

16UPH1MC01 - PROPERTIES OF MATTER AND ACOUSTICS

Category: MC

Credits: 7

Semester: I

No. of Hours/Week: 7

Course Outcomes

Co's	Statements	Bloom's Level
CO1	Differentiate between elastic and plastic. Acquire the skill to evaluate the elasticity of different materials.	L3
CO2	Identify the most and least viscous fluids and their role in daily life.	L3
CO3	Appreciate real life experiences of Surface tension and interfacial surface tension.	L4
CO4	Identify the different types of wave motion, the equations governing them and the construction of simple instruments.	L3
CO5	Design buildings based on acoustic principles.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	L	S	L	S
CO3	S	S	S	M	M
CO4	S	S	S	L	S
CO5	S	S	S	M	S

* S – Strong; M – Medium; L – Low

Unit 1: ELASTICITY**HOURS: 21**

Hooke's Law –stress–strain diagram –Moduli of Elasticity –Poisson's ratio–Relation between elastic constants and Poisson's ratio–Work done in stretching a wire–Twisting couple on a cylinder–Torsional pendulum (with and without weights)–Bending of beams–Bending moment–Cantilever loading–Expression for depression at the loaded end–Oscillations of a cantilever–Young's Modulus–Non-Uniform and uniform bending–Koenig's method.

Unit 2: VISCOSITY**HOURS: 21**

Streamline and turbulent motion–Newton's law–Poiseuille's flow–terminal velocity and Stoke's formula–Ostwald viscometer–Meyer's modification of Poiseuille's formula–Rankine's method–Effect of temperature and pressure on viscosity–Equation of continuity–Bernoulli's theorem–Venturimeter–Torricelli's theorem.

Unit 3: SURFACE TENSION**HOURS: 21**

Definition – molecular forces – Jaeger's method–Excess pressure inside a curved liquid surface–Variation of surface tension with temperature – Angle of contact–Quincke's method – Drop weight method of determining the surface tension of liquid–interfacial surface tension–experiment to determine the interfacial surface tension between water and liquid.

Unit 4: WAVES AND OSCILLATIONS**HOURS: 21**

SHM–Differential equation of SHM–Graphical representation of SHM–illustration of SHM: Oscillations of a gas in a cylinder–Wave motion–transverse and longitudinal waves–general equation of simple harmonic motion–wave velocity and particle velocity–differential equation of wave motion–Stationary waves–properties of stationary waves–Doppler effect.

Unit 5: ACOUSTICS**HOURS: 21**

Intensity of sound–Decibel and Bel–Loudness of sound–Reverberation–Sabine's reverberation formula–Acoustic intensity–Factors affecting the acoustics of Buildings–Ultrasonic waves–production of ultrasonic waves–piezoelectric crystal method–Magnetostriction effect–application of ultrasonic waves

Text books:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Elements of Properties of Matter	D.S Mathur	S .ChandAnd Co	2010	4th
2	Properties of Matter	BrijLal and N. Subrahmanyam	S.Chand and Co	2003	5th
3	Textbook of Sound	D.R.Khanna and R.S. Bedi	Atmaram and sons	1969	6th
4	A Text Book of Sound	N.Subrahmanyam And BrijLal	Vikas Publishing House	1995	2nd

Books for reference:

S.No.	Title of the Book	Author	Publisher	Year	Edition
1	Fundamental of General Properties of Matter	H.R Gulati	R Chand and Co	1977	Fifth
2	The Physics of Waves and Oscillations,	N.K Bajaj	Tata McGraw Hill	1988	Fourth
3	Vibration and Waves, MIT Introductory Physics	A.P French,	Arnold–Heinmann India	1973	Third
4	Oscillations and Waves	SatyaPrakash and Akash Saluja	Pragati Prakashan	2002	Second

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; tutorials; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH1MC02 - PHYSICS PRACTICALS – I

Category: MC

Credits: 2

Semester: I

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Estimate the properties of liquids like surface tension and viscosity by simple experiments.	L3
CO2	Gain practical knowledge and correlate it with the theory.	L3, L4
CO3	Verify the truth table of various gates using dedicated IC's	L3, L4
CO4	Experimentally determine the elastic constants like Young's modulus and Rigidity modulus.	L3
CO5	Verify the laws of transverse vibrations in stretched strings.	L4
CO6	Skill to estimate refractive index of the material of the prism.	L3

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	L
CO2	M	S	S	S	L
CO3	M	S	S	S	L
CO4	M	S	S	S	L
CO5	M	S	S	S	L
CO6	M	S	S	S	L

* S – Strong; M – Medium; L – Low

List of Experiments

1. Young's modulus – Cantilever– Pin and microscope
2. Rigidity modulus – Torsional pendulum – without weights
3. Viscosity – graduated burette
4. Verification of laws of transverse vibration – Sonometer.

5. Pressure coefficient of air – Joly's bulb.
6. Determination of A, D and μ – spectrometer – solid prism
7. Calibration of an ammeter – Potentiometer
8. Moment of a bar magnet – Deflection magnetometer – Tan C

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics	Anchal Srinivasa & R.K.Shukla	New age International Publishers	2018	Second edition.
2.	A textbook of Physics Practical – Part I	Prof.C.C. Ouseph & Prof.V. Srinivasan	S. Viswanathan Publishers	1990	-
3.	A textbook of Physics Practical – Part II	Prof.C.C. Ouseph & Prof.G. Ranga Rajan.	S. Viswanathan Publishers	1996	-
4	Advanced Practical Physics II	Dr.S.P. Singh	Pragati Prakashan – Meerut	2000	Twelfth Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics with Viva – voce	Dr. S. P. Singh	Pragati Prakashan – Meerut	1999	Twenty third Edition
2	Practical Physics	S.L. Gupta & V. Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition
3	Advanced level Practical Physics	M. Nelkon & J.M. Ogborn	Heinemann Educational Books. Ltd – London.	1967	-
4	A textbook of Practical Physics	H.S. Aller & H. Moore	Macmillan and Co & Limited.	1941	-

16UPH2MC01 - MECHANICS

Category: MC

Credits: 7

Semester: II

No. of Hours/Week: 7

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Study classical laws of physics governing the motion of particles under the influence of fields. Analyze and apply these to predict the behavior of charged particles in electric and magnetic fields.	L2
CO2	Solve common problems with the use of conservation laws in physics	L3, L4
CO3	Apply theorems in moment of inertia to rotating bodies and understand their dynamics.	L3, L4
CO4	Approach a physical system from different aspects and prove that diverse treatments lead to the same results.	L4
CO5	Use Lorentz transformation equations to bring out the counterintuitive features of special theory of relativity.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	L	S
CO3	S	S	S	M	M
CO4	S	S	S	M	S
CO5	S	S	S	L	L

* S – Strong; M – Medium; L – Low

UNIT I: NEWTON'S LAWS OF MOTION**HOURS: 21**

Newton's Laws of motion – forces and equations of motion – motion of a particle in a uniform gravitational field – Newtonian law of universal gravitation – Examples – electric and magnetic forces on a charged particle – The magnetic field and Lorentz force – Examples – motion of charged particle in a uniform constant electric field. Conservation of momentum – contact forces: friction – Problems

UNIT II: CONSERVATION LAWS**HOURS: 21**

Definition of concepts – conservation of energy – Work–kinetic and potential energy– Examples – Conservative Forces – Potential energy and conservation of energy in gravitational and electric field – Examples.

Conservation of Linear and angular momentum: Internal forces and momentum conservation – center of mass – Examples – General elastic collision of particles of different masses – System with variable mass – Examples – Conservation of angular momentum – Torque due to internal forces – Torque due to gravity – Angular momentum about center of mass – Proton scattering by heavy nucleus.

UNIT III : ELEMENTARY RIGID BODY DYNAMICS**HOURS: 21**

The equation of motion – angular momentum and kinetic energy – Moment of inertia – parallel axis theorem – Perpendicular axis theorem – examples – Rotation about fixed axis: time dependence of motion – Examples – Rolling without slipping – Torque about center of mass – Example – Rotation about fixed axes: Behavior of angular momentum vector.

UNIT IV : HARMONIC OSCILLATOR AND INVERSE SQUARE LAW OF FORCE**HOURS: 21**

Mass on spring – simple pendulum – Compound pendulum – LC circuit – motion of systems displaced from position of stable equilibrium – Average kinetic energy and potential energy – Friction – Damped Harmonic oscillator. Inverse square law of forces and static equilibrium – Orbits: Equation and eccentricity – Circular orbit – Kepler's laws – Examples

UNIT V : SPECIAL RELATIVITY**HOURS: 21**

Constancy of speed of light – Michelson–Morley experiment – invariance of c – Basic assumptions – Lorentz transformation – Length contraction – Measurement of length perpendicular to relative velocity – Time dilation of moving clocks – Examples – velocity transformation – velocity addition – aberration of light – longitudinal Doppler effect.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Mechanics (in SI units), (Berkeley Physics course– volume 1), II publication, second edition	Charles Kittel, Walter D knight, et al.	Tata McGraw Hill	2011	2 nd Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Newtonian mechanics first edition	A.P.French,	Viva Books Private Ltd	2011	Student Edition
2.	Introduction to mechanics, (Special Indian edition)	Kleppner and Kolenkow	Tata McGraw Hill	1973	1 st Edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; tutorials; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH2MC02 - PHYSICS PRACTICALS – II

Category: MC

Credits: 2

Semester: II

No. of Hours/Week: 2

Course Outcomes

COs	Statements	Bloom's Level
CO1	Evaluate surface tension by various methods	L2
CO2	Employ different methods to find the elastic moduli of the materials.	L4
CO3	Construct the working of half and full adder experimentally.	L2
CO4	Determine the specific resistance using Wheatstone bridge concept.	L3
CO5	Estimate Earth's magnetic field in the laboratory.	L5

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	S	M	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

* S – Strong; M – Medium; L – Low

List of experiments

1. Determination of g and k –Compound ba pendulum
2. Surface tension–capillary rise
3. Young's modulus–non-uniform bending–pin and microscope
4. Refractive index of a liquid-hollow prism-spectrometer
5. Specific resistance of a wire–Carey-Foster's bridge
6. Transverse and longitudinal mode–Melde's string
7. Figure of merit–Table Galvanometer
8. Determination of m and BH -deflection and vibration magnetometer

16UPH3MC01 - MATHEMATICAL PHYSICS – I

Category: MC

Credits: 6

Semester: III

No. of Hours/Week: 6

Course Outcomes

Co's	Statements	Bloom's Level
CO1	Understand the importance of real and complex analysis in Physics	L2
CO2	Apply the Cauchy integral theorem and formula to evaluate real integrals	L3
CO3	Understand the role of vectors in physics	L2
CO4	Apply the concepts Curl and Divergence in physical situations	L3
CO5	Analyze a periodic function and obtain its Fourier components	L4

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	S
CO2	S	S	L	S	M
CO3	S	S	S	L	S
CO4	S	S	S	S	M
CO5	S	M	M	S	S

* S – Strong; M – Medium; L – Low

Unit 1: COMPLEX ANALYSIS**HOURS: 20**

Complex Numbers– Complex plane–polar form– arithmetic operations– Powers and roots of complex numbers – complex functions– Derivatives – Analytic function–Cauchy– Riemann equation– Laplace equation and harmonic functions–Exponential, trigonometric and hyperbolic functions and their properties – Logarithm and general power. Line integral in the complex plane– Parametric representation– Cauchy integral theorem– Independence of path–Cauchy integral formula.

