end of Even Semester				
7		Soft Skill III	2	2	3	50	50	100
	Total		30	20		300	300	600

Scheme of Fourth Semester

S.No.	Course Components	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	PART I	Language Paper IV	6	3	3	50	50	100
2	PART II	English Paper IV	4	3	3	50	50	100
3	PART III	**Core Paper IV** Atomic Physics and Lasers	6	5	3	50	50	100
		Core Practical II B	3	2	3	50	50	100
4		Allied Chemistry II	6	5	3	50	50	100
5		Allied chemistry Practicals	3	5	3	50	50	100
6		Environmental Studies EVS	2	2	3	50	50	100

7	Part IV	Soft Skill III	2	2	3	50	50	100
	Total		30	27		400	400	800

Scheme of Fifth Semester

S.No.	Course Components	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	PART III	**Core Paper V** Electricity and Electromagnetism	5	5	3	50	50	100
2		**Core Paper VI** Mathematical methods in Physics	5	5	3	0	50	100
3		**Core Paper VII** Solid State Physics	4	5	3	50	50	100
4		**Core Paper VIII** Electronic devices and applications	4	5	3	50	50	100
5		**Elective I** a. Applied Electronics **or** b. Problem Solving in Physics **or** c. Numerical Methods	4	4	3	50	50	100
6		Core Practical III A	3	2	3	50	50	100
7		Core Practical IV A	3	2	3	50	50	100
8		Core Practical V A	2	2	3	50	50	100
9	PART IV	Value Education	-	2				100
	Total		30	26		300	300	600

Scheme of Sixth Semester

S.No.	Course Components	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	PART III	**Core Paper IX** Relativity and Quantum Mechanics	6	5	3	50	50	100
2		**Core Paper X** Nuclear and Particle Physics	6	5	3	50	50	100
3		**Elective II** a. Digital Circuits and Design **or** b. Medical Physics **or** c. Geo Physics	5	4	3	50	50	100
4		**Elective III** a. Microprocessors and fundamentals of Microcontrollers or b. Astrophysics or c. Fiber Optics or d. Weather Forecasting	5	4	3	50	50	100
6		Core Practical III B	3	2	3	50	50	100
7		Core Practical IV B	3	2	3	50	50	100
8		Core Practical V B	2	2	3	50	50	100
9	PART IV	Extension activities	-	1				
	Total		30	30		350	350	700

ALLIED PHYSICS

S.No.	Semester	Subjects	Inst. Hrs	Credits	Exam Hrs	Max. Marks		
						Ext. Marks	Int. Marks	Total
1	Odd Semester	Physics I for Allied	6	5	3	50	50	100
2		Allied Physics Practicals	3	Practical Examination at the end of Even semester				
3	Even Semester	Physics II for Allied	5	5	3	50	50	100
4		Allied Physics Practicals	3	4	3	50	50	100

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SEMESTER – 1

WAVES, MECHANICS AND PROPERTIES OF MATTER

Course Code : 09101	**Credits 5**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives

- *to make the students learn and understand Mechanics- a branch of Physics dealing with study of motion which is a fundamental idea in all of Science*
- *to get a better insight and understanding of the subject, properties of matter , which is of practical value to both the physicists and the engineers*
- *to extend one's knowledge in the study of wave motion*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering), K2(Understanding), K3(Applying) K4(Analyzing), K5(Evaluating), K6(Creating)

CO1	Appraise the concepts of mechanics and in-depth learning of rigid body Develop the fundamental ideas about linear and rotational motion	**K3, K4**
CO2	Analyze the concepts of statics and hydrodynamics and their applications	**K3,K4**
CO3	Discover the elastic behaviour in terms of three moduli of elasticity Estimate Young's Modulus using the concept of bending of beams	**K4. K5**
CO4	Build concepts of surface tension and viscosity of fluid, Support the interesting phenomena associated with liquid surface Understand fluid dynamics that gives fundamental knowledge over manypractical applications	**K3,K4**
CO5	Survey the phenomena of SHM and the properties of systems executing such motions	**K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 Moderately correlated – 2 Weakly correlated –1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Mechanics** Impulse – impact – Laws of impact – direct impact and oblique impact between two smooth spheres – loss of kinetic energy – conservation of linear momentum –- motion of two interacting bodies – reduced mass- reduction of two body problem into single body problem - Rigid Body – Dynamics of Rigid Body - Generalized co – ordinates of Rigid Body – Body & Space Reference System – Rigid Body – Fixed Axis rotation, rotation and translation - Moment of inertia – Parallel axes theorem - Compound pendulum – theory – equivalent simple pendulum – reversibility of centre of oscillation and suspension –determination of g and k– Newton's law of gravitation(statement) – Motion under a central force, Kepler's laws, derivation. Non inertial frames and fictitious forces – Introduction to Centrifugal and Coriolis force.	**1**	**CO1**
2	**Unit 2: Statics and hydrodynamics** Centre of parallel forces – Centre of mass – Centre of gravity – Centre of gravity of uniform triangular lamina – Centre of gravity of uniform parallelogram lamina, solid and hollow hemisphere - Kinematics of moving fluid –Hydrodynamics-streamline flow-turbulent flow- equation of continuity of flow –Euler's equation of unidirectional flow – Torricelli's theorem – Bernoulli's theorem - applications – Venturimeter – Pitot's tube – atomizer pump – Bunsen burner	**1**	**CO2**
3	**Unit 3: Elasticity & Bending of beams** Hooke's law – stress – strain - modulus of elasticity - elastic constants – relation between elastic moduli - Poisson's ratio - work done in stretching a wire - work done in twisting a wire – twisting couple on a cylinder– rigidity modulus - moment of inertia by static torsion method - by torsional pendulum method - Cantilever – expression for bending moment – expression for depression – cantilever oscillations – 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 pin and microscope by non - uniform method – experiment to determine Young's modulus by optic lever method – I-form girder in construction of bridges.	**1**	**CO3**

4	**Unit 4: Fluid dynamics** Surface tension - definition – excess of pressure over curved surface – spherical drop – cylindrical drop – spherical bubble – cylindrical bubble - determination of surface tension by drop weight method – experiment to determine interfacial surface tension Physics behind covid transmission through saliva droplets – surfactants – variation of surface tension with temperature – Jaegar's method. Viscosity - definition – Coefficient of viscosity of liquid – critical velocity – Rate of flow of liquid in a capillary tube – Poiseuille's formula –experimental determination by capillary flow method – variation of viscosity of a liquid with temperature – Viscosity of gases – Rankines method	**1**	**CO4**
5	**Unit 5: Waves & Oscillations** Simple harmonic motion – combination of two SHMS in a straight line - at right angles – Lissajous's figures – uses – free, damped, forced oscillations and resonance – examples and application of resonance – laws of transverse vibration – determination of frequency of a tuning fork using sonometer – determination of a.c. frequency using sonometer – steel wire – brass wire. Ultrasonics – production – piezo electric crystal method – diffraction of ultrasonics waves – ultrasonic interferometer – ultrasonic grating- Applications of ultrasonics.	**1**	**CO5**

TEXT BOOKS

1. Mechanics, D S Mathur & P S Hemne , S.Chand & Co., Revised Edition (2020).
2. Statics, Hydrostatics and Hydrodynamics, M.Narayanamoorthy & N.Nagarathinam, National Publishing Company, Chennai (2005).
3. Properties of Matter, Brij Lal and N.Subramaniam, S. Chand & Co., Revised Edition (2020).
4. Elements of Properties of Matter , D.S.Mathur, S. Chand & Co., New Delhi (Reprint 2016).
5. Clasical Mechanics , J.C.Upadhyaya, Himalaya Publishing house, Mumbai (2019).
6. Mechanics, P.Durai Pandian, Laxmi Durai Pandian, Muthamizh Jayapragasam, S.Chand & Co. Sixth revised edition (2005).
7.Waves and oscillation, N.subrahmanyam,Brij lal.,V ikas publishing house Pvt. Ltd. (2018).
8. Engineering Physics, K.Rajagopal ,PHI publishers Pvt. Ltd. (2008).
9.Engineering Physics, V.Rajendran, Tata McGraw Hill Education Pvt.Ltd., New Delhi (2012).

REFERENCE BOOKS

1. General Properties of Matter by C.J. Smith, Orient Longman Publishers Reprint (2016).

2. Fundamentals of Physics by D. Halliday, R.Rensick and J. Walker, 6th edition, Wiley, New York Reprint (2016).

3. Mechanics and General Properties of Matter by P.K. Chakrabarthy, Books and Allied (P) Ltd Reprint (2006).

4. Fundamentals of General Properties of Matter by H.R.Gulati, S. Chand & Co., New Delhi Reprint (2005).

WEB LINKS

https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
https://www.youtube.com/watch?v=gT8Nth9NWPM
https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
https://learningtechnologyofficial.com/category/fluid-mechanics-lab/

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA Tests	Generic Skills		
		Assignments	Quizzes	Current Affairs quizzes/presentations
Marks(out of 45)	**30**	**5**	**5**	**5**
Remember			5	
Understand		5		
Apply	10			
Analyze	10			
Evaluate	5			
Create	5			5

Attendance - 5 marks

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

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CORE PRACTICAL - I A

(PRACTICAL EXAMINATION AT THE END OF SEMESTER 1)

Course Code :	**Credits 2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

This course opens the window to the students about

- the methods of experimental physics
- the Emphasis to laboratory techniques as accuracy of measurements & data analyze
- Concept that is learnt in the classroom will be translated to the laboratory sessions thus providing a hands-on leaving experience.

Course Outcomes: At the end of the Course, the Student will be able to

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO 1	Apply the knowledge of mathematics physics fundamentals and using instrumentation techniques to arrive at solutions for variousproblems.	K3
CO 2	Translate basics laws and theories to demonstrations to verify experimentally, basic laws of Physics	K2
CO 3	Relate application of experiment in real life situation.	K3
CO 4	Demonstrate experiments involving basic concept of properties of matter, sound, heat, optics and usage of ICT tools.	K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2

LIST OF EXPERIMENTS:
(any eight experiments)

1. Young's modulus – Non-uniform bending – Pin & microscope.
2. Rigidity modulus – Torsional pendulum (without identical masses).
3. Surface tension and interfacial surface tension – drop weight method.
4. Comparison of viscosity of liquid by burette method – Hare's apparatusgiven.
5. Sonometer-frequency of the tuning fork
6. Sonometer – Relative density of a solid and liquid.
7. Specific heat capacity of liquid – Method of mixtures (Half-time correction).
8. Focal length and Power of a long focus convex lens.
9. Spectrometer – refractive index of a liquid – hollow prism.

Note:

- Use of Digital balance is permitted
- Error and statistical analysis of data
- Plotting graphs using software for a given data
- Learning to use software to detecting the values of electricalcomponents and basics laws of physics

SEMESTER – 2

THERMAL AND STATISTICAL PHYSICS

Course Code : 09206	**Credits 5**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

- *to make the students learn and understand Thermal Physics, which forms one of the core foundations of Modern Physics and plays a significant role in understanding Condensed Matter Physics, Material Science, even to High Energy Physics and Astrophysics.*
- *To have an insight of the statistical concepts which helps the students to understand and correlate with various thermodynamical concepts*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level-K1(Remembering), K2(Understanding),K3(Applying) ,K4(Analyzing), K5(Evaluating), K6(Creating)

CO1	Acquire 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. To identify 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	**K2,K3**
CO2	Discover the significance of laws of thermodynamics, An Insight into thermodynamic properties like enthalpy, entropy and explain fundamental thermodynamic properties	**K4**
CO3	Study and appraise the process of thermal conductivity and apply it to good and bad conductors	**K3, K4**
CO4	Interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law	**K3,K4**
CO5	Develop the statistical interpretation of Bose-Einstein and Fermi-Dirac Apply to quantum particles such as photon and electron	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 Moderately correlated - 2 Weakly correlated -1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	2	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Thermometry and Calorimetry** Platinum resistance thermometer – Calendar and Griffith's bridge – thermistor – specific heat capacity – specific heat capacity of solids – Dulong and Petit's law – specific heat capacity of liquid – method of mixtures –half time correction – specific heat capacity of gases – Meyers relation. **Low temperature physics** Joule-Kelvin effect – porous plug experiment - significance of Boyle temperature - temperature of inversion – liquefaction of gases – Linde's method of liquefying air.	**1**	**CO1**
2	**Unit 2: Thermodynamics** Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics & third law of thermodynamics – Carnot's engine – Carnot's theorem – thermodynamic scale of temperature (No derivation) – Entropy – Temperature – entropy diagram for Carnot's cycle thermodynamic potential – derivation of maxwell's thermodynamic relations – TdS equations - Clayperon's latent heat equation	**1**	**CO2**
3	**Unit 3: Conduction and Radiation** Prevost's theory of heat exchange – Kirchoff's Law - thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe's method – thermal conductivity of a bad conductor – Lee's disc method - Spatial distribution of Blackbody	**1**	**CO3**

	radiation – Planck equation – postulates – Planck's law of Blackbody radiation experimental verification, deduction of Wien's distribution law-Rayleigh Jean's Law-Stefan's law - Planck's law-Newton's law of cooling from Stefan's law – Solar constant.		
4	**Unit 4: Classical Statistics** Introduction –Phase space – Volume in phase space – no. of phase cells in the given energy range for 3-d free particle-ensemble – Types of ensemble-Liouville's Theorem – statement and explanation Macroscopic and microscopic description – Probability – Thermodynamic probability – Boltzmann's theorem on entropy & probability – Fundamental postulates of statistical mechanics Statistical equilibrium Maxwell – Boltzmann distribution law – M-B distribution in terms of temperature – application of molecular energies in an ideal gas – M- B velocity distribution law.	**1**	**CO4**
5	**Unit 5: Quantum Statistics** Ideal quantum gas – indistinguishability of particles and its consequence of B-E statistics – B–E distribution law – most probable micro state - B-E energy distribution function – B-E energy distribution law for continuous variation of energy – photon gas – most probable micro state – F-D energy distribution law for continuous variation of energy – electron gas	**1**	**CO5**

.

TEXT BOOKS:

1. Heat and Thermodynamics, Brijlal and N. Subramanyam, P.S.Hemne S.Chand & Co, Revised edition (2017).
2. Heat and Thermodynamics and statistical Physics , S.L.Kakani, Sultan Chand, Revised edition (2009).
3. Thermal Physics and Statistical Mechanics, Dr.D.jayaraman, Dr.K.Ilangovan, S.Vishwanathan (printers and publishers) pvt.Ltd (2016)
4. Statistical Mechanics, Sathyaprakash, latest edition, Kedanath Ramnath, Meerut (2021).
5. Modern Physics, Murugesan and Krithika Sivaprasath, latest edition (2019).
6. Engineering Physics, K.Rajagopal, PHI publishers Pvt.Ltd. (2008)
7. Engineering Physics , V.Rajendran, Tata McGraw hill education Pvt. Ltd. (2012)

REFERENCE BOOKS:

1. Heat and Thermodynamics, Zemansky, McGraw – Hill Book Co. Inc., New York, Revised edition (2017).
2. Fundamentals of Physics, Resnick Halliday and Walker, 6th edition,, John Willey and Sons, Asia Pvt. Ltd., Singapore, Revised edition (2001).
3. Fundamentals of Thermodynamics, Carroll Leonard, Prentice-Hall of India (P) Ltd., New Delhi (1965).

4. Heat and Thermodynamics, J.B.Rajam and C.L.Arora, 8th edition, S.Chand & Co. Ltd., New Delhi (1976).
5. Principles of Thermodynamics, Jin Sheng Hieh, 1st edition, McGraw – Hill Kogakusha Ltd., Tokyo (1975).
6. Thermodynamics, Warren Giedt, 1st edition, Van Nostrand Reinhold Company, New York (1971).

WEB LINKS

https://youtu.be/M_5KYncYNyc

https://youtu.be/ljJLJgIvaHY

https://youtu.be/7mGqd9HQ_AU

https://youtu.be/h5jOAw57OXM

https://youtu.be/SjTfNFso4mE

https://youtu.be/nzguGdF6z2I

https://youtu.be/TnDCxw0y6YM

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA Tests	Generic Skills		
		Assignments	Quizzes	Current Affairs quizzes/presentations
Marks(out of 45)	**30**	**5**	**5**	**5**
Remember			5	
Understand		5		
Apply	10			
Analyze	10			
Evaluate	5			
Create	5			5

Attendance - 5 marks

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

CORE PRACTICAL - I B
(PRACTICAL EXAMINATION AT THE END OF SEMESTER 2)

Course Code :	**Credits 2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

This course opens the window to the students about

- the methods of experimental physics
- the Emphasis to laboratory techniques as accuracy of measurements & data analyze
- Concept that is learnt in the classroom will be translated to the laboratory sessions thus providing a hands-on leaving experience.

