Integrated M.Sc. Physics

(Five Year Programme)

Curriculum, Programme Structure and Course contents

(Prepared in conformity with LOCF & CBCS)

(2022-2023 onwards)

DEPARTMENT OF PHYSICS

Manonmaniam Sundaranar University

Tirunelveli

Manonmaniam Sundaranar University

Learning Outcome based Curriculum

Vision of the University

To provide quality education to reach the un-reached

Mission of the University

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

Department of PHYSICS

Vision of the Department

- In pursuit of excellence on to provide higher education in Physics.

Mission of the Department

- By the way of innovation in teaching, inculcating problem-solving skills for the application, and empowering the students' independence.
- By the way of carrying out research on thrust areas, generating facilities through grants from research projects, and competing internationally.
- By the way of extension activities for knowledge dissemination, societal obligation, and leadership role.
- By the way of promoting human values, social harmony, and justice for moulding into responsible citizens.

1.	**Name of the Programme**	:	Integrated M.Sc. Physics
2	**Preamble of the Programme**	:	An integrated graduate programme in physics provides an opportunity to expand the understanding of the concepts and to imbibe theoretical frameworks with the support from mathematics and chemistry for equipping with skills to excel in the passion-driven career placement and to fulfill the lifelong researcher ambition.

3. Programme Structure

Semester	Part	Course Code	Course Nature	Course Name	Theory/ Practical/ Tutorial	Credits	Contact Hours Per week	Continuous Internal assessment	End Semester Exam
I	I		Language	Tamil / Other language	Theory	4	4	25	75
	II		Language	English	Theory	4	4	25	75
	III		Core 1	Mechanics and Properties of Matter	Theory	4	4	25	75
					Practical	1	2	25	25
			Core 2	Thermal Physics	Theory	4	4	25	75
					Practical	1	2	25	25
			Allied	Allied Mathematics - I	Theory	3	3	25	75
					Practical	2	4	50	50
	IV		Common	Environmental Studies	Theory	2	2	25	75
					Sub Total	**25**	**29**		
II	I		Language	Tamil / Other language	Theory	4	4	25	75
	II		Language	English	Theory	4	4	25	75
	III		Core 3	Modern Optics	Theory	4	4	25	75
					Practical	1	2	25	25
			Core 4	Electricity and Electromagnetism	Theory	4	4	25	75
					Practical	1	2	25	25
			Allied	Allied Mathematics - II	Theory	3	3	25	75
					Practical	2	4	50	50
	IV		Common	Value Based Education / Social Harmony	Theory	2	2	25	75
					Sub Total	**25**	**29**		
III	I		Language	Tamil / Other language	Theory	4	4	25	75
	II		Language	English	Theory	4	4	25	75
	III		Core 5	Classical Mechanics and Relativity	Theory	4	4	25	75
					Tutorial	1	2	25	25
			Core 6	Professional English - I	Theory	4	4	25	75
			Allied	Allied Chemistry - I	Theory	3	3	25	75
					Practical	2	4	50	50
	IV		Non-Major Elective 1	Conventional and Non-Conventional Energy sources	Theory	3	3	25	75
			Mandatory	Yoga	Theory	2	2	25	75
					Sub Total	**27**	**30**		

IV	I		Language	Tamil / Other language	Theory	4	4	25	75
	II		Language	English	Theory	4	4	25	75
	III		Core 7	Mathematical Methods and Quantum Mechanics	Theory	4	4	25	75
					Tutorial	1	2	25	25
			Core 8	Professional English - II	Theory	4	4	25	75
			Allied	Allied Chemistry - II	Theory	3	3	25	75
					Practical	2	4	50	50
	IV		Non-Major Elective 2	Biomedical Instrumentation	Theory	3	3	25	75
			Mandatory	Computers for Digital Era	Theory	2	2	25	75
	V		Extension Activity	NCC, NSS, YRC, YWF	Field Work	1		50	50
					Sub Total	**28**	**30**		
V	III		Core 9	Atomic and Nuclear Physics	Theory	4	4	25	75
					Practical	1	2	25	25
			Core 10	Solid State Physics	Theory	4	4	25	75
					Practical	1	2	25	25
			Core 11	Analog and Digital Electronics	Theory	4	4	25	75
					Practical	1	2	25	25
			Core 12	Numerical Methods a and programming in C	Theory	4	4	25	75
					Practical	1	2	25	25
	IV		Skill Based Common	Personality Development / Effective Communication / Youth Leadership	Theory	2	2	25	75
			Skill Based Core 1	Skill Course	Theory	1	2	25	75
					Sub Total	**23**	**28**		
VI	III		Elective I	Elective I (online mode)	Theory	3	3	25	75
			Elective II	Elective II (online mode)	Theory	3	3	25	75
			Skill Based Core 2	Skill Course (online mode)	Theory	1	2	25	75
			Project	Internship /Project		16	20	50	50
					Sub Total	**23**	**28**		
					TOTAL	**147**		**1425**	**3175**

Skill Based Core Courses:

Skill Based Core courses I and II are offered to the students of the physics department as given below in two groups. One course shall be taken by each student during the fifth and sixth semesters respectively.

Group I

a) Computational Physics
b) Basic Instrumentation Skills
c) Applied Optics

Group II

a) Renewable Energy
b) Radiation Safety
c) Electrical Circuit and Network Skills

Elective Courses:

Elective courses I and II are offered to the students of the physics department as given below in two groups. One course shall be taken by each student during the sixth semester

Group I

a) Energy Physics
b) Computer Programming in C++
c) Optoelectronics

Group II

a) Nanophysics
b) Medical Physics
c) Laser Physics

4	**Scheme of Evaluation:**		
(a) CIA	Theory Course	:	For the first 6 semesters, the Continuous Internal Assessment **25 marks** are divided as **20 marks** for the internal written test (average of the marks from the best two tests out of three tests) and **5 marks** for the assignment (At least one assignment in each unit by a student) activities. There is no passing minimum in the internal test marks for each paper. The question paper pattern for the internal assessment test of each theory paper is given below. The questions for the internal assessment test shall be distributed to assess all the cognitive levels of Bloom's taxonomy and the same shall be tabulated at the top of the question paper.

Section	Type of Questions	Max. Marks
Part A	Objective Type -5 Questions	2 × 1 = 2
Part B	Answer any two out of three questions of either problems or descriptive type	2 × 5 = 10
Part C	Answer any one out of two questions of either problems or descriptive type	1 × 8 = 8
	Total Marks	**20**

	Practical	:	**Phase I – Continuous Assessment (25 Marks)** "N" number of practicals be conducted based on the practicals prescribed in the syllabus and the marks should be distributed equally for each practical. There is no passing minimum in the Internal Continuous Assessment. Two tests should be conducted and the average of tests will be taken for 25 marks. **Calculation of marks for 50:** Sum of marks awarded to a number of practicals (25 marks) + the Average Marks of two tests (25 marks).
		:	