Unit 2: VECTOR CALCULUS**HOURS: 09**

Basics of Vector algebra– Vector and scalar functions and fields– Gradient of a scalar field– Directional derivatives– Divergence and curl of a vector field: rotation of a rigid body– Line integrals and independent of path– Double integrals– Green’s theorem in the plane.

UNIT III FOURIER ANALYSIS**HOURS: 09**

Periodic functions– Trigonometric series– Fourier series: Rectangular wave– Orthogonality of trigonometric system– Functions of any period: Periodic square wave and Half– wave rectifier– Even and odd functions: Rectangular pulse and saw tooth wave–Half range expansions– complex Fourier series–Forced oscillations–Fourier integrals– Square wave– Fourier cosine and sine integrals: Laplace integrals Fourier Transform: complex form of Fourier integral– Fourier transform and its inverse– Physical interpretation: Spectrum– Linearity and Fourier Transform of Derivatives.

Unit IV: PARTIAL DIFFERENTIAL EQUATIONS**HOURS: 09**

Basic Concepts– Modelling: Vibrating string, Wave equation– Separation of variables– Use of Fourier series– Examples– D’Alembert’s Solution of the wave equation– Heat Equation: Solution by Fourier series– Examples–Representation of Laplacian in polar coordinates, cylindrical and spherical coordinates (No derivation)–Boundary value problem in spherical Coordinates.

UNIT V: NUMERICAL METHODS**HOURS: 09**

Interpolation–Lagrange interpolation formula for unequally spaced data– Newton forward interpolation formula for equally spaced data –Numerical integration: Trapezoidal rule, Simpson 1/3 rule, Newton Raphson method–Curve fitting by the method of least squares–First order differential equation by Euler’s method and the improved Euler method

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Advanced Engineering Mathematics	Erwin Kreyzig	Wiley Eastern Ltd.	1991	8 th Edition,
2	Mathematical Physics	H. K. Dass,	S. Chand Publishing.	2010	First edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Mathematical methods for Physicists,	George Arfken, Hans Weber,	Academic Press	2003	6 th Edition
2	Mathematical Physics with Applications, Problems and solutions	V.Balakrishnan	Ane books	2019	First edition
2	Mathematical methods in Physical Sciences	Mary L. Boas	Wiley	2006.	3 rd Ed
3	Mathematical methods for Physical Sciences	Riley & Hobson,	Cambridge University Press,	2011	Third

Teaching Methodology:

Chalk and Talk Lectures, Tutorials, Video Lectures

Evaluation Pattern:

Internal: C1:30, C2:30, C3a:20 (MCQ and Assignment), C3b:20 (MCQ and Seminar) =100 marks

External: 100 marks (20+30 +50)

16UPH3MC02 - ELECTRONICS - I

Category: MC

Credits: 4

Semester: III

No. of Hours/Week: 4

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Solve complex circuit by using various theorems on circuit analysis.	L3
CO2	Demonstrate the basic concept behind the working of a transistor amplifier, oscillator, multivibrator etc.	L2
CO3	Perform various mathematical operations like summing, difference etc., using operational amplifier.	L3
CO4	Compute the Boolean algebra and K-map to design a simplified logic circuit.	L4
CO5	Acquire the knowledge of the different types of fabrication and fabrication of components such as resistor, capacitor, transistor and diode in integrated circuits.	L2

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	L
CO3	S	S	S	M	M
CO4	S	S	S	M	M
CO5	S	S	S	L	L

* S – Strong; M – Medium; L – Low

UNIT I: Circuit Analysis**HOURS: 12**

DC circuits – Voltage and current sources – Transformations – Maximum power transfer theorem – Superposition, Thevenin and Norton's theorems.

UNIT II: Amplifiers and Oscillators**HOURS: 12**

Single stage amplifier – DC load line – Operating point stability – Introduction to biasing – Voltage divider biasing – Multi stage amplifier, RC and direct coupled amplifiers – Feedback requirements for oscillators – Colpitt's oscillator and Wien Bridge oscillators – Multivibrators – Astable, Monostable, Bistable.

UNIT III: Operational amplifier and special devices**HOURS: 12**

Ideal operational amplifier parameters – CMRR – virtual ground – inverting, non – inverting, summing and difference amplifiers – Solving simultaneous equations – FET, MOSFET – Structure, working and V – I characteristics.

UNIT IV: Digital Electronics**HOURS: 17**

Boolean algebra – K-maps – Half adder, full adder Parallel binary adder. Flip-flop – RS flip-flop – D flip-flop – T flip-flop – JK flip-flop and Master Slave flip-flop – Truth tables.
Counters – Binary ripple counter (4-bit up counter, 4-bit down counter, 4-bit up/down counter) – modulus counter (mod-2,4,8) – decade counter – Registers –Shift registers (4-bit right, left).

UNIT V: Integrated Circuit technology**HOURS: 7**

Scale of integration – VLSI – Monolithic, thick, thin film and hybrid integrated circuits – Bipolar and MOS technology comparison – ULSI – Overview of Lithographic techniques –Fabrication of monolithic I.C. – fabrication of integrated components like resistors, capacitors, transistors and diodes – Linear and nonlinear I.Cs.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Basic Electronics (Solid State)	B. L. Theraja	S. Chand & Co.	2016	5 th edition
2	Principles of Electronics	Mehtha V K	S. Chand & Co.	2010	11 th edition
3	Integrated Electronics, Analog & Digital Circuits and systems	Millman J. and Halkias C.C	Tata McGraw – Hill	2009	2 nd edition
4	Electronics Fundamental and applications	Chattopadhyay D. and Rakshit	New age publishers	2010	11 th edition
5	Digital Principles and Applications	A.P Malvino, D.P. Leach, Gautam Saha	Tata McGraw – Hill Education	2011	11 th edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Electronic, fundamentals and applications	John D. Ryder	Prentice Hall	2009	5 th edition
2	Solid State Electronic Devices	Ben G. Streetman, Sanjay Banerjee	PHI Learning	2009	6 th edition
3	Digital Design	M. Morris Mano, Michael D. Ciletti	Pearson	2008	4 th edition
4	Digital technology Principles and practices	Virendra Kumar	New Age Intl	2015	2 nd edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; MCQs; Assignments.

Evaluation Pattern

Internal: 100 (40 (I CIA) + 40 (II CIA) + 20(Assignment & MCQs))

External: 100

16UPH3MC03 - PHYSICS PRACTICALS – III

Category: MC

Credits: 2

Semester: III

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Use the concept of bending of beams to study elasticity of materials.	L2
CO2	Demonstrate the concept of magnetic effects of steady currents	L4
CO3	Illustrate the interference and diffraction in the laboratory with the use of microscope/spectrometer	L3
CO4	Apply Newton's law of cooling to estimate the specific heat capacity of a liquid	L4
CO5	Find the temperature coefficient of resistance using Carey Fosters bridge	L3

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	S	S	L
CO3	S	S	S	L	M
CO4	S	S	S	L	L
CO5	S	S	L	S	M

* S – Strong; M – Medium; L – Low

List of experiments

1. Young's modulus – uniform bending pin and microscope
2. Rigidity modulus – Torsional pendulum – with weights
3. Determination of B_H - Field along the axis coil of a circular coil.
4. Thickness of a wire/insulation – Air wedge
5. Determination of wavelength of mercury spectrum– Grating – normal incidence

6. Temperature coefficient of resistance– Carey – Foster’s bridge
7. Specific heat of a liquid–Newton’s law of cooling
8. Refractive index of the material of a convex lens– Newton’s rings

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Practical Physics	Anchal Srinivasa & R.K.Shukla	New age International Publishers	2018	Second edition.
2	A textbook of Physics Practical – Part I	Prof.C.C. Ouseph & Prof.V. Srinivasan	S. Viswanathan Publishers	1990	-
3	A textbook of Physics Practical – Part II	Prof.C.C. Ouseph & Prof.G.Ranga Rajan.	S. Viswanathan Publishers	1996	-
4	Advanced Practical Physics II	Dr.S.P. Singh	Pragati Prakashan – Meerut	2000	Twelfth Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics with Viva – voce	Dr.S.P. Singh	Pragati Prakashan – Meerut	1999	Twenty third Edition
2	Practical Physics	S.L. Gupta & V.Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition
3	Advanced level Practical Physics	M.Nelkon & J.M. Ogborn	Heinemann Educational Books. Ltd – London.	1967	-
4	A textbook of Practical Physics	H.S. Aller & H.Moore	Macmillan and Co&Limited.	1941	-

16UPH3AL02 - PHYSICS FOR CHEMISTRY PRACTICAL - I

Category: AL

Credits: 1

Semester: III

No. of Hours/Week: 2

Course Outcomes

COs	Statements	Bloom's Level
CO1	Demonstrate the different properties of matter using simple measurement technique	L3
CO2	Measure viscosity of a fluid like water through a capillary flow method.	L4
CO3	Apply simple methods like capillary rise or forming spherical drops to measure surface tension of liquid and interfacial surface tension between immiscible liquids.	L5
CO4	Use Joule heating method to estimate the specific heat capacity of liquid	L3
CO5	Verify the laws of transverse of vibrations in a stretched string.	L2
CO6	Compute acceleration due to gravity 'g' using a compound bar pendulum.	L3

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M
CO2	S	S	S	S	S
CO3	S	S	L	M	S
CO4	S	M	M	S	L
CO5	S	S	S	M	S

