Physics Paper PHY 1501

Unit – 1 : Mathematical Physics

A: Introduction, Applications of Vector Multiplication, Triple Scalar Product, Triple Vector Product, Differentiation of Vectors, Fields, Directional Derivative; Gradient, Some other expressions involving del, Green's Theorem in the plane, The Divergence and the Divergence theorem. Gauss's law, The curl and Stoke's theorem.

A: Mathematical methods in Physical Sciences By M.L. Boas: Article nos: 6.1 to 6.11

B: Matrices: Matrix equations, Multiplication of a Matrix by a number, Multiplication of Matrices, Zero matrix, Identity Matrix or Unit Matrix, Applications of matrix Multiplication, Inverse of a Matrix, Rotation of Matrices.

B: Mathematical methods in Physical Sciences By M.L. Boas: Article no: Chapter 3 section 6

UNIT – 2 : Waves

Traveling Waves : Speed of propagation of waves in a stretched string longitudinal waves in a bar, Plane waves in a fluid, transmission of energy by a traveling wave.

Sound waves

Introduction, Intensity & intensity level, Loudness & pitch radiation from a piston, diffraction, radiation efficiency of a sound source.

Ultrasonic Waves: Magneostriction method, Piezo-electric oscillator, Piezo-electric detectors, Measurement of velocity of ultrasonic waves, diffraction effect & its applications, Stereophonic sound.

Text Book :
Mechanics, Wave motion & Heat by Francis Weston Sears (Addision Wesley Publication)
Articles: 16.3 to 16.6, 18.1, 18.2, 18.3, 18.6, 18.7
A text book on oscillations, waves & Acoustics by M. Ghosh, D. Bhattacharya (S. Chand)
Chapter 23: Art 23.1 to 23.6

Unit – 3 : Optics

A: Fermat's principle and its applications: Fermat's principle of least time, laws at reflection, laws of refraction. Interference in thin films: Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.

A: Text book: Optics by Subramanyam and Brijlal: Articles: Article no: 2.1, 2.2, 2.5, 2.6, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6

Optical system and cardinal Points: Introduction, cardinal points, Construction Of the image using cardinal points, A system of two thin lenses. Cardinal Points of a coaxial system of two thin lens

B: **A: Text book: Optics by Subramanyam and Brijlal: Articles: Article no:** 5.1, 5.2, 5.3, 5.10

Unit – 4 : Thermoelectricity

Seeback effect, Peltier effect, Thomson effect, Total emf in a thermocouple, Laws of thermoelectricity circuits, thermoelectric diagrams, Measurement of thermo-emf, Applications of thermo-emf.

Text book: Magnetism and Electricity by D.N. Vasudeva: article no: 18.1 to 18.10

Physics Practicals: PH-1502L

SET A

1. Newton's Ring

To find the wave length of light of given monochromatic source.

To find the radius of curvature of given lens.

2. Cauchy's Constant

To determine Cauchy's constant A and B using given formula and to find the

wavelength of unknown line of a mercury spectrum.

3. Least Square Fitting (Linear Fitting)

4. Characteristic of thermistor.

5. Melde's Experiment.

(i) To prove P/L constant. (ii) To prove T/l2 constant

6. Resonator

To test the accuracy of relation n2 (V + Kv) = constant and to determine the frequency

of unknown fork.

7. Analysis of Error

SET B

8. Vibrational Magnetometer

To compare the magnetic moment of two bar magnets.

9. Study of Transformer

To determine (i) turn ratio (ii) percentage efficiency (iii) energy loss due to copper, for a given transformer.

10. Value of inductance

For given two inductors determine the value of inductance for each of them. AND (i) by connecting them in series. (ii) by connecting them parallel.

11. Decay Constant

To verify the exponential law for the decay of a charged capacitor and determine the decay constant of the capacitor.

12. Series Resonance

To determine the frequency of a.c. emf by series resonance circuit varying capacitor.

13. Half-Wave Rectifier

Obtain load characteristic and %regulation for Full-wave rectifier with-out filter circuit and by using capacitor filter circuit. Determine ripple factor for Full wave rectifier without filter only.

14. Fly Wheel.

To find the moment of inertia of a fly wheel.

Examination scheme: Total 100 Marks: Internal 30 marks, External 70 Marks

Student has to perform total two experiments during practical exam. From each section student has to perform one experiment.
Marks for Section A: 35 Marks
Marks for Section B: 35 Marks

Total Time duration for practical exam: 4 hour
Practical batch size: Maximum 15 students

Physics Paper- 2501 (Basic-Physics-2)

Unit-1 Electric & Electronic Circuits

DC Circuits: RL circuits (Growth and decay of current), RC circuit (Charging and discharging of capacitor) L-C-R circuit in series with DC source.

Diode circuits: Load line analysis of a diode circuit, use of diode in rectifier, half wave, full wave and bridge rectifier with their performance, C filter, L filter.

Unit 2 Electrostatics

Differential form of Gauss law, Poisson and Laplace Equation, Field between two concentric spheres which have equal and opposite charges. A useful Theorem in electrostatics, electrostatic potential, Determination of potential Due to uniformly charged spherical shell. Determination of a potential and field on the axis and rim of a uniformly charged disc, Field of a dipole in plane polar coordinate system. Method of images.

Unit 3 Magneto statics

Magnetic effects, The magnetic field, force on a current, Biot Savart law, The laws of magnetostatics, the magnetic potentials, Magnetic dipole in non-uniform magnetic field, Magnetic vector potential due to a small current loop, Magnetic media, Magnetization, Magnetic field vector, Magnetic susceptibility & permeability.

Unit 4 Nuclear Physics

Radioactivity : The law of radioactive decay (review), Radioactive growth and decay, ideal equilibrium, Transient equilibrium and secular equilibrium, Radioactive series, Radioactive isotopes of lighter elements, Artificial radioactivity, Age of earth, Carbon dating (Archaeological time scale)

The Q Equation: Types of Nuclear Reactions, The balance of mass and Energy in Nuclear reactions, The Q Equation, Solution of the Q Equation. Constituents of the nucleus properties: Measurement of Nuclear radius, Constituents of the nucleus and their properties, Nuclear spin, moments and statistics. **Methods of measurement of half life**

Physics Practical- Sem-2: PH–2502L

SET A

1. Stefan Constant

To verify the Stefan Boltzman's fourth power law by using dc power source.

2. Radioactive decay

Simulation of Nuclear Radioactive decay using Calculator.

3. Deflection Magnetometer

To determine the magnetic moment (M) of given bar magnate using deflection magnetometer in Gauss A and B position.

4. Projection Method

To find the value of a low resistance by the method of projection of potential.

5. Value of capacitance

For given two capacitors determine the value of capacitance for each of them and (i) by connecting them in series (ii) by connecting them parallel.

6. Owen's Bridge

To find the value of an inductance of an unknown inductor by using Owen's bridge circuit.

7. To Determine Wave length of LASER light

SET B

8. LDR Characteristics

Obtain IV characteristics of given LDR and calculate its resistance (for at least three different light levels).

9. I-V Diode characteristics of a PN-junction diode and its load line analysis.

10. Parallel Resonance

To determine the frequency of a.c. emf by series resonance circuit by varying capacitor.

