COMPLEMENTARY ELECTIVE COURSE I: -MECHANICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	ICO1PHY	2	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Properties of matter
CO2: Explain the dynamics of rigid bodies.
CO3: Understand the basic concepts of wave motion and oscillations

UNIT 1: Properties of matter :13 Hours

Elasticity: Hooke's law, moduli of elasticity- Poisson ratio, Twisting Couple on a cylindrical rod- Bending of Beams-Bending Moment, Cantilever, Transverse vibrations of a loaded cantilever, Uniform and Non-uniform Bending, Determination of Young modulus using uniform bending – mirror and telescope method

Viscosity: Viscosity, Critical velocity, Flow of liquid through a capillary tube, Poiseulle's formula, Stokes formula.

Surface tension: Surface energy - expression for excess pressure on a curved surface – Capillary action – Explanation of capillary action - Measurement of surface tension by capillary tube method

(Book 1: Section – 12.1-12.10, 12.13-12.14, 12.15-12.23, 14.1-14.3, 14.6, 15.1-15.4, 16.1-16.13.16.21-16.22)

UNIT 2: Dynamics of Rigid Bodies: - **6 Hours**

Rigid body , Centre of mass , Angular momentum and Torque, Moment of inertia , Radius of gyration, Theorems on moment of Inertia, Moment of inertia of thin Rod, Circular Disc, Annular Ring, Cylinder (solid and hollow) and Sphere (solid). Moment of inertia of fly wheel

Book 1: Section – 6.2, 8.1, 8.5- 8.6.8.9)

UNIT 3: Oscillation and waves: (13 Hours)

Harmonic Oscillator : Periodic motion, Simple harmonic oscillator, Energy of Simple harmonic oscillator, Compound Pendulum , Torsion pendulum, Damping force , Damped Harmonic oscillator , Quality factor, Galvanometer with low damping , LCR circuit

Wave Motion: General equation of wave motion, Plane progressive harmonic wave, Energy density and Energy flow/current for plane progressive wave, Transverse waves in stretched strings, Longitudinal waves in rods and gases, Stationary waves, Waves in a linear bounded medium, Flow of energy in stationary waves.

Book 1: Section – 9.1- 9.4, 9.8,10.1-10.2, 10.4- 10.5, 11.1-11.4, 11.6- 11.10

Books for study:

1. Mechanics – J.C. Updhyaya
2. Mechanics - D.S.Mathur

Books for reference:

1. Feynman lectures on Physics by Richard Feynman
2. Fundamentals of Physics by Resnick & Haliday

MARKS INCLUDING CHOICE:

Unit	Marks
I	20
II	10
III	22

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Problem**s	(5questions x Marks 3 each =15
	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -52**
- **Maximum marks of the course-32**

COMPLEMENTARY ELECTIVE COURSE II:ELECTRICITY, MAGNETISM AND THERMODYNAMICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2CO2PHY	2	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Magnetism &electricity
CO2: Explain the magnetic effects of electric currents
CO3: Understand the basic principles of Thermodynamics

UNIT 1: Magnetism and Electricity **10 Hours**

Magnetism: Magnetic properties of materials – Magnetic Induction, Magnetisation, Relation between the three magnetic vectors B,H and M, Magnetic susceptibility, Magnetic permeability, properties of Dia, Para and Ferro magnetic materials, Anti ferromagnetism and ferrimagnetisms, magnetic element at a place, Deflection magnetometer, Searle's vibration magnetometer, Box type vibration magnetometer.

Electricity : Carey Foster bridge-theory, determination of resistance, resistivity and temperature coefficient, Potentiometer- theory, Calibration of Ammeter, Calibration of Voltmeter (low &High Range) conversion of galvanometer into ammeter and voltmeter.

(**Book 1: Section – 15.1 – 15.9, 42.1, 7.1-7.2, 39.2-39.3,42.10-42.15)**

UNIT 2: Magnetic effect of electric current **9 Hours**

Biot-Savart law, Magnetic induction at a point due to a straight conductor carrying current, Magnetic induction at a point on the axis of a circular coil, Lorentz force, Force on a current carrying conductor, Torque on a current loop in a uniform magnetic field, Theory and working of moving coil Ballistic Galvanometer, figure of merit of B.G and its determination.