* S – Strong; M – Medium; L – Low

List of experiments

1. Young's modulus by stretching - vernier microscope
2. Rigidity modulus -torsional pendulum
3. Surface tension and interfacial tension - method of drops
4. Surface tension - capillary rise
5. Viscosity - capillary flow
6. Specific heat of liquid - electrical heating
7. Sonometer -verification of laws
8. Compound bar pendulum - determination of 'g' and radius of gyration

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	A textbook of Physics Practical – Part I	Prof.C.C. Ouseph & Prof.V. Srinivasan	S. Viswanathan Publishers	1990	-
2.	A textbook of Physics Practical – Part II	Prof.C.C. Ouseph & Prof.G. Ranga Rajan.	S. Viswanathan Publishers	1996	-

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics	S.L. Gupta & V. Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition

16UPH4MC01 - ELECTRICITY AND MANGNETISM

Category: MC

Credits: 4

Semester: IV

No. of Hours/Week: 4

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Apply Coulombs law and Gauss law to determine the electric field due to various charge configurations	L3
CO2	Understand the principles of electrostatics in designing capacitors	L2
CO3	Understand the magnetic effects of electric currents and apply it in physical experiments.	L2, L3
CO4	Analyze the role of Faraday law in designing various types of AC systems	L4
CO5	Apply the concepts of electrodynamics to the behavior of EM waves in different mediums	L3

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	S	M	S
CO2	S	M	S	L	M
CO3	S	L	S	M	S
CO4	S	L	S	M	S
CO5	S	L	S	M	S

* S – Strong; M – Medium; L – Low

Unit I: Electrostatics**HOURS: 15**

Properties of charges – Coulomb's law and its validity – Examples – superposition principle (Discrete and continuous charge distribution) – Examples – Field concept – Scalar potential – Field and potential due to continuous charge distribution (line, ring and disc charge configurations) – Energy consideration – Relations between field and potential – Flux and lines of force – Solid angle – Integral and differential form of Gauss law – Linear charge distribution (uniform line charge density), Surface charge distribution (disc) – Volume charge distribution (uniform spherical charge distribution) – Solutions of Laplace equation (two infinite parallel surfaces) – Electric dipole – potential and field due to an electric dipole.

UNIT II: Conductors, Capacitors and Dielectrics**HOURS: 15**

Properties of conductors – Capacitance – Parallel plate capacitor – Energy and energy density – Spherical capacitor – Combination of capacitances – Energy consideration – Classical radius of an electron – Polarization density – Electronic polarizability of atoms – Polarization charge densities (surface and volume) – Relation between D, E and P, Gauss's law in the presence of a dielectric – Boundary condition on D and E – Dielectric breakdown

UNIT III: Magnetic induction**HOURS: 15**

Sources of magnetic induction B – properties of B – Magnetic induction due to long, straight current – Ampere's law – Circular loop – Helmholtz coil – Definition of ampere – Magnetic induction inside a conductor – Magnetic dipole – Gyromagnetic ratio – Solenoid and toroid

UNIT IV: Motion of Charged Particle and EM Induction**HOURS: 15**

Charged particle in uniform magnetic field – Force on current in a magnetic field – Current loop in uniform B – Potential energy of a dipole in uniform B – Charged particle in EM field – Faraday's law – Differential form – Different mechanism for change of flux – Motional EMF – Mutual inductance – Self – inductance (long solenoid, straight wire)

UNIT V: Electromagnetic waves**HOURS: 15**

The displacement current – Ampere's law in general form – Maxwell's equations – Poynting vector – wave equation – Plane electromagnetic waves – energy considerations.

Books for study:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Electricity and Magnetism	R. Murugeshan	S Chand & Co, New Delhi	2008	-
2.	Electricity and Magnetism	BrijLal & Subramanyam	Ratan Prakashan Mandir Publishers, Agra	2005	-

Books for reference:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Introduction to Electrodynamics	David J. Griffith	PHI, New Delhi	2012	-
2.	Electricity and Magnetism	NavinaWadhvani	PHI, New Delhi	2007	-
3.	Electricity and Magnetism	K.K Tewari	S Chand & Co, New Delhi	2007	-
4.	Fundamentals of Physics – Electricity and Magnetism	Halliday – Resnick and Walker	Wiley India Pvt Ltd	2011	-

Teaching Methodology

Chalk and talk lectures; Seminar; ICT based presentations; Video lectures; Mini – project; MCQs etc.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External:
External – Part A (20) + Part B (30) +Part C (50) = 100

16UPH4MC02 - PHYSICS PRACTICALS – IV

Category: MC

Credits: 2

Semester: IV

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Study the images formed by mirrors and lenses and hence evaluate the focal length.	L3
CO2	Determine the coefficient of viscosity of a highly viscous liquid by using Searle's Viscometer.	L4
CO3	Computing refractive index of liquid & glass by forming liquid lens.	L5
CO4	Apply the laws to estimate the thermal conductivity of a bad conductor.	L3
CO5	Evaluate the figure of merit of a sensitive galvanometer for future current and charge measurements.	L2
CO6	Estimating the horizontal component of the Earth's magnetic field using field along axis of circular coil & vibration magnetometer setup.	L4
CO7	Verify the parallel axis theorem using Bifilar pendulum	L3
CO8	A preliminary method to calibrate a low range voltmeter using potentiometer.	L5

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	L
CO2	S	S	M	M	S
CO3	S	S	M	S	L
CO4	S	S	S	L	S
CO5	M	S	M	S	L
CO6	S	S	S	L	S
CO7	S	S	L	S	M
CO8	S	S	S	M	L

List of experiments.

1. Focal length of a concave lens and convex mirror
2. Viscosity– Searle’s viscometer
3. Refractive index– liquid lens
4. Thermal conductivity– Lee’s disc
5. Figure of merit– BG
6. Determination of BH -Field along the axis of a circular coil and vibration magnetometer
7. Determination of g and moment of Inertia – Bifilar pendulum
8. Calibration of a low range voltmeter–Potentiometer

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics	Anchal Srinivasa &R.K .Shukla	New age International Publishers	2018	Second edition.
2.	A textbook of Physics Practical – Part I	Prof.C.C.Ouseph &Prof.V. Srinivasan	S.Viswanathan Publishers	1990	-
3.	A textbook of Physics Practical – Part II	Prof.C.C.Ouseph &Prof.G.Ranga Rajan.	S.Viswanathan Publishers	1996	-
4	Advanced Practical Physics II	Dr.S.P.Singh	Pragati Prakashan – Meerut	2000	Twelfth Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics with Viva – voce	Dr.S.P.Singh	Pragati Prakashan – Meerut	1999	Twenty third Edition
2	Practical Physics	S.L.Gupta &V.Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition
3	Advanced level Practical Physics	M.Nelkon &J.M.Ogborn	Heinemann Educational	1967	-

			Books .Ltd – London.		
4	A textbook of Practical Physics	H.S.Aller &H.Moore	Macmillan and Co&Limited.	1941	-

16UPH4ES01 - ASTRONOMY AND ASTROPHYSICS

Category: ES

Credits: 4

Semester: IV

No. of Hours/Week: 6

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Use the fundamental concepts in astrophysics to analyse better the scientific discoveries made so far.	L2
CO2	Discuss the techniques and methods used in Astrophysics and astronomy.	L3
CO3	Use analytical and logical reasoning to solve problems.	L4
CO4	Design and construct the telescopes.	L3
CO5	Describe the properties and evolution of different types of galaxies.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	S
CO2	S	L	S	L	S
CO3	S	S	S	M	M
CO4	S	S	S	L	S
CO5	S	S	S	M	S

* S – Strong; M – Medium; L – Low

UNIT I : ASTRONOMICAL TECHNIQUES**HOURS: 18**

Celestial Sphere, Coordinate systems(Basics), Diurnal motion of the sun and stars – sidereal day – sidereal time, Zones and seasons of Earth –equinoxes and solstices– Variations in the durations of day and night during the year– Time (GMT, JD)

UNIT II: OBSERVATIONS AND INSTRUMENTS**HOURS: 18**

Observing Through the Atmosphere – Different wavelength regions– Optical Telescopes(Refracted and Reflected) – Mounting systems(alt–azimuth–equatorial) Angular resolution– Magnification– Detectors and Instruments– CCD camera– Working principle – Radio Telescopes – Interferometry techniques.

UNIT III :PHOTOMETRIC CONCEPTS AND MAGNITUDES**HOURS: 18**

Stellar distances, Trigonometric parallax, Intensity, Flux Density and Luminosity, Apparent Magnitudes, Magnitude Systems, Absolute Magnitudes, Extinction and Optical Thickness.

UNIT IV : CLASSIFICATION OF STARS**HOURS:18**

Life–cycle of the Stars, The Black Body Model of a Star, Spectral Classification of Stars, Stellar Colours, Colour index, Hertzsprung–Russell Diagram -Visual Binaries, Astrometric Binary Stars, Spectroscopic Binaries, Photometric Binary Stars

UNIT V : GALAXIES AND COSMOLOGY**HOURS: 18**

Observable Universe, Classification of Galaxies Based on Hubble Sequence, Properties of each Galaxies, Our Milky way Galaxy, Star formation in galaxies, Explanations of spiral structure, Dark matter in galaxies, Red–Shifts and Blue–Shifts – Hubble’s Law in Relation to the Expanding Universe

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Fundamental of astronomy	Karttunen	Springer	2006	5 th Edition
2	Astronomy: A physical perspective	Marc. L Kutner	Cambridge University Press	2003	1 st Edition
3	Astronomy & Astrophysics	A.B. Bhattacharya, S.Joradar and R. Bhattacharya,	Infinity Science Press	2008	1 st Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Astronomy	S. Kumaravelu and SusheelaKumaravelu	R Chand and Co,	2013	5 th Edition
2	Astronomy: A self teaching guide	Dinah L. Moché	John Wiley & Sons	2009	7 th Edition
3	Handbook of CCD astronomy	Steve B. Howell	Cambridge University Press	2006	1 st edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; Mini – project; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH4ES02 – ENERGY PHYSICS

Category: ES

Credits: 4

Semester: IV

No. of Hours/Week: 6

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Identify different types of energy sources and their uses.	L2
CO2	Design solar pond and solar cell for energy conversion.	L3
CO3	Discuss the construction of Wind Energy Conversion System (WECS) and biomass plants.	L3
CO4	Utilize renewable energy for different needs.	L5
CO5	Explore other energy resources for future purpose.	L6

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	S
CO2	S	S	L	S	M
CO3	S	M	S	L	S
CO4	S	S	S	S	M
CO5	S	M	S	S	L

* S – Strong; M – Medium; L – Low

Unit 1: INTRODUCTION TO ENERGY RESOURCES

HOURS:15

World Energy Reserves and Future — Various forms of energy – Conventional energy Sources – Fossil fuels – Coal, Oil and Natural Gas – impact of conventional energy sources on environment – global warming – climate change – non– conventional energy sources – Prospects in the energy sector.