11. Full-wave Rectifier

Obtain load characteristic and % regulation for Full-wave rectifier with-out filter circuit and by using capacitor filter circuit. Determine ripple factor for Full wave rectifier without filter only.

12. 'g' by bar pendulum

13. Universal Logic Gates AND, OR, NOT, NAND, NOR (Using discrete components)

Verification of truth tables and giving understanding of voltage level for '0'and '1'level.

14. Dispersion Power of Prism

Examination scheme: Total 100 Marks: Internal 30 marks, External 70 Marks

Student has to perform total two experiments during practical exam. From each section student has to perform one experiment.
Marks for Section A: 35 Marks
Marks for Section B: 35 Marks
Total Time duration for practical exam: 4 hour
Practical batch size: Maximum 15 students

Physics Paper- PH-3501 (Adv. Physics 1)

Unit 1: Solid State Physics

1. **The crystalline State** : Crystalline, polycrystalline and glassy materials; Basis of crystal structure; Unit cell-Primitive cell structures; Symmetry operations- translation, point, hybrid operations; Classification of Crystal types-two dimensional crystal lattice and three dimensional crystal lattices; Indices of a lattice direction and a lattice plane (Miller indices); Crystal point groups and space groups, space groups, space groups; Common crystal structures, simple cubic structure, BCC, FCC, closed packed and hexagonal close-packed structure, diamond structure.
2. **Crystal binding**: Cohesion of atoms; Primary bonds, Covalent bond, metallic bond, ionic bond, mixed bonding; Secondary bonds: Van der Waals bond, hydrogen bond, Cohesive energy, Madelung energy of ionic crystal.

Modern Physics by Manpreet Kaur

3. Reciprocal lattice and Crystal Diffraction: Reciprocal lattice; Bragg Law, Laue's interpretation of X-ray diffraction by crystals, Construction of reciprocal lattice, Relationship between a, b, c and a*, b*, c*, Experimental Diffraction Methods, Laue method, Rotating crystal method, powder method, Determination of lattice constants; Selection of incident beam.

Solid State Physics by Rita John

Unit 2: Electronics

Basic characteristics of the Transistor: Basic Transistor amplifier, Two diode analogy for a transistor, Transistor input characteristics, Transistor collector characteristics, collector cut off current ICEO, Forward current transfer ratio CE , Permissible operating area of a transistor CE, The basic common base amplifier, CB, Forward current transfer ratio CB, relation between and β, collector cut off current ICBO, physical explanation of CB and CE amplifying action, reduction of CE leakage current to ICO, common collector amplifier, identifying the transistor leads The common emitter amplifier: Graphical analysis of CE class A amplifier, input and output resistance, effect of adding a class A amplifier, conversion efficiency of class A amplifier with a direct coupled resistive load, phase relationship in CE amplifier, input waveform consideration, comparison of basic transistor amplifier

Solid state electronics Devices: Tunnel diode, application of tunnel diode, the silicon controlled rectifier, the Uni junction transistor

Opto Electronic diodes: LED, Photo diodes, Opto Couplers.

Electronic devices and circuits by Salivanhanan and N. Suresh Kumar

Unit 3: Optics & Modern Physics

Black body radiation, Compton effect, Frank- Hertz experiment, Stationary states of atoms. The correspondence principle, Bohr atom, Spectroscopic series, Quantization of the orbits. The Elliptic Orbits, Particle in a box

Modern Physics by Arthur Beiser: article no: 2.2, 2.7, 4.3, 4.4, 4.6, 4.8, 3.6

Harmonic oscillator, Short coming of an old quantum theory, Compton effect, particle diffraction, Wave packets and Einstein De Broglie relation.

Book: Quantum Mechanics by Aruldhas

Reference: Quantum Mechanics by Mathews and Venkatesan

Unit 4: Wave Optics

1. Diffraction of Light (Fresnel class): Frensnel's half period zones, zone plate, difference between interference & diffraction, Fresnel & Fraunhofer diffraction.
2. Fraunhofer class: Fraunhofer diffraction at two slits, diffraction at N slits, Plane diffraction power of the grating,
3. Resolving power of optical Instrument : Resolving power, Rayleigh's criterion of resolution, Resolving power of a plane diffraction grating, difference between resolving power & dispersive power of grating, comparison of prism & grating spectra

Optics by Brijlal & Subramanyam

Text Book: Optics & atomic physics by Singh, Agrawal (Pragati Prakashan, Meerut)

1. For A - Chapter 7.Article Nos. : 7.3 to 7.6,
2. For B - Chapter 8.Article Nos. : 8.6 to 8.8, 8.15,8.16
3. For C - Chapter 9.Article Nos. : 9.1 to 9.4, 9.8 to 9.10

PH- 3502 (Adv. Physics 2)

Unit 1: Sound and Mathematical Physics (AR)

1. A: Sound: Architectural Acoustics, Sabine's formula, Reverberation time-theoretical treatment Reverberation time of a live room, Reverberation time of a dead room, optimum reverberation time.

   Text Book of Oscillations, Waves and Acoustics by Ghosh and Bhattacharya: article no. 24.1-24.6

2. B: Fourier series : Introduction, Simple Harmonic motion & wave motion – Periodic functions, Applications of fourier series, Average value of a function, Fourier co-efficients, Dirchlet conditions, complex form of fourier series, other intervals, Even & odd functions, Parsevel's theorem, Applications/Numericals on Fourier series.

   Mathematical Methods in Physical Science by M. L. Boas

Unit 2: Classical Mechanics

Motion in a Central force field: General features of the motion, Motion in an inverse square law force field, Equation of the orbit, Kepler's laws of planetary motion

Collision of particles : Elastic & inelastic scattering, Elastic Scattering : Laboratory & Centre of mass system, Kinematics of elastic scattering in the laboratory system, inelastic scattering, cross-section, The Rutherford formula

Moving Co-ordinate System: Rotating co-ordinate system, The Coriolis force, Motion on the earth, Effect of Coriolis force on freely falling particles

Text Book: Classical mechanics by R.G. Takwale & P.S. Puranik, Tata McGraw Hill (Article Nos. : 5.2 to 5.6, 7.1 to 7.6, and 9.2, to 9.5)

Reference Books:

1. Classical Mechanics by A. B. Bhatia, Narosa Publication.
2. Classical Mechanics by H. Goldstein, Addison Wesley.
3. Classical Mechanics by J. C. Upadhyay, Himalaya publications
4. Classical Mechanics by Rana and Jog

Unit 3: Nuclear Physics

Physical tools: Introduction, Interaction between particles & Matter, brief survey, Detectors for Nuclear particles (i) Proportional counter (ii) The Geiger counter (iii) Scintillation counter (iv) Solid state or semi-conductor detectors (v) Cloud & Bubble chambers (vi) Spark chamber;

Particle Accelerators : Need for an accelerator of charged particles, (i) Van de Graff Generator (ii) The cyclotron (iii) Synchrotron (iv) The Betatron; Beta ray spectrometer.