(**Book 1: Section – 10.1 - 10.4, 10.7, 10.10-10.13)**

UNIT 3: Thermodynamics **13 Hours**

Thermodynamic systems, Thermodynamic processes, Thermodynamic equilibrium, Zeroth law thermodynamics, Work- A path dependent function, Internal Energy, First Law of thermodynamics, Applications of first law, The indicator Diagram, Work done during an Isothermal Process and Adiabatic Process, Adiabatic and Isothermal Elasticises, Second law of thermodynamics, Carnot's engine , Derivation of efficiency using Carnot's cycle , Carnot's theorem , Refrigerator, Coefficient of performance , Concept of entropy, Change of entropy in reversible and irreversible cycles, Principle of increase of entropy.

(Book 2: Section – 4.1 – 4.7, 4.10-4.15, 4.21-4.29, 5.1-5.6)

Books for study:

1. Electricity and Magnetism (2008th edition)-R.Murugeshan
2 Heat and Thermodynamics (16th edition) by Brijlal and Subramanian

Books for reference:

1. Electricity and Magnetism-D.N .Vasudeva
2. Heat and Thermodynamics-D.S.Mathur.
3. Introduction to electrodynamics -David .J .Griffiths
4. Heat & Thermodynamics: W.Zemansky, McGraw Hill

MARKS INCLUDING CHOICE:

Unit	Marks
I	18
II	14
III	20

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Problem**s	(5questions x Marks 3 each =15
	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)

- **Total marks including choice -52**
- **Maximum marks of the course-32**

COMPLEMENTARY ELECTIVE COURSE III: OPTICS AND PHOTONICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3C03PHY	3	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Interference
CO2:Understand the basic concepts of Diffraction
CO3: Understand the basic concepts of Polarization
CO4: Understand the basic concepts of Photonics and Fibre Optics

UNIT – 1: Interference **12 Hours**

Interference of light, principle of superposition, Conditions for maximum and minimum intensities, Coherent sources, Theory of interference fringes, Colours of thin films-interference due to reflected light, Interference due to transmitted light, Fringes produced by a wedge shaped thin film, Newton's Rings by reflected light, Determination of wave length of sodium light and Refractive index of a transparent liquid by Newton's rings. (**Book 1: Section: 2.1 – 2.2, 2.5 - 2.10)**

UNIT- 2: Diffraction **12 Hours**

Fresnel and Fraunhofer diffraction - Fresnel's Explanation of Rectilinear Propagation of light- Zone plate, Diffraction at a straight edge, Fraunhofer Diffraction at a single slit, Plane Transmission Diffraction Grating, Dispersive power of a Grating, Determination of wavelength of light using Transmission Grating. Comparison between interference and Diffraction (**Book 1: Section: 3.1 – 3.5, 3.7, 3.10, 3.12, 3.14, 3.17, 3.25)**

UNIT - 3: Polarization **9 Hours**

Introduction, Polarization of light, Polarization by reflection, Pile of Plate, Law of Malus, Double Refraction, Huygen's theory of double refraction in uniaxial crystal, Nicol Prism, Theory of production of Elliptically and Circularly Polarised light, Quarter wave plates, Half wave plate, Production and detection of Plane, Circularly and Elliptically polarized light **(Book 1: Section: 4.1-4.6, 4.8, 4.10 - 4.14)**

UNIT– 4: Photonics **15 Hours**

Laser: Absorption and emission of light, Induced absorption, Spontaneous emission and Stimulated emission, Einstein's relations , Principle of Laser, Meta stable state, Population inversion, Pumping, Pumping methods – Optical pumping, Electrical pumping and Direct conversion, Types of laser - Ruby laser, Helium Neon laser and Semi conductor laser, Properties of laser beams, Applications of lasers-Holography (principle, recording and reconstruction)

Fibre Optics: Introduction, Total internal reflection, Step index fibre, Graded index fibre, Light propagation in fibres, Acceptance angle, Numerical Aperture, The Coherent

Bundle, Fibre optic Communication system, Advantage of Fibre – Optic Communication system, Fibre optic sensors, Applications- Fibre optic Communication system.