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<td>Project</td>
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<td>The project work shall be based on any research-oriented topics, both in the fields of theoretical and experimental physics under the guidance of a faculty member of the Department as a Project Supervisor. After completion of the project work at the end of semester VI, each student should submit two copies of the project report/thesis to the Department on or before a date as notified for the same. The project viva-voce examination for the students will be conducted individually.
<u>Calculation of marks for 50:</u>
Sum of marks awarded to continuous assessment of the project work (25 marks) + the Average Marks of two project reviews (25 marks).</td>
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<td>Internship*
:</td>
<td>:</td>
<td>An internship is carried out by the student throughout the sixth semester in companies/institutions/hospitals/organizations. There are two mentors for an internship, one from the department and another from the company to guide them and monitor their progress.
Two review presentations should be conducted and the average of presentations will be taken for 25 marks.
<u>Calculation of marks for 50:</u>
Sum of marks awarded by the companies/institutions/hospitals/organizations (25 marks) + the Average Mark of two review presentations given by the department mentor (25 marks).</td>
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<td>(b) ESE</td>
<td>Theory Course</td>
<td>:</td>
<td>The duration of the University examination for each theory course is 3 hours. There is a passing minimum of 50% in the University examinations in each theory course and there is a passing minimum of 50% in the overall component, i.e. out of the total marks in the CIA component and the University examination for each theory course. There will be a special supplementary examination for those candidates who have failed only one subject in the entire programme. The questions for the end semester examination shall be distributed to assess all the cognitive levels of Bloom’s taxonomy and the same shall be tabulated at the top of the question paper. The question paper pattern for the end-semester examination of each theory paper is given below.
<table>
<tr><th>Section</th><th>Type of Questions</th><th>Max. Marks</th></tr>
<tr><td>Part A</td><td>Objective Type -10 Questions
(2 from each units)</td><td>10 × 1 = 10</td></tr>
<tr><td>Part B</td><td>Unit-wise choice – Either (a) or (b) type – 5 Questions Problems</td><td>5 × 5 = 25</td></tr>
<tr><td>Part C</td><td>Unit-wise choice-Either (a) or (b) type – 5 Descriptive or analytical Questions</td><td>5 × 8 = 40</td></tr>
<tr><td colspan="2">Total Marks</td><td>75</td></tr>
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	Practical	:	Only one practical examination should be conducted at the end of the semester for the students on a lot basis by appointing TWO examiners; one (Course Teacher) and another from the other institution (External Examiner). (In the absence of an external examiner, any other teacher from the same department shall be the external examiner. Out of the 50 marks, 10 marks shall be given for record/observation notes. **Calculation of marks for 50:** Course teacher and External Examiner in consensus shall award marks for 50.
	Project	:	Only one Viva-Voce examination shall be conducted at the end of the semester and the students should give ppt presentations and defend the project work. TWO examiners; one (project supervisor) and another from the other institution (External Examiner). (In the absence of an external examiner, any other teacher from the same department shall be the external examiner. Out of the 50 marks, 25 marks shall be given for the dissertation. **Calculation of marks for 50:** Course teacher and External Examiner in consensus shall award marks for 50.
	Internship		An interactive presentation shall be conducted at the end of the semester to assess the skill harnessed and career awareness towards the prospective job. The students should give PPT presentations and defend the internship work. TWO examiners; one (department mentor) and another from the other institution (External Examiner). (In the absence of an external examiner, any other teacher from the same department shall be the external examiner. Out of the 50 marks, 25 marks shall be given for the report. Certificate from the mentor concerned from companies/institutions/hospitals /organizations shall mandatorily be included in the report. **Calculation of marks for 50:** Course teacher and External Examiner in consensus shall award marks for 50.
(c)	***Model End Semester Question Paper****		

Mechanics and Properties of Matter

PART - A Answer ALL the Questions (10 x 1 = 10)

1. The value of e for a perfectly elastic bodies is _____
   (a) 0 (b) 1 (c) 0.94 (d) 0.2
2. The moment of inertia of a uniform thin stick about an axis at one end perpendicular to the stick is
   (a) $\frac{1}{2}ML^2$ (b) ML^2 (c) $\frac{6}{5}ML^2$ (d) $\frac{2}{3}ML^2$
3. The large force acting for a short interval of time is called _____
   (a) Impulsive force (b) repulsive force
   (c) restitution (d) none of these
4. Identify the dimensions for angular momentum
   (a) ML^2T^{-1} (b) ML^1T^{-1} (c) $ML^{-2}T^{-1}$ (d) ML^2T^1
5. The value of acceleration due to gravity at the depth is
   (a) g' = g (1- h/R) (b) g' = g (1+ h/R)

(c) g' = g (1- hR) (d) g' = g (1- R/h)

6. If the diameter of the earth becomes half its present value but its average density remains unchanged then how would be the weight of an object on the surface of the earth affected?
   (a) The weight of the object remains unchanged
   (b) weight is doubled
   (c) Weight will become ¼ of the present value
   (d) weight is halved.

7. A copper wire of length 3 m and 1mm diameter is subjected to a tension of 5 N. Calculate the elongation produced, if the young's modulus of copper is 12GPa
   (a) 15m (b) 1.5m (c) 1500m (d) 15.9mm

8. The Newton's law of viscosity is not applicable to _____ flow
   (a) streamline (b) turbulent (c) laminar (d) both a & b

9. The viscosity of a fluid in motion is 1Poise. What will be its viscosity (in Poise) when the fluid is at rest?
   (a) 0 (b) 0.5 (c) 1 (d) 2

10. The rise in the level of a liquid in a tube is h. If half the amount is poured outside, what will be the new rise in liquid level?
   (a) 0 (b) h/2 (c) h (d) 2h

PART - B Answer ALL the Questions (5 x 5 = 25)

11. a. Ball A of mass 1 kg moving with a velocity of 2 m/s, strikes directly on ball B of mass 2 kg at rest. The ball A, after striking, comes to rest. Find the velocity of ball B after striking and co-efficient of restitution.

OR

b. A 50Kg women jumps straight into the air rising 0.8 m from the ground. What impulse does she receive from the ground to attain the height.

12. a. A body weighs 90kgon the surface of the earth. How much will it weigh on the surface of the Mars, whose mass is 1/9 and radius ½ that of the earth.

OR

b. Imagine a light planet revolving around a very massive star in a circular orbit of radius with a period of revolution T. If the gravitation force of attraction between the planet and star is proportion to $R^{-5/2}$. Find T^2

13. a. If a single stage rocket fixed vertically from rest at the earth's surface burns its fuel in a time of 30s and the exhaust velocity of the gases relative to the rocket is $3000ms^{-1}$. What must be the mass ratio m_o/m for a final velocity v of $8 \times 10^3 ms^{-1}$?

OR

b. A thin metal ring of diameter 0.6m and mass 1kg starts from rest and rolls down on a inclined plane. Its linear velocity on reaching the foot of the plane is 5m/s. Calculate the moment of Inertia of the ring and the kinetic energy of the rotation at that instant.

14. a. Describe the experimental determination of Young's modulus of a cantilever

OR

b. Derive the expression for the relation between shearing strain and linear strain and find the energy stored in a wire 5m long and 10^{-3} m in diameter when it is stretched through $3x10^{-3}$m by a load. Young's modulus of material is $2x10^{11}$ N/m^2.