Nuclear Physics By S.B. Patel

Reference Book:

1. Nuclear Physics by Kenneth Krane
2. Modern Physics By Aruldhas

Unit 4: Dielectrics

1. Polarisation: Dielectrics, Induced dipoles, alignment of polar molecules, field of a polarized object, Physical interpretation of bound charges, The field inside a dielectric.
2. The Electric Displacement: A deceptive parallel, boundary conditions.
3. Linear Dielectrics: Boundary value problems with linear dielectrics, Energy in dielectric systems. Forces on dielectric

Introduction to Electrodynamics by Griffith: article no: 4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2, 4.2.1, 4.2.2, 4.2.3, 4.3, 4.3.1, 4.3.2, 4.3.3, 4.4, 4.4.1, 4.4.2, 4.4.3, 4.4.4

Reference Book: Electromagnetism by B.B. Laud

PHYSICS PRACTICAL: PH – 3503L (Physics Lab-3)

(2.5 Credit)

Group A

1. Y-by Koening's method.
2. Wavelength of prominent spectral lines by diffraction grating.
3. Flatness of plate by Newton's ring.
4. Resolving power of telescope.
5. Resonance pendulum.
6. Absorption coefficient of liquid.
7. Study of electron diffraction pattern.
8. Stefan's Constant
9. Solar Cell

Group B

1. Figure of Merit of a mirror galvanometer.
2. C1/C2 by Desauty's method: (To be done with AC source and DMM)
3. Zener diode as a voltage regulator.
4. h-parameters of CE transistor.
5. To study the variation of IC & VCE with temperature in fixed bias circuit & potential divider bias for CE configuration.
6. L by Maxwell's bridge.
7. Thermocouple
8. Theoretical study of Fourier series.
9. To find Planck's constant.

Examination scheme: Total 100 Marks: Internal 30 marks, External 70 Marks

Student has to perform total two experiments during practical exam. From each section student has to perform one experiment.
Marks for Section A: 35 Marks
Marks for Section B: 35 Marks
Total Time duration for practical exam: 6 hour
Practical batch size: Maximum 15 students

PH- 4501 (Modern Physics-1)

Unit 1: Solid State Physics

1. Lattice Vibrations : Harmonic crystals : the "Ball & strings" model; Normal modes of one dimensional monoatomic lattice, periodic boundary condition, concept of the first Brioullin zone, salient features of the dispersion curve; Normal modes of one dimensional diatomic lattice, salient features of the dispersion curves, optical and acoustical mode; Quantization of lattice vibrations-phonons; Measurement of phonon dispersion by inelastic neutron scattering.

   Solid State Physics by Rita John and J. S. Blackmore

2. Thermal properties : Classical lattice heat capacity Quantum theory of lattice heat capacity, Einstein model, phonon density of states; Debye continuum model; Anharmonic effects, Thermal expansion, Gruneisen parameter; Phonon collision processes, Phonon thermal conductivity.

   Solid State Physics by C. Kittel and S.O. Pillai

Unit 2: Heat and Thermodynamics

Entropy: Reversible part of the second law (claussis theorem), Entropy, Entropy of the ideal gas, TS diagram, Application of the Entropy principle. Pure substances: Volume expansitivity: Cubic Expansion coefficient, Compressibility. Mathematical methods in thermodynamics: Characteristics functions, Enthalpy, Helmholtz & Gibb's functions, two mathematical theorems, Maxwell's relations, Tds equations, Internal energy equations,

Heat Energy equations, Heat capacity equations. Open Systems: Joule-Thomson expansion, Liquefaction of gases by the Joule-Thomson expansion

Heat & Thermodynamics by Zeemansky

Unit 3: Electronics

1. Transistor Biasing: Factors contributing to thermal stability, effect of temperature increase, stability factor S, common base stability, collector to base bias, disadvantage of collector to base

bias, emitter bias, voltage divider bias with emitter bias, emitter bypass capacitor, summary of stabilization circuit, additional stability factors, bias compensation
Hybrid equivalent circuit for a transistor: conversion of a transistor to a standard form, general Black box theory, Hybrid 'h' parameters, obtain the hybrid h parameters, typical h parameter value, Amplifier equation, voltage and current gains taking into account Rg of source, dependence of amplifier characteristics on RL and Rg, comparison of CB, CC and CE

Electronic devices and circuits by Salivanhanan and N. Suresh Kumar

2. AC Bridges: Condition for bridge balance, Maxwell bridge, Schering bridge, Wein bridge, Heaviside bridge.

Book: Electronic Instrumentation by *Helfrick Cooper*

Unit 4: Atomic Spectroscopy

The vector atom model, Spin-orbit interaction and fine structure, Pauli's exclusion principle and electronic configuration, Total angular momentum in many electron atoms, L-S coupling, j-j coupling, Hund's rules, Energy levels and transitions of Helium, Alkali spectra, Shielding of core electrons, Spectral terms of equivalent electrons, Normal Zeeman effect, experimental arrangement and theory, Anomalous Zeeman effect, Paschen-Bach effect, Stark effect, Characteristics X-ray spectrum, Moseley's law, Width of spectral lines. Stern- Gerlach experiment.

Book: Modern Physics By Aruldhas

Reference Book:

1. Modern Physics by Arthur Beiser
2. Modern Physics by Kenneth Krane

PH- 4502 (Classical Physics-1)

Unit 1: Optics

1. Double refraction or birefringence, geometry of calcite crystal, Optical axis principal section & principal plane, Nicol prism, Parallel & Crossed Nicol prism, Huygen's theory of double refraction in uniaxial crystals, refractive indices for o-rays & e-rays, Polaroids.
   Production & Analysis of Polarized light : Introduction, superposition of two plane polarized waves having perpendicular vibrations, The elliptically & circularly polarized light, quarter wave plate, half wave plate, production of plane elliptically & circularly polarized light, detection of plane elliptically & circularly polarized light, systematic analysis of polarized light.

   Optics and Atomic Physics by Singh and Agrawal

   Dispersion and Scattering: Theory of dispersion of light; absorption bands and anomalous dispersion. Theory of Rayleigh scattering; scattering of X-rays and determination of Z of an atom

   1. **A. K. Ghatak, Physical Optics**
   2. **D. P. Khandelwal, Optics and Atomic Physics**

Unit 2: Statistical Mechanics

1. **Macroscopic and microscopic states**: Macroscopic states, Microscopic states, Phase spaces, μ-space, Γ-space, Postulate of equal a priori probabilities, Ergodic hypothesis, Density distribution in phase space, Liouville's theorem, Principle of conservation of density in phase and principle of conservation of extension in phase, Condition for statistical equilibrium,

2. **Statistical ensemble:** Micro canonical ensemble, Canonical ensemble, Mean value and fluctuations, Grand canonical ensemble, Fluctuations in the number of particles of a system in a

grand canonical ensemble. Reduction of Gibbs distribution to Maxwell and Boltzmann distributions, Barometric formula

Text books:

Fundamentals of Statistical Mechanics by B.B. Laud, New Age International Publishers

Article Nos: 4.1 to 4.11, 5.1, 5.2, 5.4, 5.5, 5.7, 5.8, 5.8.1, 5.8.2, 5.9

Reference books:

1. Statistical Mechanics An Introduction by Evelyn Guha, Narosa Publications
2. Introduction to Statistical Mechanics by S.K. Sinha, Narosa Publication
3. Fundamentals of Statistical and Thermal Physics by F. Reif, McGraw Hill Book Co.

