Kashi Naresh University, Bhadohi

Syllabus
of
Physics

Effective from Academic Session: 2026-27

For
M.Sc.

Approved by
Board of Studies
Department of Physics
Faculty of Science
Kashi Naresh University
Bhadohi

Convenor/Head
Department of Physics
Kashi Naresh University, Bhadohi

Dean
Faculty of Science
Kashi Naresh University, Bhadohi

(Dr. Priyanka Srivastava)
Member of Board of Studies

(Dr. Raj Kumar Yadav)
Member of Board of Studies

(Dr. M.K. Vishwakarma)
Member of Board of Studies

(Dr. S. P. Mishra)
Member of Board of Studies

Kashi Naresh University, Bhadohi

M.Sc. (PHYSICS)

Examination and Syllabus Scheme

Credit and Grading System

Course Code		Course Title	T/P	Credits	Evaluation (MM=100)	
					Internal	External
Programme: BACHELOR (RESEARCH IN PHYSICS)						
First Semester						
PHY-101	Core	Mathematical Physics	T	4	25	75
PHY-102	Core	Classical Mechanics	T	4	25	75
PHY-103	Core	Electromagnetic Theory and Electrodynamics	T	4	25	75
PHY-104	Core	Quantum Mechanics	T	4	25	75
PHY-105	Practical	Related to Theory Papers	P	4	25	75
Second Semester						
PHY-201	Core	Advanced Quantum Mechanics	T	4	25	75
PHY-202	Core	Condensed Matter Physics	T	4	25	75
PHY-203	Core	Atomic and Molecular Physics	T	4	25	75
PHY-204	Core	Statistical Mechanics	T	4	25	75
PHY-205	Practical	Related to Theory Papers	P	4	25	75
Programme: MASTER IN PHYSICS						
Third Semester						
PHY-301	Core	Nuclear and Particle Physics	T	4	25	75
PHY-302(S1)	Special	Electronics-I	T	4	25	75
PHY-303(S1)	Special	Electronics-II	T	4	25	75
PHY-302(S2)	Special	Basics of Space Physics	T	4	25	75
PHY-303(S2)	Special	Basics of Remote Sensing	T	4	25	75
PHY-304	Practical	Related to Theory Papers	P	4	25	75
PHY-305	Research	Research Project/Dissertation		4	100	
Fourth Semester						
PHY-401	Core	Laser and Nonlinear optics	T	4	25	75
PHY-402(S1)	Special	Advanced Electronics-I	T	4	25	75
PHY-403(S1)	Special	Advanced Electronics-II	T	4	25	75
PHY-402(S2)	Special	Introduction to Astrophysics and Cosmology	T	4	25	75
PHY-403(S2)	Special	Atmospheric Physics	T	4	25	75
PHY-404	Practical	Related to Theory Papers	P	4	25	75
PHY-405	Research	Research Project/Dissertation		4		100

M.Sc. (Physics) First Semesters
PHY-101
Mathematical Physics

Credit-04

Unit-I Matrix Analysis and Tensors

Fundamental of matrix, types of matrices, Algebraic operation on matrices, Determinant and Inverse of a matrix, elementary operations on matrix, rank of matrices, transformation matrices, similarity transformations, Trace, Eigenvalues and eigenvectors, solution of linear equation, Cramer's rule, Cayley-Hamilton theorem, Diagonalization of matrix.

Tensors in 3D & 4D Space, Rank of tensor, Addition, Multiplication, Contraction of tensors, Covariant and contravariant tensors, Pseudo tensors, Symmetric and anti-symmetric tensors.

Unit-II Complex Variables

Elements of complex analysis, Continuity and differentiability of complex functions, Analyticity and Cauchy-Riemann condition, Laplace's equations and Harmonic functions, Cauchy's Integral theorem and formula, Taylor's series and Laurent's series expansion, singularities, Zeroes and poles, Residue Theorem, Contour Integration.

Unit-III Integral Transforms

Fourier Transformation: Fourier series, Fourier Transform: Sine and Cosine transforms, Properties of Fourier Transforms, Application of Fourier Transform.
Laplace transform: Definition, Properties and examples of Laplace Transforms, Inverse Transform, and Laplace transform method of solving differential equations.

Unit-IV Special Functions

Second order linear differential equations and solutions, Bessel, Legendre, Hermite, and Laguerre differential equations, derivations, generating functions, Orthogonality properties, recurrence relations, and Rodrigue's formula of Polynomials.

Text and Reference Books:

1. Mathematical methods for Physicist: G. Artken
2. Mathematical Physics: Harper
3. Advanced Engineering Mathematics: Kreyazig
4. Elements of Complex variable: Churchill
5. Mathematical methods for Physicist and Engineers: K F Reilly, M P Hobsen

M.Sc. (Physics) First Semesters
PHY-102
Classical Mechanics

Credit-04

Unit – I

Mechanics of a system of particles, Generalized Co-ordinates, D Alembert's principle, The Lagrangian formulation and equations of motion (with full derivation), The Hamiltonian formulation and equations of motion (with full derivation).