Unit 2: Solar Energy**HOURS:15**

Solar Radiation at the Earth's surface—Physical Principles of the Solar Energy Conversion - Solar pond – Applications: Solar Water Heating, Space Cooling, Distillation, Green Houses – Solar Photovoltaics – Solar Cells – Principles, types and power generation – Merits and Demerits.

Unit 3: Wind Energy and Biomass Energy**HOURS:15**

The Nature of the Wind –Wind Data and Energy Estimation – Basic Components of a Wind Energy Conversion System (WECS) – Classification of WECS – Applications – Merits and Demerits.Biomass Conversion Technologies – Photosynthesis – Photosynthetic Efficiency – Biogas Generation – Applications – Advantages and Disadvantages.

Unit 4: Emerging Sources of Renewable Energy**HOURS:15**

Geothermal energy – Ocean Thermal Energy Conversion (OTEC) – Tidal Energy – Micro Hydel Systems – Chemical Energy Sources – Fuel Cells, Hydrogen Energy – Magneto Hydro Dynamic Power Generation – (Basic Principles, Applications, Advantages and Disadvantages).

Unit 5: Energy Consumption, Conservation and Options**HOURS:15**

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors – Principles of Energy Conservation and Energy Audit – energy crisis and possible solutions – energy options for the developing countries – International Policies on Climate Change – UNFCCC; COP; Kyoto Protocol; CANCUN Agreement and Paris Agreement.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Non-Conventional Energy Sources.	G.D. Rai,	Khanna Publishers	2007	4 th Edition
2	Non-conventional Energy Resources,	D.S. Chauhan and S. K. Srivastava,	New Age Int. Pvt. Ltd.,	2014	3rd Edition
3	Solar Photovoltaics: Fundamental, technologies and applications	CS Solanki,	PHI private limited, Delhi	2015	3rd Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	. B.H. Khan, Non-conventional Energy Resources,	. B.H. Khan,	Tata McGraw Hill, 2009	2009	2nd Edition
2	Solar Energy Utilization	G.D. Rai,	Khanna Publishers, Ed. V	1995	5th Edition
3	Solar energy	S.P. Sukhatme,	Tata McGraw-Hill Publishing Company.	1997	2 ND EDITION
4	Renewable Energy: Power for a sustainable Future, Oxford Univ. Press, 2nd Ed., 2004.	Godfrey Boyle	Oxford Univ. Press,	2004	2 ND EDITION
5	Energy models for 2000 and Beyond, Tata McGraw Hill, 1997. 7. A.	Jyoti K. Parikh	Tata McGraw Hill,	1997	
6	Plant technology	A.K. Wahil,	Tata McGraw Hill, 1st	REPRINT 2010	1 ST EDITION

Teaching Methodology:

Chalk and Talk Lectures, Tutorials, Video Lectures

Evaluation Pattern:

Internal: C1:30, C2:30, C3a:20 (MCQ and Assignment), C3b:20 (MCQ and Seminar) = 100 marks

External: 100 marks

16UPH4ES03 – INTRODUCTORY NANO SCIENCE & NANO TECHNOLOGY

Category: ES

Credits: 4

Semester: IV

No. of Hours/Week: 6

Course Outcomes

Co's	Statements	Bloom's Level
CO1	Explain the basic ideas of nanoscience and nanotechnology.	L1, L2
CO2	Describe the fundamental properties of nanoparticles.	L3
CO3	Understand the working principle of various tools and techniques to characterize the nanoparticles.	L1
CO4	Demonstrate the different methods to synthesis nanoparticles.	L3, L4
CO5	Apply the principles of nanotechnology in the field of medicine, energy sector, communication technology.	L4, L5

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	M
CO2	S	S	S	M	L
CO3	S	S	S	L	S
CO4	S	S	L	S	S
CO5	S	S	S	M	L

* S – Strong; M – Medium; L – Low

UNIT I: Introduction to Nanoscience and Nanotechnology**HOURS:15**

Introduction – Nanoscience and nanotechnology – Length, energy, and time scale of nanoscale systems – Classification – Nanoparticles – nanoclusters – 0D nanostructures (quantum dots) – 1D, 2D and 3D nanostructures – NANO – revolutionize the world.

UNIT II: Properties of Nanomaterials**HOURS:15**

Introduction – Size and shape effect – surface area and aspect ratio – band gap energy – Mechanical properties – Elastic behaviour; Hardness and strength – Electrical properties – Quantum transport – Dielectric properties – Optical properties of nanoparticles – Surface plasmon resonance (SPR) – Quantum size effects.

UNIT III: Synthesis of Nanomaterials**HOURS:15**

Introduction – Bottom up approach – Wet chemical methods – Solvothermal/hydrothermal methods – Sol gel process – Top down – Ball milling – Physical vapour deposition – Laser ablation – Chemical vapour deposition – Molecular beam epitaxy.

UNIT IV: Characterization techniques**HOURS:15**

X – Ray diffraction (XRD) – Crystallite size – Scherrer formula – UV spectroscopy – Band gap – Blue shift and red shift – Field emission scanning electron microscopy (FESEM) – Transmission electron microscopy (TEM) – Scanning tunnelling microscopy (STM) – Atomic force microscopy (AFM).

UNIT V: Applications of Nanotechnology**HOURS:15**

Introduction – Nanomaterials in medicine – Drug delivery system – Cellular imaging – Nano – robots for diagnostics and therapy – Nanomaterials in energy sector – High energy density batteries – Solar photovoltaic cells – Photo – degradation – Bioremediation.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Nanotechnology	G. Timp	AIP press, Springer Verlag. Editor, New York.	1999	Second
2	Introduction to nanotechnology	Charles Poole	A Wiley Interscience Publication	2003	Fourth
3	Principles of Nanoscience and Nanotechnology	M.A.Shah, Tooker Ahmad.	Narosa Publishing House,	2010	Second
4	Textbook of Nanoscience and Nanotechnology	B S Murthy, P Shankar, Baldev Raj, B BRath and James Murday,	University Press	2012	Third
5	Nanotechnology	Thomas Varghese, K.M. Balakrishna	Atlantic Publishers and Distributors	2012.	Second

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Nanomaterials Synthesis properties and applications	A.S Edelstein,	A.S Edelstein, IOP Publishing, UK	1996	Second
2	Nanostructured materials and nanotechnology,	Hari Singh Nalwa	Concise Edition, Editor: Academic Press, USA	2002	First
3	Handbook of Nanostructured	Hari Singh Nalwa	Academic Press, USA	2000	First

	Materials and Technology				
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Teaching Methodology

Chalk and Talk Lectures, ICT based presentations, Video Lectures, Interactive activities, Mini project, MCQs.

Evaluation Pattern

Internal: 100 {CIA 1 & CIA 2 (30 +30 +40 [MCQ/Mini project/Assignment])}

External: 100

16UPH5MC01 – QUANTUM MECHANICS

Category: MC

Credits: 7

Semester: V

No. of Hours/Week: 7

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Understand and appreciate quantum mechanical methods.	L1, L2
CO2	Apply the mathematical and conceptual tools like operator algebra in quantum mechanical analysis.	L4, L5
CO3	Set up and solve Schrodinger wave equation for simple and exactly solvable systems.	L3, L4
CO4	Apply commutator algebra of operators and demonstrate their utility in the quantum mechanical treatment of a system.	L4, L5
CO5	Extend the principles for one dimensional to three dimensional problems.	L4, L5

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	L
CO2	S	S	S	M	L
CO3	S	S	M	L	S
CO4	S	S	M	S	L
CO5	S	S	M	S	L

* S – Strong; M – Medium; L – Low

UNIT I: EMERGENCE OF QUANTUM MECHANICS**HOURS: 23**

Failure of classical mechanics, black – body radiation, photoelectric effect, Compton effect, de – Broglie hypothesis, experimental confirmation (Davisson – Germer experiment and GP Thompson experiment), wave – particle duality, Heisenberg’s uncertainty principle, wave packets and motion of wave packets, group velocity and wave velocity, application of uncertainty relation

UNIT II: FOUNDATION OF QUANTUM MECHANICS**HOURS: 23**

Observing through the Atmosphere – Different wavelength regions – Optical telescopes (Refracted and Reflected) – Mounting systems (alt – azimuth – equatorial) – Angular resolution – Magnification – Detectors and Instruments – CCD camera – Working principle

UNIT III: APPLICATION OF SCHRODINGER WAVE EQUATION TO 1D SYSTEMS**HOURS: 22**

Free particle, particle in a 1D box, particle in a potential well, non-classical behavior, potential barrier, barrier penetration and α -decay, linear harmonic oscillator, energy eigenvalues and eigenfunctions, operator method of LHO, matrix representation of operators.

UNIT IV: ANGULAR MOMENTUM**HOURS: 20**

Orbital angular momentum, general formalism, commutation relations, matrix representation, spin angular momentum, experimental evidence - Stern & Gerlach experiment, spin 1/2 particles, Pauli matrices, eigenfunctions of L_z and L^2 , properties of spherical harmonics.

UNIT V: THREE DIMENSIONAL PROBLEMS**HOURS: 17**

In Cartesian coordinates: Free particle, 3D box, degeneracy, harmonic oscillator - In spherical polar coordinates: rigid rotator – reducing two body problem to single body problem, central potential – general treatment, Hydrogen atom – energy eigenvalues and eigenfunctions.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Quantum Mechanics – concepts and applications	Nouredine Zettili	Wiley	2009	2 nd Edition
2.	Quantum Mechanics	G Aruldas 2013	PHI	2013	2 nd Edition
3.	Introduction to Quantum Mechanics	David Griffiths	Pearson	2015	2 nd edition
4.	Concepts of Modern Physics	Arthur Beiser et al	Tata-McGraw Hill	2009	6 th edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	A text book of Quantum Mechanics	PM Mathews & K Venkatesan	Tata-McGraw Hill	2011	2 nd edition
2.	Quantum Mechanics – an introduction	Walter Greiner	Springer	1997	4 th edition
3.	Quantum Physics – Berkeley series	Sie, EyvindWichman	Tata McGraw Hill	1971	1 st edition
4.	The Feynman Lecturers on Physics, Volume 3	Feynman, Leighton, Sands,	Pearson	2015	The new millennium edition

Teaching Methodology

Chalk and Talk Lectures, Seminar, ICT based presentations, Video Lectures, Interactive activities, MCQs etc.