	15.a. Discuss about the variation of surface tension with temperature OR b. Derive the expression for Reynolds's number and explain the types of fluid motion **PART - C Answer ALL the Questions (5 x 8 = 40)** 16 a. Find the velocities of the two smooth spheres after direct impact moving in the same direction OR b. A smooth sphere of mass m_1 moving with velocity u_1 impinges obliquely on a smooth sphere of mass m_2 moving with velocity u_2. If the directions of motion before impact make angles α and β with the common normal, find the velocities and direction of the spheres after impact. 17. a. Obtain the expressions for variation of g with (i) altitude (ii) depth (iii) rotation of earth. OR b. Discuss the Boys method for determining G with a schematic diagram. What are the merits of this method. 18. a. Find the velocity of a rocket V at any instant 't' where V_O and M_O are the initial velocity and mass respectively, υ is the exhaust velocity of the gas and M is the mass at the instant 't' OR b. Find the moment of Inertia of a uniform thin stick of mass M, length L, passing the axis through the midpoint and perpendicular to the stick 19. a. How to determine the rigidity modulus using Searle's apparatus and explain a work done in twisting a wire or b. Write a note on bending of beams and derive the expression for bending moment 20. a. Describe Rankine's experiment to measure viscosity of a gas or b. Explain the determination of coefficient of viscosity of fluids inside a capillary tube by Poiseuille's formula
(d)	***Passing Minimum*** CIA – No passing minimum (3 Internal Tests – Average of the best 2 will be considered) ESE – 50% Cumulative Aggregate – 50%

5. Programme Outcomes (POs):

On the successful completion of the Bachelor of Science programme, the student will be able to

PO1	Demonstrate comprehensive knowledge and understanding of science concepts and their relevant fields during the course of study
PO2	Communicate effectively on different aspects of Physics through examples with any forum and scientific society
PO3	Critical thinking, designing experiments and research-based analytical knowledge for the interpretation of data to provide

	conclusions
PO4	Apply knowledge to analyze and solve scientific/ complex problems using theoretical and experimental techniques/tools
PO5	Find suitable software and related resources for having learning activities and meet the demands of the workplace throughout life by using information and communications technology (ICT)
PO6	Employ critical and analytical thinking in understanding the concepts and apply them to various problems appearing in different branches of Science and competitive examinations in various sectors.
PO7	Function successfully as a member/leader in any team and follow ethics, accountability, and equity in their life
PO8	Take responsibility for finding the solution to different issues related to the society

6. Programme Specific Outcomes (PSO):

On the successful completion of the B.Sc. Physics programme, the learner will be able to

PSO1	Explain the system by Newtonian, Lagrangian, and Schrodinger equation of motion and apply them to atom, nucleus, and solids
PSO2	Explain thermodynamic laws, Ray and Laser optics, and their application to simple devices
PSO3	Explain the direct & alternating circuits, discrete components, and integrated circuits and perform experiments
PSO4	Relate their understanding of physics to other subjects like Professional English, Chemistry, Environmental Science, and hence widen their knowledge and work towards multi-disciplinary/inter-disciplinary context and problems
PSO5	Learn how to design and perform experiments demonstrating their understanding of scientific concepts/phenomena/methods/techniques
PSO6	Develop written and oral communications skills to communicate physics-related topics effectively through verbal, written, computational and graphical presentations using ICT.
PSO7	Critical application of the concepts through the relations for solving Physics problems in IIT-JAM, JEST, and CUCET
PSO8	Demonstrate Physics-related technological skills that are relevant to Physics-related trades and employment opportunities

CORE 1: MECHANICS AND PROPERTIES OF MATTER - THEORY

a. Course Code:

L	T	P	C
4	-	-	1

b. Course Objectives:

1. To gain ideas on conservation laws, rotational and vibrational motion of rigid bodies
2. To know the concept of flow of liquids, elastic behaviour of materials, rocket motion

c. Learning Progression

HSC – I
Frame of references, Equation of motion, relative velocity, projectile motion Newton's law, friction, dynamics of circular motion, work energy and power, centre of mass, gravitation Elastic behavior of materials, Stress and strain and its types Hooke's law, Modulus of elasticity, Poisson's ratio, Streamlined and turbulent flow of fluids Intermolecular forces, Angle of contact

d. Theoretical Foundations:

Newton's law**,** Moment of Inertia, Gravitational Field, Bernoulli's Theorem, Excess pressure inside a liquid drop and soap bubble

e. Course Outcomes (COs):

At the end of the Course, the student will be able to -

CO1: State Work Energy Theorem, coefficient, Perpendicular axis Theorem, Parallel axis Theorem, Kepler's laws, angular momentum, Stokes law.

CO2: Explain fundamental laws of impact, surface tension, the practical applications of Stoke's formula

CO3: Apply the laws of conservation of energy, Apply Poiseuille's method to determine the viscosity of fluids

CO4: Analyze the practical flow of liquids, Calculate the gravitational potential energy of a system, To deduce the excess pressure inside a liquid drop. Explain the basics of properties of matter and how they are evaluated for different shapes of practical relevance.

CO5: Estimate the speed of rocket in the earth's gravity field

CO6: Design new experimental methods to determine the fluid flow

f. Course Outline:

Unit 1

Module: **1** **(6 Hrs)**

Laws of Motion: Newton**'**s law of motion, linear momentum and angular momentum, velocity and acceleration in Cartesian, polar and cylindrical coordinate systems, uniformly **rotating**

frames, centrifugal and cariolis forces, conservative and non conservative forces

Module: 2 **(6 Hrs)**

Collision: Elastic and inelastic collision – Newton's law of impact – coefficient of restitution – Impact of a smooth sphere on a fixed plane – Direct impact between two smooth spheres

Unit II

Module: 1 **(10 Hrs)**

Gravitation: Newton's law of gravitation, Kepler's laws of gravitation: G by Boy's method, Acceleration due to gravity, Variation of g with altitude, depth and rotation of earth, Value of g at poles and equator. Gravitational field: Gravitational potential, Gravitational potential due to spherical shell

Unit III

Module: 1 **(6 Hrs)**

Dynamics of Rigid body: Moment of inertia – Theorems of perpendicular and parallel axes – M.I of a circular ring, disc, solid sphere, hollow sphere and cylinder about all axes

Module: 2 **(6 Hrs)**

Compound pendulum – theory – equivalent simple pendulum – reversibility of centers of oscillation and suspension – determination of g and k

Module: 3 **(6 Hrs)**

Central Force Motion: Angular velocity, Torque and angular acceleration, Relation between them, Center of mass: velocity and acceleration of centre of mass, determination of motion of individual particle, system of variable mass, Rocket motion: Satellite

Unit IV

Module: 1 **(6 Hrs)**

Torsion: work done in twisting a wire - Torsional oscillations of a body – Rigidity modulus by Torsion pendulum, Searle's method for the comparison of young's modulus and coefficient of rigidity modulus

Module: 2 **(6 Hrs)**

Bending of beams: Bending couple – Expression for bending moment – Cantilever - Cantilever depression and oscillation – Measurement of Young's modulus by non–uniform bending, uniform bending and cantilever depression

Unit V

Module: 1 **(6 Hrs)**

Surface tension: Excess Pressure inside a Liquid Drop - Bernoulli's equation: proof and applications - Venturimeter and Pitot tube - Rise of Liquid in a Capillary Tube - Quincke's method - variation of surface tension with temperature - Jaegar's method

Module: 2 **(3 Hrs)**

Viscosity: Units and dimensions - expression for critical velocity– Reynolds number and its significance - Poiseuille's formula for coefficient of viscosity

g. Text Books:

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hil
2. Mechanics, D.S.Mathur, S. Chand & Co., 2ndEdition (2001)
3. Properties of Matter, R. Murugeshan, S. Chand & Co., New Delhi (2001)

h. Books for Reference:

1. Fundamentals of Physics, D. Halliday, R.Rensick and J. Walker, 6th edition, Wiley,NY (2001).

2. Charles Kittel, Walter Knight, Malvin Ruderman, Carl Helmholtz and Moyer, *Mechanics,* 2nd edition, Mc Graw Hill Pvt. Ltd,
3. Mechanics, P. Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam S. Chand & Co., New Delhi (1988).
4. Mechanics – Part I and II, Narayanamoorthy, National Publishing Company
5. . Elements of properties of matter, D.S. Mathur, S. Chand & Co., 2004

i. Mapping of Cos to POs and PSOs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1 (K1)	H	H	H	M	H	H	L	L
CO2 ((K2)	H	M	M	M	L	M	L	L
CO3(K3)	H	H	M	M	M	H	L	L
CO4(K4)	H	M	M	H	M	M	L	L
CO5(K5)	H	H	M	L	H	H	L	L
CO6(K6)	H	M	L	L	L	L	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1(K1)	H	L	M	M	H	H	L	L
CO2(K2)	H	M	L	M	M	L	M	L
CO3(K3)	H	L	M	M	H	H	L	L
CO4(K4)	H	L	L	M	M	L	M	L
CO5(K5)	H	L	L	M	H	H	L	L
CO6(K6)	L	L	L	L	H	H	L	L

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

CORE 1: MECHANICS AND PROPERTIES OF MATTER - PRACTICAL

a. Course Code:

L	T	P	C
-	-	2	1

b. Course Outcome:

CO1: Determine the g at the given place, Moment of Inertia of the materials, the elastic constants Like Young's modulus and Rigidity modulus, by experimental methods
CO2: Estimate the properties of liquids like surface tension and viscosity by simple experiments
CO3: Design experimental models to verify Parallel axis and Perpendicular axis theorem

c. List of Practcals

1. Young's modulus – Cantilever– Pin and microscope
2. Rigidity Modulus – Torsional pendulum (with identical masses)
3. Surface Tension of a liquid by capillary rise.
4. Surface tension and interfacial surface tension – Drop weight method.
5. Variation of Surface Tension with temperature (Jaeger's method)
6. Coefficient of Viscosity of liquid – Graduated burette
7. Comparison of Viscosity of two liquids

8. Viscosity of a liquid – Stoke's method
9. Compound pendulum – Determination of g at a place
10. Torsional pendulum – Moment of Inertia of the disc
11. To study the one dimensional elastic collision using two hanging spheres
12. To find the angular acceleration of a fly wheel
13. Verification of Perpendicular axis theorem
14. Verification of Parallel axis theorem
15. Any other experiment

d. Reference Books

1. B. L. Flint and H.T. Worsnop, Advanced Practical Physics for students, Asia Publishing House, 1971.

e. Mapping of COs to POs & PSOs with correlation level and Cognitive level of COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1 (K4)	H	M	M	M	M	M	M	L
CO2 (K5)	H	M	M	M	M	M	M	L
CO3 (K6)	H	M	L	L	L	L	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1(K4)	M	L	L	M	H	L	M	L
CO2(K5)	M	L	L	M	H	L	M	L
CO3(K6)	H	M	M	M	H	L	L	L

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

CORE 2: THERMAL PHYSICS - THEORY

a. Course Code:

L	T	P	C
4	-	-	1

b. Course Objectives:

1. To calculate heat, work and other important thermo-dynamical properties for ideal gases and apply various Thermodynamics laws to real system.
2. To know the concept of lowering the temperature, liquefying gases and process of making heat to do mechanical work

c. Learning Progression:

HSc
Ideal gas laws, Newton's law of cooling, Concepts of specific heat Laws of Thermodynamics, Stefan's law Kinetic theory of gases, Degrees of freedom

d. **Experimental & Theoretical Foundations:**

1. Different laws of Thermodynamics, Kelvin-Planck statement
2. Clausius statement
3. Specific heat capacity

e. Course Outcomes (COs):

At the end of the Course, the student will be able to -

CO1: State Seebeck effect, Joule - Kelvin effect, Stefan Boltzmann law, Wien's law, Planck's law, Rayleigh Jean's law, Meyer's relation

CO2: Explain Brownian motion and its features, change of entropy in reversible and irreversible processes,

CO3: Apply low temperature in refrigerators and air-conditioning machines, sketch a p-V diagram for the cycle of a Carnot engine.

CO4: Analyze Maxwell thermo-dynamical relations, Calculate the net energy-transfer rate of an object emitting radiation to its environment and absorbing radiation from that environment,

CO5: Estimate the efficiency of a Carnot engine in terms of the heat transfers and also in terms of the temperatures of the reservoirs,

CO6: Create new experimental methods to determine the transmission of heat. Designing new energy conversion devices using laws of thermodynamics

f. Course Outline:

Unit I: Thermometry and Calorimetry

Module: 1 **(4 Hrs)**

Thermometers: Platinum resistance thermometer, Calendar and Griffith's bridge, Thermistor, Thermoelectric effect, Seebeck effect, Thermo-electric thermometers

Module: 2 **(4 Hrs)**

Specific heat: Specific heat capacity of solids: Regnaults method, Callendar and Barnes method, Specific heat capacity of liquids, Newton's law of cooling, Joules Electrical method

Unit II: Kinetic Theory of Gases

Module: 1 **(7 Hrs)**

Molecular collisions : mean free path , expression for mean free path , Transport phenomenon: Viscosity , Diffusion and thermal conductivity of gas, Brownian motion and its features, Specific heat of mono , di and polyatomic gases., C_p and C_V – Meyer's relation

Module: 2 **(4 hrs)**

Real Gases: Experimental verification: Vander walls equation of state, Determination of Vander walls constant, Relation between Vander Wall's constant and critical constants

Module: 3 **(6 hrs)**

Low Temperature Physics: Production of low temperatures - Joule – Thomson Porous plug experiment, Adiabatic demagnetization, Liquefaction of Air: Linde's Process, Practical applications of low temperature: Refrigerators and Air-conditioning machines

Unit III: Transmission of Heat

Module: 1 **(5 Hrs)**

Conduction: Rectilinear flow of heat along a bar, Coefficient of thermal conductivity, Searles Method, coefficient of thermal conductivity of a bad conductor by Lee's disc method, Forbes method to find thermal conductivity of a metal, **convection**: lapse rate, Stability of the atmosphere.

Module: 2 **(6 Hrs)**

Radiation: Black body, Stefan – Boltzmann law, energy distribution in black body spectrum, Wien's law, Rayleigh Jean's law, Planck's law, solar constant, water flow pyroheliometer

Unit IV: Thermodynamics

Module: 1 **(5 Hrs)**

Zeroth and First law of thermodynamics: Extensive and Intensive thermodynamic variables, isothermal process, adiabatic process, gas equation during adiabatic process, work done during adiabatic and isothermal process, Application of first law

Module: 2 **(4 Hrs)**

Second law of thermodynamics: Reversible, irreversible and quasi static processes, Heat engine: Carnot cycle, Carnot's engine, its efficiency

Module: 3 **(2 Hrs)**

Entropy: Concept of entropy, Temperature – entropy diagrams – physical significance of entropy - third law of thermodynamics

Module: 4 **(7 Hrs)**

Thermo-dynamical potentials and Maxwell thermo-dynamical relations: Thermo-dynamical potentials - Internal energy, Enthalphy, Helmholtz free energy, Gibbs free energy, Phase transition, Derivation and application of Maxwell thermo-dynamical relations, Clausius – Clapeyron equation