Course Outcomes: At the end of the Course, the Student will be able to Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) ,K5(Evaluating) ,K6(Creating)

CO 1	Apply the knowledge of mathematics physics fundamentals and using instrumentation, techniques to arrive at solutions for various problems.	K3
CO 2	Translate basics laws and theories to demonstrations To perform experimentally and find the physical parameters	K3
CO 3	Relate application of experiment in real life situation.	K3
CO 4	Demonstrate experiments involving basic concept of properties of matter, sound, heat, optics and usage of ICT tools.	K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2

LIST OF EXPERIMENTS:
(any eight experiments)

1. Young's modulus – Uniform bending – Optic lever – scale and telescope.
2. Rigidity modulus and moment of inertia – Torsional pendulum (with identical masses).
3. Coefficient of viscosity of liquid using graduated burette (radius of capillarytube by Mercury pellet method)
4. Sonometer – Verification of laws of transverse vibration
5. Specific heat capacity of a liquid – Newton's law of cooling
6. Focal length and Power of a concave lens.
7. P.O. Box – Temperature coefficient of resistance of a coil
8. Potentiometer - Low range Voltmeter calibration

Note:

- Use of Digital balance is permitted
- Error and statistical analysis of data
- Plotting graphs using software for a given data
- Learning to use software to detecting the values of electrical components and basics laws of physics

NON MAJOR ELECTIVE PAPERS

Learning Objectives:

By studying this course students will be able to

- *Demonstrate her/his understanding of facts and ideas on various facts of Physics.*
- *Relate the strong contribution to Laws of Nature and daily life.*

1. PHYSICS IN EVERYDAY LIFE - I

Course Code : 09103	**Credits 2**
L: T: P: S : 2:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Extend the basic knowledge of workforce energy to understand real life happening.	K2,K3
CO2	Relate different forms of energy and interpret working of various appliances / concepts involving energy.	K2,K3
CO3	Demonstrate the application of heat energy in everyday life.	K2,K3
CO4	Build the concepts and understanding about light its proportion various phenomena.	K2,K3
CO5	Extend the knowledge of heat to understand the principle behind various happenings day to life.	K2,K3

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	Unit-1: Force- Newton's laws of motion- circular motion – centripetal force – centrifugal force. Principle Behind Centrifuge – washing machine. Reason Behind 1) We weigh less in moon. 2) Long jump athletes run a little before they jump. 3) Iron nails, safety pins which have sharp edge poke easily, polished knife cut easily. 4) While jumping around in a bike with high speed, if the rider loses his control, why is he thrown outside? 5) Speed increases when we slide.	**1**	**CO1**
2	**Unit-2:** Energy – different forms of energy – Law of conservation of energy. Principle Behind Electric bulb-tube light-CFL bulbs. Reason Behind 1) Electric bulb adds to global warming. 2) Electric bulbs are replaced by CFL. 3) TV flickers when cell phone nearby rings? 4) Why tube light does not give shadow unlike an electric bulb? 5) Why are LED arrays used for illuminating in these days instead of fluorescent tubes?	**1**	**CO2**
3	**Unit-3:** Boiling point – variation of boiling point with pressure – latent heat. Principle Behind Pressure cooker – microwave oven – milk boiler – fridge. Reason Behind 1) Metal vessels must not be used in microwave oven. 2) Salt is used to melt ice on roads during winter. 3) Cooking in a pressure cooker saves fuels and time. 4) While glucose is dissolved in water, water becomes cold. 5) When detergents dissolve in water it gives out heat.	**1**	**CO3**

4	**Unit-4:** Light – reflection. Principle Behind Traffic sticker – laws of reflection – total internal reflection – refraction – constructive interference – destructive interference - diamonds glow. Reason Behind 1) Why do stars twinkle? 2) Why do we get rainbow? 3) Deep swimming pools look shallow. 4) Peacock feathers, soap bubbles give beautiful colors. 5) We use black umbrellas to protect ourselves from sunlight.	**1**	**CO4**
5	**Unit-5:** Expansion due to heat – evaporation. Principle Behind Mud pot - cool drink straw- why do we sweat. Why it is so? 1. Wet clothes that are spread out dry faster 2. Hot milk kept in big bowl cool faster 3. Why we are not able to open our closed wooden door easily during rainy season? 4. Why do rails have links in between? 5. Why does glass bottle with hot water breaks when we suddenly pour cold water on it?	**1**	**CO5**

TEXT BOOKS:

1. The Learner's series – Everyday science. Jean Lave, Published by Infinity Books, New Delhi
2. Sujatha (2007). Ean? Etharku? Eppadi? Vol I & II, Vikatan publishers Chennai.
3. Kasturi Ranga (2006). The Hindu speaks on Science, Vol I & II Publishers, Chennai.
4. Q-Series, How and Why-Popular Science books, NISCAIR, New Delhi.
5. P.Ayngaranesan (2007). Theriyuma?, Arumbu Publishers, Chennai.

2. PHYSICS IN EVERYDAY LIFE – II

Learning Objectives:

By studying this course students will be able to

- *Demonstrate her/his understanding of facts and ideas on various facts of Physics.*
- *Relate the strong contribution to Laws of Nature and daily life.*

Course Code : 19-2109206, 22-2309208	**Credits 2**
L: T: P: S : 2:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Apply the idea of Bernoulli's theorem to interpret various important things around us.	K2,K3
CO2	Summarize principles of physics to understand the concept of real life situation.	K2,K3
CO3	Plan experiments to translate the learning into hands on activities.	K2,K3
CO4	Relate the optical phenomena in sky and space with knowledge of light.	K2,K3
CO5	Construct demonstration and build on the basic ideas on sound and acoustics.	K2,K3

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	**CONTENTS OF MODULE**	**Hrs**	**COs**
1	**Unit-1: Bernoulli's theorem.** Principle Behind Gas stove burner- room- spray- fan- atomizer- syringe. Reason Behind 1. We should not stand at the edge of the platform, when the express train crosses the station 2. LPG gas has peculiar odor 3. Blades in a fan are slightly curved 4. When wind blows strongly why roofs fly away not pushed down. 5. You get water in showers forcefully.	**1**	**CO1**
2	**Unit-2: surface tension – capillary rise – osmosis.** Principle Behind Wick in oil lamp – rain coat. Reason Behind 1. Soap removes dirt and detergents clean clothes. 2. Some insects are able to walk on water 3. Water from soil goes to plants 4. Pickle becomes saltier and smaller 5. Gulab jamun become sweeter and swell.	**1**	**CO2**
3	**Unit-3: Friction – lubrication – Newton's law of gravitation.** Principle Behind Speed breaker – walking stick and crutches. Reason Behind 1. We get high tide during new moon and full moon day 2. A snake cannot crawl on smooth surface and lizard cannot move on tiles 3. Why do not we get eclipse during every new moon and full moon? 4. Planets revolve round the sun. 5. We use oil along with fuel in vehicles	**1**	**CO3**
4	**Unit-4: Myopia – Hypermetropia – power of lens.** Principle Behind Contact lens - reading lens- spectacles correct short sightedness- spectacles corrects long sightedness. Reason Behind 1. Cotton kept under lens burnt in sunlight 2. Sky is blue 3. Sky appears reddish during sun rise and sunset 4. Dust particle in path of sunray passing through a small hole in a dark room becomes more visible. 5.Space above atmosphere is colorless.	**1**	**CO4**

5	**Unit-5: Sound waves – reverberation – echo – noise - earth quake – Ritcher scale.** Principle Behind Reason Behind 1) Sound is heard first in TV, before picture, while lightning is seen before thunder. 2) We get less noise outside, when people talk inside glass room and also we don't hear noise from outer space. 3) Bursting of balloon or electric bulb produce noise. 4) Building reverberates (or) glass panes crack sometimes when an aero plane passes. 5) Gravels are put in between the rails in railway tracks.	**1**	**CO5**

TEXT BOOKS:

1. The Learner's series – Everyday science – Published by Infinity Books, New Delhi

2. Sujatha (2007). Ean? Etharku? Eppadi? Vol I & II, Vikatan publishers Chennai.

3. Kasturi Ranga (2006). The Hindu speaks on Science, Vol I & II Publishers, Chennai.

4. Q-Series, How and Why-Popular Science books, NISCAIR, New Delhi.

5. P.Ayngaranesan (2007). Theriyuma?, Arumbu Publishers, Chennai.

3. ASTROPHYSICS

Learning Objectives:

By studying this course students will be able to

- *Demonstrate her/his understanding of facts and ideas on various facts of AstroPhysics.*
- *Relate the strong contribution to astronomical instruments, solar system, universe , galaxies.*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Extend the knowledge of optics to understand the working various astronomical instruments	K2,K3
CO2	Outline various physical concepts of Solar System	K2,K3
CO3	Interpret the Solar System based on various models	K2,K3
CO4	Rephrase the concept of Stellar revolution under white dwarf – Supernovae	K2,K3
CO5	Apply their knowledge and develop cognition about theories of universe and galaxies	K2,K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Astronomical instruments** Optical telescopes-refracting telescope-reflecting telescope- types of reflecting telescopes – detectors and image processing	**1**	**CO1**
2	**Unit 2: Solar system** The Sun- physical and orbital data-photosphere-chromosphere-corona-solar prominences – sunspot - solar flare- mass of the sun- solar constant-temperature of the sun- sources of solar energy-solar wind.	**1**	**CO2**
3	**Unit 3: Members of the solar system** Mercury – Venus- Earth – Mars – Jupiter- Saturn- Uranus- Neptune- Pluto-Moon – Bode's law – asteroids- comets – meteors.	**1**	**CO4**
4	**Unit 4: Stellar evolution** Birth and death of a star –brightness of a star – stellar distance-Chandrasekar limit- white dwarfs- Neutron stars – black holes-Supernovae.	**1**	**CO5**
5	**Unit 5: Theories of the Universe and Galaxies** Origin of the Universe - the big bang theory- the steady state theory- the oscillating universe theory – Hubble's law. Galaxies – types of galaxies-Milky way	**1**	**CO5**

TEXT BOOKS:

1. K.S.Krishnaswamy (2002). Astrophysics - a modern perspective, New Age International (P) Ltd, New Delhi

2. Baidyanath Basu (2001). An introduction to Astro physics, second printing, Prentice – Hall of India (P) Ltd, New Delhi.

3. Dr.P.Iyemperumal (2002).Vindaimigu paerandam(Tamil), Chennai.

4. Dr.P.Iyemperumal, Tamizhaga vaanaviyal sindanaigal (Tamil),World Tamil Research Centre, Chennai.

5. Mohan Sundar rajan (2003). Indriya Vinveli (Tamil), NBT New Delhi.

6. Dept.of.Physics, DGVC College (1977). Topics in Physics Compiled, Rochouse & Sons, Chennai.

REFERENCE BOOKS:

1. R. Murugeshan (2003). Modern Physics (11th edition), S. Chand & Company Ltd, New Delhi.
2. S. Kumaravelu (1993). Astronomy, Janki Calendar Corporation, Sivakasi.

4. NON CONVENTIONAL ENERGY SOURCES

Learning Objectives:

By studying this course students will be able to

- *Demonstrate her/his understanding of facts and ideas on various facts of non conventional energy*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Extend the knowledge on conventional energy and renewable energy to understand Solar energy	K2,K3
CO2	Explain application of Solar energy for various purposes	K2,K3
CO3	Translate the idea of renewable energy resource to understand wind energy	K2,K3
CO4	Outline the concept of utilizing tidal energy and the process behind	K2,K3
CO5	Summarize the nature and application of chemical and nuclear energy	K2,K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1 : Solar energy** Conventional Energy sources – Renewable Energy sources- solar energy – solar radiation and its measurements- solar energy collectors- parabolic collector- storage of solar energy	**1**	**CO1**
2	**Unit 2 : Applications of solar energy** Solar water heater- solar driers- solar cells- solar electric power generation- solar distillation- solar pumping – solar cooking	**1**	**CO2**
3	**Unit 3: Wind energy** Basic principles of wind energy conversion- power in the wind – forces in the Blades- wind energy conversion- Advantages and disadvantages of wind energy conversion systems (WECS) Energy storage- Applications of wind energy	**1**	**CO3**

4	**Unit 4: Oceanic energy** Energy from the oceans- Energy utilization- Energy from tides- Basic principle of tidal power – Utilization of tidal energy	**1**	**CO4**
5	**Unit 5 : Energy from other sources** Chemical energy – Nuclear energy - Energy storage and distribution	**1**	**CO5**

TEXT BOOKS:

1. G.D. Rai (1996). Non-conventional sources of energy (4th edition), Khanna Publishers, New Delhi.

2. S.P.Sukhatme (1997). Solar Energy, Principles of thermal collection and storage (2nd edition), Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

3. A.K.Bakhshi (2006). Energy, National Book Trust, New Delhi.

4. Dept.of.Physics, DGVC College (1977). Topics in Physics Compiled, Rochouse & Sons, Chennai.

REFERENCE BOOKS:

1. S. Rao and Dr. Parulekar (2015). Energy Technology, Khanna Publishers.
2. Jyoti Parikh (1997). Energy Models for 2000 and beyond, Tata McGrawHill Publishers, New Delhi.

5. BIOPHYSICS

Learning Objectives:

By studying this course students will be able to

- *Demonstrate her/his understanding of facts and ideas on various facts of biomechanics, connection between Physics and biology*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Extend the knowledge on hydrodynamics to understand the fluid flow under various circumstances.	K2,K3
CO2	Explain the physiology of respiration using the concept of transport of gases.	K2,K3
CO3	Interpret having and the physics of audition.	K2,K3
CO4	Construct the ideas to understand vision, power of eye myopia and hypermetropia.	K2,K3
CO5	Rephrase various concept of biomechanics, locomotion in the background of laws of physics.	K2,K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Fluid Flow** Steady laminar flow, turbulence, capillary rise, Poiseuille's formula, energetics of fluid flow, hemodynamics, fluid flow in plants	**1**	**CO1**
2	**Unit 2: Gas Transport** Ideal gas, convection and diffusion of gases, Physiology of respiration.	**1**	**CO2**
3	**Unit 3: Physics of Audition** Transverse and longitudinal waves, physiological characteristics of sound, human ear, Doppler Effect.	**1**	**CO3**
4	**Unit 4: Physics of Vision** Wave nature of light, lenses, focal length, refractive power, retina and photoreceptors, resolving power of eye, short sight and long sight, contact lenses	**1**	**CO4**
5	**Unit 5: Biomechanics** Introduction, biostatics, mechanical properties of muscle, biodynamic, locomotion on land, water and air.	**1**	**CO5**

TEXT BOOKS:

1. P. K. Srivastava (2005). Elementary Biophysics: An Introduction, Narosa Publishing House, New Delhi.

2. Vasantha Pattabhi and N. Gautham (2009). Biophysics (2nd edition), Narosa Publishing House, New Delhi.

REFERENCE BOOKS:

1. Rodney Cotterill (2005). Biophysics: An Introduction, Wiley and Sons, England

2. Philip Nelso (2003). Biological physics: Energy, Information and Life, W. H. Freema and Co., New York.

3. Daniel M (1992). Basic biophysics and biologists, Wiley International, New Delhi.

4. Sybesma C (1989). Biophysics: An Introduction, Kluwer Publishers, New York.

6. INTRODUCTION TO NUMERICAL METHODS

Learning Objectives:

By studying this course students will be able to

- *Demonstrate her/his skills to solve various numerica;s, able to apply various formulae and mathematical methods to solve Physics problems and everyday applications*
- *Will be able to apply various computational techniques*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Apply the concept of statistics to solve problems in Physics	K2,K3
CO2	Extend the knowledge probability to compare error analysis	K2,K3
CO3	Solve various numerical problems having the idea of curve fitting	K2,K3
CO4	Demonstrate computational techniques for solving related problems	K2,K3
CO5	Solve numerical problems using Trapezoidal rule- Simpson's rule	K2,K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit-1: Statistics** Mean, meridian, mode, standard deviation, variance, range, co-efficient of variation, covariance Related problems-role of Statistical methods in Physics	**1**	**CO1**
2	**Unit-2: Probability** Probability theory – application of probability in physics- Relation to randomness and errors- types of errors in physics-Theory of errors - errors analysis	**1**	**CO2**
3	**Unit-3 Curve fitting** Curve fitting, principle of least squares- Straight line fitting- numerical problems	**1**	**CO3**
4	**Unit-4 Computational techniques** Iteration – iteration techniques – Bisection method, Newton-Raphson method –numerical problems	**1**	**CO4**
5	**Unit-5 Numerical analysis** Trapezoidal rule- Simpson's 1/3rd Rule- Numerical problems	**1**	**CO5**

TEXT BOOKS:

1. Sathya Prakash (1996). Mathematical Physics, Sultan Chand and Sons, New Delhi.

2. M.K. Venkatraman (1990). Numerical method, National Publishing Company.

3. V. Rajaraman (2003). Numerical methods, Prentice - Hall India Pvt. Ltd.,

4. P. Kandasamy, K. Thilagavathy and K. Gunavathy (2002). Numerical methods, S. Chand & Co.

REFERENCE BOOKS:

1. B.D. Gupta (1996). Mathematical Physics, Vikas Publishing House Pvt. Ltd., New Delhi.

2. Jain Iyenger and Jain (2004). Numerical methods for Scientific and Engineering computation New Age International (P)Ltd.,

3. S.S.Sastry (2003). Numerical methods, Prentice Hall of India Pvt. Ltd., New Delhi

7. CONTRIBUTION OF INDIA TO MODERN SCIENCE

Learning Objectives:

By studying this course students will be able to

- *Get an overview of different views on Philosophy and Physics*

Appreciate contribution of our country to Modern Science

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the view of world in the Greco- Roman perspective.	K2,K3
CO2	Compare and contrast Indian knowledge system with Western World view summarize contribution of our country to Mathematics and astronomy.	K2,K3
CO3	Outline the idea of cognition in plants impact of Swami Vivekanandha, J.C Bose, Schrodinger and Heisenberg. Interpret evolution of duality principle.	K2,K3
CO4	Relate the growth of science and Technology with great trignometrical survey of India	K2,K3
CO5	Interpret the importance of Triple helix Structure based on x-ray crystallography and outline the contribution of many Indian Physicist	K2,K3

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl. No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit -1** Aristotle's view of world –Pythagorean view-Indian Philosophy and its impact on Greek Philosophers-Geocentric theory-Heliocentric theory-Newtonian view of world	**1**	**CO1**
2	**Unit -2** Contribution of Indians to Mathematics and Astronomy-Indian Mathematicians during 10th to 15th century-Almagest - Ptolemy-Mathematicians form Kerala- Value of Pi-Contributions of Ramanujan	**1**	**CO2**
3	**Unit-3** Idea of Biosphere-Ecosystem-Pyramid & Oceanic circle-Cognition in plants-J.C.Bose-Impact of Vivekananda on J.C.Bose – Einstein-wave particle duality- Quantum theory-Double Slit experiment Heisenberg-Copenhagen scientist-Schrodinger – Impact of Indian philosophy in the evolution of duality principle- S.N. Bose –Saha	**1**	**CO3**
4	**Unit-4** The great trigonometrical survey of India –Sir C.V. Raman- Raman effect and his contributions- Prof. K.S. Krishnan- Swami Vivekananda and genesis of II Sc	**1**	**CO4**
5	**Unit-5** Prof. G.N. Ramachandran- Triple Helix Structure of collagen- Crik & Watson-Dorothy Hudkinson ECG. Sundarshan	**1**	**CO5**