Unit 3: Relativity

Galilean Transformation; Electromagnetism and Galilean Transformation; Michelson-Morley Experiment; The postulates of Special theory of relativity; Lorentz transformation; Velocity transformation; Length contraction; Time dilation; Simultaneity; Relativity of mass; Mass and energy; Space-Time diagrams; General Relativity; Principle of Equivalence; Some Predictions of General Relativity

Book : Modern Physics by G. Aruldhas and P. Rajagopal

Reference: Atomic & Nuclear Physics by Sharma, Publisher: Pearson education and Modern Physics by Gurbinder Kaur

Unit 4: Quantum Mechanics

Ehrenfest's Theorem, Admissibility conditions on the wave functions, Stationary states: The time independent Schrodinger equation.

Simple one dimensional problems; particle in a box with rigid walls, concept of a potential well, wave functions and energies for the ground and excited states; quantization of energy, qualitative discussion of the solution for a shallow potential well.

Book: Quantum Mechanics by Aruldhas

PHYSICS PRACTICAL: PH – 4503L (Physics Lab. 4)

Unit	PH – 5501 Mathematical Physics, Classical Physics & Quantum Mechanics	PH – 5502 Molecular Spectroscopy, Statistical Mechanics & Solid State Physics	PH-5503 Electrostatics, Magnetostatics & Nuclear Physics	PH-5504 Electronics	PH-5505 Elective Plasma Physics	PH 5506L Physics Practical

Group A

1. Searl's goniometer.
2. Double refraction in calcite prism (To be investigated by polarizer).
3. Resolving power of grating.
4. Diffraction by single slit.
5. Wavelength of light by Biprism.
6. Identification of elements in line spectra.
7. e/m by Thomson's method.
8. Wavelength of light by Edser's 'A' pattern.
9. Analysis of elliptical polarized light.

Group B

1. FET Characteristics.
2. 'C' by ballistic galvanometer.
3. UJT Characteristics
4. High Resistance by leakage method.
5. To measure Permeability of free space
6. L by Anderson's bridge.
7. Experimental set up for studying Fourier analysis
8. Shunt Regulator
9. 'M' By B.G.

Examination scheme: Total 100 Marks: Internal 30 marks; External 70 Marks

Student has to perform total two experiments during practical exam. From each section student has to perform one experiment.
Marks for Section A: 35 Marks
Marks for Section B: 35 Marks
Total Time duration for practical exam: 6 hour
Practical batch size: Maximum 15 students

I	Mathematical Physics-1	Molecular Spectroscopy-1	Electrostatics	Electronics-1		
II	Mathematical Physics-2	Molecular Spectroscopy-2	Magnetostatics	Electronics-2		
III	Classical Mechanics-1	Statistical Mechanics-1	Nuclear Physics-1	Electronics-3		
IV	Quantum Mechnics-1	Solid State Physics-1	Nuclear Physics-2	Electronics-4		

TY-PHYSICS SEM-5 SYLLABUS

PH-5501(Mathematical Physics, Classical Physics & Quantum Mechanics)

Unit 1 Mathematical Physics

Differential equations:

Some partial differential equations in physics, the method of Separation of variables, separation of Helmholtz equation in Cartesian coordinates, in spherical polar and cylindrical Coordinates, Laplace's equation in various coordinates, Choice of coordinate system and separability of a partial differential equation, Parabolic coordinates system, Prolate Spheroidal coordinates system, various examples based on the separation of variables.

Text Book: Mathematical Physics by P K Chattopadhyay (New Age International Publishers), Chapter 2

Reference Book:

1. Mathematical Methods for Physicists by G. Arfken, Academic Press
2. Mathematical Methods in the Physical Science by Mary L Boas, Wiley India Pvt. Ltd.

Unit 2 Mathematical Physics

Second Order Differential equations: Ordinary and Singular points, Series solution around an ordinary point, Series solution around a regular singular point: the method of Frobenius, Getting a second solution, Alternative method of getting the second solution, System of linear first order differential equations, Non-linear differential equations, related examples. Bessel functions.

Text Book: Mathematical Physics by P K Chattopadhyay (New Age International Publishers), Chapter 3 articles 3.1 to 3.7

Reference Book:

1. Mathematical Methods for Physicists by G. Arfken, Academic Press
2. Mathematical Methods in the Physical Science by Mary L Boas, Wiley India Pvt. Ltd.

Unit 3 Classical Mechanics

Lagrangian Formulation:

Introduction, Constraints, holonomic and non-holonomic constraints, scleronomous and rheonomous constraints, generalized coordinates, D'alembert's principle, Lagrange's equations, a general expression for kinetic energy, Symmetries and the laws of conservation, Cyclic or ignorable coordinates (including illustrations), Velocity dependent potential of electromagnetic field, Rayleigh's dissipation function.

Motion of a rigid body: Introduction, Euler's theorem, Angular momentum and kinetic energy, The inertia tensor, Euler's equations of motion, Torque free motion, Euler's Angles.

Text Book: Introduction to Classical Mechanics by *R. G. Takawale and P. S. Puranik*,
Published by: Tata McGraw-Hill Publishing Co. Ltd. Article Nos.:

Chapter 8: Articles: 8.1 to 8.9;
Chapter 10: Articles: 10.1 to 10.7

Reference Books:
1. Classical Mechanics by *A. B. Bhatia*, Narosa Publication.
2. Classical Mechanics by *H. Goldstein*, Addison Wesley.
3. Classical Mechanics by *J. C. Upadhyaya*, Himalaya publications

Unit 4 General Formalism of Quantum Mechanics

Linear Vector Space, Linear Operators, Eigen functions and Eigen Values, Hermitian Operators, Postulates of Quantum mechanics, Simultaneous Measurability of Observables, General Uncertainty Relation, Dirac Notation, Equation Of Motion, Momentum Representation

Text Book: Quantum Mechanics By: *G Aruldhas*, Published by: PHI Learning Private Limited
Chapter 3: Articles: 3.1 to 3.10

Reference Book:

1. Introductory Quantum Mechanics by Liboff.
2. Introdution to Quantum Mechanics by B H Bransden and C J Joachain.
3. Quantum Mechanics by Franz Schwabl Springer.

PH-5502 (Molecular Spectroscopy, Statistical Mechanics & Solid State Physics)

Unit 1 Molecular Spectroscopy

A: Types of Molecular Spectra and Molecular Energy States: Separation of electronic and nuclear motion - The Born Oppenheimer approximation, types of molecular spectra.

B: Pure Rotational Spectra: Salient features of Rotational spectra, Molecular requirement for rotation spectra, experimental arrangement, Molecule as a rigid rotator, explanation of rotational spectra (without the process of solving Schrodinger equation to get energy formula), the non-rigid rotator, Isotope effect on rotational spectrum, tunable laser and pulse laser - introduction

C: Vibrational - Rotational Spectra: salient features of vibrational - Rotational spectra, Molecule as a harmonic oscillator, Molecule as anharmonic oscillator, Vibrational frequency and force constant for anharmonic oscillator, Fine structure of Infrared bands.