Unit V: Statistical Physics

Module: 1 **(6 Hrs)**

Fundamentals of statistics: Macrostates and microstates, Thermo-dynamical probability, ensembles, Types of ensembles, partition function, equipartition energy, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions

g. Text Books:

1. Heat and Thermodynamics – Brijlal and Subramanyam, S.Chand & Co, 16th Edition New Delhi, 2005.
2. Thermal Physics – R. Murughesan and Kiruthiga Sivaprasath, S.Chand & Co, II Edition, New Delhi, 2008

h. Books for Reference:

1. J.B. Rajan, Heat & Thermodynamics –SC Publisher, New Delhi, 1985.
2. H.C. Varma, Concepts of Physics Volume I and II, Bharati Bhawan Publishers, New Delhi, 2015
3. M. Narayanamoorthy and N. Nagarathinam, Heat, National publishing Co,Chennai, Eight edition, 1987.
3. D.S. Mathur, Heat and Thermodynamics, Sultan Chand & Sons, 5th Edition, New Delhi, 2014
4. M.W. Zemansky, and Richard Dittman, Heat and Thermodynamics, McGraw-Hill, 1981,

i. Mapping of Cos to POs and PSOs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1(K1)	H	H	M	M	H	H	L	L
CO2(K2)	H	H	M	H	H	H	L	L
CO3(K3)	H	H	M	M	H	H	L	L
CO4(K4)	H	M	M	M	M	M	L	L
CO5(K5)	H	H	L	L	H	H	L	L
CO6(K6)	H	M	M	L	L	M	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1(K1)	H	M	M	M	H	H	L	L
CO2(K2)	H	M	L	M	H	H	M	L
CO3(K3)	H	M	M	M	H	H	M	
CO4(K4)	H	L	L	M	H	H	M	L
CO5(K5)	M	M	M	M	H	M	M	L
CO6(K6)	L	L	L	L	H	L	L	L

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

CORE 2: THERMAL PHYSICS - PRACTICAL

a. Course Code:

L	T	P	C
-	-	2	1

b. Course outcome:

CO1: To determine the coefficient of thermal conductivity for different materials experimentally

CO2: To estimate the specific heat capacity of different liquids

CO3: To calculate Planck's constant

c. List of Practicals

1. Thermal conductivity- Searle's method
2. Thermal conductivity - Forbe's apparatus
3. Verification of Newton's Law of Cooling
4. Specific heat capacity of a liquid – Method of mixtures (Half-time correction)
5. Specific heat capacity of a liquid – Newton's law of Cooling
6. Coefficient of apparent expansion of a liquid – Pyrometer
7. Thermal conductivity of a bad conductor- Lee's Disc method
8. Thermal conductivity of powder - Lee's Disc method
9. Joules calorimeter – Specific heat capacity of liquid
10. To determine Planck's constant
11. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions
12. To determine the coefficient of linear expansion of the given material
13. Any other experiment

d. Reference Books

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House

e. Mapping of COs to POs & PSOs with correlation level and Cognitive level of COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1 (K4)	H	M	M	M	M	M	M	L
CO2(K5)	H	M	M	M	M	M	M	L
CO3(K6)	H	M	L	L	L	L	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1(K4)	M	L	L	M	H	L	M	L
CO2(K5)	M	L	L	M	H	L	M	L
CO3(K6)	M	L	L	M	H	M	M	M

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

ALLIED I: ALLIED PHYSICS – I - THEORY

L	T	P	C
3	-	-	3

a) Course Code:

b) Course Objectives:

a) Understand the concept of strength of materials, viscous properties of liquids
b) Demonstrate practical knowledge gained from the elastic properties of solids
c) Learn the thermodynamic laws and its connection to Carnot engine
d) Get an idea about interference and diffraction and its applications

c) Learning Progression:

HSc Physics	
Elastic behaviour of materials	Ray optics
Stress and strain and its types	Angle of minimum deviation
Hooke's law, Modulus of elasticity	Refractive index
Poisson's ratio	Dispersion
Streamlined and turbulent flow of fluids	Dispersive power
Intermolecular forces	
Ideal gas laws	
Concept of specific heat capacity	
Laws of thermodynamics	

d) Theoretical/Experimental Foundations of the course:

1. Relation between the elastic moduli
2. Bernoulli's Theorem
3. Theory of transmission grating
4. Determine the wavelength of spectral lines by diffraction

e) Course Outcome:

CO1: Remember the basic concepts of elasticity
CO2: Explain the basics of properties of matter and how they are evaluated for different shapes of practical relevance
CO3: Evaluate the moment of Inertia of different bodies
CO4: Apply Poiseuille's method to determine the viscosity of fluids
CO5: Distinguish conduction, convection and radiation and learn the radiation laws
CO6: Adopt interference and diffraction to determine the wavelength of spectral lines

f) Course Outline:

UNIT-I PROPERTIES OF MATTER

Module: 1 **(3 Hr)**

Elastic Moduli: Young's modulus – Rigidity modulus – Bulk modulus – Poisson's ratio

Module: 2 **(3 Hr)**

Bending of beams: Expression for bending moment – determination of young's modulus –uniform and non-uniform bending

Module: 3 **(4 Hr)**

Torsion: Expression for Couple per unit twist – work done in twisting a wire – Torsional oscillations of a body– Rigidity modulus of a wire and M.I. of a disc by torsion pendulum

UNIT-II VISCOSITY

Module: 1 **(3 Hr)**

Viscosity: Viscous force – Co-efficient of viscosity – units and dimensions – Poiseuille's formula for co-efficient of viscosity of a liquid

Module: 2 **(4 Hr)**

Determination of Viscosity: coefficient of viscosity using burette and comparison of Viscosities - Bernoulli's theorem – Statement and proof – Venturimeter – Pitot tube

UNIT-III CONDUCTION, CONVECTION AND RADIATION

Module: 1 **(3 Hr)**

Conduction: Specific heat capacity of solids and liquids – Dulong and Petit's law – Newton's law of cooling – Specific heat capacity of a liquid by cooling – thermal conduction –coefficient of thermal conductivity by Lee's disc method

Module: 2 **(2 Hr)**

Convection: Lapse rate – green house effect

Module: 3 **(3 Hr)**

Radiation: Black body radiation – Planck's radiation law – Rayleigh Jean's law, Wien's displacement law – Stefan's law of radiation. (No derivations)

UNIT-IV THERMODYNAMICS

Module: 1 **(2 Hr)**

Law of Thermodynamics: Zeroth and I Law of thermodynamics – II law of thermodynamics

Module: 2 **(2Hr)**

Carnot's engine: Carnot's cycle – Efficiency of a Carnot's engine

Module: 3 **(4 Hr)**

Entropy: Change in entropy in reversible and irreversible process – change in entropy of a perfect gas – change in entropy when ice is converted into steam

UNIT-V OPTICS

Module: 1 **(3 Hr)**

Interference: conditions for interference maxima and minima – Air wedge – thickness of a thin wire – Newton's rings – determination of wavelength using Newton's rings

Module: 2 **(3 Hr)**

Diffraction: Difference between diffraction and interference – Theory of transmission grating – normal incidence

Module: 3 **(2 Hr)**

Optical activity: Biot's laws – Specific rotatory power – determination of specific rotatory power using Laurent's half shade polarimeter

g) Books for Study:

1. Heat and Thermodynamics – D.S. Mathur – S. Chand & Co., 2004
2. Properties of matter – R. Murugesan – S. Chand & Co., 2004
3. A text book of Optics – Subramanyam and Brijlal, S. Chand and co. New Delhi, 22nd, Edition 2004

h) Books for References:

1. Properties of matter – Brijlal and Subramanian S. Chand & Co., 2006
2. Element of properties of matter – D.S.Mathur – S.Chand & Company Ltd, New Delhi, 1976
3. Heat and Thermodynamics–Brijlal& Subramanyam, S.Chand & Co, 16th Edition, 2005
4. Optics – Sathyaprakash, Ratan Prakashan Mandhir, New Delhi, VIIth Edition, 1990

ALLIED I: ALLIED PHYSICS – I - PRACTICAL

a) Course Code:

L	T	P	C
-	-	2	1

b) Course Outcome:

CO1: Determine the elastic constants like Young's modulus and Rigidity modulus

CO2: Estimate the properties of liquids like surface tension and viscosity by simple experiments

CO3: Determine the wavelength of spectral lines and thickness of given thin object, from the knowledge acquired from interference and diffraction

c) List of Practicals:

1. Young's modulus – Cantilever– Pin and microscope
2. Rigidity Modulus – Torsional pendulum
3. Coefficient of Viscosity of liquid – Graduated burette
4. Viscosity of a liquid – Stoke's method
5. Joule's calorimeter- Specific heat capacity of a liquid
6. Coefficient of thermal conductivity of a bad conductor - Lee's Disc
7. Air Wedge – Thickness of a thin wire
8. Newton's ring – Radius of curvature and refractive index
9. Spectrometer – Refractive index of material of a prism
10. Spectrometer – Wavelength of mercury lines – grating – minimum deviation method
11. Spectrometer – Dispersive power of the prism for various colors
12. Spectrometer – Wavelength of Spectral lines in normal incidence – grating
13. Spectrometer – Wavelength of Spectral lines in oblique incidence – grating
14. Any other experiment

CORE 3: MODERN OPTICS - THEORY

L	T	P	C
4	-	-	4

a. Course Code:

b. Course Objectives:

1. To understand the properties of light, its nature and its propagation
2. To gain knowledge in geometrical optics involving geometrical consideration of image –formation based on the rectilinear propagation of light
3. To emphasize the different fundamental principles and the techniques used for different optical phenomena such as Interference, Diffraction and Polarization exhibited by light using suitable theories

c. Learning Progression:

HSc PHYSICS
Reflection, Spherical Mirror, Mirror equation
Refraction, Lens makers formula
Optical instruments, Telescope, Microscope
Interference, Young's double slit experiment
Diffraction, Grating
Polarisation, Malu's law, Brewster's law

d. Theoretical/Experimental Foundations of the course:

1. Fermat's principle
2. Malu's Law
3. Michelson interferometer
4. Fresnel and Fraunhofer diffraction

e. Course Outcomes (COs):

CO1: Apply cardinal points technique and aberration to study the image formation in optical systems

CO2: Solve numerical problems based on aberration and cardinal points

CO3: Apply division by wave front and division by amplitude techniques to study interference patterns

CO4: Interpret conditions for Fresnel class diffraction and Fraunhofer class diffraction

CO5: Analyze the types of polarized light with the help of Nicol Prism and retardation plate

CO6: Understand the basic concepts of lasers and fibre optic communications

f. Course Outline

UNIT – I GEOMETRICAL OPTICS

Module: 1 **(6 hrs)**

Aberration: Lens – Spherical aberration in lenses – Methods of minimizing spherical aberration –

chromatic aberration in lenses – condition for achromatism of two thin lenses (in and out of contact) – Aplanatic lens

Module: 2 **(3 hrs)**

Dispersion: Dispersion – Angular and Chromatic dispersion – combination of prisms to produce i) dispersion without deviation ii) deviation without dispersion

Module: 3 **(4 hrs)**

Optical instruments: Eyepieces – Ramsden's and Huygens's eyepieces – simple microscope (magnifying glass) – compound microscope.

UNIT – II INTERFERENCE

Module: 1 **(7 hrs)**

Interference: Conditions for interference – Theory of interference fringes – interference due to reflected light (thin films) - colures of thin films -Wedge shaped thin film – theory – determination of diameter of a thin wire by Air wedge – test for optical flatness – Newton's rings by reflected light

Module: 2 **(4 hrs)**

Interferometer: Michelson's Interferometer – theory and its Application (Measurement of wavelength) – Jamin's interferometers

UNIT – III DIFFRACTION

Module: 1 **(6 hrs)**

Fresnel's diffraction: Fresnel's diffraction –Rectilinear propagation of light – zone plate –action of zone plate -diffraction at circular aperture – opaque circular disc

Module: 2 **(8 hrs)**

Fraunhofer diffraction: Fraunhofer diffraction at single slit –Double slit – Plane diffraction grating – theory of plane transmission grating - experiment to determine wavelength(Normal incidence method) – resolving power– Rayleigh's criterion for resolution – resolving power of a telescope – resolving power of a prism

UNIT – IV POLARISATION

Module: 1 **(8 hrs)**

Polarisation: Double refraction – Nicol Prism – Nicol Prism as polarizer and analyzer – Huygens's explanation of double refraction in uni-axial crystals– Plane, elliptically and circularly polarized light– Quarter wave plates and half wave plates – Production and detection of plane, circularly and elliptically polarized light

Module: 2 **(4 hrs)**

Optical activity: Fresnel's explanation of optical activity – Specific rotatory power –Laurent's half shade polarimeter.

UNIT – V LASERS

Module: 1 **(7 hrs)**

Lasers: Introduction- Einstein Coefficient- Light amplification – Threshold condition – Cavity resonator – Pumping – Ruby – He-Ne- Laser application in medicine industry and metrology

Module: 2 **(3 hrs)**

Fiber optics: Basic ideas on optical communication – Optical fiber and types – Losses – Sources and detectors.

g. Mapping of COs to POs & PSOs with correlation level and Cognitive level of COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	L	M	L	M	L	L
CO2	M	L	H	H	L	M	L	L
CO3	M	M	H	M	L	M	L	L
CO4	H	M	M	M	M	M	L	L
CO5	H	M	M	H	L	M	L	L
CO6	H	M	H	M	M	M	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	L	H	L	M	M	L	H	M
CO2	L	H	L	L	M	M	H	L
CO3	M	H	L	L	H	M	H	L
CO4	L	H	L	L	M	L	M	L
CO5	M	H	L	L	H	M	M	L
CO6	M	H	L	L	H	M	H	H

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

h. Books for Study

a. Fundamentals of Optics – Khanna & Gulati, R. Chand & Co., 14th Edn., New Delhi

b. Optics – Ajoy Ghatak, 2nd Edition, Tata McGraw Hill Ltd., New Delhi, 1992

i. Books for Reference

1. Introduction to Classical and Modern Optics-J.R. Meyer Arendt-2nd edition-PHI, 1984
2. Optics and Atomic Physics, Singh & Agarwal, , Pragati Prakashan Meerut, Nineth edition, 2002.
3. Fundamentals of Physics, D.Halliday, R. Resnick and J. Walker, Wiley, 6thEdition, New York (2001).
4. Textbook of Optics – Subramanyam and Brijlal, Publishers: S. Chand & Co