TEXT BOOKS:

1. Journey into light:Life and Science of C.V.Raman by G.Venkatraman : Some famous Indian Scientist by TIFR Booklet
2. Book series on History of Science & Technology, Government of India.
3. Arvind Gupta (2019), Bright Sparks
4. Vignettes in Physics by G.Venkatraman
5. Seeing and Believing by Richard Panek
6. Surely you're Joking Mr.Feynman by Feynman, Leighton et al
7. Uncommon wisdom by Fritj of Capra
8. Cosmos by Carl Sagan

SEMESTER – 3

OPTICS AND SPECTROSCOPY

Course Code	**:09311**	**Credits**	**05**
L:T:P:S	**: 5:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

Learning Objectives:

In this course, students are exposed to

- *concept related to lens and prism*
- *working knowledge of Optical Physics including interference, diffraction, polarization, & Spectroscopy*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering),K2(Understanding),K3(Applying),K4(Analyzing), K5(Evaluating), K6(Creating)

CO1	Outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces	**K3,K4**
CO2	Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer	**K3,K4**
CO3	Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyse the optical instruments	**K4**
CO4	Interpret basic formulation of polarization and gain knowledge about polarimeter, appraise its usage in industries	**K4,K5**
CO5	Relate the principles of optics to various fields of IR and Raman spectroscopy	**K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 Moderately correlated - 2 Weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1:Geometrical Optics** Dispersion- Dispersion produced by a thin prism– dispersive power – Achromatic prisms-Combination of two small angled prisms to produce dispersion without deviation - deviation without dispersion – Direct vision spectroscope-Aberration in lenses-defects of images – coma – distortion - Spherical aberration in lenses - methods of minimizing sphericalaberration - condition for minimum spherical aberration in the case of two lenses separated by a distance - Chromatic aberration in lenses - Condition for achromatism of two thin lenses (In and out of contact) Eyepieces and oculars-Types-Huygenian, Ramsden,Kellner-eyepieces in wide range cameras-viewfield diameter-intraocular lenses	**1**	**CO1**
2	**Unit 2: Interference** Young's double slit experiment-Analytical treatment of interference - expression for intensity - condition for maxima and minima in terms of phase and path difference –Coherent sources- Interference in thin films – reflected ray- transmitted ray – colours of thin films - Air wedge - determination of diameter of thin wire - Test for optical flatness – Determination of wavelength of light using Newton's rings-Haidinger's fringes - Michelson's interferometer - theory - applications - determination of wavelength –LIGO gravitational wave interferometer-seismic isolation, operating in vacuum-LIGO INDIA	**1**	**CO2**
3	**Unit 3: Diffraction** Fresnel diffraction – Zone plate, Theory of Zone plate - diffraction at a circular aperture – at a narrow wire - Fraunhofer diffraction - single slit - double slit (simple theory)- Plane transmission grating -grating element-theory-normal incidence – experimental determination of wavelength using grating - Dispersive power of a grating - Rayleigh's criterion for resolution - limit of resolution of theeye - resolving power of telescope and microscope - Difference between resolving power and dispersive power	**1**	**CO3**
4	**Unit 4: Polarization** Double refraction - Nicol prism -polarizer and analyzer - Huygen's explanation of double refraction in uniaxial crystals - dichroism - polaroids and their uses – polaroid camera-polaroid glasses-quarter wave plate - halfwave plate - plane, elliptically and circularly polarized light - production and detection - Babinet's compensator - optical activity - Fresnel's explanation of optical activity - specific rotatory power - determination using Laurent's half shade polarimeter-application in sugar industry	**1**	**CO4**

5	**Unit 5: Spectroscopy** Introduction to spectroscopy - Electromagnetic spectrum - characterization of electromagnetic radiation - quantization of energy - regions of the spectrum -scattering of light – blue of the sky - Raman effect - experimental set up - characteristics of Raman lines – Stokes, anti-Stokes line-Rayleigh line-Quantum theory of Raman effect-Vibrational Spectroscopy-vibrational energy of a diatomic molecule-IR and Raman bands-outline of normal modes of vibration-linear and bent molecules-mutual exclusion principle-structural determination of XY_2 molecule using IR and Raman Spectroscopy	**1**	**CO5**

.

TEXT BOOKS:

1. Optics, Ajay Ghatak, Tata McGraw-Hill publishing Co.Ltd.,New Delhi (1998).
2. A Text book of Optics, Subrahmanyam N., Brij Lal and M.N. Avadhanulu, S.Chand & Co., New Delhi (2006).
3. Optics and Spectroscopy, R.Murugeshan and Kiruthiga Sivaprasath, S. Chand & Co., New Delhi (2006).
4. Molecular structure and spectroscopy, Aruldhas, Prentice Hall of India Pvt. Ltd., New Delhi (2005).
5. Photonics, P.R.Sasi kumar , PHI publishers (2012)
6. Engineering Physics, K.Rajagopal, PHI publishers (2008)
7. Engineering Physics, V.Rajendran, Tata McGraw Hill educational Pvt. Ltd. New Delhi (2012).

REFERENCE BOOKS:

1. Fundamentals of Physics, by D.Halliday, R. Resnick and J. Walker, Wiley, 6th Edition, New York (2001).
2. Optics by Khanna D.R. & Gulati H.R., S.Chand & Co., New Delhi (1979).
3. Spectroscopy by Gurdeep Chatwal, Sham Anand, Himalaya Publishing House (1990)
4. Fundamentals of molecular spectroscopy, C N Banwell, McGraw-Hill book Co.,4th edition(2017).
5. Vibrational spectroscopy by D.N.sathyanarayanan , New age international publishers (2011)

WEB LINKS:

https://science.nasa.gov/ems/
https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
https://imagine.gsfc.nasa.gov/educators/gammaraybursts/imagine/index.html
http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/
http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/

https://www.youtube.com/watch?v=DwD3HD6t5Vs

https://www.youtube.com/watch?v=E0Z8rn2dBmM

https://www.youtube.com/watch?v=PvYdgYq0_pc

https://www.youtube.com/watch?v=qxlR7ZdgV7w

https://www.youtube.com/watch?time_continue=135&v=0b1fqodmZJ0&feature=emb_logo

https://spaceplace.nasa.gov/blue-sky/en/

https://www.youtube.com/watch?v=xWMei1IUG7E

https://www.nrcan.gc.ca/maps-tools-publications/satellite-imagery-air-photos/remote-sensing-tutorials/introduction/interactions-atmosphere/14635

http://math.ucr.edu/home/baez/physics/General/BlueSky/blue_sky.html

https://www.rebresearch.com/blog/why-isnt-the-sky-green_/

https://sciencenotes.org/why-is-the-sky-green-before-a-tornado/

https://www.youtube.com/watch?v=ndXhTjMr1hk

https://www.bbvaopenmind.com/en/science/leading-figures/john-tyndall-the-man-who-explained-why-the-sky-is-blue/

https://www.validyne.com/blog/leak-test-using-pressure-transducers/

https://www.validyne.com/blog/basics-pneumotach-flow-measurement/

https://www.atoptics.co.uk/atoptics/blsky.htm

https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

https://books.google.co.in/books?id=grqxTeY1z4oC&pg=PA897&lpg=PA897&dq=size+of+nitrogen+molecule+and+blue+light&source=bl&ots=hC0V9FvzP-

https://www.youtube.com/watch?v=MZktgCWvHlE

https://www.youtube.com/watch?time_continue=129&v=iMGvTYDC5MA&feature=emb_logo

https://www.youtube.com/watch?v=uohd0TtqOaw

https://www.youtube.com/watch?v=LAQ1m_1W5ys

https://www.youtube.com/watch?v=VyQAg4j-7K4

https://www.youtube.com/watch?v=KDaQhpYYo50

https://www.olympus-lifescience.com/en/microscope-resource/primer/anatomy/oculars/

https://www.ligo.caltech.edu/page/technology-transfer

https://www.ligo.caltech.edu/page/ligo-gw-interferometer

https://www.youtube.com/watch?v=fGJRIgnDXzA&list=PL2IXS7LFVI82ofqh38I90imTzJgkD-0BV
https://youtu.be/jy6QltMfSY8?si=4nSWITzDyU2GTfd4
https://youtu.be/FtrG2H-5Trg?si=RsG_F4z72gXY4gYF

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA Tests**	**Generic Skills**		
		Assignments	**Quizzes**	**Current Affairs quizzes/presentations**
Marks(out of 45)	**30**	**5**	**5**	**5**
Remember			5	
Understand		5		
Apply	10			
Analyze	10			
Evaluate	5			
Create	5			5

Attendance – 5 marks

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	**Weightage %**
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

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CORE PRACTICAL - II A
(PRACTICAL EXAMINATION AT THE END OF SEMESTER 3)

Course Code :	**Credits 2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

On taking this course the student will be able to

- Explain demonstrating various optical phenomena principles, working and application of optical instruments.
- Understanding the basic concept of electricity, magnetism, optics and properties of matter and their applications.

Course Outcomes: At the end of the Course, the Student will be able to Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) ,K5(Evaluating) ,K6(Creating)

CO 1	Develop skills to understand the concept of elastic constants of solid and acquire knowledge of applications.	K3
CO 2	Demonstrate experiments to involving various optical phenomena, principles, workings and application of optical instruments.	K2
CO 3	Apply standard method to calibrate the analog meters and to measure various physical quantities.	K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2

LIST OF EXPERIMENTS:
(any eight experiments)

1. Young's modulus - cantilever - depression - Static method-Scale and telescope
2. Compound pendulum - g and k
3. Sonometer - A.C. Frequency - Using Steel wire.
4. Thermal conductivity of a bad conductor - Lee's disc method
5. Spectrometer - μ of a glass prism - i-d Curve
6. Spectrometer - Grating N and λ - normal incidence method
7. m and BH - deflection magnetometer -Tan C position and vibration magnetometer
8. Potentiometer - Ammeter calibration
9. Determination of conductivity of Human body and various liquids using EXP EYES –software.
10. Verification of the Malus law for plane polarized light

Note:

- Use of Digital balance is permitted
- Error and statistical analysis of data
- Plotting graphs using software for a given data
- Learning to use software to detecting the values of electrical components and basics laws of physics

SEMESTER 4

ATOMIC PHYSICS AND LASERS

Course Code	**: 09415**	**Credits**	**5**
L:T:P:S	**: 5:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

Learning Objectives:

This course provides a coherent and concise coverage of

- *evolution of atom models*
- *atomic structure and spectral series*
- *in-depth knowledge in Lasers and its application*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level-K1(Remembering),K2(Understanding),K3(Applying),K4(Analyzing) K5(Evaluating), K6(Creating)

CO1	Demonstrate qualitative understanding of the photoelectric effect and appreciate the working of photoelectric/solar devices	**K3**
CO2	Develop semi classical model of the atom and show how these models lead to quantum mechanics	**K4**
CO3	Correlate the instrumentation techniques with the evolution of atomic models, Apply selection rules and analyze the fine structure of atomic Spectra Relate the effect of magnetic field on atomic spectra with normal and anomalous Zeeman effect	**K3, K4**
CO4	Categorize X-ray spectra, Pivot growth based on Compton scattering	**K4**
CO5	Generalise the principle, working methodology behind different lasers and correlate their significance in S&T	**K5**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 Moderately correlated - 2 Weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	2	3	3	2	3	3	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3
CO4	3	3	3	3	3	2	3	2	3	3	3	2	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit1: Photo-electric effect** Photo electric effect - Lenard's experiment - Richardson and Compton experiment - Laws of photoelectric emission – Einstein's photo electric equation – Experimental verification of Einstein's photo electric equation by Millikan's experiment - photo electric cell – photodetectors-sensor pixels- photovoltaic cell - photo conducting cell – photomultiplier-solar cells-solar panel	**1**	**CO1**
2	**Unit 2: Atomic structure** Bohr atom model - Sommerfeld atom model – Vector atom model- various quantum numbers - Pauli's exclusion principle - electronic configuration of elements and periodic classification - magnetic dipole moment of an electron due to orbital and spin motion - Bohr magneton - coupling schemes - LS and JJ coupling - spatial quantization-Stern and Gerlach experiment	1	**CO2**
3	**Unit 3: Fine structure of spectral lines** Excitation and ionization potential – experimental determination of critical potential – Frank and Hertz experiment – Davis and Gaucher method- Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines - Zeeman effect – Zeeman shift - Larmor's theorem- Debye's explanation of normal Zeeman effect - anomalous Zeeman effect - theoretical explanation - Lande's `g' factor - explanation of splitting of D1 and D2 lines of sodium - Paschen Back effect - Stark effect (qualitative study only).	1	**CO3**
4	**Unit 4: X-Rays** X- rays - continuous X-ray spectrum - characteristic X-ray spectrum- Moseley's law - absorption of X-rays by matter -diffraction of X- rays - Bragg's law – Bragg's spectrometer - Compton effect – expression for Compton shift in wavelength - experimental verification-- uses of X-rays	1	**CO4**
5	**Unit 5: Lasers** Basic principles of Laser-absorption-spontaneous emission-stimulated emission-population inversion-Einstein coefficients-condition for light amplification-construction of laser-lasing medium-pumping-optical resonator-threshold condition-types of lasers-solid state laser-Ruby laser-gas laser-He-Ne and CO_2 laser-construction, working and uses-applications -laser in DRDO-DURGA, ophthalmic lasers, Laser marking (UID), laser cutting, drilling, pasteurization, ultrafast laser spectroscopy	1	**CO5**

TEXT BOOKS

1. Concepts of Modern Physics, A. Beiser, Tata McGraw-Hill, New Delhi (1997).
2. Atomic Physics, J.B. Rajam, S. Chand & Co., 20th Edition, New Delhi (2004).
3. Modern Physics, D.L.Sehgal, K.L.Chopra and N.K.Sehgal., Sultan Chand & Sons Publication, 7th Edition, New Delhi (1991).
4. Atomic and Nuclear Physics, N. Subrahmanyam and BrijLal, S. Chand & Co. 5th Edition, New Delhi (2000).
5. Modern Physics, R. Murugeshan, Kiruthiga Sivaprasath, S. Chand & Co., New Delhi (2008).
6. Laser theory and applications, K Thyagarajan and Ajoy Ghatak, Cambridge University Press (1999).
7. Laser Physics, S.Mohan,V.Arjunan,M.Selvarani,M.Kanchana Mala, MJP publishers(2012)
8. Fiber optic communications, Joseph C. Palaris (2013)
9. Physics of atoms and molecules, Suresh Chandra, Narosa publishers Pvt. Ltd. (2010)
10. Engineering Physics, K.Rajagopal, PHI publishers Pvt.Ltd. (2008)
11. Engineering Physics, V.Rajendran, Tata McGraw Hill Education Pvt. Ltd. (2012)
12. An introduction to Lasers Theory and applications, M.N.Avadhanulu & Dr.P.S.Hemne, S. Chand &Co. (2012)
13. Photonics, P.R.Sasi kumar, PHI publishers Pvt.Ltd. (2012)

REFERENCE BOOKS

1. Modern Physics by J.H. Hamilton and Yang, McGraw-Hill Publication, (1996).
2. Fundamentals of Physics by D.Halliday, R.Resnick and J. Walker, Wiley, 6th Edition, New York (2001).
3. Modern Physics by Kenneth S.Krane, John Willey & sons, Canada (1998).
4. Lasers and non-linear optics, B B Laud, New Age International (P) Ltd., III Edition (2011).

WEB LINKS

http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/atomstructcon.html

http://hyperphysics.phy-astr.gsu.edu/hbase/Bohr.html

https://physics.info/atomic-models/

http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/xrayc.html

https://physics.info/x-ray/

https://www.youtube.com/watch?v=MFPKwu5vugg

http://hyperphysics.phy-astr.gsu.edu/hbase/mod1.html

https://www.youtube.com/watch?v=v-1zjdUTu0o

https://physics.info/photoelectric/

https://www.livescience.com/58816-photoelectric-effect.html

https://www.theweek.in/news/sci-tech/2021/03/17/drdo-developing-durga-ii-laser-weapon-for-land-naval-air-use.html

https://pubmed.ncbi.nlm.nih.gov/12233862/

https://en.wikipedia.org/wiki/Laser_cutting

https://en.wikipedia.org/wiki/Laser_drilling

https://ophthalmologyltd.com/the-eye/eye-disorders/ophthalmic-laser/

https://en.wikipedia.org/wiki/Ultrafast_laser_spectroscopy

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA Tests**	**Generic Skills**		
		Assignments	**Quizzes**	**Current Affairs quizzes/presentations**
Marks(out of 45)	**30**	**5**	**5**	**5**
Remember			5	
Understand		5		
Apply	10			
Analyze	10			
Evaluate	5			
Create	5			5

Attendance – 5 marks

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	**Weightage %**
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

CORE PRACTICAL - II B
(PRACTICAL EXAMINATION AT THE END OF EVEN SEMESTER)

Course Code :	**Credits 2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

On taking this course the student will be able to

- Explain demonstrating various optical phenomena principles, working and application of optical instruments.
- Understanding the basic concept of electricity, magnetism, optics and properties of matter and their applications.