Text Book: Atomic & Molecular Spectra: Laser by *Rajkumar*
Published by: Kedarnath Ramnath Meerut

A: Chapter 17: Articles: 1, 2
B: Chapter 18: Articles: 1 to 6;
C: Chapter 19: Articles: 1 to 4 and 6

Reference Book:

1. Spectroscopy (Atomic and Molecular) by G Chatwal and S Anand.
2. Fundamentals of Molecular Spectroscopy by C N Banvel
3. Elements of Spectroscopy by Gupta, Kumar and Sharma (Pragati Prakashan Meerut)

Unit 2 Molecular Spectroscopy

A: Raman Spectra : Nature of the Raman spectra, experimental arrangement for Raman spectra, Classical theory of Raman effect, Quantum theory of Raman effect, Raman spectra and Molecular structure, Infrared spectra versus Raman spectra, Laser as intense source.

B: Triatomic and complex molecules: Normal modes of a triatomic molecule; Selection rules for infrared absorption, molecular orbitals in complex molecules, approximation for treating H,O,C, vibrations relative to rest of the molecule.

Text Book: Atomic & Molecular Spectra: Laser by *Rajkumar;* Published by: Kedarnath Ramnath Meerut
A: Chapter 20: Articles: 1 to 6

Reference Book:

1. Spectroscopy (Atomic and Molecular) by G Chatwal and S Anand.
2. Fundamentals of Molecular Spectroscopy by C N Banvel
3. Elements of Spectroscopy by Gupta, Kumar and Sharma (Pragati Prakashan Meerut)

Unit3 Statistical mechanics

Bose Einstein and Fermi Dirac Distributions: Symmetry of wave function, The quantum distribution functions, The Bolzmann limit of Boson and Fermion gases, Evaluation of partition function, Partition function for diatomic molecules, Equation of state for an ideal gas, The quantum mechanical paramagnetic susceptibility, Photon gas, Einstein's derivation of Planck's law, Bose-Einstein Condensation, Specific heat from lattice vibration, Debey's model of solids: Phonon gas

Text book: Fundamentals of Statistical Mechanics by *B B Laud*, Published by: New Age International Publishers

Chapter 8: Articles: 8.1 to 8.7 and
Chapter 9: Articles: 9.1 to 9.5

Unit 4 Solid State Physics

A: Elastic wave in solids: Stress and strains, Elastic constants, Elastic energy, Effect of crystal symmetry on elastic constants
B: Electrical Properties in Metal: Classical free electrical theory of metal, Drawback of classical theory, Particle in a box with impenetrable walls, Fermi-Dirac statistic and Electronic distribution in solids, Density of energy state and Fermi energy, The Fermi distribution function, Heat capacity and electron gas, Mean energy of electron gas at absolute temperature, Effect of temperature on Fermi distribution function, Electrical conductivity from quantum mechanical consideration, Electron scattering and source of resistance in metal, Electron scattering mechanism and variation of resistivity with temperature, resistivity in alloy, Variation of resistivity with pressure, Thermal conductivity in metal, Thermal expansion, Effect of magnetic field, Failure of Sommerfeld's free electron theory

C: Physics of Semiconductors: The band structure of semiconductors, semiconductors, intrinsic semiconductors, Conductivity and temperature, Statistic of electron and holes in intrinsic semiconductors,

Text Book: Solid State Physics: by *H C Gupta*, Published by: Vikas Publishers
A: Chapter 4: Articles: 4.1….to …4.4

Text Book: Solid State Physics: by *S O Pillai*, Published by: New Age Publishers
B: Chapter 6: Articles: 1,2 13 to 26, 33,35
C: Chapter 10: Articles: 2 to 6

PH-5503(Electricity, Magnetism & Nuclear Physics-1)

Unit 1 Electrostatics & Electrodynamics

Special Techniques: Laplace's Equation: Introduction, Laplace's equation in one dimension, Laplace's equation in two dimension, Laplace's equation in two dimension, Boundary conditions and Uniqueness Theorem, Conductors and second Uniqueness Theorem.
The Method of Images: The Classic Image Problem, Induced surface charge, Force and Energy, Other Image Problems,
Separations of variables: Cartesian coordinates, Spherical coordinates
Multipole Expansion: Approximate potential at large distances, The monopole and dipole terms, Origin of Coordinates in Multipole Expansions, The Electric field of a Dipole.
Maxwell's Equations: Electrodynamics before Maxwell, How Maxwell Fixed Ampere's law, Maxwell's Equations, Magnetic Charge, Maxwell's Equations in matter, Boundary Conditions.

Text Book: Introduction to Electrodynamics by David J. Griffiths
Published by: Prentice Hall of India Private Limited
Chapter 3: Articles: 3.1 to 3.1.6, 3.2 to 3.2.4, 3.3 to 3.3.2 3.4 to 3.4.4

Reference Books:

1. Electromagnetics by *B. B. Laud* Published by: Wiley Eastern Limited
2. Electricity and Magnetism by A S Mahajan and A A Rangwala, Published by: Tata McGraw Hill, publishing Company Limited

Unit 2 Magnetostatics

Magnetic Fields in Matter: *Magnetization*: Diamagnets, Paramagnets, Ferromagnets, Torques and Forces on Magnetic Dipoles, Effect of Magnetic Field on Atomic Orbits, Magnetization
The Field of a Magnetized Object: Bound currents, Physical Interpretation of Bound currents, The Magnetic field inside Matter
The Auxiliary Field H: Ampere's law in Magnetized Materials, Deceptive Parallel, Boundary Condition
Linear and Non Linear Media: Magnetic Susceptibility and Permeability, Ferromagnetism

Text Book: Introduction to Electrodynamics by *David J. Griffiths,* Published by: Prentice Hall of India Private Limited
Articles: 6.1 to 6.1.4; 6.2 to 6.2.3; 6.3 to 6.3.3; 6.4 to 6.4.2

Reference Books:

1. Electromagnetics *by B. B. Laud*; Published by: Wiley Eastern Limited
2. Electricity and Magnetism by *A S Mahajan and A A Rangwala*; Published by: Tata McGraw Hill Publishing Company Limited

Unit 3 Nuclear Physics

Alpha and Beta Decay: Alpha Rays: Range of alpha particles, Disintegration energy of the spontaneous alpha decay, Alpha decay paradox - barrier penetration.

Beta Rays: Introduction, Continuous Beta ray spectrum - difficulties encountered to understand it, Pauli's Neutrino Hypothesis, Fermi's theory of Beta decay, the detection of neutrino, Parity non-conservation in Beta decay.

Text Book: Nuclear Physics: An Introduction by *S.B. Patel,* Published by: New Age International.

Unit 4 Nuclear Physics

Liquid Drop Model: The liquid drop model of the nucleus: Introduction, Binding energies of nuclei : plot of B/A against A., Weizsacher's semi empirical mass formula Mass parabolas: prediction of stability against Beta decay for members of an isobaric family, Stability limits against spontaneous fission, Barrier penetration - decay probabilities for spontaneous fission, Nucleon emission.

Gamma Rays: Introduction, Gamma-ray emission – selection rules, Internal conversion, Nuclear isomerism.

Text Book: Nuclear Physics: An Introduction by *S.B. Patel,* Published by: New Age International.

Articles: 4-II-1 to 4-II-3, 4-III-1 to 4-III-6, 4-IV-1 to 4-IV-4, 5.1 to 5.7

PH-5504(Electronics-1)

Unit1

Low frequency response of a transistor amplifier: Effect of an emitter by pass capacitor on low frequency response, effect of coupling capacitor on low frequency response, cascading of CE stages, mid frequency gains, low frequency response of cascaded stages amplifier, low frequency response to a square wave, transformer coupled transistor amplifier, low frequency response of TC amplifier, step response of a TC amplifier.