Evaluation Pattern

Internal: **100** {30(I CIA) +30(II CIA) + 40(MCQs, Seminar)}

External: **100**

16UPH5MC02 – THERMAL PHYSICS

Category: MC

Credits: 7

Semester: V

No. of Hours/Week: 7

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Recognize the basic assumptions of kinetic theory of gases and interpret temperature.	L1, L2
CO2	Derive Vander Waal's equations of state in a thermodynamic state.	L2
CO3	Recall the first and second law of thermodynamics along with their applications.	L1, L3
CO4	Describe the entropy change in reversible and irreversible process.	L2
CO5	Compare adiabatic and isothermal process in general conditions for thermodynamic equilibrium.	L2

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	M
CO2	S	S	S	M	S
CO3	S	S	L	L	S
CO4	S	S	M	L	M
CO5	S	M	S	S	S

* S – Strong; M – Medium; L – Low

UNIT I: Kinetic theory of gases**HOURS: 18**

Introduction – Basic assumptions of kinetic theory – Pressure Exerted by gas–kinetic interpretation of Temperature – classical theory of heat capacities – Distribution of molecular velocities in a perfect gas – Distribution of molecular speeds – Average speed, RMS speed, most probable speed, Energy distribution function – Examples

Unit 2: Transport Phenomena & Basic concepts of Thermodynamics**HOURS: 18**

Mean free path (Zeroth and First order) – Van der Waal's equation of state (Derivation) – Thermodynamic system, surroundings, boundaries –state of system and thermodynamic variables – Thermodynamic equilibrium– Processes – The Zeroth law and concept of temperature – Some deductions from the equation of state.

Unit 3: First and second law of thermodynamics**HOURS: 18**

Introduction–origin of the first law – internal energy – Various interactions – the first law – applications of first law (heat capacities of gas, adiabatic equation of state & lapse rate) – Enthalpy–the second law – Kelvin and Planck statement – Heat engines – the Carnot cycle – Carnot theorem –Thermodynamic Temperature – irreversibility and unavailable energy.

Unit 4: Entropy and thermodynamics relations**HOURS: 18**

Introduction – Entropy – Entropy change in reversible processes – Reversible heat transfer – the inequality of Clausius – Entropy change in irreversible process – the principle of increase of entropy – Joule's expansion – the entropy form of first law – Unavailable energy: Thermal death of universe – Physical concept of entropy – Maxwell's relations – thermodynamic relations involving heat capacities –The TdS equations – The energy equations.

Unit 5: Free energies and thermodynamic equilibrium**HOURS: 18**

Introduction – General condition for natural change – Adiabatic process, isothermal Processes – Free energies and Maxwell's relations – Thermodynamic mnemonic diagrams – General conditions for thermodynamic equilibrium – Equilibrium between phases – First order Phase transition.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Thermal physics	S.C. Garg, R M Bansal & CK Ghosh	Tata McGraw Hill Publications	1993	1st edition.

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Heat and thermodynamics	M W Zemansky, R.H. Dittman	McGraw Hill International publication	1997	7th edition
2.	Thermodynamics, kinetic theory and statistical thermodynamics	Sears Salinger	Narosa Publishing House	2013	3rd Edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; tutorials; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH5MC03 – PHYSICS PRACTICALS – V

Category: MC

Credits: 2

Semester: V

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Calculate the wavelength of mercury spectrum using grating.	L3
CO2	Calibrate a high range voltmeter and determine the emf per unit temperature of a thermo couple using potentiometer.	L3, L4
CO3	Calculate the moment of a bar magnet using a current carrying circular coil.	L3, L4
CO4	Compare the mutual inductance of two coils using ballistic galvanometer.	L3
CO5	Identify the use of spectrometer in finding the refractive index, resolving power and Cauchy's constant of a prism.	L4

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	L
CO2	M	S	S	S	L
CO3	M	S	S	S	L
CO4	M	S	S	S	L
CO5	M	S	S	S	L

* S – Strong; M – Medium; L – Low

List of experiments

1. Determination of wavelength of mercury spectrum–Spectrometer – grating – minimum deviation
2. i–d curve– spectrometer
3. Comparison of mutual inductance – BG
4. Calibration of a high range voltmeter – potentiometer- Method1
5. Emissivity and emissive power

6. Moment of a bar magnet -Field along the axis of a circular coil.
7. EMF of a thermo couple-potentiometer
8. Resolving power and Cauchy's constant – prism-spectrometer

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics	Anchal Srinivasa & R.K.Shukla	New age International Publishers	2018	Second edition
2.	A textbook of Physics Practical – Part I	Prof.C.C. Ouseph & Prof.V. Srinivasan	S. Viswanathan Publishers	1990	-
3.	A textbook of Physics Practical – Part II	Prof.C.C. Ouseph & Prof.G. Ranga Rajan.	S. Viswanathan Publishers	1996	-
4	Advanced Practical Physics II	Dr.S.P. Singh	Pragati Prakashan – Meerut	2000	Twelfth Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics with Viva – voce	Dr.S.P. Singh	Pragati Prakashan – Meerut	1999	Twenty third Edition
2	Practical Physics	S.L. Gupta & V. Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition
3	Advanced level Practical Physics	M.Nelkon & J.M. Ogborn	Heinemann Educational Books. Ltd – London.	1967	-
4	A textbook of Practical Physics	H.S. Aller & H. Moore	Macmillan and Co & Limited.	1941	-

16UPH5MC04 – PHYSICS PRACTICALS VI

Category: MC

Credits: 2

Semester: V

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Construct logic gates using discrete components (Transistor)	L5
CO2	Perform the mathematical operations and construct high pass filter using OP-AMP.	L4, L5
CO3	Study the characteristics of an RC coupled amplifier.	L2
CO4	Build the Universal logic gates NAND and NOR using IC's.	L5
CO5	Design a Colpitt's oscillator and compute the frequency.	L5
CO6	Generate a square wave using 555 Timer IC.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S
CO2	S	S	S	S	S
CO3	M	M	M	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S
CO6	S	S	S	S	S

* S – Strong; M – Medium; L – Low

List of experiments.

1. Inverting and non – inverting amplifier – OP AMP.
2. Summing and difference – OP AMP.
3. Colpitt’s oscillator.
4. AND, OR and NOT using transistor.
5. Transistor - RC coupled amplifier.
6. Astable Multivibrator using 555 Timer.
7. NAND and NOR as universal building blocks.
8. High pass filter - OP AMP.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics	Anchal Srinivasa &R.K .Shukla	New age International Publishers	2018	Second edition.
2.	A textbook of Physics Practical – Part I	Prof.C.C.Ouseph &Prof.V. Srinivasan	S.Viswanathan Publishers	1990	-
3.	A textbook of Physics Practical – Part II	Prof.C.C.Ouseph &Prof.G.Ranga Rajan.	S.Viswanathan Publishers	1996	-
4	Advanced Practical Physics II	Dr.S.P.Singh	Pragati Prakashan – Meerut	2000	Twelfth Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics with Viva – voce	Dr.S.P.Singh	Pragati Prakashan – Meerut	1999	Twenty third Edition
2	Practical Physics	S.L.Gupta &V.Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition
3	Advanced level Practical Physics	M.Nelkon &J.M.Ogborn	Heinemann Educational Books .Ltd London.	1967	-
4	A textbook of Practical Physics	H.S.Aller &H.Moore	Macmillan and Co&Limited.	1941	-

16UPH5ES01 – PROBLEM SOLVING SKILLS IN PHYSICS

Category: ES

Credits: 4

Semester: V

No. of Hours/Week: 6

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Apply the right physics concept for the given problem.	L4
CO2	Solve problems using vector notations.	L2
CO3	Develop the expertise required to face competitive exams like JEST, JAM etc.	L3
CO4	Draw graphs for various important mathematical functions that are involved in physics.	L4
CO5	Calculate the errors involved in laboratory measurements using error analysis.	L2

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	L	S
CO2	S	S	S	L	S
CO3	S	S	S	M	M
CO4	S	L	S	L	S
CO5	M	S	S	M	S

* S – Strong; M – Medium; L – Low

UNIT I : PROBLEMS IN MECHANICS**HOURS: 18**

Newton laws of motion for various systems (1, 2 and 3 dimension), Conservation laws and collisions, Rotational mechanics, central force, Harmonic oscillator, special relativity

UNIT II: PROBLEMS IN THERMAL PHYSICS**HOURS: 18**

Kinetic theory– MB distribution–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

UNIT III: PROBLEMS IN ELECTRICITY & MAGNETISM**HOURS: 18**

Electrostatics– calculation of Electrostatic quantities for various configurations– Conductors, Magneto statics– Calculation of Magnetic quantities for various configuration, Electromagnetic induction, Poynting vector, Electromagnetic waves.

UNIT IV: PROBLEMS IN QUANTUM MECHANICS**HOURS:18**

Origin of Quantum mechanics– Fundamental Principles of Quantum mechanics– potential wells and harmonic oscillator– Hydrogen atom.

UNIT V: PROBLEMS IN GENERAL PHYSICS & MATHEMATICS**HOURS: 18**

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.