Course Outcomes: At the end of the Course, the Student will be able to Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) ,K5(Evaluating) ,K6(Creating)

CO 1	Develop skills to understand the concept of elastic constants of solid and acquire knowledge of applications.	K3
CO 2	Demonstrate experiments to involving various optical phenomena, principles, workings and application of optical instruments.	K2
CO 3	Apply standard method to calibrate the analog meters and to measure various physical quantities.	K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2

LIST OF EXPERIMENTS:
(any eight experiments)

1. Young's modulus - cantilever oscillations - Dynamic method
2. Rigidity modulus - Static torsion
3. Melde's string - frequency, Relative Density of a solid and liquid
4. Spectrometer - Grating N and λ - minimum deviation method
5. Air wedge - Thickness of a wire
6. Carey Foster's bridge - Temperature coefficient of resistance of a coil
7. Young's modulus - non uniform bending scale and telescope
8. Figure of merit of galvanometer (Mirror Galvanometer or Table Galvanometer).
9. Determination of the specific rotation of sugar solution using polarimeter
10. Characteristics of laser diode

Note:

- Use of Digital balance is permitted
- Error and statistical analysis of data
- Plotting graphs using software for a given data
- Learning to use software to detecting the values of electrical components and basics laws of physics

SEMESTER – 5

ELECTRICITY AND ELECTROMAGNETISM

Course Code :	**Credits 05**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

The aim of the course is

**to acquire knowledge about chemical effects of electric current and understand various circuit laws, network theorems*

**to enable the student to get strong foundation in magnetism, as well laws associated with it and their application*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Summarize electrostatics by Coulomb's law, Gauss theorem and capacitors	**K2,K3**
CO2	Compare and contrast D.C and A.C circuits	**K2**
CO3	Analyse the magnetic effect of electric current	**K4, K5**
CO4	Relate the principles and of electromagnetic and build simple circuits involving inductors	**K3**
CO5	Discuss the Four Maxwell's equation that govern all electromagnetic phenomena	**K4,K5**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	CONTENTS OF MODULE					Hrs	Cos
1	**Unit 1: Electrostatics** Coulomb's law-Electric field –continuous charge distribution-line, surface and volume charge density– electric dipole - electric field due to a point charge and dipole - potential and field due to a quadrapole Gauss law – Differential form of Gauss law - electric field due to uniformly charged spherical shell and conducting sphere. Capacitors – Principle - capacitance of parallel plate, spherical and cylindrical capacitor – effect of dielectric – capacitance of a parallel plate capacitor partly filled with dielectric slab - Gauss law in dielectrics – relation between E, D and P.					**1**	**CO1**
2	**Unit 2: DC and AC Circuits** DC Circuits 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 - condition for the discharge to be oscillatory - frequency of oscillation. AC Circuits AC voltage and current - Power factor and current values in AC circuit containing LCR - series and parallel resonant circuits- wattless current - star and delta connections – Transmission of power over long distances - electric fuses - circuit breakers.					**1**	**CO2**
3	**Unit 3: Magnetic effect of electric current** Biot and Savart's law - magnetic field intensity due to a solenoid carrying current - effect of iron core in a solenoid – magnetic field at a point due to circular current carrying coil - Helmholtz galvanometer --					**1**	**CO3**

	moving coil ballistic galvanometer - theory - damping correction – experimental determination of the absolute capacity of a condenser using B.G – experiment to compare the capacitance, emf of cells using B.G. Hyperloop India- introduction –need, status and advantages of hyperloop technology in India.						
4	**Unit 4: Electromagnetic induction and its applications** Faraday's laws of electromagnetic induction - inductance - determination of self-inductance of a coil using Anderson method - mutual inductance - experimental determination of absolute mutual inductance - coefficient of coupling - earth inductor - Uses of earth inductor - measurement of horizontal component of the earth's magnetic field - measurement of vertical component of earth's magnetic field – angle of dip - calibration of B.G. - Induction coil and its uses.					**1**	**CO4**
5	**Unit 5: Maxwell's equations and Electro Magnetic Theory** Basic equations - types of currents - vacuum displacement current - Maxwell's equations - Maxwell's equations in free space – boundary conditions – Reflection and transmission at normal incidence - propagation of electromagnetic wave in a non-conducting medium - Hertz Experiment - energy density of e.m. wave - Poynting's theorem					**1**	**CO5**

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TEXT BOOKS:

1. Electricity and Magnetism by R. Murugeshan, S.Chand & Co., New Delhi, (2017).
2. Electricity & Magnetism by M.Narayanamurthy & N.Nagarathnam, NPC pub., Revised edition (1996).
3. Electricity and Magnetism by Brijlal and Subrahmanyam; S.Chand & Co., New Delhi, (2000).
4. Electricity & Magnetism by D.Chattopadhyay and P.C. Rakshit, Books and Allied (P) Ltd.(2001).
5. Fundamentals of Electricity and Magnetism by B.D. Dugal and C.L. Chhabra, Shobanlal Nagin, S. Chand &

Co., 5th edition, New Delhi (2005).
6. Electricity & Magnetism by Sehgal DL, Chopra KL, Sehgal NK, Sultan Chand & Sons, (2020)

REFERENCE BOOKS:

1. Electricity & Magnetism by K.K.Tewari, S.Chand & Co., New Delhi (2002).
2. Introduction to Electrodynamics by D.J.Griffiths, Prentice Hall of India Pvt. Ltd., 3rd Edition, New Delhi (2003).

LINKS

https://youtu.be/X4EUwTwZ110?si=z4rkP6eoP_yU7gSj
https://youtu.be/f_MZNsEqyQw?si=CJZyvQJqf2c6mVB5
https://www.youtube.com/@nhmfl
https://youtu.be/km8MSWm39Z0?si=zCKbaZpQCevbyoCj
https://www.youtube.com/watch?v=_6bKJrGCuJk
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https://www.youtube.com/watch?v=tC6E9J925pY
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https://www.youtube.com/watch?v=evVb_i9NXsY
https://diademy.com/hyperloop
https://www.quora.com/What-is-Hyperloop-India-project-by-BITS-Pilani
https://courses.lumenlearning.com/physics/chapter/20-5-alternating-current-versus-direct-current/
https://www.elprocus.com/main-difference-between-ac-and-dc-currents/
https://www.tf.uni-kiel.de/matwis/amat/elmat_en/kap_2/backbone/r2_3_3.html
http://electricalenergydzumeshiko.blogspot.com/2017/08/electrical-energy-hyperphysics.html

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA Tests**	**Generic Skills**		
		Assignments	**Quizzes**	**Current Affairs quizzes/presentations**
Marks (out of 45)	**30**	**5**	**5**	**5**
Remember			5	
Understand		5		
Apply	10			
Analyze	10			
Evaluate	5			
Create	5			5

Attendance - 5 marks

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	20

Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

MATHEMATICAL METHODS IN PHYSICS

Course Code :	**Credits 5**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

The aim of this course is to

**Prepare the students to solve various physical phenomena using mathematical tools like vectors, matrixes, serves solution approach, special function.*

**To educate them necessary classical dynamics to understand various physical systems.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering), K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Discuss basic mathematical concepts in vector calculus and apply them to solve problems in hydrodynamics.	K2
CO2	Outline the fundamentals of matrixes and illustrate their importance in physics.	K2
CO3	Explain special functions such as Beta Gamma and series solution of Bessel and Legendre differential equations.	K2
CO4	Deduce Lagrangian equation of motion and compute solutions of various simple physical systems.	K5
CO5	Solve Hamiltonians of simple system and derivations of equation of motion.	K3

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

CO2	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	1	**2**	**3**	**3**	**2**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**3**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**3**

Sl NO	**CONTENTS OF MODULE**	**Hrs**	**COs**
1	**Unit 1: Vector Analysis** Scalar and vector fields: Gradient, divergence and curl - physical interpretation, Lamellar and solenoidal field – (only definition), line, surface and volume integrals – Gauss Divergence theorem – Stoke's theorem – Green's theorem - Application of vectors to hydrodynamics: Equation of continuity, Bernoulli's theorem.	**1**	**CO1**
2	**Unit 2: Matrices** Characteristic equation of a matrix – eigen values and eigen vectors – Cayley Hamilton theorem – Theorems on eigen values and eigen vectors – Hermitian and unitary matrices – Diagonalisation of matrices – matrices in Physics: rotation matrix, Pauli spin matrices (elementary ideas only).	**1**	**CO2**
3	**Unit 3: Special functions** Gamma and Beta functions – definition – Evaluation – other forms of the functions – symmetry property of Beta function- relation between Beta and Gamma functions - Series solutions of Bessel's differential equation and Legendre differential equation.	**1**	**CO3**
4	**Unit 4: Lagrangian formulation** Mechanics of a system of particles – Degrees of freedom – constraints – Generalised coordinates – Configuration space – principle of virtual work – D'Alembert's principle – Lagrange's equation of motion from D'Alembert's principle for a conservative system - Applications of Lagrange's equation: Atwood's machine, a bead sliding on uniformly rotating wire – simple pendulum	**1**	**CO4**

5	**Unit 5: Hamiltonian formulation** Phase space – Hamiltonian function H – physical significance – Hamilton's equations - Applications of Hamiltonian equations: Simple pendulum – motion of a particle in a central force field.	**1**	**CO5**

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TEXT BOOKS:

1. Satya Prakash (1996). Mathematical Physics, S. Chand & Sons, New Delhi.
2. J.C. Upadhyaya (2003). Classical Mechanics, Himalaya Publishing House, Mumbai
3. R. Murugesan (1996). Mechanics and Mathematical methods, S. Chand & Company, New Delhi.

REFERENCE BOOKS:

1. B.D. Gupta (1996). Mathematical Physics, Vikas Publishing House Pvt. Ltd, New Delhi.
2. H. Goldstein (1985). Classical Mechanics, Special Indian Student Edition Narosa Publishing House, New Delhi.

WEB LINKS:

https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-61-aerospace-dynamics-spring-2003/lecture-notes/lecture7.pdf

http://kestrel.nmt.edu/~raymond/classes/ph321/notes/lagrange/lagrange.pdf

http://www.iitg.ac.in/physics/fac/padmakumarp/Courses/PH101/Lecture7.pdf

https://www.physics.rutgers.edu/~shapiro/507/book3.pdf

https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Book%3A_Classical_Mechanics_(Tatum)/14%3A_Hamiltonian_Mechanics/14.03%3A_Hamilton's_Equations_of_Motion

https://cds.cern.ch/record/399399/files/p1.pdf

https://www.youtube.com/watch?v=PFDu9oVAE-g

https://www.mathsisfun.com/algebra/eigenvalue.html

https://medium.com/fintechexplained/what-are-eigenvalues-and-eigenvectors-a-must-know-concept-for-machine-learning-80d0fd330e47

SOLID STATE PHYSICS

Course Code :	**Credits :5**
L: T: P: S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

On taking this course the student will be able to learn and assimilate,

- *Fundamentals concepts of crystal structure.*
- *Different methods of X-ray analysis of crystal structure.*
- *Types of bonding in crystals.*
- *The behavior of dielectric and magnetic materials and their application.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Compare and contrast bonding in crystals, Summarize the fundamentals of crystals structure, Relate the significance of crystal study with industry and other applications, Experiment with X-ray diffraction techniques	**K2, K3**
CO2	Understand the lattice dynamics and thus learn the electricaland thermal properties of materials	**K2, K3**
CO3	Compare the different types of magnetic materials and discuss the necessary theory to understand their basic properties of magnetic materials	**K3, K4**
CO4	Analyze concepts of dielectrics; Categorize types of polarization and apply theory to inspect different types of materials	**K4, K5**
CO5	Appreciate the ferroelectric and super conducting propertiesof materials	**K4, K5**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO2	3	3	3	3	2	3	3	2	3	3	3	3	3	3	2
CO3	3	3	2	3	3	2	3	2	3	3	3	3	3	3	3
CO4	3	3	2	3	2	2	3	2	2	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	2	2	3	3	2	3	2	2

S. NO	CONTENTS OF MODULE	Hrs	Cos
1	**Unit 1: Bonding in solids, Crystal structure** Types of Bonding –Ionic Bonding – Covalent Bonding – Metallic Bonding – Hydrogen Bonding – Van der Waals Bonding - Bond Energy of NaCl Molecule Crystal system-Lattice-Basis – Unit Cell – Bravais Lattices –-Miller Indices – Procedure for finding Miller indices –Packing fraction of SC, BCC, FCC and HCP Structures – Structures of NaCl and Diamond Crystals – Diffraction of X-Rays in crystals– Bragg's Law in one dimension– Experimental Methods: Laue Method, Powder Method and Rotating Crystal Method	**1**	**CO1**
2	**Unit 2: Elementary lattice dynamics & Crystal Defects** Lattice Vibrations - Phonons - Linear Monoatomic one dimensional lattice- Dulong and Petit's Law – Einstein Theory of specific Heat of Solids –merits and demerits- Debye Theory of specific Heat of Solids – Debye's T^3 Law – merits and demerits Crystal Defects: point defects, line defects, surface defects, volume defects, effects of crystal imperfections	**1**	**CO2**

3	**Unit 3 : Magnetic properties of solids** Classification of Magnetic Materials – Properties of Dia, Para,Ferro, Ferri and Antiferromagnetism – Langevin's theory of Diamagnetism – Langevin'sTheory of Paramagnetism – Curie-Weiss Law – Weiss Theory ofFerromagnetism (Qualitative Only) – Heisenberg's Quantum Theory of Ferromagnetism – Domains – Discussion of B-H Curve –Hysteresis and Energy Loss – Soft and Hard Magnets – applications-Magnetic Alloys	**1**	**CO3**
4	**Unit 4: 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 - Langevin-Debye equation–Internal Field – Clausius-Mosotti Relation –Frequency Dependence of Dielectric Constant – Dielectric Loss – Effect of Temperature on Dielectric Constant – Dielectric Breakdown and its types –Properties, classification and applications of different insulating materials	**1**	**CO4**
5	**Unit 5: Ferroelectrics & Superconducting materials** Ferroelectric Effect: Ferroelectrics- Types of ferroelectric materials- Curie-Weiss Law – Ferroelectric Domains, P-E Hysteresis Loop Superconductivity: general properties, Onne's experimental results – critical temperature –critical magnetic field – Meissner effect –type-I and type-II superconductors –Thermal properties-entropy, specific heat, energy gap, London's equation and penetration depth – isotope effect – idea of BCS theory (no derivation)-Cooper pair, applications of superconductors: magnetic levitation, cryogenic cables, SQUID, BHEL HTSC Transformer	**1**	**CO5**

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TEXT BOOKS

1. Solid state Physics, Rita John,1st edition, TataMcGraw Hillpublishers (2014).
2. Solid State Physics , R L Singhal, Kedarnath Ram Nath& Co.,Meerut (2003)
3. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, Prentice-Hall of India (2006).
4. Introduction to Solids, Leonid V. Azaroff, Tata Mc-Graw Hill (2004)
5. Solid State Physics, N.W. Ashcroft and N.D. Mermin, Cengage Learning (1976)
6. Solid-state Physics, H. Ibach and H. Luth, Springer (2009)
7. Elementary Solid State Physics, 1/e M. Ali Omar, Pearson India. (1999)
8. Solid State Physics, M.A. Wahab, Narosa Publishing House, ND (2011)

REFERENCE BOOKS

1. Charles Kittel (2004). Introduction to Solid State Physics (7th edition), John Wiley and sons.
2. V.Raghavan (2004). Material Science and Engineering First Course (5th edition), Prentice Hall (India) Pvt. Ltd.
3. S.O. Pillai (2005). Solid state physics (6^{th} edition), New Age International Pvt.Ltd.
4. A.J. Dekker (2005). Solid State Physics, Macmillan India Ltd.
5. S.L. Kakani and L. Hemrajani (1997). Text Book of Solid State Physics, Sultan Chand and sons, New Delhi.
6. R.K Puri & V K Babber (2010)– Solid State Physics – S.Chand & Co. New Delhi.