High frequency response of a transistor amplifier: High frequency model for a CE amplifier, approximate CE high frequency model with a resistive load, CE short circuit current gain, high frequency current gain with a resistive load, high frequency response of cascaded CE stages, amplifier high frequency response to a square wave high frequency response of a transformer coupled amplifier.

Text Book: Electronic Devices and circuits – An Introduction by *Allen Mottershead*,
Published by: Printice-Hall of India Private Limited

Article Nos.: 15.1 – 15.8, 16.1 – 16.7

Unit 2

Negative Feedback in transistor amplifier: General theory of feedback, reasons for negative feedback, loop gain, types of negative feedback in transistor circuits,

Transistor Oscillators: Introduction, Effect of positive feedback, requirements for oscillations, the phase shift oscillator, Wien bridge oscillator, LC oscillators, Colpitt and Heartely oscillators with analysis.

Text Book: Electronic Devices and circuits – An introduction by Allen Mottershead
Published by: Prentice Hall of India Private Limited

Article Nos.: 17.1 to 17.4, 18.1 to 18.7

Hand Book of Electronics by *Gupta and Kumar*
Published by:

Article Nos.: 22.4, 22.5

Unit 3

Circuit analysis and design: Boolean laws and theorems, sum of products method, truth table to Karnaugh map, pairs, quads and octets, Karnaugh simplification, don't care conditions, product of sums method product of sums simplification

Sequential logic circuit: 1- bit memory cell using transistor, NAND gates and NOR gates,Clocked RS flip-flop, J-K flip-flop, Master slave J-K flipflop, D flip flop, T flipflop

Text Book: Digital Principles and Applications by Malvino and Leach
Published by:

Article Nos.: 2.1 - 2.8

Digital electronics by *G K Kharate*
Published by:

Articles no. 5.1 to 5.6

Unit 4

Network Transformations: Reduction of complicated network, conversion between T and π sections, bridge T network, the lattice network, superposition theorem, the reciprocity theorem, thevenin's theorem, Norton theorem, maximum power transfer theorem, compensation theorem.

Resonance: Definition of Q, the figure of merit, series resonance, Bandwidth of the series resonant circuit, parallel resonance or antirsonance, current in antiresonant circuits, Bandwidth of antiresonant circuits.

Text Book: Network Lines and Field by *J D Ryder*
Published by:
Articles: 1.4 to 1.13; 2.1 to2.4; 2.6; 2.8

Reference Books: Network Analysis by M. S. Van Valkenburg

Network Analysis by G K Mithal

PH-5401 - Introduction to Plasma Physics (Elective)

Unit : I

Introduction and brief history of plasma physics, concept of temperature, plasma as the fourth state of matter, types of plasma, plasma parameter, collective behavior, quasi-neutrality, plasma frequency ,plasma sheath, Debye shielding, criteria for existence of plasma. Basic plasma diagnostics: electric probes (single and double), optical emission spectroscopy (basic idea).

Unit-II

Single particle dynamics; charged particle motion in electric field, magnetic field and in combined electric and magnetic field, basics of ExB drift, drift of guiding center, gradient drift, curvature drift and magnetic mirror.

Unit-III

Plasma production: breakdown of gases, I-V characteristic of electrical discharge, Paschen curve, Plasma devices and machines; glow discharge, dc and rf sputtering, vacuum arcs, stabilized atmospheric arc plasma.

Plasma Applications: Controlled thermo-nuclear fusion, Tokamaks, Space & Astrophysical plasmas. Industrial applications of plasma:

Text Book and Reference Books:

1. Introduction to Plasma Physics and Controlled Fusion, Francis F. Chen, Plenum Press, 1984
2. Fundamentals of plasma physics, J. A. Bittencourt, Springer-Verlag New York Inc., 2004
3. The Fourth state of matter- Introduction to plasma science, S. Eliezer and Y. Eliezer, IoP PublishingLtd., 2001
4. Elementary plasma physics, L.A. Arzimovich, Blaisdell Publishing Company, 1965
5. Plasmas – The fourth state of Matter, D. A. Frank-Kamenetskii, Macmillan Press, 1972

B.Sc. (PHYSICS) SEMESTER -V PH-5506L (Physics-Lab-5)

(5 credit: 12 hrs / week)

Total: 200 Marks Internal: 60 Marks External: 140 marks

NO.	GROUP –A
01	Acceleration due to gravity by Kater's pendulum (fixed knife edges.)
02	To determine melting point of a substance by platinum resistance thermometer using Callender-Griffiths bridge.
03	Characteristics of G.M. Tube.
04	Viscosity by Log decrement.

05	To measure helical pitch and diameter of spring using diffraction pattern

NO.	GROUP –B
01	Refractive index by total internal reflection using Gauss eye piece.
02	Fabry-Perot etalon. Determination of the thickness of air film and wavelength of light using spectrometer.
03	Michelson interferometer. To determine the wavelength of monochromatic light.
04	Absorption spectrum of iodine molecule.
05	Biprism.

NO.	GROUP –C
01	Mutual Inductance by Ballistic Galvanometer.
02	Determination of capacity of Scherreing Bridge
03	Determination of Curie temperature of ferroelectric ceramic.
04	An optical method of determining dielectric constant, dipole moment and polarizability of a polar liquid using Hollow prism
05	Determination of unknown frequency using Wein bridge

NO.	GROUP –D
01	Hartley Oscillator.Measurement of frequency by C.R.O.(Transisterised)
02	Series and parallel resonance.To find the band width and Q value of a coil.
03	Frequency response of CE amplifier
04	Half adder,full adder and substractor using IC 7483.
05	A.C. circuit analysis by C.R.O. Measurement of frequency and phase difference

Reference Books:

1.Practical Physics by S.L.Gupta & V. kumar

2. Advanced Practical physics I &II by S.P.Singh,Pragati prakashan vol. 1& 2

3. B.Sc. Practical Physics by C.L.Arora.S Chand.

4. An advanced course in practical physics by D.Chattopadhyay & P.C.Rakshit,New central book agency(P),Kolkata.

Unit	PH – 6501 Mathematical Physics & Quantum Mechanics	PH – 6502 Molecular Spectroscopy, Statistical Mechanics, Instrumentation & Lasers	PH – 6503 Electromagnetism, Solid state Physics, Nuclear Physics & Particle Physics	PH – 6504 Electronics	PH-6505 Elective Project	PH-6506 L Practical
I	Mathematical Physics-3	Molecular Spectroscopy	Electromagnetism	Electronics-5		

TY-PHYSICS SEM-6 SYLLABUS

II	Classical Mechanics-2	Statistical Mechanics	Solid State Physics-2	Electronics-6		
III	Quantum Mechanics-2	Lasers	Nuclear Physics-3	Electronics-7		
IV	Quantum Mechanics-3	Instrumentation	Particle Physics	Electronics-8		

PH- 6501(Adv. Quantum Mechanics)

Unit 1 Mathematical Physics

Some special functions: Bessel function, recurrence relations satisfied by Bessel's functions, Integral representation of Bessel fuction, Orthogonality, Neumann function, Bessel functions of the second kind, Henkel functions, Spherical Bessel functions, Legendre polynomials, Associated Legendre polynomials and spherical harmonics, Hermite polynomials, Laguerre polynomials, The gamma function, the Dirac delta function, examples.