Books for Study:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Mechanics (SI units)	Charles Kittel, Walter D knight,	Tata McGraw Hill publication	2006	Second edition
2	Thermal physics	S.C.Garg, RM Bansal&CK Ghosh	Tata McGraw Hill Publications	2003	1 st Edition
3	Electricity &magnetism(in SI units)	E.M.Purcell	Tata McGraw Hill Publications	2008	2 nd Edition
4	Quantum mechanics: Concepts and applications	N.Zeteli	Wiley Publishers	2006	2 nd Edition
5	Properties of Matter	D.S.Mathur	S.Chand Publications	2003	11 th edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Introduction to quantum mechanics	D.J.Griffiths	Pearson Publications	2006	2 nd Edition
2	Advanced level physics,	Nelkon & Parker	CBS publishers	2009	7 th Edition
3	Fundamentals of Physics	Resnick & Halliday	Wiley Publications	2006	8 th edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; Mini – project; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH5ES02 – BIOMEDICAL INSTRUMENTATION

Category: ES

Credits: 4

Semester: V

No. of Hours/Week: 6

Course outcomes

CO's	Statements	Bloom's Level
CO1	Identify and appreciate the operation of biomedical instruments.	L2
CO2	Discuss the different processes involved in human body and the instruments used to measure the related parameters.	L4
CO3	Employ various biomedical sensors, medical instruments and other technical information necessary for medical diagnosis.	L3
CO4	Interpret the data obtained from biomedical signals and distinguish the characteristic features.	L4
CO5	Gain the practical knowledge of biomedical instruments in operation theaters and modern surgical equipments.	L3

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	S
CO2	S	S	L	S	M
CO3	S	M	S	L	S
CO4	S	S	S	S	M
CO5	S	M	S	S	L

* S – Strong; M – Medium; L – Low

UNIT I: BIOMEDICAL ELECTRODES AND TRANSDUCERS**HOURS:15**

Introduction – Design of medical instruments – components of the biomedical instrument system
– Electrodes – Transducers

UNIT II: BIOSIGNALS**HOURS:15**

Introduction - Physiological signal amplifiers – Isolation amplifiers – Medical preamplifier design
– Bridge amplifiers – Line driving amplifier – Biosignal analysis.

UNIT III: BIOPOTENTIAL RECORDERS**HOURS:15**

Introduction – Characteristics of the recording system – Electrocardiography (ECG) –
Electroencephalography (EEG) – Electromyography (EMG)

UNIT IV: PHYSIOLOGICAL ASSIST DEVICES**HOURS:15**

Introduction – Pacemakers – Pacemaker batteries – Artificial heart valves – Nerve and Muscle
stimulators

UNIT V: OPERATION THEATRE EQUIPMENT**HOURS: 15**

Introduction – Surgical diathermy – Shortwave diathermy – Microwave diathermy – Therapeutic
effect of heat

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Bio–Medical Instrumentation.	M.Arumugam	Anuradha Agencies	2003	-
2	Introduction to Biomedical Equipment Technology	Joseph J. Carr and John M. Brown	Pearson Education	2004	-
3	Medical Instrumentation Application and Design	John G. Webster	John Wiley and sons, New York	2004	-
4	A course in electronic and electrical measurements and instrumentation,	J.B.Gupta	S.K Kataria & son	-	12 th Edition

5	Biomedical Instrumentation Systems	Shakti Chatterjee and Aubert Miller	Delmar, Cengage Learning,	2010	-
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Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Biomedical Instrumentation and measurement.	Leslie Cromwell,	Prentice hall of India, New Delhi,	2007	-
2	Handbook of Biomedical Instrumentation	Khandpur R.S	Tata McGraw–Hill, New Delhi,	2003	-
3	Standard Handbook of Biomedical Engineering & Design	Myer Kutz	McGraw–Hill Publisher, 2003.	2003	-

Teaching Methodology:

Chalk and Talk Lectures, Tutorials, Video Lectures

Evaluation Pattern:

Internal: C1:30, C2:30, C3a:20 (MCQ and Assignment), C3b:20 (MCQ and Seminar) = 100 marks

External: 100 marks

16UPH5ES03 – GEOPHYSICS

Category: ES

Credits: 4

Semester: V

No. of Hours/Week: 6

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Discuss the physics and geology of the earth through geophysical observation and measurements.	L2
CO2	Comprehend the broad scale structure of the Earth and the physical processes governing the Earth's interior	L3
CO3	Empower students to understand the principles of applying geophysical methods to socially relevant problems, including natural hazards, ground water resource management and other environmental issues.	L4
CO4	Create the ability to interpret the data obtained from the geoelectrical, geochemical, magnetic and seismic methods.	L3
CO5	Investigate the models by solving the equations with the use of both analytical and computational methods.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	S
CO2	S	L	S	L	S
CO3	S	S	S	M	M
CO4	S	S	S	L	S
CO5	S	S	S	M	S

* S – Strong; M – Medium; L – Low

UNIT I : PHYSICS OF THE EARTH**HOURS: 18**

Introduction to Geophysics- Earth as a member of the solar system-Atmosphere-Ionosphere-Asthenosphere-Lithosphere- Hydrosphere and Biosphere-Meteorology-Oceanography and Hydrology.

UNIT II :GEOPHYSICAL AND GEOCHEMICAL METHODS**HOURS: 18**

Geophysical methods: Geo referencing using Arc GIS software. Electrical methods-Quantitative 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.

UNIT III : INTRODUCTION TO SEISMOLOGY**HOURS: 18**

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.

UNIT IV : GEOMAGNETISM AND GRAVITY**HOURS:18**

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.

UNIT V : GEOCHRONOLOGY AND GEOTHERMAL PHYSICS**HOURS: 18**

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.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Water quality data -Analysis and Interpretation	Arthur W. Hounslow	Lewis publishers ,Washington D.C	1995	11th Edition
2	Physics of the Earth and Planets	Cook. A.H	McMillan Press, London	1973	4 th Edition
3	Field geophysics-The geophysical	John Milsom	Wiley publications ,England		6 th Edition

	field guide III edition				
4	Introduction to Geochemistry	Krauskopf. K.B	McGraw Hill.	1967	6 th Edition
5	Outline of geophysical prospecting-a manual for geologists	Ramachandra Rao	University of Mysore	1975.	5 th Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Introduction to Geophysics	Garland	WB Saunder Company, London,	1979	5 th Edition
2	Fundamentals of Geophysics	William Lowrie	Cambridge press,UK	1984	11th Edition
3	Geochronology- Methods and case studies .	Nils-Axel Morne	INTECH publications	1989	5 th Edition
4	Geochronology – Dating and Precambrian time –The beginning of the world as we know it	John Raferty	Britannica Educational publishers, New York.	2011	7 th Edition
5	Theory of the Earth,	Don L.Anderson	Blackwell scientific Publications-,UK	1989	6 th Edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; Mini – project; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH5SK01 – ELECTRONICS - II

Category: SK

Credits: 3

Semester: V

No. of Hours/Week: 4

Course Outcomes

Co's	Statements	Bloom's Level
CO1	Discuss the concept of non-linear circuits.	L4
CO2	Design A/D and D/A converter.	L2
CO3	Write own programs in microprocessor 8085.	L3
CO4	Interface the microprocessor with the I/O devices.	L3
CO5	Discuss the architecture of the microprocessor 8085.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	M	M	S	M	S
CO3	S	M	L	S	M
CO4	M	S	S	M	L
CO5	S	S	M	S	L

* S – Strong; M – Medium; L – Low

Unit 1: Operational amplifiers (non-linear circuits) (Introduction–1 hr, content–10 hrs, revision–1 hr)

Integrator–Differentiator–solving differential equations–logarithmic amplifiers–II order high pass and low pass filters–astable and monostable multivibrators–instrumentation amplifiers.

Unit 2: Digital to analog and analog to digital conversion (Introduction–1 hr, content–10 hrs, revision–1hr)

Weighted resistor D/A converter – R–2R ladder D/A converter –parallel A/D converter –A/D conversion by counter method–A/D conversion by successive approximation method.

Unit 3: Architecture of μ P 8085 (Introduction–1 hr, content–10 hrs, revision–1 hr)

Pin functions of 8085–Architecture of 8085–Instruction set–data transfer, arithmetic, logic, branching and machine control group of instructions–addressing modes of data.

Unit 4 : Assembly language programming– μ P8085 (Introduction–1 hr, content–10 hrs, revision–1 hr)

Assembly language programs: addition–subtraction–multiplication–division (by all modes of programming) – square–square root–sorting in ascending and descending order–picking largest/smallest in an array–code conversion–subroutines.

Unit 5: Interfacing I/O devices (Introduction–1 hr, content–10 hrs, revision–1 hr)

Types of interfacing devices –address decoding for I/O–input/output ports–Programmable peripheral interface 8255–Features of 8255–programming 8255.

Books for study:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Op – amps and Linear Integrated circuits.	Ramakant A Gayakwad	PHI Learning	2009	4 th edition
2	Microprocessor Architecture, Programming, and Applications with the 8085	Ramesh S. Gaonkar	PenramInternational	2000	4 th edition
3	Handbook of Electronics	Gupta S.L, Kumar V	Pragati Prakashan	2012	-
4	Modern Digital Electronics	R.P. Jain	Tata McGraw – Hill Education	2009	4th Edition

Books for reference:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Introduction to Integrated Electronics	V.Vijayendran	Viswanathan S.,Printers& Publishers Private. Ltd.,	2009	-
2	Digital Principles and Applications	A.P Malvino, D.P. Leach, Gautam Saha	Tata McGraw – Hill Education	2011	11 th edition
3	Basic Electronics	B. L. Theraja	S. Chand & Co.	2016	5 th edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; tutorials; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH5SK02 – ELECTRONICS – II PRACTICAL

Category: SK

Credits: 1

Semester: V

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Construct and verify R-2R ladder D/A converter.	L4
CO2	Write and execute a machine language program for microprocessor 8085 for ascending and descending operators	L3
CO3	Write algorithm for arithmetic operations like addition, subtraction, multiplication and division.	L3
CO4	Execute a assembly language program for flashing and rolling of LED arrays.	L4
CO5	Construct an Astable multivibrator using 555 timer IC.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	S	M	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Experiments

- 1.OPAMP–Solving simultaneous equations
- 2.OPAMP–R–2R ladder D/A converter
- 3.ASM programs–Add, subtraction, multiplication & division (all modes of addressing)–microprocessor 8085
- 4.ASM programs–factorial & square root (all modes of addressing)–microprocessor 8085
- 5.ASM programs–sorting & determining largest and smallest in an array–microprocessor 8085
- 6.Microprocessor 8085–Interface I (LEDs)
- 7.Microprocessor 8085–Interface II (LEDs & Switches)
- 8.Microprocessor 8085–Interface IV (waveform generation)

16UPH6MC01 – ATOMIC AND NUCLEAR PHYSICS

Category: MC

Credits: 7

Semester: VI

No. of Hours/Week: 7

Course Outcomes

COs	Statements	Bloom's Level
CO1	Comprehend the behavior of charged particles in electric and magnetic fields to understand the working of mass spectrographs in the measurement of specific charge of charged particles. Utilize this understanding to predict the structure of atoms.	L1, L2
CO2	Calculate the wavelengths of atomic spectra and predict the fine structure.	L4, L5
CO3	Explain nuclear processes, nuclear reactions and nuclear models.	L1, L2
CO4	Calculate the energy released during nuclear reactions and to analyze the working of nuclear reactors, atomic bomb and hydrogen bomb.	L3, L4
CO5	Analyze elementary particle reactions and the associated conservation laws to predict the nature of nuclear forces.	L4, L5