WEB LINKS

https://youtu.be/B1JzFAD1GAo
https://youtu.be/cND8JvpUN5k?si=iyh_8w1kxJXAqj_m
https://youtube.com/playlist?list=PL04QVxpjcnjjl1_KX5BGBP78jqj8KioNB&si=ClKIAuV6-9oLK2x5
https://www.icts.res.in/research/statphys
https://www.rri.res.in/research/soft-condensed-matter
https://www.youtube.com/live/mymm1c-DMxc?si=sgB5cd005H_6DPJ7
https://youtu.be/QNOmfqAO7bg?si=OZarWsWz5ZRwWpMP

ELECTRONIC DEVICES AND APPLICATIONS

Course Code :	**Credits 5**
L: T: P: S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

- *By studying this course student will be able to acquire theoretical and application orientation knowledge on semiconductor and various semiconductor devices.*
- *They will be able to construct various electronic circuits and study them in detail.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the properties of semiconductors, their basic configuration, their characteristics, construct and analyze various electronic circuits which have very relevant applications, classify various rectifier circuits based on their efficiency and components used. Acquire the information about various Govt. programs/ institutions in this field.	**K2,K3,K4**
CO2	To extend the ideas of diodes to understand transistors, build amplifier circuits.	**K3**
CO3	Classify various transistors amplifier circuits based on their nature, characteristics and working.	**K3**
CO4	Develop oscillators, models using amplifiers construct, classify and categorize various types of oscillators. Extend these oscillators towards designing different types of multivibrators.	**K3**
CO5	Identify the need for special semiconductor devices, Extend the theoretical knowledge in construction of these devices and analyze their behavior using application oriented electronic circuits. Gain the knowledge of government initiative virtual labs	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	2	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	2	3

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Special diodes** Energy bands in a solid - intrinsic semiconductors- elemental and compound semiconductors - doping- extrinsic semiconductors - n type and p type semiconductors- pn junction – volt – ampere characteristic curve – biasing the pn junction - diode as rectifier – half wave rectifier – full wave rectifier – center tapped, bridge rectifier – efficiency and ripple factor – Zener diode – Zener diode as voltage regulator. LED-Application of LED as seven segment display-Photodiode-Characteristics-Photodiode in alarm circuits- Overview of initiatives Government of India: Software-Technological Parks of India under MeitY; Indian semiconductor mission – NIELIT- Semiconductor Laboratories under Dept. of Space	**1**	**CO1**

2	**Unit 2: Transistors** Transistor types-symbol- Transistor action: working of npn transistor - working of pnp transistor. Characteristics of common base, common emitter, common collector configurations - Expression for α,β and γ - relation between α,β and γ – comparison of transistor connections- transistor as an amplifier- load line analysis - cut off, saturation, operating point.	**1**	**CO2**
3	**Unit 3 : Transistor amplifiers** Faithful amplification- proper zero signal collector current, proper minimum V_{BE} and V_{CE} -Transistor biasing techniques –Base resistor method- emitter bias method – voltage divider bias method Application of transistor as an Amplifier-Design of Single stage-double stage RC coupled amplifiers- frequency response- Band width- Negative feedback –CC amplifier as an Emitter follower - construction and application (no analysis)	**1**	**CO3**
4	**Unit 4 : Oscillator, switching circuits and wave shaping circuits** Oscillators- Sinusoidal Oscillator-Oscillatory Circuit-Positive feedback - Essential parts of transistor oscillator –Barkhausen criterion- Hartley oscillator – phase shift oscillator – Wein's bridge oscillator – expression for frequency. Types of multivibrators – Astable – monostable and bi-stable multivibrators-Clippers-Clampers	**1**	**CO4**
5	**Unit 5: Special semiconductor devices** Junction field transistor (JFET) – Principle – working - Difference between JFET and Bipolar transistor- characteristics –JFET parameters- UJT – characteristics – UJT – working – Equivalent circuit of UJT- UJT as relaxation oscillator – SCR – Working-Equivalent circuit of SCR-characteristics – SCR as a full wave rectifier- SCR as switch- Overview of virtual labs offered by MoE	**1**	**CO5**

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TEXT BOOKS:

1. V.K. Metha (2006). Principles of electronics (10th edition), S.Chand and company.

2. M. K. Bagde, S.R. singh and Kamal Singh (2002). Elements of electronics, S.Chand and company.

3. R.S. Sedha (1998). A Textbook of Applied Electronics, S. Chand and Company, New Delhi.

4. Gupta and Kumar (1991). Handbook of Electronics, Pragati Prakashan, Meerut.

REFERENCE BOOK

1. Allen Mottershead (1989). Electronic devices and circuits, Prentice Hall of India.

2. Millman and Halkias (2005). Integrated electronics, Tata McGrawHill Publication, New Delhi.

3. Mitchell E Schultz (2006). Grob's Basic Electronics (10th Edition), Tata McGraw Hill., NewDelhi.

WEB LINKS:

https://youtu.be/NMD4KECE-7I

https://youtu.be/KynKHr2cXgk

https://youtu.be/MNp-WxkF5h4

https://youtu.be/rERBi7Ao9To

https://youtu.be/dQbrI_iQWig
https://be-iitkgp.vlabs.ac.in/Introduction.html
https://www.meity.gov.in/emerging-technologies-division

ELECTIVE 1

(Any one of the three below)

I a. APPLIED ELECTRONICS

Course Code :	**Credits 4**
L: T: P: S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

This course helps the students to gain basic ideas of the construction and working of digital electronic devices / circuit to understand the fundamentals of communication systems,

design circuit for solving problems.

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Summarize the characteristics of operational amplifier its parameters and construct circuit to perform various mathematical operations	K2,K3
CO2	Solve simultaneous equation and differential equation using electronic circuit analyzes the performance of electronic circuit in handling mathematical equations. Design circuits to generate waveform to perform analog computation.	K3,K4,K5
CO3	Extend their knowledge of digital analog circuit to understand 555 times, design circuits which are very commonly used in various applications.	K4
CO4	Compare digital and analog systems, discuss the need for conversion and design circuits for the same.	K4,K5
CO5	Explore various applications of operational amplifier	K3, K5

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Operational Amplifier fundamentals** Double ended differential Amplifier, differential gain, Common-mode gain, CMRR, Block diagram representation of a typical Op-amp, schematic symbol. Op-Amp Parameters-Input Impedance, Output impedance, input offset voltage, Open Loop Voltage gain, input bias current, slew rate Op-amp - Inverting & non-inverting configuration, Summing amplifier, Difference amplifier, Differentiator, integrator, comparator using op-amp	**1**	**CO1**
2	**Unit 2: Analog computation and waveform generation** Analog computation and waveform generation using op amp - solving simultaneous equation – second order differential equation – square wave generation (astable operation) – sine wave generation – Wien's Bridge oscillator.	**1**	**CO2**
3	**Unit 3: 555 Timer** 555 Timer – internal block diagram – and working – applications – Schmitt Trigger – astable, monostable multivibrator.	**1**	**CO3**
4	**Unit 4: D/A and A/D converters** Introduction – Binary weighted resistor D/A converter – R -2R ladder method – resolution A/D converter – counter type – successive approximation type – resolution.	**1**	**CO4**
5	**Unit 5: Applications of Operational amplifier** Voltage regulation – Comparator – Zero crossing detector – Active filters – Low pass, High pass, Band pass – Voltage to current converter – Logarithmic amplifier	**1**	**CO5**

TEXT BOOKS:

1. Ramakant A. Gayakwad (1994). Op- AMPs and Linear Integrated Circuits, Prentice Hall of India.

2. V. Vijayendran, S. Viswanathan (2005). Introduction to Integrated Electronics, Printers and

publishers Pvt. Ltd, Chennai.

3. Millman and Halkias (2005). Integrated electronics, Tata McGrawHill Publication, New Delhi.

REFERENCE BOOKS:

1. D. Roy Choudhury and Shail Jian (2003). Linear integrated circuits, New Age International (P) Ltd.

2. J. Millman and C. Halkias (2001). Integrated Electronics , Tata McGraw Hill, New Delhi.

WEB LINKS:

https://learnabout-electronics.org/Amplifiers/amplifiers60.php

https://www.youtube.com/watch?v=kiiA6WTCQn0

https://www.youtube.com/watch?v=HicZcgdGxZY&list=PLwjK_iyK4LLCnW-df-_53d-6yYrGb9zZc

https://www.youtube.com/watch?v=66KqmPRy1uI

https://courses.lumenlearning.com/zeliite115/chapter/reading-read-only-memory/

http://www.555-timer-circuits.com/

I b NUMERICAL METHODS

Course Code :	**Credits 4**
L: T: P: S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives: *By studying this course student will be able to learn fundamentals of Numerical methods*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Solve simultaneous equations using method of triangularisation	**K2,K3**
CO2	Find the inverse of a matrix using Gauss Jordan Method	**K3**
CO3	Solve Algebraic, Transcendental and Differential Equation using different methods	**K3,K4**
CO4	To fit a curve for the given data using principles of least squares	**K3,K4**

CO5	Integrate the functions using different rules like Simpsons 1/3 rule	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S. NO	**CONTENTS OF MODULE**	**Hrs**	**COs**
1	**Unit 1: Method of Triangularisation** - Gauss elimination method - Inverse of a matrix - Gauss- Jordan method	**1**	**CO1**
2	**Unit 2: Numerical solution of algebraic, transcendental and differential equation** Bisection method – Regula falsi method - Newton - Raphson method - - Horner'smethod - Solution of ordinary differential equation - Euler's method.	**1**	**CO2**
3	**Unit 3: Interpolation** Finite differences – Operators $\Delta\nabla$ D – Relation between operators –Linear interpolation – Interpolation with equal intervals – Newton forward interpolation formula –Newton backward interpolation formula.	**1**	**CO3**

4	**Unit 4: Curve fitting** Principles of least squares - fitting a straight line - linear regression - fitting an exponential curve.	**1**	**CO4**
5	**Unit 5: Numerical integration** Trapezoidal Rule - Simpson's 1/3 rule and 3/8 rule - Applications - Weddle's rule	**1**	**CO5**

TEXT BOOKS:

Trapezoidal Rule - Simpson's 1/3 rule and 3/8 rule - Applications - Weddle's rule Books for Study:

1. M.K.Venkatraman, (1990) Numerical methods, National Publishing Company.

2. V. Rajaraman, (2003) Numerical methods, Prentice - Hall India Pvt. Ltd.

3. P. Kandasamy, K. Thilagavathy and K. Gunavathy, (2002) Numerical methods, S. Chand & Co.

REFERENCE BOOKS:

1. Numerical methods for Scientific and Engineering computation, Jain Iyenge and Jain, New Age International (P) Ltd. (2004).

2. Numerical methods, S.S. Sastry, Prentice Hall of India Pvt. Ltd., New Delhi (2003).

Web Site:
https://www.tat.physik.uni-tuebingen.de/~kokkotas/Teaching/Num_Methods.html

ELECTIVE I c. PROBLEMS SOLVING SKILLS IN PHYSICS

Course Code :	**Credits 4**
L: T: P: S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

Physics without problems "pressure"

To inculcate the problem solving skills in different areas of physics

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Think Laterally and provide necessary solution	**K2,K3**
CO2	Use appropriate mathematical methods to given problem	**K3**
CO3	Verify whether the answer obtained is correct or not	**K3,K4**
CO4	Use logical and other skills to solve problem	**K3,K4**
CO5	Clear all the entrance examinations leading higher education in premier institutions	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S. NO	CONTENTS OF MODULE	Hrs	Cos
1	**UNIT 1: Problems in mechanics** Newton laws of motion for various systems (1, 2 and 3 dimension), Conservation laws and collisions, Rotational mechanics, central force, Harmonic oscillator, special theory of relativity	**1**	**CO1**
2	**UNIT 2: Problems in thermal physics** Kinetic theory– Laws of Thermodynamics – Ideal Gas law–Various Thermodynamic process– Entropy calculation for various process– Heat engine–TS and PV diagram–Free energies and various relations	**1**	**CO2**
3	**UNIT 3: Problems in electricity & magnetism** Electrostatics– calculation of Electrostatic quantities for various configurations– Conductors, Magneto statics– Calculation of Magnetic quantities for various configuration, Electromagnetic induction, Poynting vector, Electromagnetic waves.	**1**	**CO3**
4	**UNIT 4: Problems in quantum mechanics** Origin of Quantum mechanics– Fundamental Principles of Quantum mechanics– potential wells and harmonic oscillator– Hydrogen atom	**1**	**CO4**
5	**UNIT 5: Problems in general physics & mathematics** Plotting the graphs for various elementary and composite functions– Elasticity–Viscosity and surface tension– fluids– Buoyancy–pressure– Bernoulli's theorem–applications– waves and oscillations, Errors and propagation of errors	**1**	**CO5**

TEXT BOOKS:

1. Charles Kittel, Walter D knight, Mechanics (in SI units) (Berkeley Physics course–volume 1), Tata McGraw Hill publication, second edition.

2. S.C.Garg, RM Bansal &CK Ghosh, Thermal physics, (Tata McGraw Hill Publications), 1stedition.

3. E.M.Purcell, Electricity &magnetism(in SI units), Tata Mcgraw hill Publication, 2ndEdition.

4. N.Zettili, Quantum mechanics, Wiley Publishers, second edition.

5. David. J.Griffith, Introduction to quantum mechanics, Pearson cPublications, second edition

REFERENCE BOOKS:

6. Halliday&Resnick, Fundamentals of Physics, Wiley Publications, 8thEdition

7. Nelkon and Parker, Advanced level physics, CBS publishers, 7thedition

8. AmithAgarwal, Play with graphs, ArihantPublications

9. D.S.Mathur, Properties of matter, S.Chand Publications, 11th Edition

CORE PRACTICAL III A
(Practical Examination at the end of the Semester 5)

Course Code :	**Credits :2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

This course opens the window to the student about

- *The design of the concepts of electricity, magnetism, light that are learnt in the theory, providing hands on learning experience.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	The student will be able to Analyze the nature of light both quantitative and quantitatively.	**K4**
CO2	Apply the theory the design basic electrical circuits.	**K3**
CO3	Associate theoretical concepts like seebeck effect and electromagnetism with practical demonstration.	**K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

List of General experiments (Any 7 experiments)

1. Young's modulus – Koenig's method – Non uniform bending.
2. Spectrometer – Cauchy's constants
3. Field along the axis of a circular coil – Deflection Magnetometer – B_H.
4. Newton's Rings - R_1 R_2 and μ of a long focus convex lens.
5. Figure of merit – B.G.
6. Comparison of Capacitances – B.G.

7. Calibration of high range Voltmeter – Potentiometer
8. Absolute mutual inductance of an inductance coil -B.G.
9. EMF of Thermocouple – Potentiometer (199 P method).
10. Hysteresis loop of a ferromagnetic material-B-H Curve
11. Virtual carbon dating
    https://www.sciencecourseware.org/VirtualDating/

CORE PRACTICAL IV A
(Practical Examination at the end of the Semester 5)

Course Code :	**Credits 2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

- *This course helps the students to acquire practical knowledge to design basicelectrical circuits using diodes, transistors etc.*
- *Relate digital electronics concepts learnt in lecture session toconstruct digital circuits.*

Course Outcomes:

At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Substitute basic laws and theories learnt in class to use junction diode, Zener diode, transistors etc.	K2
CO2	Apply the theory to design basic electrical circuits.	K3
CO3	Analyze the response of various electrical devices using the circuits construction.	K4
CO4	Interpret the application of basic circuit to create amplification, oscillation, regulate power supply, logical combinations etc.	K4

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

List of Basic Electronics Experiments (Any 7 experiments)

1. Centre tapped Full wave Rectifier
2. Zener regulated power supply – 9V - regulation characteristics.
3. Transistor characteristics – CE mode.
4. Single Stage RC coupled amplifier – gain – frequency response.
5. Hartley oscillator
6. NAND as universal building block
7. Half adder – full adder using IC - XOR, AND and OR gates.
8. De Morgan's theorem – Verification
9. 4 bit ripple counter using IC 7473
10. Voltage regulation using IC 7805
11. Analyzing (a) Diode I-V characteristics (b) Rectifier characteristics using EXP EYES – Software**.**

CORE PRACTICAL V A

(Practical Examination at the end of the Semester 5)

Course Code :	**Credits 2**
L: T: P: S : 0:0:2:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

On taking this course the student acquires

- Practical knowledge to design electronic circuits using OP-AMP-555 timer, microprocessor and related software.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Solve combinational circuits of linear IC's and compute the necessary output.	**K3**
CO2	Relate the theory learnt to design OP-AMP and IC-555 circuits.	**K3**
CO3	Apply the algorithm learnt in classroom to write and execute assembly language program using 8085 Microprocessor.	**K3**

CO4	Correlate theoretical and practical ideas with software	**K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

List of Applied Electronics (Any 7 experiments)

1. OP Amp – IC 741 – Inverting amplifier, non –inverting amplifier, unity follower.
2. OP Amp – Square wave generator.
3. OP Amp – Wien's bridge oscillator.
4. 555 Timer – Schmitt Trigger.
5. D/A convertor – 4 bit binary weighted resistor method.
6. µp- 8085 8 bit addition, multiplication.
7. µp - Sorting in ascending order – 8 bit data.
8. µp - Finding the smallest number in an array.
9. OP Amp – Solving simultaneous equation
10. Analyzing OP Amp inverting and non-inverting amplifier using EXP EYES – Software.

SEMESTER – 6

RELATIVIY AND QUANTUM MECHANICS

Course Code :	**Credits 5**
L: T: P: S : 6:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

The aim of this course is to acquire sufficient knowledge in relativity, properties of matter wave, operator formalism, schrodinger wave equation and applications.