(Book 2 : Section – 19.1-19.5Book 1: 8.1 – 8.6, 8.10, Ref. Book 3- chapter 38)

Books for study:

1. Optics and Spectroscopy by R Murugeshan, Kiruthiga ivaprasath, S Chand
2. Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand

Books for reference:

1. Optics by Subramanayam, Brijlal, MN Avadhanalu, S.Chand
2. Optics- Ajay Ghatak
3. Basic Electronics – Solid state – B..L. Thereja
4. Laser fundamentals – Silfast

MARKS INCLUDING CHOICE:

Unit	**Marks**
I	12
II	12
III	10
IV	18

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)
Part C	**Problem**s	(5questions x Marks 3 each =15

	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -52** • **Maximum marks of the course-32**		

COMPLEMENTARY ELECTIVE COURSE IV:ELECTRONICS AND MODERN PHYSICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C04PHY	3	2	3

COURSE OUTCOME

CO 1: Understand the basic concepts of Basic electronics
CO2: Understand the basic concepts of Digital electronics
CO3: Understand the basic concepts of Nuclear Physics
CO4: Understand the basic concepts of Particle physics and Astrophysics

UNIT – 1: Basic Electronics **15 Hours**

Semiconductors, pn junction, Current-voltage characteristics of pn junction- Forward and Reverse bias, Diode, Half wave, Full wave and bridge rectifier circuits, Efficiency and ripple factor, Filter circuits- capacitor filter and π filters, Zener diode and its characteristics, Voltage stabilization, Transistors- CB, CE, CC Configurations, Characteristics, Current amplification factors, Relation connecting α, β and γ , CE Amplifier, Feedback, Principle of negative voltage feedback in Amplifier, Gain and advantage of feedback – Sinusoidal oscillator , Oscillatory Circuit, Positive feedback Amplifier – Oscillator, Colpit's oscillators and Hartley oscillators.

(Book 1: 5.1, 5.8 – 5.20, 6.1, 6.7 –6.11, 6.13 - 6.15, 6.18, 6.20-6.21, 6.25, 6.27 – 6.28, 8.1 – 8.5, 8.7 – 8.10, 8.12 – 8.16, 13.1 – 13.4, 14.1 – 14.3, 14.5, 14.10- 14.11)

UNIT2– 2: Digital Electronics **9 Hours**

Introduction, Analogue and Digital signals, Number systems – Decimal, binary, Octal, Hexadecimal number systems- Conversion between different number systems, BCD Code, Logic gates - AND, OR, and NOT Universal gates – NAND and NOR , XOR gate, Boolean Algebra, Boolean Theorems, de Morgan's theorems, Binary Addition, Half adder and Full adder

(Book 1: Section – 26.1 – 26.17, 26.20 – 26.22, 26.31 – 26.32)

UNIT – 3: Nuclear Physics **12 Hours**

Introduction, Classification of Nucleus, General properties of Nucleus, Binding energy, Nuclear Stability, Nuclear force, Stability of nucleus, Radioactivity , Natural radioactivity, Alpha, Beta and Gamma Rays and its Properties, Law of radioactive decay , Half life, Mean life, Radioactive dating – age of the earth, Nuclear fission, Energy Released in Fission, Nuclear reactors, Nuclear fusion, Source of Stellar Energy

(Book 2: Section – 27.5 – 27.6, 27.7, 31.2-31.6, 31.29 – 31.33, 31.35, 35.2 – 35.3, 35.6- 35.8)

UNIT– 4: Particle physics and Astrophysics **12 Hours**

Particle Physics: Introduction, Classification of elementary particles – Particles and Anti- particles, Fundamental interaction, , Elementary particle quantum number, Idea of Quarks, The quark model, Compositions of hadrons according to quark model.