CORE 3: MODERN OPTICS - PRACTICAL

L	T	P	C
-	-	2	1

a. Course Code

b. Course Outcome

CO1: Test the refractive index and dispersive power of given material

CO2: Measure the thickness of thin object by interference

CO3: Estimate the slit width and wavelength of given laser by diffraction

c. List of Practicals

1. Focal length of convex lens
2. Focal length of concave lens
3. Air Wedge – Thickness of a thin wire
4. Newton's ring – Radius of curvature and refractive index
5. Spectrometer – Refractive index of material of a prism

6. Spectrometer – Wavelength of mercury lines – grating – minimum deviation method
7. Spectrometer – Dispersive power of the prism
8. Spectrometer – Wavelength of Spectral lines in normal incidence – grating
9. Spectrometer – Wavelength of Spectral lines in oblique incidence – grating
10. Spectrometer – i-d curve
11. Refractive index of water – hollow prism
12. Fraunhofer diffraction
13. Cauchy's constant
14. Any other experiment

Mapping of COs to POs & PSOs with correlation level and Cognitive level of COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	M	M	H	M	L	M	L	L
CO2	M	M	H	H	L	M	L	L
CO3	M	M	H	M	L	M	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	L	H	L	M	H	L	M	M
CO2	L	H	L	L	M	L	M	L
CO3	M	H	L	L	H	L	M	M

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

CORE 4: ELECTRICITY AND ELECTROMAGNETISM - THEORY

L	T	P	C
4	-	-	1

a. Course Code:

b. Course Objectives

4. To calculate the electric and magnetic fields & their respective potentials of different charge and current geometries using special techniques
5. To study the growth and decay of current and voltage in direct and alternating circuits
6. To study electromagnetic induction and Maxwell field equations.

c. Learning Progression

HSc Physics	
Electrostatics: Coulomb's law, dipole, Electric field, potential, potential energy, Gauss law, capacitors Magnetostatics: Bar magnet, Biot-Savart law, Ampere law, Lorentz force law, torque, moving coil galvanometer Electromagnetic induction: Faraday's law, Lenz's law, Fleming's RH rule, motional emf, eddy current, self-induction, transformer Electromagnetic waves: Displacement current, Maxwell's equations, EM spectrum, absorption, emission	Direct electricity: ohm's law, Kirchoff rule, Joule's law, thermoelectric effects Alternating Current: resistive, inductive and capacitive circuits, RLC series circuit, power in ac circuits

d. Experimental and Theoretical Foundations of the course

Coulomb's law, Parallel plate capacitor, Faraday's experiment, Oersted's experiment, Poisson's equations, Maxwell field equations

e. Course Outcomes (COs)

At the end of the Course, the student will be able to -

CO1: State the relations among ρ, **E** & V and **J**, **B** & **A**, Maxwell's equations

CO2: Describe Faraday's experiment, Lorentz force, induced electric field, growth and decay characteristics of current and voltage in circuits

CO3: Apply the relations to get the desired fields from different geometries

CO4: Deduce the fields using special techniques originated due to sources of charge and current

CO5: Evaluate the fields at the boundaries of the medium

CO6: Formulate a new electrical energy storage configuration and new devices using the dielectrics and magnetic materials

*Based on Bloom's Taxonomy (Refer Appendix 2) & it is suggestive

f. Course Outline:

Unit – I ELECTROSTATICS IN FREE SPACE

Module 1: Electrostatic Field – Coulomb's law, superposition principle, electric field continuous charge distribution in different geometry (2 Lectures)

Module 2: Gauss law – Application of it with Gaussian surfaces in different geometry (3 Lectures)

Module 3: Potential – calculation of potential in different continuous charge distribution (2 Lectures)

Module 4: Boundary condition – relations among ρ, E and V, calculation of field and potential at the boundary (2 Lectures)

Module 5: Electrostatic Energy – Energy in system of charges and continuous charge distributions (1 lecture)

Module 6: Conductors – induced charge, Surface charge and force on a conductor, Capacitors (2 lectures)

Unit – II ELECTROSTATICS IN MEDIUM

Module 7: Laplace equations – Boundary condition and uniqueness theorem (2 lectures)

Module 8: Method of images – classic image problem, induced surface charge, force and energy (3 lectures)

Module 9: Multipole expansion – dipole, electric field of dipole (2 lectures)

Module 10: Dielectrics – induced dipole, torque on polar molecules, Polarization, field due to polarised objects, filed inside a dielectric (2 lectures)

Module 11: Electric displacement – Gauss law in the presence of dielectric, boundary condition, susceptibility, permittivity, boundary value problems with linear dielectrics, energy in dielectrics, force on dielectrics (3 Lectures)

Unit III DC AND AC CIRCUITS

Module 12: Electrical conduction – current density, conservation of charge, Ohm's law, drift velocity (2 Lectures)

Module 13: Circuits – Circuit elements, energy dissipation, emf and voltaic cell (2 lectures)

Module 14: **Kirchhoff''s law** – voltage and current laws, Thevenin's theorem, variable currents in C and R (3 Lectures)

Module 15: Alternating circuits – resonant circuit, RL, RC and RLC circuits (4 Lectures)

Unit IV MAGNETOSTATICS IN FREE SPACE AND MEDIUM

Module 16: Lorentz force – magnetic fields, forces, currents (2 Lectures)

Module 17: Biot-Savart law – steady currents, magnetic field (2 Lectures)

Module 18: Divergence and curl of B – straight line currents, applications of Ampere's law (3 Lectures)

Module 19: Vector potential – magnetic vector potential, relations among B, J and A, (3 Lectures)

Module 20: Magnetic medium – dipole, magnetization, magnetic field inside medium H, Ampere's law in medium (3 Lectures)

Unit V: MAXWELL'S FIELD EQUATIONS

Module 21: Electromagnetic Induction – Faraday's Law, induced electric field, Lenz's Law, self Inductance, Mutual Inductance (3 lectures)

Module 22: Energy stored in a Magnetic Field (2 lectures)

Module 23: Maxwell equations – Maxwell modification of Ampere's law, Maxwell's Equations and boundary conditions (4 Lectures)

g. Books for Study:

1. David J. Griffith, Introduction to Electrodynamics, 3rd Edition(2012) PHI, New Delhi
2. Edward M. Purcell and David I. Morin, Electricity and Magnetism, 3rd Edition(2013), Cambride University Press, New Delhi

h. Books for Reference:

1. R. Murugeshan, Electricity and Magnetism (2008) S. Chand & Co, New Delhi
2. BrijLal and Subramanyam, Electricity and Magnetism,(2005)
3. M.Narayanamurthy and N.Nagarathnam, Electricity & Magnetism, NPC pub., Revised edition.
4. K.K.Tiwari Electricity and Magnetism - (S. Chand &Co.)
5. D.Halliday, R.Resnick and J.Walker, Fundamentals of Physics – Electicity and Magnetism (2011), Wiley India,Pvt Ltd

i. Mapping of COs to POs & PSOs with correlation level and Cognitive level of COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	L	M	L	M	L	L
CO2	M	L	H	H	L	M	L	L
CO3	M	M	H	M	L	M	L	L
CO4	H	M	M	M	M	M	L	L
CO5	H	M	M	H	L	M	L	L
CO6	H	M	H	M	M	M	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	L	H	L	M	M	L	H	M
CO2	L	H	L	L	M	M	H	L
CO3	M	H	L	L	H	M	H	L
CO4	L	H	L	L	M	L	M	L
CO5	M	H	L	L	H	M	M	L
CO6	M	H	L	L	H	M	H	H