Text Book: Mathematical Physics by P K Chattopadhyay (New Age International Publishers), Chapter 5

Reference Book:

1. Mathematical Methods for Physicists by G. Arfken, Academic Press
2. Mathematical Methods in the Physical Science by Mary L Boas, Wiley India Pvt. Ltd.

Unit 2 Classical Mechanics

Variational principle: Lagrange's and Hamilton's equations:

Introduction, Configuration space, Some techniques of calculus of variation, the delta-notation, Applications of the variational principle, Hamilton's principle, Equivalence of Lagrange's and Newton's equations, Advantages of the Lagrangian formulation -Electromechanical analogies, Lagrange's undetermined multipliers, Lagrange's equation for non-holonomic systems, Applications of the Lagrangian method of undetermined multipliers, Hamilton's equations of motion, some applications of the Hamiltonian formulation, Phase space, Comments on the Hamiltonian formulation.

Text Book: Introduction to Classical Mechanics by *R. G. Takawale and P. S. Puranik,*
Published by: Tata McGraw-Hill Publishing Co. Ltd.

Chapter 11 Articles: 11.1 to 11.13

Reference Books:
1. Classical Mechanics by *A. B. Bhatia*, Narosa Publication.
2. Classical Mechanics by *H. Goldstein*, Addison Wesley.
3. Classical Mechanics by *J. C. Upadhyay*, Himalaya publications

Unit 3 Quantum Mechanics

One Dimensional Energy Eigen Value Problems: Bloch Waves in a Periodic Potential, Kroing –Penny Square Well Periodic Potential, Linear Harmonic Oscillator: Schrodinger Method, Linear Harmonic Oscillator: Operator Method, The Free Particle

Angular Momentum: The Angular Momentum Operators, Angular Momentum Commutations Relations, Eigen values and Eigen functions of L^2 and L_z

Text Book: Quantum Mechanics By: *G Aruldhas*;
Published by: PHI Learning Private Limited
Articles: 4.5, 4.6, 4.7, 4.8, 4.9, 8.1, 8.2, 8.3
Reference Books:

1. A Text Book of Quantum Mechanics by *P M Mathew, K Venkatesan*
   Published by: Tata McGraw Hill Publishing Company Limited
2. Quantum Physics by *H C Verma;*
   Published by: Surya Publications, Ghaziabad

Unit 4 Quantum Mechanics

Three Dimensional energy Eigenvalue Problems: Particle moving in a spherical Symmetric Potential, System of Two Interacting Particles, Rigid rotator, Hydrogen atom, Hydrogenic Orbitals, The free Particle, Three Dimensional Square –Well Potential, The Deuteron.

Text Book: Quantum Mechanics By: *G Aruldhas;*
Published by: PHI Learning Private Limited
Articles: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8
Reference Books:

3. A Text Book of Quantum Mechanics by *P M Mathew, K Venkatesan*
   Published by: Tata McGraw Hill Publishing Company Limited
4. Quantum Physics by *H C Verma;*
   Published by: Surya Publications, Ghaziabad

Unit 1 Molecular Spectroscopy

A: Classification of Molecular Electronic States: Molecular electronic states, Symmetry properties of electronic eigen functions (symmetry classification of electronic states)

B: Electronic Spectra: Electronic Spectra, salient features, formation of electronic spectra, Vibrational (Gross) structure of electronic band system in emission, electronic band spectra in absorption, Rotational structure of electronic bands; Rotational structure of three branch bands; observed intensity distribution (vibrational) in band systems : Franck-Condon principle; explanation of intensity distribution in absorption bands from Franck-Condon principle. Explanation of intensity distribution in emission bands : Condon parabola. Line intensities in a band: Rotational intensity distribution. Quantum mechanical Exploting Franck-Condon principle.

Text Book: Atomic & Molecular Spectra: Laser by *Rajkumar*
Published by: Kedarnath Ramnath Meerut
A: Chapter 24 Articles: 1, 2;

B: Chapter 21 Articles 1 to 7 and 9 to 11

Reference Book:

1. Spectroscopy (Atomic and Molecular) by G Chatwal and S Anand.
2. Fundamentals of Molecular Spectroscopy by C N Banvel
3. Elements of Spectroscopy by Gupta, Kumar and Sharma (Pragati Prakashan Meerut)

Unit 2 Statistical Mechanics

Introduction, Mean collision time, Scattering cross-section, viscosity, electrical conductivity, thermal conductivity, thermionic emission, photoelectric effect, molecular collision, effusion, diffusion, Brownian motion, Einstein's relation for mobility.

Text Book: Fundamentals of Statistical Mechanics by *B. B. Laud*,
Published by: New Age International Publishers

Article Nos.: 12.1 – 12.12
Reference Books:

1. Statistical Mechanics - Theory and Application by *S K Sinha*, Published by: Tata McGraw- Hill Publishing Company Limited New Delhi:
2. Statistical Mechanics - An introduction by *Evelyn Guha*, Published by: Narosa publication.
3. Statistical Mechanics by *R.K. Patharia*, Published by: Pergamon Press

Statistical Mechanics by *B.K. Agarwal & Melvin Eisner*; Published by: Wiley Eastern

Unit 3 Lasers

Introduction; Attenuation of light in an optical medium; Thermal Equilibrium; Interaction of light with matter; Einstein Coefficient and their relations; Light Amplification; Meeting the three requirements; Components of laser; Lasing action; Principal pumping scheme; Role of resonant cavity; Types of laser; Semiconductor laser; Laser beam characteristic; Applications

Text Book: A textbook of Optics by *Subramanyam, BrijLal and Avadhanulu*
Published by: S Chand Publications

Reference Book:

1. Lasers Theory and Applications by Thyagrajan and A K Ghatak (Macmillan India Ltd., 2008)
2. Lasers and Non-Liear Optics by B B Laud (New Age International(P) Ltd., India, Second Edition, 1996)

Unit 4 Instrumentation

A: Michelson Interferometer

B: Multiple Interference, Febry Perot Interference and Etalon

C: Babinet Compensator

D: Electronic Instruments: Cathode ray oscilloscope: CRO, CRT, electron gun, deflecting plates, screen, methods of focusing, deflection systems, mathematical expression for electrostatic deflection sensitivity, electromagnetic deflection system, magnetic deflection in CRT, Time base (without circuits), CRO Parts, operation of a typical oscilloscope control, uses of CRO.

Text Book: Text Book of Optics by *Subramanyam and Brijlal*
Published by: S. Chand Publication
A: Articles: 15.7.1 to 15.7.7 & 15.8.1 to 15.8.3

B: Articles: 15.11.1 to 15.11.4

C: Articles: 15.12.1 to 15.12.3

Text Book: Electronic & Radio Engineering by *M. L. Gupta*
Published by: Dhanpat Rai & Sons

D: Article Nos.: 36.1 to 36.11, 36.17, 36.18, 36.20.

PH-6503(Electromagnetism, Solid State Physics and Nuclear Physics-2)

Unit1 Electromagnetism

A Electromagnetic waves

Waves in One Dimension: The wave Equation, Sinusoidal Equation, Boundary Conditions: Reflection and Transmission, Polarization.