Astrophysics : Introduction, Classification of stars –The Harvard classification system, Hertzprung - Russel diagram, Luminosity of a star, Stellar Evolution, Chandrasekhar limit, White dwarfs, Neutron stars, Black Holes , Supernova Explosion.

(Book 2: Section – 38.1 – 38.2, 38.4 – 38.5, 38.7, 78.1 – 78.6, 78.8 - 78.11

Books for study:

1 Principles of Electronics-VK Mehta, S. Chand
2 Modern Physics – R .Murugeshan and Kiruthiga Sivaprasath , S. Chand

Books for reference:

1 Basic Electronics – Solid state – B..L. Thereja
2 Electronic Devices and Circuits- 5th Edition, David A Bell (Oxford)
3 Digital Principles and Applications - D P Leach and A P Malvino (TMH)
4 Concepts of Modern Physics, Arthur Beiser, TMH

MARKS INCLUDING CHOICE:

Unit	Marks
I	16
II	10
III	14
IV	12

PATTERN OF QUESTIONS

Part A	**Short answer**	(5 questions x Mark 1 = 5**)**
	Answer all questions	(5 questions x Mark 1 = 5)
Part B	**Short Essay**	(6 questions x Marks 2 each =12)
	Answer any 6 questions	(4questions x Marks 2 each=8)

Part C	**Problems**	(5questions x Marks 3 each =15
	Answer any 4 questions	(3questions x Marks 3 each=9)
Part D	**Long Essay**	(4 questions x Marks 5 each =20)
	Answer any 2 questions	(2 questions x Marks 5 each=10)
• **Total marks including choice -52** • **Maximum marks of the course-32**		

COMPLEMENTARY COURSE V – PHYSICS PRACTICAL

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS
4C05PHY	PHYSICS PRACTICAL	IV	2	4	3

COURSE OUTCOME

CO1: Familiarise with apparatus for experiments in mechanics, optics, electricity and magnetism and electronics and electronics experiments.

CO2: Develop skill in setting up of apparatus for accurate measurement of physical quantities.

CO3: Understand multiple experimental techniques for determining physical quantities.

CO4: Develop skill in systematic way of measurements by minimizing possible errors.

Note: A brief theoretical back ground of each experiment must be given to the students before each cycle of experiments . Students are to maintain a practical log book regularly signed by the teacher in charge. Fair record not required. All the experiments are to be done.

LIST OF EXPERIMENTS

1. Flywheel- Moment of inertia
2. Compound pendulum-determination of g and K
3. Torsion pendulum- Moment of inertia of a disc
4. Young's modulus - Uniform Bending - using optic lever
5. Young's modulus – Non-uniform bending - using pin and microscope
6. Liquid lens - Refractive Index of material of lens using liquid of known refractive index
7. Spectrometer – Refractive index of the material of a prism
8. Spectrometer – grating-normal incidence
9. Surface tension-Determination of surface tension of given liquid
10. Air Wedge-Diameter of a thin wire
11. Newton's Rings- wavelength of sodium light
12. Deflection Magnetometer –Tan A and Tan B
13. Searle's Vibration magnetometer- magnetic moment
14. Carey Fosters Bridge- resistivity
15. Potentiometer- resistivity
16. Potentiometer- Calibration of ammeter
17. Newton's law of cooling- Specific heat capacity of given liquid
18. Construction of half wave rectifier with and without filter - ripple factor & load regulation

19. Construction of regulated power supply using Zener diode
20. Construction of Logic gates – AND , OR, NOT- verification of truth table

Reference Books

1. Practical Physics by P R Sasi Kumar PHI Learning Private Limited
2. BSc Practical Physics by C L Arora ,S Chand
3. An advanced course in Practical Physics by D.Chattopadhyay& P C Rakhit New Central Book Agency(P)Ltd
4. BSc Practical Physics - C L Arora (S Chand & Co.)

MARK DISTRIBUTION

Section	**Marks**
Principle and formula	6
Performance	6
Observation	14
Calculation ,Graph & Result	6