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

CORE 4: ELECTRICITY AND ELECTROMAGNETISM - PRACTICAL

L	T	P	C
-	-	2	1

a. Course Code:

b. Course Objectives

1. To demonstrate the concepts learned in the theory and experience inferences learned in theory
2. To measure the physical quantities from the circuits and plot their variation

c. Course Outcomes (COs)

At the end of the Course, the student will be able to -

CO1: show Faraday's experiment, Oersted's experiment (K2)

CO4: Analyse the field patterns due to different source configurations (K4)

CO5: Measure various physical quantities in a circuits and their characteristic parameters (K5)

d. Course Outline:

List of Experiments/Demonstrations (Any Eight from the list)

1. Equipotential lines – Drawing the graph of the equipotential lines of copper rod immersed in water bath
2. Measuring the dielectric constant of the liquids
3. Oersted's experiment – measurement of steady direct current in straight wire from the deflection of the campus needle
4. Photographing of the magnetic field induced due to straight line wire, circular wire and bar magnet using iron filings
5. Measurement of defection caused due to torque acted on a rectangular loop when subjected magnetic field
6. Moving coil galvanometer – measurement of current in the loop
7. Faraday's experiment – Electromagnetic induction – Narration of the visual observations
8. Demonstration of eddy currents – listing the observations
9. Potentiometer- Measurement of Resistance
10. Potentiometer-Calibration of Voltmeter by standardization method of low range
11. Potentiometer- Calibration of an Ammeter.
12. Comparison of Capacitance- Ballistic Galvanometer
13. Comparison of EMF 's using Ballistic Galvanometer
14. Measurement of Inductance using Ballistic Galvanometer
15. Owen's Bridge – Inductances in series and parallel
16. De Sauty's Bridge – Capacitances in series and parallel
17. LCR series resonant circuit
18. Any other experiment in electromagnetism
19. Any other experiment in Electricity

e. Mapping of COs to POs & PSOs with correlation level and Cognitive level of COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1(K2)	M	L	H	H	L	M	L	L
CO2(K4)	H	M	M	M	M	M	L	L
CO3(K5)	H	M	M	H	L	M	L	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1(K2)	L	H	L	L	M	M	H	L
CO2(K4)	L	H	L	L	M	L	M	L
CO3(K5)	M	H	L	L	H	M	M	L

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

ALLIED 2: ALLIED PHYSICS –II - THEORY

L	T	P	C
3	-	-	3

i. Course Code:

j. Course Objectives:

7. To understand the basics of current electricity and electromagnetism
8. To gain knowledge in the working of semiconducting devices
9. To infer the atom models and energy released in fission and fusion reactions

k. Learning Progression:

HSc Physics
Ohm's law, Kirchhoff's laws – Whetstone's bridge
Faraday's laws – Lenz law, Self Inductance
Bohr's atom model, Radioactivity
Nuclear fusion and nuclear fission
Types of semiconductors, p-n junction diode
Logic gates, De-Morgan's theorem

l. Theoretical/Experimental Foundations of the course:

5. Bragg's law
6. Number System
7. Double Dabble method
8. De-Morgan's theorem

m. Course Outcomes (COs):

At the end of the Course, the student will be able to -

CO1: Recall a.c. and d.c. circuits and their application

CO2: Role –play of electromagnetic induction in renewable energy resources

CO3: Explain the application of X-rays and radio isotopes

CO4: Connect the working of semiconductors in amplifier and oscillator

CO5: Differentiate Analog and digital electronic devices

CO6: Construct combinational logic circuits

f. Course Outline:

UNIT I: CURRENT ELECTRICITY

Module: 1 **(3 hrs)**

Electrical Circuits: Ohm's law – Law of resistance in series and parallel – Specific resistance – capacitors –capacitors in serial and parallel

Module: 2 **(5 hrs)**

D.C. Circuits: Kirchhoff's laws – Whetstone's network - condition for balance - Carey-Foster's bridge – measurement of resistance – measurement of specific resistance – determination of temperature coefficient of resistance – Potentiometer – calibration of Volt meter

UNIT II: ELECTROMAGNETISM

Module: 1 **(4 hrs)**

Electromagnetic Induction: Faraday's laws – Lenz law – Self Inductance – Mutual Inductance – Coefficient of Coupling

Module: 2 **(4 hrs)**

A.C. Circuits: Mean value – RMS value – Peak value – LCR in series circuit – impedance – Resonant frequency – sharpness of resonance

UNIT III: ATOMIC AND NUCLEAR PHYSICS

Module: 1 **(3 hrs)**

Atomic Physics: Bohr's atom model – radius energy – Atomic excitation – Ionization potential – Frank and Hertz Method

Module: 2 **(3 hrs)**

Nuclear Physics: Nucleus – Nuclear properties – Mass defect – Binding energy - Radio isotopes – Uses of radio isotopes – Nuclear fusion and nuclear fission

Module: 3 **(2 hrs)**

X-rays: Derivation of Bragg's law – Powder diffraction method-uses in industrial and medical fields

UNIT IV: ANALOG ELECTRONICS

Module: 1 **(4 hrs)**

Semiconductor: PN junction diode – Bridge rectifier – Zener diode – Regulated power supply.

Module: 2 **(4 hrs)**

Transistor: Working of a transistor – CE Configuration – current gain relationship between α and – Transistor Characteristics – CE Configuration only – CE amplifier – feedback –Hartley oscillator – Colpitt's oscillator.

UNIT V: DIGITAL ELECTRONICS

Module: 1 **(4 hrs)**

Number system: Decimal – Binary – Octal and Hexadecimal system – Double Dabble method– Binary addition, subtraction and multiplication – conversion of one number system to another number system

Module: 2 **(4 hrs)**

Logic gates: OR, AND, NOT, XOR, NAND and NOR gates – truth tables – Half adder and Full adder – Laws and theorems of Boolean's algebra – De Morgan's theorems.

g. Books for Study:

1. Modern Physics – R. Murugesan, S. chand & co, 1998.
2. Basic Electronics – B.L. Theraja, S. chand & co, 2003

h. Books for Reference:

1. Concepts of Modern Physics, Arthur Beiser Tata McGraw Hill Co
2. Modern Physics – R. Murugesan, S. chand & co, 1998.
3. Electricity and Magnetism with Electronics – K.K. Tiwari
4. Basic Electronics – B.L. Theraja, S. chand & co, 2003
5. Atomic Physics, J.B.Rajam, S.Chand Co

ALLIED 2: ALLIED PHYSICS –II - PRACTICAL

L	T	P	C
-	-	2	1

a. Course Code:

b. Course Outcome:

CO1: Construct rectifier and oscillator circuits
CO2: Infer the voltage Vs current behavior in PN junction and Zener diode
CO3: Construct combinational logic circuits

c. List of Practicals:

1. Potentiometer – Calibration of low range ammeter
2. Potentiometer – Calibration of low range voltmeter
3. Carey-Foster's bridge – measurement of resistance
4. Bridge Rectifier using diodes
5. p-n Junction Diode –I-V Characteristics
6. Zener diode Characteristics – I-V Curve and break down voltage
7. Hartley oscillator
8. Colpitt's oscillator
9. Basic logic gates (OR, AND and NOT) – Construction and Verification using discrete components
10. Basic logic gates (OR, AND and NOT) – Construction and Verification using ICs
11. De Morgan's theorem – Verification using ICs
12. NAND as universal gate
13. Any other experiments

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