Electromagnetic waves in Vacuum: The wave equation for **E** and **B**, Monochromatic Plane waves, Energy and momentum in Electromagnetic waves

Electromagnetic waves in matter: Propagation in Linear Media, Reflection and Transmission at normal incidence, Reflection and transmission at Oblique incidence

B: Electromagnetic Radiation: Retarded Potential, Radiation from an oscillating dipole.

Text Book:
Introduction to Electrodynamics by *David J. Griffiths*
Published by: Prentice Hall of India Private Limited

Articles: 9.1 to 9.1.4, 9.2: 9.2. to 9.2.3, 9.3 to 9.3.3

Reference Books:

1. Electromagnetics by *B. B. Laud* Published by: Wiley Eastern Limited
2. Electricity and Magnetism by *A S Mahajan and A A Rangwala*, Published by: Tata McGraw Hill Publishing Company Limited

Unit 2 Solid State Physics

Magnetic Properties of Materials: Theory of Magnetism in Electrons, Diamagnetism, Summary, Paramagnetism, Weiss theory of Paramagnetism, Paramagetic Susceptibility, Quantum Theory of Paramagnetism, Ferromagnetism, Spontaneous Magnetization in Ferro-Magnetic Materials, Quantum Theory of Ferromagnetism, Weiss Molecular Field, Behavior of Ferromagnetic Material for $T>\theta_f$

Text Book: Solid State Physics by *S. O. Pillai* Published by New Age International Publishers

Chapter 9: Articles 8 to 14, 19 to 23

Reference book:

1. Elementary Solid State Physics by *M. Ali Omar*

2. Solid State Physics by *Ajay Kumar Saxena*

Unit 3 Nuclear Physics

Introduction, Neutron induced fission, Asymmetrical fission - mass yield, Emission of delayed neutrons by fission fragments, Energy released in the fission of U235, Fission of lighter nuclei, Fission chain reaction, neutron cycle in a thermal nuclear reactor, Nuclear reactors. **Nuclear Physics in other areas of Physics:** The Mossbauer effect, some experiments using Mossbauer effect, Natural Fusion - energy production in stars, Possibility of controlled fusion.

Text Book: Nuclear Physics - An Introduction by *S. B. Patel*

Published by: New Age International.

Articles: 6.1 to 6.9 and 9.5 to 9.7

Unit 4 Elementary particles

The four basic forces, Particles and antiparticles, Families of particles, conservation laws, particle interactions and decays, energetics of particle reactions, the quark model, the standard model, Numerical Examples. Introduction to Universe.

Text Book:
Modern Physics by Kenneth Krane, Published by: John Wiley and sons.
Articles: 14.1 to 14.9

Reference Books:

1. Nuclear Physics by *D. C. Tayal* , Published by Himalaya Publisher
2. Modern Physics by *A. Beiser*, Published by McGraw Hill International Edition, 4th Ed

PH-6504 (Electronics- 2)

Unit 1

Field effect transistor amplifier: Advantages and disadvantages of the FET, Basic construction of the JFET, Characteristics curve of the JFET, Principle of operation of the JFET, Effect of the V_{DS} on channel conductivity, Channel ohmic region and pinch off region. Characteristics parameters of the FET, Common source AC amplifier

Operational Amplifier: The basic operational amplifier, the differential amplifier, offset error voltages and currents, the basic operational amplifier application

Text Book:

1. Electronic Devices and circuits – An introduction by *Allen Mottershead*
   Published by: PHI Learning Private Limited
   Articles: 21.1 to 21.7 and 21.9

2. Integrated Electronics by *Millman Halkias*
   Published by:
   Article Nos.: 15.1, 15.2, 15.6, 16.1

Unit 2

Arithmetic circuits: Exclusive OR gate,Binary addition, binary subtraction, unsigned binary number, sign magnitude numbers, 2's compliment representation, 2's compliment arithmetic, building blocks, the adder - subtructactor, binary multiplication and division
Data processing circuit: Multiplexer, Demultiplexer, 1-of-16 Decoder, seven segment Decoder, Encoder, Magnitude comparator,

Text Book:
Digital Principles and Applications by *Malvino and Leach*
Articles: 3.7, 6.1 to 6.8, and 4.1 to 4.6 and 4.9

Unit 3

Regulated Power Supply: Introduction, stabilization, limitations of Zener diode regulator, Transistor series voltage regulator, transistor shunt voltage regulator, a series regular with two transistors, current regulator

Cathode ray oscilloscope: CRT, electrongun, deflecting plates, screen, methods of focusing, deflection systems, mathematical expression for electrostatic deflection sensitivity, electromagnetic deflection system, magnetic deflection in CRT, Time base (without circuits), CRO Parts, operation of a typical oscilloscope control, uses of CRO.

Text Book:
Electronic & Radio Engineering by **M. L. Gupta**,
Published by Dhanpat Rai & Sons.

Article Nos.: 36.1 to 36.11, 36.17, 36.18, 36.20.

Unit 4

Amplitude modulation techniques: Elements of Analog communication, Theory of AM techniques, Frequency spectrum of AM wave, power relation in AM wave, modulation by several sine wave, Double side band suppressed technique, single side band technique, Generation of AM signal

Text Book:
Kennedy's Electronics communication system By *Kennedy, Davis & Prasanna*
Published by:

Article Nos. 3.1, 3.2.1 to 3.2.3, 3.3.1

PH-6401 Elective (Project)

B.Sc. (PHYSICS) SEMESTER-VI PH-6506L (Physics-Lab-6)

NO.	GROUP –A
01	Acceleration due to gravity by Kater's pendulum (variable knife edges.)
02	e/k by power transistor.
03	Hall effect.
04	Study of thermocouple.
05	To find the value of permeability of free space.
06	Study of optical fiber.

NO.	GROUP –B
01	Michelson interferometer-To determine "d λ " of close doublets of sodium light.
02	To calibrate the spectrometer using Edser-Butler plate.
03	To analyse elliptically polarized light using Babinate's compensator.
04	To determine the charge on electron by Millikan's experiment.
05	Determination of dead time of G.M. tube. Comparison of relative intensities of different sources using G.M. tube.
06	Measurment of sound velocity using UV sensor.

NO.	GROUP –C
01	Heaviside mutual inductance bridge.
02	Self inductance of a coil by Rayleigh's method.
03	Use of Excel for data analysis and graph plotting.
04	Susceptibility of ferromagnetic substance by Quink's method (Magnetic fluid)
05	Study of Hysterisis using C.R.O.

NO.	GROUP –D
01	Frequency response of a common source FET amplifier.
02	Colpitts oscillator.
03	Negative feedback amplifier using transistor.
04	Study of voltage regulated circuit using IC7805.
05	To measure a threshold current of a LASER diode at room temperature.
06	Operational amplifier as a inverting amplifier.

Reference Books:

1.Practical Physics by S.L.Gupta& V. kumar

2. Advanced Practical physics I &II by S.P.Singh,Pragati prakashan vol. 1& 2

3. B.Sc. Practical Physics by C.L.Arora,S Chand.

4. An advanced course in practical physics by D.Chattopadhyay & P.C.Rakshit,New central book agency(P),Kolkata.