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	To describe the basic concepts of relativity and to translate the mathematical equations to physical concepts and vice-versa.	K2
CO2	To identify the wave nature of matter; to illustrate the wave-particle duality with experiments.	K3
CO3	To apply the concepts of basic postulates Quantum mechanics; compute the Schrodinger equation for the systems To associate the Quantum mechanics wave functions with the corresponding operators and eigen values	K3
CO4	To deduce angular momentum operators. To evaluate various commutator relations of orbital and spin angular momenta.	K4
CO5	To solve the Schrodinger equation of physically important one dimension potentials. To estimate the shape of wave functions; to conceive methods such as separation of variables to solve three dimension problems.	K4, K5

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**2**

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Relativity** Frame of reference – Gallilean transformation – Michelson – Morley experiment – Postulates of special theory of relativity – Lorentz transformation – length contraction – time dilation – concept of simultaneity –Doppler effect- addition of velocities – variation of mass with velocity – Einstein's mass energy relation – relativistic momentum energy relation Elementary ideas of general theory of relativity – Principle of equivalence – Bending of rays of light due to gravitational field- shift of spectral lines - Minkowski's four dimensional space.	**1**	**CO1**
2	**Unit 2: Wave nature of matter** Matter wave – phase and group velocity – wave packet – expression for de Broglie wavelength – experimental confirmation of particle waves – Davisson and Germer's experiment – G.P. Thomson's experiment – applications of electron diffraction – electron microscope – principle of complementarity – Heisenberg's uncertainty principle – experimental illustration of uncertainty principle – applications of uncertainty principle.	**1**	**CO2**
3	**Unit 3: Schrodinger's Equation** Inadequacy of classical mechanics – basic postulates of wave mechanics – properties of wave function – probability interpretation of a wave function – operator formalism – linear operators – eigen values and eigen functions-Hermitian operator-properties of Hermitian operator-observable-operators for position, linear momentum and angular momentum components- expectation value — commutativity and compatibility – Schrodinger's equation - steady state and time dependent form.	**1**	**CO3**
4	**Unit 4: Angular Momentum** Orbital angular momentum operators and their commutation relations – elementary ideas of spin angular momentum of an electron – Pauli matrices – spin matrices - properties.	**1**	**CO4**

5	**Unit 5: Solving of Schrodinger Equation for simple problems** One dimensional problems: Free particle, particle in a box, Barrier penetration problem- quantum mechanical tunneling, linear harmonic oscillator Higher dimensional problems: rigid rotator, Hydrogen atom	**1**	**CO5**

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TEXT BOOKS:

1. Brijlal Subramanyam, (1990), Mechanics and Relativity, S. Chand & Co., New Delhi, ISBN: 8121926114

2. G. Aruldas, (2002), Quantum mechanics, Prentice Hall India.
ISBN: 9789390464869

3. R. Murugeshan and Kiruthiga Sivaprasath, (2008), Modern Physics, S. Chand & Co. ISBN:9789352533107

4. Satyaprakash, (2009), Quantum Mechanics, Pragati Prakashan, Meerut.
ISBN: 9789387812352

REFERENCE BOOKS:

1. P.M. Mathews and S. Venkatesan, (2005), A text book of Quantum mechanics, Tata McGraw – Hill, New Delhi. ISBN: 9780071322140
2. Arthur Beiser. (1997), Concepts of modern physics, (5th edition), Tata McGraw – Hill, New Delhi. ISBN: 9780072448481
3. A. Ghatak and Loganathan, Quantum mechanics, McMillan India Pvt. Ltd. ISBN: 9781402018503
4. V.K. Thankappan, (2003), Quantum Mechanics, New Age International (P) Ltd. Publishers, New Delhi. ISBN: 9781781830871

WEB LINKS:

https://youtu.be/TcmGYe39XG0

https://www.youtube.com/playlist?list=PL2IXS7LFVI82LQCu3OalA26DG3awjH4kF
https://youtube.com/playlist?list=PL2IXS7LFVI83e_3ROCP5Fk4F4rxhlUq3F&si=wCES5R5lrfl1Nq8p
https://youtu.be/_SbmkXE5s9U?si=p1pUS5I8_t0we_Fm
https://youtube.com/playlist?list=PLKjfqpIvVuwRNbjRdVUnHK4Vy6yOcISs0&si=fHdpPn7ULNz95jiZ
https://youtube.com/playlist?list=PLqLyTdPNhQZwfLoL4QMeI6scnyH1c__tE&si=LKa8HtQrFSWIaUIe

NUCLEAR AND PARTICLE PHYSICS

Course Code :	**Credits 5**
L: T: P: S : 6:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives: *On taking course the student will be able to*
**Gain an insight into the theories of nuclear structure & radioactivity.*
**Understand the working of various particle detectors and accelerators.*
**Obtain knowledge about various nuclear reactions and their application.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Characterize nuclei based on their general properties and describe qualitatively models of nuclear structure.	**K2**
CO2	Outline the mechanism of radioactivity and summarize the necessary theories related to it.	**K3**
CO3	Relate the properties of nature of nuclear system with radiation detectors and particle acceleration	**K3,K4**
CO4	Paraphrase basic aspects of nuclear reaction and calculate Q-value and realize the nature of the reaction Apply the fission and fusion well as nuclear energy in nuclear reactors and stellar energy in star.	**K3,K4**
CO5	Appraise the theoretical prediction of nuclear reaction to understand the host of sub atomic particle nature reveals.	**K5**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**1**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**3**

CO3	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: General Properties of Nuclei** Nuclear size, charge, mass- isotopes, isobars, isotones-determination of nuclear radius-mirror nucleus - mass defect and binding energy-packing fraction – nuclear spin – magnetic dipole moment – electric quadrupole moment nuclear models – liquid drop model – Weizacker semi empirical mass formula – shell model and magic numbers – nuclear forces-meson theory of nuclear force(qualitative)	**1**	**CO1**
2	**Unit 2: Radioactivity** Natural radioactivity – properties of alpha, beta and gamma rays - – determination of e/m of alpha particle – determination of range of alpha particle– Geiger Nuttal experiment and law – α-ray spectra – Gamow's theory of α-decay (qualitative study) - beta ray spectra – neutrino hypothesis – violation of parity conservation – gamma rays – determination of wavelength - internal conversion – nuclear isomerism - law of disintegration – half life and mean life period – units of radioactivity – transient and secular equilibrium – radiocarbon dating – age of earth Artificial radioactivity- radio isotopes and its uses.	**1**	**CO2**
3	**Unit 3: Radiation Detectors and Particle Accelerators** Gas Detectors-Ionization chamber – G.M. Counter and resolving time – scintillation counter – photo multiplier tube – application in medical physics: dosimetry Linear accelerators – cyclotron – synchrocyclotron – betatron	**1**	**CO3**

4	**Unit 4: Nuclear Reactions** Conservation laws – nuclear reaction Kinematics-Q-value-threshold energy – classification of neutrons-nuclear fission – chain reaction – critical mass and size – nuclear reactor- transuranic elements- breeder reactor - nuclear fusion – thermonuclear reactions – sources of stellar energy. Importance of commissioning PFBR in our country- heavy water disposal, safety of reactors: Seismic and floods- introduction to DAE, IAEA	**1**	**CO4**
5	**Unit 5: Cosmic rays & Elementary Particles** Discovery of cosmic rays- primary and secondary cosmic rays- cascade theory of cosmic ray showers- altitude and latitude effects- discovery of positron-pair production- annihilation of matter Classification of elementary particles – particles and antiparticles – anti matter - fundamental interaction – elementary particle quantum numbers – isospin and strangeness – conservation laws- A note tachyons proposed ECG Sudharshan	**1**	**CO5**

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TEXT BOOKS:

1. N. Subrahmanyam and Brijlal (1996). Atomic and nuclear Physics, S. Chand & Co., New Delhi.
2. Tayal D.C (2006). Nuclear Physics, Himalaya publishing House, Mumbai.
3. R.C. Sharma (2000). Nuclear Physics, K. Nath& Co., Meerut.
4. R. Murugesan and Kiruthiga Sivaprasath (2005). Modern physics, S. Chand and Company, New Delhi.

REFERENCE BOOKS:

1. R.R. Roy and B.P. Nigam (1997). Nuclear Physics, New Age International (P) Ltd., New Delhi.
2. Irving Kaplan (2002**).** Nuclear Physics, Narosa Publishing house, New Delhi.
3. Faiz M. Khan and John P. Gibbons (2014). Khans' The Physics of radiation therapy, 5th edition, Wolters Kluwer Publications, USA.

WEB LINKS:

https://www.ias.ac.in/article/fulltext/reso/024/02/0129-0167
http://hyperphysics.phy-astr.gsu.edu/hbase/nuccon.html
http://hyperphysics.phy-astr.gsu.edu/hbase/Nuclear/nucstructcon.html
http://hyperphysics.phy-astr.gsu.edu/hbase/Nuclear/radact.html
http://hyperphysics.phy-astr.gsu.edu/hbase/Particles/parcon.html
https://www.int.washington.edu/users/mjs5/Class_560/lec560_1/node2.html
https://brilliant.org/wiki/nuclear-decay/
https://www.britannica.com/science/radioactivity
https://www.youtube.com/watch?v=1iOI8PIosVU
https://home.cern/science/accelerators/how-accelerator-works

https://digilib.dae.gov.in/DAEHomePage
https://phet.colorado.edu/en/simulations/radioactive-dating-game
https://www.sciencecourseware.org/VirtualDating/
https://www.youtube.com/playlist?list=PL2IXS7LFVI81ZgNWIXaI0wnkr-lYmWofA

(Any one of the three below)

Elective II a. Digital Circuits and Design

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives*: By studying this course student will be able to learn fundamentals of Boolean algebra synthesis of Boolean functions and combinational and sequential circuits and basics of IC fabrication technology.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Interpret real life situations using AND, OR, NOT, basic logic gates and extend their ideas to universal building blocks. Classify numbers based on various number systems using digital technology and apply to solve binary operation.	**K2,K3**
CO2	Infer operations using Boolean Algebra, simplify using mapping techniques. Construct analyze digital circuits - combinational and sequential using logic circuits	**K3**
CO3	Build sequential circuits and analyze working	**K3,K4**
CO4	Construct digital circuits – registers and counters analyze their working.	**K3,K4**
CO5	Explain basic of IC technology various process during fabrication and integration. Gain the knowledge of Qbit, biological synthetic circuits, Digital India.	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/	**PO**										**PSO**				
PSO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**

CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S. NO	**CONTENTS OF MODULE**	**Hrs**	**COs**
1	**Unit 1 : Number system and Boolean Algebra** Introduction to number system -binary, octal and hexadecimal -Binary Operations-Addition-Subtraction, Multiplication and Division. Subtraction using 1's and 2's complement; BCD system. Boolean algebra-DeMorgan's theorem-basic logic gates-NAND and NOR as universal gates	**1**	**CO1**
2	**Unit 2: Combinational Logic Design** Minterm-SOP- Karnaugh map representation and simplification, pair, quad, octet -2,3,4 Variable K Maps-Don't care conditions- Maxterm-POS. Arithmetic circuits - half and full adders, half and full subtractors using logic gates- using NAND gates- BCD adder- Multiplexers-Demultiplexers – Decoders (3 to 8) Encoders (8 to 3)- BCD to seven segment decoders	**1**	**CO2**
3	**Unit 3: Flip flops** Sequential logic circuits – 1-bit memory, Latch, S R Flip flop using NAND gates –Using NOR gates, J-K Flip flop – Race-around condition – Master Slave Flip flop – Conversion of JK flip flop to D flip flop - T flip flop.	**1**	**CO3**
4	**Unit 4: Registers and Counters** Registers, Modes of operation, shift right, shift left registers- Applications of registers- Conversion of registers to Ring Counters, Johnson Counter- Counters (4 bit). Ripple (or) Asynchronous Counters —Up - down counters – decade counter – BCD counter- Synchronous counters-Design of Synchronous Counters –Application – Random sequence generator- Synchronous BCD counter	**1**	**CO4**

5	**Unit 5: Introduction to IC technology** Basic fabrication steps: epitaxial growth, oxidation, photolithography, etching, diffusion, ion implantation, film deposition and metallization. Note on to Qubit- Overview of DeitY, Digital India- Introduction to Synthetic Biological circuits	**1**	**CO5**

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TEXT BOOKS:

1. V. Vijayendran (2005). Introduction to Integrated Electronics, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.
2. D Uthra and V Renganayaki (2023). Digital Electronics- oor arimugam, UGC e-kumbh
3. R.P.Jain (1996). Digital Electronics by Practice Using Integrated Circuits, Tata McGraw Hill.
4. J. Millman and C. Halkias (2001). Integrated Electronics, Tata McGraw Hill, New Delhi.
5. Malvino Leach (1992). Digital Principles and Application (4th Edition), Tata McGraw Hill.

REFERENCE BOOKS:

1. D. Roy Choudhury and Shail Jain (2003). Linear Integrated Circuits, New Age Internation (P) Ltd.
2. I.J. Nagrath (1999). Electronics - Analog and Digital, Prentice Hall of India, New Delhi.

WEB LINKS:

Digital Electronics videos created by our alumni
https://youtu.be/JLz7qASICYU

https://youtu.be/u6m4lI-qZ58

https://youtu.be/C0HsQykDdKg

Other sources

https://youtu.be/-paFaxtTCkI
https://youtu.be/s1DSZEaCX_g
https://ekumbh.aicte-india.org/allugcbook.php#
https://dst.gov.in/national-quantum-mission-nqm
https://www.cdot.in/cdotweb/web/quantumAlliance.php#:~:text=The%20India%20Quantum%20Alliance%20is,%2C%20academia%2C%20startups%2C%20etc.
https://dst.gov.in/national-quantum-mission-unprecedented-opportunity-india-leapfrog-quantum-computing-technologies

https://www.digitalindia.gov.in/programme-pillars/

ELECTIVE II b. GEOPHYSICS

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

To make the students understand the basic principles of geophysics, geomagnetism and concepts of earthquakes.

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Understand the different layers of the atmosphere.	**K2,K3**
CO2	Know the details about geophysical and chemical methods	**K3**
CO3	Gain sufficient knowledge on the earthquakes and Tsunami warning systems	**K3,K4**
CO4	Have an idea on geomagnetism and gravity	**K3,K4**
CO5	Understand the radioactivity of the earth	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S. NO	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**Unit 1: Physics of the earth** Introduction to Geophysics- Earth as a member of the solar system-Atmosphere-Ionosphere- Asthenosphere-Lithosphere-Hydrosphere and Biosphere-Meteorology-Oceanography and Hydrology	**1**	**CO1**
2	**Unit 2: Geophysical and geochemical methods** Geophysical methods: Geo referencing using Arc GIS software- Electrical methods- Quatitative interpretation of Vertical Electrical Sounding curves –Preparing pseudo cross section for electrical resistivity data and interpretation. Geochemical methods: Introduction-Principles of groundwater chemistry-Sources of contamination- Ground water quality analysis using geochemical methods.	**1**	**CO2**
3	**Unit 3: Introduction to seismology** The earth's interior and crust as revealed by earthquakes-Rayleigh waves and Love waves- Elastic rebound theory-Continental drift -Earthquake magnitude and intensity-Horizontal seismograph and seismograph equation-Tsunami-Causes and Impacts-Tsunami warning systems.	**1**	**CO3**
4	**Unit 4: Geomagnetism and gravity** Historical introduction –The physical origin of magnetism-Causes of the main field-Dynamo theory of earth's magnetism. Gravitational potential-Laplace's equation and Poisson's equation-Absolute and relative measurements of gravity-Worden gravimeter.	**1**	**CO4**
5	**Unit 5: Geochrology and geothermal physics** Radioactivity of the earth-Radioactive dating of rocks and minerals-Geological time scale- The age of the earth. Flow of heat to the surface of the earth –Sources of heat within the earth-Process and heat transport and internal temperature of earth.	**1**	**CO5**

TEXT BOOKS:

1. Arthur W.Hounslow, 1995. Water quality data -Analysis and Interpretation, Lewis publishers

Washington D.C.
2. Cook A.H, 1973. Physics of the Earth and Planets, McMillanPress, London.
3. John Milsom, Field geophysics-The geophysical field guide III edition, Wiley publications, England.
4. Krauskopf. K.B, 1967. Introduction to Geochemistry, McGraw Hill.
5. RamachandraRao, 1975. Outline of geophysical prospecting-a manual for geologists, University of Mysore.

REFERENCE BOOKS:

1. Garland, Introduction to Geophysics (11 edition), WB Saunder Company, London,
2. William Lowrie, Fundamentals of Geophysics (11Edition), Cambridge press UK.
3. Nils-Axel Morne, Geochronology-Methods and case studies, INTECH publications.
4. John Raferty, 2011. Geochronology –Dating and Precambrian time –The beginning of the world as we know it, Britannica Educational publishers, New York-.
5. Don L.Anderson, 1989. Theory of the Earth, Blackwell scientific Publications-UK.

ELECTIVE II c. MEDICAL PHYSICS

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives: *To gain a broad and fundamental understanding in Physics while developing particular expertise in medical applications Learning Outcomes*:

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Functional knowledge regarding the need of radiological protection	**K2,K3**
CO2	Gain knowledge on diagnostic and therapeutic application like X-rays, Ultrasound imaging , Magnetic resonance imaging etc.,	**K3**
CO3	Gets familiar with various detectors used in medical imaging	**K3,K4**
CO4	Hands on training which will be useful for the students to enter the job market	**K3,K4**

CO5	Learn importance concepts of radiation as an applied knowledge	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S.No.	**CONTENTS OF MODULE**	**Hrs**	**COs**
1	**Unit-1: X-rays** Electromagnetic spectrum - production of x-rays - x-ray spectra - Brehmsstrahlung - Characteristic x-ray - X-ray tubes - Coolidge tube - x-ray tube design - tube cooling - stationary mode - Rotating anode x-ray tubes -Tube rating - quality and intensity of x-ray. X- ray generator circuits - half wave and full wave rectification - filament circuit - kilo voltage circuit - high frequency generator - exposure timers - HT cables.	**1**	**CO1**

2	**Unit-2: Radiation physics** Radiation units - Exposure - Absorbed dose - rad to gray - kera relative biological effectiveness - Effective dose: Sievert (Sv)- Inverse Square Law - Interaction of radiation with matter - Linear Attenuation coefficient- Radiation Detectors -Thimble Chamber - Condenser Chambers - Geiger counter - Scintillation counter -Ionization Chamber - Dosimeters - Survey methods - Area monitors - TLD and Semiconductor Detectors.	**1**	**CO2**
3	**UNIT-3: Medical imaging physics** Radiological Imaging - Radiography - Filters - grids - Cassette - X-ray film - Film processing - Fluoroscopy - Computed Tomography Scanner - Principle Function -Display - Generations - Mammography- Ultrasound imaging - Magnetic Resonance Imaging - Thyroid Uptake system - Gamma camera (Only Principle, function and display)	**1**	**CO3**
4	**Unit-4: Radiation therapy physics** Radiotherapy - Kilo voltage machines - Deep Therapy Machines - Tele-cobalt machines - Medical Linear Accelerator - Basics of Teletherapy units - Deep x-ray, telecobalt units, Medical linear accelerator - Radiation Protection - External Beam Characteristics - Phantom - Dose maximum and build up - Bolus - Percentage depth dose - Tissue - Air ratio - Back Scatter factor.	**1**	**CO4**
5	**Unit-5: Radiation protection** Principles of radiation protection - Protective materials - Radiation effects -Somatic, genetic stochastic and deterministic effect- Personal monitoring devices- TLD film badge - Pocket dosimeter.	**1**	**CO5**

TEXT BOOKS:

1. Dr. K. Thayalan, Jayapee Brothers (2003). Basic Radiological Physics, Medical Publishing Pvt. Ltd. New Delhi .
2. Williams and Wilkins (1990) Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry -Lippincot
3. FM Khan, Williamd and Wilkins, (2003) Physics of Radiation Therapy (Third edition).
4. The essential Physics of Medical Imaging: Bushberg, Seibert, Leidhold

Elective III

(Any one of the below four)