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	L	S	S
CO4	S	S	M	M	S
CO5	S	S	L	L	S

* S – Strong; M – Medium; L – Low

UNIT I: CHARGED PARTICLES AND ATOM MODELS**HOURS: 23**

Detection of charged particles in electric and magnetic fields- specific charge of electron – Dunnington's method –charge of electron – Millikan's method –mass of electron - positive ray analysis: Thomson's parabola method –mass spectrometers – Dempster's and Bainbridge mass spectrograph

Bohr's atom model – Sommerfeld's relativistic atom model- hydrogen spectrum – orbital magnetic moment of H atom – Larmor precession – electron spin - Stern and Gerlach experiment- the Vector atom model and the quantum numbers- spin – orbit interaction and fine structure – Pauli's exclusion principle and electronic structure - Many electron systems - Coupling schemes: L-S coupling and j-j coupling – Hund's rule

UNIT II: ATOMIC AND MOLECULAR SPECTRA**HOURS: 20**

Fine structure and sodium doublet – normal Zeeman effect: experiment – Quantum mechanical explanation – anomalous Zeeman effect – Paschen Back effect

Molecular energies – pure rotational spectra – intensities of spectral lines – vibration – rotation spectra – rotation – vibration – electronic spectra -Frank – Condon principle – Raman effect – characteristics of Raman lines – Quantum theory of Raman effect.

UNIT III: PROPERTIES OF NUCLEI AND RADIOACTIVITY**HOURS: 20**

Constituents of nuclei – isotopes, isobars, isotones and mirror nuclei, nuclear mass and binding energy – unit of atomic mass – BE and stability of the nucleus- mass defect and packing fraction – binding fraction vs mass number curve – nuclear size – nuclear spin - nuclear energy levels - nuclear magneton – parity of the nuclei – electric multipole moments –Rutherford's scattering formula

Radioactivity: Decay law – activity of a radioactive sample – radioactive radiations – general properties of α, β, γ - rays- radioactive series: Displacement law – successive transformation – radioactive dating – radioactivity of light elements

UNIT IV: NUCLEAR MODELS, FISSION AND FUSION**HOURS: 22**

Discovery of neutron, Mass, half life, charge, Magnetic Moment, production and detection– Liquid drop model of nucleus – semi-empirical mass formula –application - Shell model– assumptions of shell model – predictions – quadrupole moment

Nuclear fission – energy released – liquid drop theory of fission - fission of light nuclei – Chain Reaction – critical mass – reproduction factor – nuclear reactor – types of reactors –breeder reactor – nuclear power plant – atom bomb - Nuclear Fusion – thermonuclear reaction – source of stellar energy – uncontrolled fusion - Hydrogen bomb – controlled fusion – stellarator, levitron and tokamak – radiation hazards

UNIT V: ELEMENTARY PARTICLE PHYSICS**HOURS: 20**

Four fundamental interactions in nature, elementary particle classification, conservation laws (exact and approximate), CPT theorem, anti-particles, anti-nucleon, quarks model, unification of interactions, the standard model and GUT.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Modern Atomic and Nuclear Physics, 2014	AB Gupta	Books and Allied	2014	-
3.	Modern Physics	R.Murugeshan and Kiruthiga Sivaprasath	S Chand and Co	2009	14 th edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Introduction to Modern Physics	H.S.Mani and Mehta (G.K)	Affiliated East-West Press	1989	-
2.	Concepts of Modern Physics,	Arthur Beiser et al	Tata-McGraw Hill	2009	6 th edition

Teaching Methodology

Chalk and Talk Lectures, Seminar, ICT based presentations, Video Lectures, Interactive activities, MCQs etc.

Evaluation Pattern

Internal: **100 {30(I CIA) +30(II CIA) + 40(MCQs, Seminar)}**

External: **100**

16UPH6MC02 – OPTICS

Category: MC

Credits: 7

Semester: VI

No. of Hours/Week: 7

Course Outcomes

COs	Statements	Bloom's Level
CO1	Discuss optics and its role in the modern society	L2
CO2	Analyze interference, diffraction and polarization of light.	L4
CO3	Study the response of different materials to optical sources.	L1
CO4	Explain the basic principle of LASER and their industrial applications.	L2
CO5	Determine the wavelength of light and thickness of thin film using Michelson's interferometer	L4

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	L
CO2	S	S	S	S	M
CO3	S	S	S	S	M
CO4	S	S	S	M	L
CO5	S	S	S	M	L

* S – Strong; M – Medium; L – Low

Unit I: Geometrical Optics

HOURS: 21

Matrix method in ray optics–Effect of translation and refraction – Thick and thin lens formulae – Unit planes–Nodal planes– System of two thin lenses. Dispersive power of a prism– Cauchy's formula–combination of prisms to produce –dispersion without deviation – deviation without dispersion –Direct vision spectroscope. Lens aberrations –monochromatic aberrations – spherical

aberration –Coma–astigmatism–curvature of the field– distortion– Chromatic aberrations methods of minimizing aberrations–Huygen’s eyepiece–Ramsden’s eyepiece.

UNIT II: Interference

HOURS: 15

Fresnel’s biprism –determination of wavelength of light and thickness of thin sheet of transparent materials– Fresnel’s mirrors and Lloyd’s single mirror experiments– Achromatic fringes– Interference in thin films due to reflected and transmitted light–Fringes in wedge shaped films – Reflected and anti-reflected coating –Michelson’s interferometer– determination of wavelength of light and thickness of thin transparent sheet.

UNIT III: Diffraction

HOURS: 21

Rectilinear propagation of light–Zone plate – Fresnel diffraction – Diffraction at circular aperture, circular disc and a straight edge – Fraunhofer diffraction – Diffraction at a single and double slit– Missing orders in double slit– Theory of diffraction grating – Determination of wavelength – Dispersive power – Rayleigh’s criterion for resolution power of a telescope, microscope, prism and grating.

UNIT IV: Polarization

HOURS: 21

Plane of polarization– Polarization of reflection – Brewster’s law– pile of plates – Polarization by reflection – Malu’s law – Double refraction – Nicol prism – Huygen’s explanation of double refraction in uniaxial crystals– Elliptically and circularly polarized light– Quarter and half wave plates – Production and determination of plane, elliptically and circularly polarized light– Optical activity – Fresnel’s theory –Specific rotation – Laurent’s half shade polarimeter.

UNIT V: Applied Optics

HOURS: 21

Lasers – spontaneous and stimulated emission – Einstein’s coefficients – He– Ne Laser – properties of laser beam –Carbon dioxide and Nd–YAG lasers. Semiconductor Laser –Homo junction and Hetro-junction laser–Industrial and medical applications of Laser. Nonlinear optics – Harmonic Generation, sum and difference frequency generation, wave mixing, Pockwl and Kerr effect. Optical Fibers – Principle – configuration– Characteristics of optical fiber, Electromagnetic wave propagation through optical fiber, Losses and dispersion in optical fiber – wave propagation in multimode and single mode optical fibers.

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Optics	AjoyGhatak	Tata McGraw Hill Co.	2005	3 rd Edition
2	Fundamental of optics	Jenkins & White	McGraw Hill	1981	4 th Edition
3	A Text Book Of Optics	Brijlal and M. N. Avadhanulu	S. Chand and Co.	2012	25th edition
4	Optics	Khanna D.R &Gulati H.R.,	Chand& Co., pvt.Lid., New Delhi.	2000	4 th Edition
5	photonics	R.Menzel	springer,	2001	1 st Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Optical Physics	H. Lipson and D.S Tannhauser S. G. Lipson,	Cambridge University	2012	3rd Edition
2	Optics,	Miles V. klein and Thomas E.Furtak	JohnWiley& sons	1987	2 nd edition
3	Optics and spectroscopy	R. Murugesan and kiruthika sivaprasath	S. Chand Co, New Delhi	2007	6 th edition
4	Photonics Essentials: An introduction with experiments	T.P.Pearsall,	McGraw – Hill,	2002.	1 st Edition
5	Optical Fiber Communication	Gerd Keiser	McGraw – Hill International, Singapore,	2000.	3rd Edition
6	Introduction to Optics	Pedrotti and Pedrotti	Addison Wesley	2006	3rd Edition
7	Optics	Eugine Hecht	pearson publication	2008.	4 th Edition
8	Laser physics	S.Mohan, V.Arjunan, M.Selvarani, M.Kanchanamala	MJP Publishers	2012	1 st Edition

9	Optical Electronics and Fiber optics communications	C.K.Sarkar, D.C.Sarkao,	New Age International (P) Limited,	2010	1 st Edition
10	Introduction to Fiber Optics	AjoyGhatak & K.Thyagarajan	Cambridge University Press (UK)	1998.	1 st Edition

Teaching Methodology

Chalk and talk lectures; Seminar; ICT based presentations; Video lectures; Mini – project; MCQs etc.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External:

External – Part A (20) + Part B (30) +Part C (50) = 100

16UPH6MC03 – SOLID STATE PHYSICS

Category: MC

Credits: 6

Semester: VI

No. of Hours/Week: 6

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Examine the symmetries in 3D solids and the experimental methods to unfold the same.	L3,L5
CO2	Employing simple theoretical models to understand the different physical properties like lattice heat capacity and electrical property.	L2,L3
CO3	Analyze and classify magnetic materials based on their field and temperature response.	L4
CO4	Validating the microscopic view point of the different physical properties of solids.	L5
CO5	An idea of the properties and usefulness of the superconducting materials and the existing theories to explain the experimental facts.	L4

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M
CO2	S	M	L	M	S
CO3	S	S	S	L	M
CO4	S	M	S	S	S
CO5	S	S	S	L	S

* S – Strong; M – Medium; L – Low

UNIT I: Crystal Structure**HOURS: 18**

Solids :- Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non– Central Elements. Unit Cell. Reciprocal Lattice. Types of Lattices. Laue equations– Bragg’s Law–Diffraction of X–rays by Crystals –Powder and rotating crystal method – Brillouin Zones.