III a. MICROPROCESSORS AND FUNDAMENTALS OF MICROCONTROLLERS

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

On taking this course students can understand

**Basic concepts of microprocessor.*

**Programming instructions and interfacing concepts.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the basic concepts of microprocessor architecture and describe the functions of different pins.	K2
CO2	Apply programming instruction sets of microprocessors and execute Assembly language programs.	K3
CO3	Recognize basic ideas of memory and apply the programming techniques to interface I/O ports to 8085.	K4
CO4	Exploring interrupts of 8085 and applying instruction sets	K3
CO5	Acquire knowledge about memory organization of microcontroller 8051 and execute assembly language Programs.	K5

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Architecture** Architecture of 8085 – registers, flags, ALU, address and data bus, multiplexing address/data bus – control and status signals – control bus, Programmer's model of 8085 – Pin out diagram – Functions of different pins. Note on India's indigenous SHAKTI microprocessor	**1**	**CO1**
2	**Unit 2: Programming Techniques** Instruction set of 8085 – data transfer, arithmetic, logic, branching and machine control group of instructions – addressing modes – register indirect, direct, immediate and implied addressing modes. Assembly language & machine language – programming techniques: addition, subtraction, multiplication, division, ascending, descending order, largest and smallest (single byte)	**1**	**CO2**
3	**UNIT 3: Interfacing memory and I/O Ports to 8085** Memory interfacing – Demultiplexing Address/ Data bus- Generating control signals- EPROM and RAM Interfacing - Interfacing 2kx8 EPROM using 8-input NAND gate, Interfacing 2kx8 EPROM using 3 to 8 decoder (74LS138) and Interfacing 2kx8 RAM using 8-input NAND gate, Interfacing 2kx8 RAM using 3 to 8 decoder (74LS138). Programmable peripheral interface 8255 – Block Diagram and Working, Control Word-Mode 0, Mode 1 – Port A as Input port – Port A as Output port , Mode 2 –BSR Mode .	**1**	**CO3**
4	**Unit 4: Interrupts** Interrupts in 8085 –INTR, INTA, RST 5.5,RST 6.5,RST 7.5 and TRAP, Software interrupts- Generation of RST 7 code, Hardware interrupts – Interrupt Acknowledge Machine cycle with RST 7 – RIM, SIM instructions – Triggering levels – Interrupt priorities .	**1**	**CO4**
5	**Unit 5: Introduction to Microcontroller 8051 and Assembly Language Programs** Introduction - Main features of 8051- Pin out Functions of 8051-(architecture block diagram not required) Program Memory - Data Memory- Internal RAM- Assembly language programming techniques: Addition (8 bit and 16 bit numbers) , Multiplication of 8 bit numbers, Division of 8 bit numbers.	**1**	**CO5**

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TEXT BOOKS:

1. R.S. Gaonkar (1992). Microprocessor Architecture programming and application with 8085 / 8080A, Wiley Eastern Ltd.

2. V. Vijayendran (2003). Fundamental of microprocessor 8085, S. Viswanathan Publishers, Chennai.

3. V. Vijayendran (2009). Fundamental of microprocessor 8086, S. Viswanathan Publishers, Chennai.

4. B. Ram. Fundamentals of Microprocessors and microcomputers, DhanpatRai publication.

REFERENCE BOOKS:

1. Aditya Mathur (1987). Introduction to microprocessor, Tata Mc.Graw Hill Publishing Company Ltd.
2. Dougles V. Hall (1983). Microprocessor and digital system by (2nd Edition), McGraw Hill Company.

WEB LINKS:

https://youtu.be/VhMWtJUiAgQ
https://youtu.be/uvupli4nik8
https://www.youtube.com/watch?v=YFhLBXggbL4&list=PL6So-guiA-TXZqMUZ0pjAdTz4JFK9dnBn
https://youtu.be/-i3FLKezNqg
https://gpbarkot.org.in/download/file/ihoN4LlRHP.pdf
https://www.electronicshub.org/8051-microcontroller-memory-organization/
https://www.circuitstoday.com/8051-addressing-modes
https://youtu.be/hf7I-KpC5wI?feature=shared
https://shakti.org.in/
https://shakti.org.in/tapeout.html
https://youtu.be/hf7I-KpC5wI?si=Cil6misxsjyE9siX

ELECTIVE III b. FIBRE OPTICS

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives*: To gain in depth knowledge in optical fibres , application in telecom field*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Understand the overview of communications signals transmitted over optical fibers and optical fiber communication devices.	**K2,K3**
CO2	Understand the importance of fiber optic material like GA As laser, LED, modulation formats and modulation and demodulation.	**K3**
CO3	understand and differentiate losses and couplers and its function	**K3,K4**
CO4	Understand the basic concepts in the process involving the parameters like modulation and demodulation.	**K3,K4**
CO5	Learn the various fiber optic materials.	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S. NO	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**Unit 1: Fiber optics** – Introduction Structure of fiber-why silica (SiO_2) as fiber-Snell's Law- Total internal reflection-meridional and skew rays- - acceptance angle and cone- numerical aperture- Goos-Haenchen shift-step and graded index fibers - single mode and multimode fiber – V-number – number of modes in step and graded multimode fibers. Analog & digital optical fiber communication (OFC) system- advantages of OFC.	**1**	**CO1**
2	**Unit 2: Transmission characteristics of optical fibers** Losses in silica glass fibers-intrinsic, extrinsic and OH- absorption losses – scattering losses- Linear: Rayleigh and Mie scattering, Nonlinear: Stimulated Brillouin and Raman scattering- intramodal and intermodal dispersion losses-micro and macro bending losses-evanescent field-attenuation spectrum for an ultra-low-loss single mode fiber.	**1**	**CO2**
3	**Unit 3: Optical fiber connection** Introduction - Multimode and single mode fiber joints–Fusion and mechanical splices– Cylindrical ferrule & duplex and multiple fiber connectors –Grin-rod lenses-Three & four port and WDM couplers	**1**	**CO3**
4	**Unit 4: Optical sources** Basic concepts of absorption and emission of radiations-LED power and efficiency-Double heterojunction LED-surface & edge emitting LED– optical output power-output spectrum- modulation bandwidth-reliability-LASER diodes-Gain guided lasers-quantum-well lasers- Fiber lasers.	**1**	**CO4**
5	**Unit 5: Optical detectors** Optical detection principles-quantum efficiency-responsivity-PIN photodiode-speed of response-noise-Avalanche Photodiodes (APD): Germanium APD-Merits and demerits- multiplication factor-Mid-infrared photodiodes – photo transistors-photo conductive detectors-eye diagrams.	**1**	**CO5**

TEXT BOOKS:

1. John M. Senior, (2009). Optical fiber communications: Principles and Practice), Pearson-Prentice Hall, (unit I – V)

2. Gerd Geiser, (2017). Optical Fiber Communications, (5th edition), Tata McGraw-Hill Education Pvt. Ltd., (unit IV-V)

REFERENCE BOOKS:

1. Henry Zanger and Cynthia Zanger, (1991). Fiber Optic Communication And Other Application, Merrill Pub. Co.
2. N. Sharma, (1987) Fiber Optics in Telecommunications, Tata McGraw Hill.
3. K. Kao Charles, (1982). Optical Fiber Systems: Technology, Design and Applications, (1st edition) McGraw- Hill.
4. Govind P Agrawal, John Wiley (2007). Fiber-optic communication systems.
5. Ajoy Ghatak and K. Thyagarajan, (2004). Introduction to fiber optics.
Cambridge University Press.
6. K. Thyagarajan and Ajoy Ghatak, John Wiley (2007). Fiber optic essentials.

ELECTIVE III c. ASTROPHYSICS

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives*: To make the students understand the nature of universe from various theories and phenomena. To study the importance and science behind the Astrophysics for the future invention and space research.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	There are many institutions have the department as Department of Physics and Astronomy that offers courses and jobs for the students those who study Astrophysics.	**K2,K3**

CO2	The Indian institute of Astrophysics and several other astronomical institutions offer the job opportunities based on this course.	**K3**
CO3	Later in future after the study and experience, the job opportunities are available in famous Indian agencies like DRDO and ISRO and in foreign astronomical institutions and agencies	**K3,K4**
CO4	Understand the evolution of stars, white dwarfs, binary stars, quasars	**K3,K4**
CO5	Learn about various galaxies, cosmic rays	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S.No.	**CONTENTS OF MODULE**	**Hrs**	**COs**
1	**Unit 1: Earliest astronomy and theories of universe** Earliest Astronomy (2500 – 100 BC) – Pythagorean Spherical Earth – Aristotle's Earth as Centre – Copernicus Theory – Kepler's Law – Galileo's observations – Newton's Synthesis. Origin of the universe – The Big Bang Theory – The steady state theory – The Oscillating Universe theory	**1**	**CO1**

2	**Unit 2: Astronomical scales and instruments** Astronomical Scales – Astronomical Distance – Mass and Time – Stellar Temperature – Astronomical Instruments –The Earth's Atmosphere and the Electromagnetic Radiation – Optical Telescopes – Radio Telescopes – The Hubble Space Telescope (HST) – Astronomical Spectrographs – Photographic Photometry – Photoelectric Photometry – Spectrophotometry.	**1**	**CO2**
3	**Unit 3: Solar system** The sun – Structure of the Sun – Nuclear reactions in sun – Photosphere – Chromosphere – corona – solar prominences – Sunspot cycle – Theory of sunspots – Solar flare – solar constant – Temperature of the sun – Solar energy – Solar wind – Other members of the solar system.	**1**	**CO3**
4	**Unit 4: Stellar evolution** Birth of a star– Death of a star –Red giant stars – Chandrasekhar limit – white dwarfs – Black holes – Quasars – Nebulae – Supernovae Binary stars – Origin of binary stars – Variable stars – Flare stars – Constellations – Zodiac – Magnitude and brightness – Luminosities of stars – Measurement of stellar distance – Geometrical parallax method – Distance from red shift measurement	**1**	**CO4**
5	**Unit 5: The milky way galaxy** The milky way – Basic Structure and Properties of the Milky Way – The General Rotation Law – Density Distribution of Gas and Spiral structure of the Galaxy – The Mass of the Galaxy – Magnetic Field in the Galaxy – Cosmic Rays – Continuous Radio Emission in the Galaxy – Hubble's law – Types of galaxies.	**1**	**CO5**

TEXT BOOKS:

1. Astronomy, S. Kumaravelu, (1993). Janki calendar corporation, Sivakasi.
2. Physics of the Universe, Hewish. (1992). A, CSIR publication, New Delhi.
3. Inside Stars, Biman Basu, (1992). CSIR Publication, New Delhi.
4. Cosmic Vistas, Biman Basu, (2002). National Book Trust of India.

5. Space today, Mohan Sundara Rajan, (2000). National Book Trust of India.
6. William K. Hartmann, (1990). The Cosmic Voyage through time and space, Wads worth Publishing company, California.
7. Astronomy, Baker and Fredrick, (1964). ninth edition, Van No strand Rein hold, Co, New York
8. Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Publication.
9. B.W. Carroll & D.A. Ostlie, Modern Astrophysics Addison-Wesley Publishing Co.
10. M. Zeilik and S.A. Gregory, Introductory Astronomy and Astrophysics, (4th Edition), Saunders College Publishing.

ELECTIVE III d. WEATHER FORECASTING

Course Code :	**Credits 4**
L: T: P: S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives *To enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	To learn basic techniques to measure temperature and its relation with cyclones and anti-cyclones..	**K2,K3**
CO2	Gain knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall	**K3**
CO3	Understand various causes of climate change like global warming, air pollution, aerosols, ozone depletion, acid rain	**K3,K4**
CO4	Develop skills needed for weather forecasting.	**K3,K4**
CO5	Uncertainties in predicting weather based on statistical analysis.	**K3,K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CO2	3	3	3	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	2	3	3	3	3	3	3	3

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Introduction to Atmosphere** Elementary idea of atmosphere- Physical structure and composition- compositional layering of the atmosphere- Variation of pressure and temperature with height- Air temperature- Requirements to measure air temperature- Temperature sensors- types; atmospheric pressure: its measurement- Cyclones and anticyclones- its characteristics.	**1**	**CO1**
2	**Unit 2: Measuring the Weather** Wind- forces acting to produce wind; wind speed direction units, its direction- measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere- Radiation laws.	**2**	**CO2**
3	**Unit 3: Weather Systems** Global wind systems- air masses and fronts- classifications- jet streams- local thunderstorms- tropical cyclones: classification- tornadoes- hurricanes	**1**	**CO3**

4	**Unit 4: Climate and Climate Change** Climate: its classification- causes of climate change-global warming and its outcomes- air pollution- aerosols, ozone depletion, acid rain, environmental issues related to climate.	**1**	**CO4**
5	**Unit 5: Basics of Weather Forecasting:** Weather forecasting: analysis and its historical background- need of measuring weather- types of weather forecasting- weather forecasting methods- criteria of choosing weather station- basics of choosing site and exposure- satellites observations in weather forecasting- weather maps- uncertainty and predictability- probability forecasts.	**1**	**CO5**

TEXT BOOKS:

2. Aviation Meteorology (2014). I.C. Joshi, 3rd edition, Himalayan Books
3. Stephen Burt, (2012), The weather Observers Hand book, Cambridge University Press.
4. S.R. Ghadekar, (2001), Meteorology, Agromet Publishers, Nagpur.
5. S.R. Ghadekar, (2005), Text Book of Agrometeorology, Agromet Publishers, Nagpur.
6. Charls Franklin Brooks, (1924), Why the weather, Chpraman & Hall, London.
7. John G. Harvey, (1995), Atmosphere and Ocean, The Artemis Press.

CORE PRACTICAL III B
(Practical Examination at the end of the Semester 6)

Course Code :	**Credits :2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

This course opens the window to the student about

- *The design of the concepts of electricity, magnetism, light that are learnt in the theory, providing hands on learning experience.*

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	The student will be able to Analyze the nature of light both quantitative and quantitatively.	**K4**
CO2	Apply the theory the design basic electrical circuits.	**K3**
CO3	Associate theoretical concepts like seebeck effect and electromagnetism with practical demonstration.	**K4**

Mapping of Course Outcomes to Program Outcomes:
Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

List of General experiments (Any 7 experiments)

1. Spectrometer i – i′ curve fixing i.
2. Spectrometer – narrow angled prism.
3. EMF of Thermocouple – Potentiometer (108 P method).
4. Comparison of EMFs – B.G

5. Absolute capacitance of a capacitor -B.G.
6. Spectrometer-Dispersive power of grating
7. Series resonance Circuit – LCR – finding L, Resonant frequency, Bandwidth, Q.
8. Self-inductance of a coil- BG
9. Field along the axis of a Circular coil – vibration magnetic needle
10. Ultrasonic interferometer-Determination of velocity of ultrasound in a liquid
11. Virtual Seismologist
    https://www.sciencecourseware.org/VirtualEarthquake/

CORE PRACTICAL IV B
(Practical Examination at the end of the Semester 6)

Course Code :	**Credits 2**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

- *This course helps the students to acquire practical knowledge to design basicelectrical circuits using diodes, transistors etc.*
- *Relate digital electronics concepts learnt in lecture session toconstruct digital circuits.*

Course Outcomes:

At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) , K5(Evaluating) ,K6(Creating)

CO1	Substitute basic laws and theories learnt in class to use junction diode, Zener diode, transistors etc.	K2
CO2	Apply the theory to design basic electrical circuits.	K3
CO3	Analyze the response of various electrical devices using the circuits construction.	K4
CO4	Interpret the application of basic circuit to create amplification, oscillation, regulate power supply, logical combinations etc.	K4

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

Basic Electronics (Any 7 experiments)

1. Bridge rectifier.
2. Transistor characteristics – CB mode.
3. Emitter follower.
4. Colpitt's oscillator
5. Transistor – astable multivibrator.
6. JFET characteristics
7. UJT characteristics
8. UJT - relaxation oscillator
9. NOR as universal building block
10. Half subtractor, full subtractor using IC - XOR, AND and OR gates.
11. Decade counter - IC 7490.
12. Analyzing Transistor characteristics using EXP EYES – Software**.**

CORE PRACTICAL V B
(Practical Examination at the end of the Semester 6)

Course Code :	**Credits 2**
L: T: P: S : 0:0:2:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

On taking this course the student acquires

- Practical knowledge to design electronic circuits using OP-AMP-555 timer, microprocessor and related software.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Solve combinational circuits of linear IC's and compute the necessary output.	**K3**
CO2	Relate the theory learnt to design OP-AMP and IC-555 circuits.	**K3**

CO3	Apply the algorithm learnt in classroom to write and execute assembly language program using 8085 Microprocessor.	**K3**
CO4	Correlate theoretical and practical ideas with software	**K4**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

List of Applied Electronics Experiments (Any 7 experiments)

1. OP Amp – Summing and difference amplifier.
2. OP Amp – AC frequency response.
3. OP Amp – Phase Shift oscillator.
4. Construction of seven segment display
5. 555 Timer – astable multivibrator.
6. µp- 8085 8 bit subtraction, division.
7. µp -Sorting in descending order – 8 bit data.
8. µp - Finding the largest number in an array.
9. Analyzing IC-555 oscillator using EXP EYES – Software.
10. Design and verification of OP Amp as integrator and differentiator using EXP EYES – Software

The following procedure is to be followed for internal marks in practicals (50 marks)

Attendance: 5 marks
Practical test – best 2 out of 3: 40 marks
Record: 5 marks

Physics –I for Allied

(For I B.Sc. Mathematics students)

Effective for 2021 -24 batch onwards

Course Code :	**Credits 05**
L: T: P: S : 6:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives: *Demonstrate basic principles of physics and one's knowledge of physics relate theoretical concepts acquired at schooling level to do experiments.*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering), K2(Understanding), K3(Applying), K4(Analyzing) K5(Evaluating), K6(Creating)

CO1	Explain SHM, Extend their knowledge in the study of various dynamic motions analyzes and it demonstrates mathematically. Relate theory with practical applications in medical field.	**K2,K4**
CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.	**K3**
CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.	**K5**
CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze them mathematically verify circuits and apply the concepts to construct circuits and study them.	**K3,K4**
CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. . Acquire information about various Govt. programs/ institutions in this field. Construct circuits using semiconductor devices and ICs and analyze their working.	**K5**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	2	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Waves, Oscillations and Ultrasonics** Simple harmonic motion – composition of two simple harmonic motion at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of a.c frequency using sonometer (steel and brass wires) Ultrsound- production – piezoelectric method – Application of ultrasonics : In Medical field- lithotripsy, ultrasonography- ultrasonoimaging- ultrasonics in dentistry, physiotheraphy, opthalmology – advantages of noninvasive surgery – Ultrasonics in green chemistry	1	CO1

2	**Unit 2: Properties of Matter** Elasticity: Elastic constant – 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 behind Human saliva Droplets formation–shape, size and lifetime- Physics behind COVID transmission through droplets- drop weight method – interfacial surface tension.	**1**	**CO2**
3	**Unit 3: Heat and Thermodynamics** Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – Liquefaction of Oxygen gas– Linde's process of Liquefaction from separation from 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.	**1**	**CO3**
4	**Unit 4: 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	**1**	**CO4**

5	**Unit 5: Digital Electronics and Digital India** **L**ogic gates : OR, AND, NOT, NAND, NOR , EXOR logic gates – Universal building blocks – Boolean algebra – De Morgan's theorem – verification – Overview of initiatives Government of India: Software Technological Parks of India under MeitY; – NIELIT- Semiconductor Laboratories under Dept. of Space – An Introduction to Digital India	**1**	**CO5**

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TEXT BOOKS:

1. R. Murugesan (2001). Allied Physics, S. Chand & Co, New Delhi.
2. Brijlal and N. Subramanyam (1994). Waves and Oscillations, Vikas Publishing house, New Delhi.
3. Brij Lal and N.Subramaniam (1994). Properties of Matter, S. Chand & Co., New Delhi.
4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8^{th} edition), S.Chand & Co., New Delhi.
5. R. Murugesan (2005). Optics and Spectroscopy, S.Chand & Co, New Delhi.
6. A. Subramaniyam Applied Electronics (2nd Edition), National Publishing Co., Chennai.

REFERENCE BOOKS:

1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11^{th} edition), John Willey and Sons, Asia Pvt. Ltd., Singapore.
2. V.R.Khanna and R.S.Bedi (1998). Text book of Sound (1^{st} edition), Kedharnaath Publish & Co, Meerut.
3. N.S. Khare and S.S. Srivastava (1983). Electricity and Magnetism (10^{th} Edition), Atma Ram & Sons, New Delhi.
4. D.R. Khanna and H.R. Gulati (1979). Optics, S. Chand & Co. Ltd., New Delhi.
5. V.K. Metha (2004). Principles of electronics (6th edition), S.Chand and company.

WEB LINKS:

https://youtu.be/M_5KYncYNyc
https://youtu.be/ljJLJgIvaHY
https://youtu.be/7mGqd9HQ_AU
https://youtu.be/h5jOAw57OXM
http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
https://www.youtube.com/watch?v=gT8Nth9NWPM
https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
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https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
https://learningtechnologyofficial.com/category/fluid-mechanics-lab/

Physics –II for Allied

(For I B.Sc. Mathematics students)
Effective for 2021-24 batch onwards

Course Code :	**Credits 5**
L: T: P: S : 6:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:
Understand the basic concepts of optics, modern physics, concepts of relativity and quantum physics, semiconductor physics, and digital electronics. Plan and execute experiments and appropriate methods.

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing)

,K5(Evaluating) ,K6(Creating)

CO1	Explain the concepts of Interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns	K2
CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate interdisciplinary nature of science and in solar energy related applications.	K3,K4
CO3	Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half life and mean life. Interpret nucleus process like fission and fusion . Understand the importance of nuclear energy, safety measures carried and get our Govt.agencies like DAE guiding the country in the nuclear field.	K3,K2
CO4	To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and translate the mathematical equation to physical concepts and vice versa. Relate this with current research in this field and get an overview of research projects of National and International importance , like LIGO, ICTS, and opportunities available for them.	K3,K2
CO5	Summarize the working of semiconductor devices like junction diode, zener diode, transistors and practical devices we daily use like USB chargers and EV charging stations.	K2,K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	2	2	3
CO3	3	3	3	3	2	3	3	3	3	3	3	3	2	2	3
CO4	3	3	3	3	2	3	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1 : Optics** Interference – interference in thin films - Colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – Diffraction – bending of light vs. bending of 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	1	CO1

2	**Unit 2: Atomic Physics** Atom model – Bohr atom model – mass number – atomic number – nucleons- vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration of elements and 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, digital cameras	**1**	**CO2**
3	**Unit 3: Nuclear Physics** Nuclear model – liquid drop model – magic numbers - shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and its 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 – difference between fission and fusion.	**1**	**CO3**
4	**Unit 4 : 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 – An introduction on Gravitational waves, LIGO, importance of GWAstrophysics –ICTS, opportunities at International Centre for Theoretical Sciences	**1**	**CO4**
5	**Unit 5: Semiconductor Physics** pn 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	**1**	**CO5**

TEXT BOOKS:

1. R. Murugesan (2005). Allied Physics, S. Chand& Co, New Delhi.
2. K. Thangaraj and D. Jayaraman (2004). Allied Physics, Popular Book Depot, Chennai.
3. Brijlal and N. Subramanyam (2002). Text book of Optics, S. Chand & Co, New Delhi.
4. R. Murugesan (2005). Modern Physics, S.Chand& Co, New Delhi.
5. A. Subramaniyam Applied Electronics (2nd Edition), National Publishing Co., Chennai.

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1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11th edition), John Willey and Sons, Asia Pvt.Ltd., Singapore.
2. D.R. Khanna and H.R. Gulati (1979). Optics, S. Chand & Co. Ltd., New Delhi.
3. A.Beiser (1997). Concepts of Modern Physics, Tata McGraw Hill Publication, New Delhi.
4. Thomas L.Floyd (2017). Digital Fundamentals (11th edition), Universal Book Stall – New Delhi.
5. V.K. Metha (2004). Principles of electronics (6th edition), S.Chand and company.

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https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo
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https://www.validyne.com/blog/basics-pneumotach-flow-measurement/

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https://youtu.be/JLz7qASICYU

https://youtu.be/u6m4lI-qZ58

https://youtu.be/C0HsQykDdKg

Physics –I for Allied

(For II B.Sc. Chemistry students)
Effective for 2020-23 batch onwards

Course Code :	**Credits 05**
L: T: P: S : 6:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives: *Demonstrate basic principles of physics and one's knowledge of physics relate theoretical concepts acquired at schooling level to do experiments.*

Course Outcomes: At the end of the Course, the Student will be able to:

Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing)

K5(Evaluating) ,K6(Creating)

CO1	Explain SHM, Extend their knowledge in the study of various dynamic motions analyzes and it demonstrates mathematically. Relate theory with practical applications in medical field.	**K2,K4**
CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.	**K3**
CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.	**K4, K5**
CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze them mathematically verify circuits and apply the concepts to construct circuits and study them.	**K3,K4**
CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. Acquire information about various Govt. programs/ institutions in this field. Construct circuits using semiconductor devices and ICs and analyze their working.	**K5**

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated – 3 moderately correlated – 2 weakly correlated –1

CO/PO/ PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	2	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Waves, Oscillations and Ultrasonics** Simple harmonic motion – composition of two simple harmonic motion at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of a.c frequency using sonometer (steel and brass wires) Ultrsound- production – piezoelectric method – Application of ultrasonics : In Medical field- lithotripsy, ultrasonography- ultrasonoimaging- ultrasonics in dentistry, physiotheraphy, opthalmology – advantages of noninvasive surgery – Ultrasonics in green chemistry	1	CO1
2	**Unit 2: Properties of Matter** Elasticity: Elastic constant – 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 behind Human saliva Droplets formation–shape, size and lifetime- Physics behind COVID transmission through droplets- drop weight method – interfacial surface tension.	1	CO2

3	**Unit 3: Heat and Thermodynamics** Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – Liquefaction of Oxygen gas– Linde's process of Liquefaction from separation from 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.	**1**	**CO3**
4	**Unit 4: 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	**1**	**CO4**
5	**Unit 5: Digital Electronics and Digital India** **L**ogic gates : OR, AND, NOT, NAND, NOR , EXOR logic gates – Universal building blocks – Boolean algebra – De Morgan's theorem – verification – Overview of initiatives Government of India: Software Technological Parks of India under MeitY; – NIELIT- Semiconductor Laboratories under Dept. of Space – An Introduction to Digital India	**1**	**CO5**

TEXT BOOKS:

1. R. Murugesan (2001). Allied Physics, S. Chand & Co, New Delhi.
2. Brijlal and N. Subramanyam (1994). Waves and Oscillations, Vikas Publishing house, New Delhi.
3. Brij Lal and N.Subramaniam (1994). Properties of Matter, S. Chand & Co., New Delhi.
4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8^{th} edition), S.Chand & Co., New Delhi.
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3. N.S. Khare and S.S. Srivastava (1983). Electricity and Magnetism (10th Edition), Atma Ram & Sons, New Delhi.
4. D.R. Khanna and H.R. Gulati (1979). Optics, S. Chand & Co. Ltd., New Delhi.
5. V.K. Metha (2004). Principles of electronics (6th edition), S.Chand and company.

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https://youtu.be/h5jOAw57OXM

http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html

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https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s

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https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-th

ey-work

https://learningtechnologyofficial.com/category/fluid-mechanics-lab/

Physics –II for Allied

(For II B.Sc. Chemistry students)
Effective for 2020-23 batch onwards

Course Code :	**Credits 5**
L: T: P: S : 6:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:
Understand the basic concepts of optics, modern physics, concepts of relativity and quantum physics, semiconductor physics, and digital electronics. Plan and execute experiments and appropriate methods.

Course Outcomes: At the end of the Course, the Student will be able to:
Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing)

,K5 (Evaluating) ,K6(Creating)

CO1	Explain the concepts of Interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns	K2
CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate interdisciplinary nature of science and in solar energy related applications.	K3,K4
CO3	Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half life and mean life. Interpret nucleus process like fission and fusion . Understand the importance of nuclear energy, safety measures carried and get our Govt.agencies like DAE guiding the country in the nuclear field.	K3,K2
CO4	To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and translate the mathematical equation to physical concepts and vice versa. Relate this with current research in this field and get an overview of research projects of National and International importance , like LIGO, ICTS, and opportunities available for them.	K3,K2
CO5	Summarize the working of semiconductor devices like junction diode, zener diode, transistors and practical devices we daily use like USB chargers and EV charging stations.	K2,K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 **moderately correlated - 2** **weakly correlated -1**

CO/PO/ PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**

CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1 : Optics** Interference – interference in thin films - Colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – Diffraction – bending of light vs. bending of 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	**1**	**CO1**
2	**Unit 2: Atomic Physics** Atom model – Bohr atom model – mass number – atomic number – nucleons- vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration of elements and 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, digital cameras	**1**	**CO2**
3	**Unit 3: Nuclear Physics** Nuclear model – liquid drop model – magic numbers - shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and its 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 – difference between fission and fusion.	**1**	**CO3**

4	**Unit 4 : 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 – An introduction on Gravitational waves, LIGO, importance of GWAstrophysics –ICTS, opportunities at International Centre for Theoretical Sciences	**1**	**CO4**
5	**Unit 5: Semiconductor Physics** pn 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	**1**	**CO5**

TEXT BOOKS:

6. R. Murugesan (2005). Allied Physics, S. Chand& Co, New Delhi.
7. K. Thangaraj and D. Jayaraman (2004). Allied Physics, Popular Book Depot, Chennai.
8. Brijlal and N. Subramanyam (2002). Text book of Optics, S. Chand & Co, New Delhi.
9. R. Murugesan (2005). Modern Physics, S.Chand& Co, New Delhi.
10. A. Subramaniyam Applied Electronics (2nd Edition), National Publishing Co., Chennai.

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6. Resnick Halliday and Walker (2018). Fundamentals of Physics (11th edition), John Willey and Sons, Asia Pvt.Ltd., Singapore.
7. D.R. Khanna and H.R. Gulati (1979). Optics, S. Chand & Co. Ltd., New Delhi.
8. A.Beiser (1997). Concepts of Modern Physics, Tata McGraw Hill Publication, New Delhi.
9. Thomas L.Floyd (2017). Digital Fundamentals (11th edition), Universal Book Stall – New Delhi.
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https://books.google.co.in/books?id=grqxTeY1z4oC&pg=PA897&lpg=PA897&dq=size+of+nitrogen+molecule+and+blue+light&source=bl&ots=hC0V9FvzP-

&sig=ACfU3U270Hhk0SD3yXV10QDHjPrC1qGnDg&hl=en&sa=X&ved=2ahUKEwjKgrP6rvzpAhWNyDgGHRB_DGYQ6AEwDnoECA0QAQ#v=onepage&q=size%20of%20nitrogen%20molecule%20and%20blue%20light&f=false

https://youtu.be/JLz7qASICYU

https://youtu.be/u6m4lI-qZ58

https://youtu.be/C0HsQykDdKg

Allied Physics – Practical A

(For I B.Sc. Mathematics and II B.Sc. Chemistry students)

(PRACTICAL EXAMINATION AT THE END OF ODD SEMESTER)

Course Code :	**Credits 5**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

The aim of this course is to enable the students to gain practical knowledge of various basic concepts of physics.

Course Outcomes: At the end of the Course, the Student will be able to Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) ,K5(Evaluating) ,K6(Creating)

CO 1	Relate scientific methods and recall the process of measuring different physical variables.	K2
CO 2	Demonstrate the fundamentals of instrumentation data acquisition and interpretation of results.	K2
CO 3	Apply the concepts of Physics to understand material properties.	K3
CO 4	Experiment with fundamental of optics, acoustics, electricity and magnetism.	K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2

LIST OF EXPERIMENTS:
(any eight experiments)

1. Young's Modulus by Non-uniform bending using Pin and Microscope.
2. Rigidity modulus by torsional oscillations without mass
3. Surface tension and interfacial tension – Drop Weight method – Hare's apparatus given.
4. Sonometer – Determination of a.c frequency
5. Newton's rings - Radius of curvature
6. Potentiometer – low range Voltmeter Calibration
7. P.O. Box – Specific resistance of a coil
8. Construction of AND, OR, NOT gates – using diodes and transistor
9. Zener Diode – Study of Characteristics
10. Deflection magnetometer – Field along the axis of the coil – Determination of BH.
11. Refraction order of liquid hollow prism – Spectrometer
12. Determination of latitude and longitude of a place

Note:

- Use of Digital balance is permitted
- Error and statistical analysis of data
- Plotting graphs using software for a given data
- Learning to use software to detecting the values of electrical components and basics laws of physics

Allied Physics – Practical B

(For I B.Sc. Mathematics and II B.Sc. Chemistry students)

(PRACTICAL EXAMINATION AT THE END OF EVEN SEMESTER)

Course Code :	**Credits 5**
L: T: P: S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objectives:

The aim of this course is to enable the students to gain practical knowledge of various basic concepts of physics.

Course Outcomes: At the end of the Course, the Student will be able to Knowledge level - K1(Remembering) ,K2(Understanding),K3(Applying) ,K4(Analyzing) ,K5(Evaluating) ,K6(Creating)

CO 1	Relate scientific methods and recall the process of measuring different physical variables.	K2
CO 2	Demonstrate the fundamentals of instrumentation data acquisition and interpretation of results.	K2
CO 3	Apply the concepts of Physics to understand material properties.	K3
CO 4	Experiment with fundamental of optics, acoustics, electricity and magnetism.	K3

Mapping of Course Outcomes to Program Outcomes:

Strongly correlated - 3 moderately correlated - 2 weakly correlated -1

CO/PO/PSO	PO										PSO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2

LIST OF EXPERIMENTS
(any eight experiments)

1. Young's Modulus by Non-uniform bending using Optic lever – Scale and telescope
2. Rigidity modulus by Static torsion method
3. Comparison of viscosities of two liquids – Burette method
4. Specific heat Capacity of a liquid – Half time correction
5. Air wedge – Thickness of a wire
6. Spectrometer – Grating – Wavelength of Mercury lines – Normal Incidence
7. Figure of merit – Table Galvanometer
8. NAND gate as a Universal logic gate
9. NOR gate as a Universal logic gate
10. Verification of De Morgan's Theorems.
11. Junction diode - study of characteristics
12. Refraction order of solid prism – Spectrometer

Note:

- Use of Digital balance is permitted
- Error and statistical analysis of data
- Plotting graphs using software for a given data
- Learning to use software to detecting the values of electrical components and basics laws of physics

APPENDIX

The Graduate Attributes of B.Sc.Physics programme are as follows:

- **Disciplinary knowledge and skills:** Capable of demonstrating

(ii) Good knowledge and understanding of major concepts, theoretical principles and experimental findings in Physics and other related fields of study, including broader interdisciplinary subfields.

(iii) Ability to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable.

- **Skilled communicator:** Ability to transmit complex technical information in a clear and concise manner in a simple language for better understanding.
- **Critical thinker and problem solver:** Ability to employ critical thinking and efficient problem solving skills
- **Sense of inquiry:** Capability for asking relevant/appropriate questions relating to the issues and problems and planning, executing and reporting the results of a theoretical or experimental investigation.
- **Team player/worker**: Capable of working effectively in diverse teams in classroom, laboratory and Physics workshop, in industry and field-based situations.
- **Skilled project manager:** Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.
- **Digitally Efficient:** To analyze acquired data using computers, utilize e-learning tools effectively, create teaching learning materials.
- **Ethical awareness / reasoning:** The graduate should be capable of demonstrating ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, and adopting objectives, unbiased and truthful actions in all spects of work.
- **National and international perspective:** To motivate the students to develop an idea on various projects of National and International significance.
- **Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling in all areas of Physics.