Unit 2: Elementary Lattice Dynamics**HOURS: 18**

Lattice Vibrations and Phonons: – Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Einstein and Debye Theories of Specific Heat of Solids. Law– phonon– photon interaction

Unit 3: Electrical Properties of Materials**HOURS: 18**

Elementary Band Theory of Solids. Effective Mass of Electron. Concept of Holes. Band Gaps. Energy Band Diagram and Classification of Solids. Law of Mass Action. Insulators, and Semiconductors. Direct and Indirect Band Gap. Intrinsic and Extrinsic Semiconductors. p– and n– Type Semiconductors. Conductivity in Semiconductors. Hall Effect in Semiconductors (Qualitative Discussion Only)

Unit 4: Magnetic Properties of Matter**HOURS: 18**

Dia, Para, Ferro and Ferri magnetic Materials. Classical Langevin Theory of dia and Paramagnetism – magnetic domains – Quantum Mechanical Treatment of Paramagnetism. Curie’s law, Weiss’s Theory of Ferromagnetism . Discussion of B–H Curve. Hysteresis and Energy Loss.

Unit 5: Superconductivity:**HOURS: 18**

Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors - HTS - London’s Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation): Cooper Pair and Coherence length. Variation of Superconducting Energy Gap with Temperature. Experimental Evidence of Phonons. AC/DC Josephson Effect (No derivation)

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Introduction to Solid State Physics	Charles Kittel	JohnWiley and Sons, Inc	2007	7th Edition
2	Solid State Physics	A J Dekkar	Macmillan India Limited	2000	New 1 st edition
3	Solid State Physics	J. S. Blackmore	Cambridge University Press	1985	2 nd edition
4	Solid State Physics	Wahab	Narosa Publication house,	2005	2nd edition.

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1	Solid State Physics	N. W. Ascroft and N. D. Mermin	Cengage learning	2003	1 st edition
2	Elementary solid state physics: principles and applications	M. Ali Omar	Pearson Education	2008	4 th edition

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; tutorials; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) +Part C (50) = 100

16UPH6MC05 – PHYSICS PRACTICALS – VII

Category: MC

Credits: 2

Semester: VI

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Design and study the working of OPAMP based circuits such as astable multivibrator, Wien's oscillator, low pass filter and temperature to voltage controller.	L3
CO2	Use transducers such as LDR and thermistor in electronic circuits as sensors.	L3, L4
CO3	Construct regulated power supplies.	L3, L4
CO4	Construct modulus counters for digital applications.	L3
CO5	Design tone decoders using PLL IC567 by controlling the frequency of oscillation of the VCO of the IC.	L4

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	L
CO2	M	S	S	S	L
CO3	M	S	S	S	L
CO4	M	S	S	S	L
CO5	M	S	S	S	L

* S – Strong; M – Medium; L – Low

List of experiments

1. Light to frequency converter- Astable multivibrator– OP AMP
2. Wien's bridge oscillator – OP AMP
3. Zener regulated power supply
4. Half adder and full adder

5. Low pass filter – OP AMP
6. Mod n counter– (2-9) - IC 7493
7. Temperature to voltage converter-OP AMP
8. Phase locked loop- lock-in-range- relay

Books for Study

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics	Anchal Srinivasa & R.K.Shukla	New age International Publishers	2018	Second edition.
2.	A textbook of Physics Practical – Part I	Prof.C.C. Ouseph & Prof.V. Srinivasan	S. Viswanathan Publishers	1990	-
3.	A textbook of Physics Practical – Part II	Prof.C.C. Ouseph & Prof.G. Ranga Rajan.	S. Viswanathan Publishers	1996	-
4	Advanced Practical Physics II	Dr.S.P. Singh	Pragati Prakashan – Meerut	2000	Twelfth Edition

Books for Reference

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Practical Physics with Viva – voce	Dr.S.P. Singh	Pragati Prakashan – Meerut	1999	Twenty third Edition
2	Practical Physics	S.L. Gupta & V. Kumar	Pragati Prakashan – Meerut	1999	Twenty third Edition
3	Advanced level Practical Physics	M.Nelkon & J.M. Ogborn	Heinemann Educational Books. Ltd – London.	1967	-
4	A textbook of Practical Physics	H.S. Aller & H. Moore	Macmillan and Co & Limited.	1941	-

16UPH6MC05 – PHYSICS PRACTICALS – VIII

Category: MC

Credits: 2

Semester: VI

No. of Hours/Week: 2

Course Outcomes

CO's	Statements	Bloom's Level
CO1	Evaluate the value of Planck's constant using LEDs.	L3
CO2	Determine the refractive index of small angled prism.	L3, L4
CO3	Method to measure high resistance and absolute capacitance using sensitive Ballistic Galvanometer.	L3, L4
CO4	Determine the thermo EMF per unit temperature difference of a thermocouple using spot galvanometer.	L3
CO5	Determine the moment of bar magnet using Searle's vibration magnetometer.	L4

Mapping of COs–PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	L
CO2	M	S	S	S	L
CO3	M	S	S	S	L
CO4	M	S	S	S	L
CO5	M	S	S	S	L

* S – Strong; M – Medium; L – Low

List of experiments

1. To determine the value of Planck's Constant by using LEDs of at least 4 Different Wavelengths.
2. Refractive index– small angled prism
3. $i-i'$ – spectrometer
4. High resistance by leakage– BG

5. Determination of absolute capacitance – B.G
6. Thermo EMF of a thermo couple– spot galvanometer
7. Moment of a bar magnet-Seale’s vibration magnetometer
8. Calibration of a high range voltmeter – potentiometer- Method 2

Books for Study

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1.	Practical Physics	Anchal Srinivasa & R.K.Shukla	New age International Publishers	2018	Second edition.
2.	A textbook of Physics Practical – Part I	Prof.C.C. Ouseph & Prof.V. Srinivasan	S. Viswanathan Publishers	1990	-
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3	Advanced level Practical Physics	M.Nelkon & J.M. Ogborn	Heinemann Educational Books. Ltd – London.	1967	-
4	A textbook of Practical Physics	H.S. Aller & H. Moore	Macmillan and Co & Limited.	1941	-

16UPH6MS01 – MATERIALS SCIENCE

Category: MS

Credits: 4

Semester: VI

No. of Hours/Week: 6

Course Outcomes

Co's	Statements	Bloom's Level
CO1	Conceptually analyze the behavior of engineering materials based on their type, structure and composition.	L3
CO2	Discuss the basic properties of materials to calculate the stress, strain and modulus of elasticity for various engineering applications	L5
CO3	Identify the engineering materials for specific applications by finding their mechanical properties such as: yield strength, tensile strength, ductility or elongation, impact strength, toughness.	L4
CO4	To identify and explain smart materials and Nano phase materials.	L5
CO5	Outline the non-destructive testing methods and computer simulation necessary for qualitative analysis of engineering materials.	L3

Mapping of COs – PSOs

Course Outcomes	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	L
CO2	S	S	L	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	L
CO5	S	S	M	S	M

* S – Strong; M – Medium; L – Low

Unit 1: Engineering materials and chemical bonding

Classification of engineering materials – levels of structure – structure-property relationship in materials – stability and metastability – bond energy – bond type and bond length – ionic and covalent bonding – Metallic bonding-secondary bonding-lattice energy – Born Haber cycle – cohesive energy – variation in bonding character and properties.

Unit 2: Mechanical and thermal behaviour of materials

Elastic behaviour – atomic model of elastic behaviour – Young's modulus – Poisson's ratio – shear modulus – bulk modulus – composite materials - the modulus as a parameter of design – rubber like elasticity – plastic deformation – tensile – yield strength – toughness – elongation – hardness – impact strength – stress - strain curve -Heat capacity, thermal conductivity, thermal expansion of materials.

Unit 3: Magnetic materials and dielectric materials

Terminology and classification – magnetic moment due to electron spin – ferromagnetism, Antiferromagnetism and Ferrimagnetism – Influence of temperature on magnetic behaviour – Domains and Hysteresis – soft and hard magnetic materials. Polarization – electronic, ionic, orientation and space charge polarization – temperature and frequency effects – Determination of dielectric constant – dielectric loss – uses of dielectric materials – dielectric breakdown – ferroelectric materials and applications.

Unit 4: Smart materials

Definition of smart materials – Types – Piezoelectric materials- Materials for MEMS and NEMS- Ferro fluid- Magnetic shape- memory alloys (MSMAs)- Shape memory alloy (SMA)- One way and Two way memory effect- Dielectric elastomers (DEs)- Light sensitive materials- Smart catalysts–solar cell materials (single crystalline, amorphous and thin films) - surface acoustic wave and sonar transducer materials and applications - Introduction to Nano phase materials and their properties.

Unit 5: Non-destructive testing and materials characterization

Radiographic methods – photo-elastic methods – magnetic methods – electrical method – ultrasonic method – Equipment used for NDT – metallurgical microscope - electron microscope-scanning electron microscope (SEM) – Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy. Characterisation of materials with electrometer- Mechanical hardness using Vickers's micro hardness tester – thermal properties using TG/DTA, functional group analysis by FTIR- characterisation of materials by UV-Visible Spectroscopy – Photoconductivity – Computer simulation of crystal structure.

Books for study:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Materials science and engineering	Raghavan V	Prentice Hall India	2012	5 th Edition
2.	Materials Science	Arumugam	Anuradha agencies & publishers	1990	-
3.	Smart Materials and Structures	Gandhi M V and Thompson B S	Chapman & Hall	1992	-
4.	Practical Non-destructive Testing	Baldev Raj, T. Jayakumar, M. Thavasimuthu	first published Narosa publishing house New Delhi	2002	2 nd Edition

Books for reference:

S.No.	Title of the Book	Author	Publisher	Year	Vol./Edition
1.	Introduction to Solid State Physics	Kittel C	Wiley Eastern		7 th Edition
2.	A text book of Materials Science	Manchandra V K	New India Publishing House	1992	-
3.	Mechanical Engineers' Handbook: Materials and Mechanical Design, Volume 1	Myer Kutz	John Wiley & Sons	2006	3 rd Edition
4.	Smart Structures and Materials	Culshaw B	Artech House	1996	-

Teaching Methodology

Chalk and Talk Lectures; Seminar; ICT based presentations; Video Lectures; Group Discussions; Interactive activities; tutorials; MCQs.

Evaluation Pattern

Internal: CIA I (30) + CIA II (30) + Component I (20) + Component II (20) = 100 External: Part A (20) + Part B (30) + Part C (50) = 100