Unit – II

Calculus of variations and its application–Hamilton's principle, The modified Hamilton's principle and principle of least action, the rigid body motion–Euler angles, Motion of symmetrical top.

Unit – III

Canonical transformations, Poisson brackets, Equations of motion and infinitesimal canonical transformations in the Poisson bracket formulation, Liouville's theorem.

Unit – IV

Hamilton – Jacobi equations, Action angle variables, the connection between Hamilton-Jacobi theory and geometrical optics, Theory of small oscillations – Free vibrations of linear tri- atomic molecule.

Text and Reference Books:

1. Classical Mechanics: N C Rana & P S Joag, TMH 1991
2. Classical Mechanics: H Goldstein, Addison Wasley, 1980
3. Mechanics: A Sommerfield, Academic Press, 1952
4. Introduction to Dynamics: I Perceival & D Richards, Cambridge Univ Press, 1982

M.Sc. (Physics) First Semester
PHY-103
Electromagnetic Theory and Electrodynamics

Credit-04

Unit – I

Propagation of Electromagnetic Plane Waves in Vacuum, Non-conducting Medium, Conducting Medium and Plasma; Reflection, Refraction and Polarization of Electromagnetic Waves, Stokes Parameters; Frequency Dispersion Characteristics of Dielectrics and Conductors; Normal and Anomalous Dispersion, Spreading of Pulse in Dispersive Media, Kramer-Kronig Relations.

Unit-II

Motion of charged particles in electromagnetic field: Uniform E and B fields, non- uniform magnetic fields, diffusion across magnetic field, time varying E and B fields, adiabatic invariants: first, second and third adiabatic invariants.

Unit – III

Gauge Transformations: Coulomb and Lorentz Gauge, Retarded potential and Lienard-Wiechert potential, electric and magnetic fields due to a uniformly moving charge and an accelerated charge, Linear and circular acceleration and angular distribution of power radiated Bremsstrahlung, synchrotron radiation and cherenkov radiation, reaction force of radiation.

Unit – IV

Propagation of Electromagnetic Waves in Rectangular Waveguides, TE and TM Modes, Cut off frequency, Energy Flow and Attenuation. Modal Analysis of guided modes in a cylindrical waveguide. Field and Radiation due to an Oscillating Electric Dipole. Magnetic dipole and electric quadrupole fields.

Text and Reference Books:

1. Electromagnetic Theory by Julius Adams Stratt
2. Electromagnetic Theory: A Critical Examination of Fundamentals (formerly titled: Electromagnetics) (1938) by Alfred O'Rahilly
3. Electromagnetic Field Theory and Electrodynamics by Satya Prakash
4. Electrodynamics by Gupta Kumar Singh
5. Introduction to Electrodynamics by David J.Griffiths

M.Sc. (Physics) First Semester
PHY-104
Quantum Mechanics

Credit-04

Unit-I Fundamentals

Uncertainty principle and applications, Schrödinger wave equation, normalization, probability current density, expectation values, Ehrenfest theorem, energy eigen function and eigen values, Hermitian operators and their properties, Orthonormality, free particle solution. One dimensional step potential (finite and infinite) particle in one dimensional square potential well (finite and infinite), linear harmonic oscillator, zero point energy, rectangular potential barrier.

Unit-II Three Dimensional System

Particle in three dimensional box, commutation relations, central force problems, solution of Schrödinger equation for spherical symmetric potentials, Hydrogen atom- reduced mass, wave function, energy levels, degeneracy, Energy Eigen function and Eigen values of three dimensional harmonic oscillator, and rigid rotator.

Unit-III Matrix Theory

Matrix, formulation of quantum theory, operators and their matrix representation, bra and ket notations, angular momentum and their commutation rules, eigen values of L^2 and L_x, spin, Pauli spin matrices, and their algebra, matrices for J^2 and J_x, Addition of two angular momenta, Clebsch – Gordon Coefficients.

Unit-IV Approximation Methods

Time independent perturbation theory for degenerate and non degenerate case, formulation upto second order, applications to perturbation of linear harmonic oscillator- estimation of correction up to second order for perturbation term depending on x and x^2 ,Ground state of Helium atom and normal Zeeman effect, Stark effect.

Text and Reference Books:

1. Quantum Mechanics: L I Schiff, TMH
2. Quantum Mechanics: S gasioriwiez, Wiley
3. Quantum Mechanics: J D Powell, Addision Wiley
4. Quantum Mechanics: Mathews and Ventesan
5. Modern Quantum Mechanics: J J sakurai

M.Sc. (Physics) Second Semester
PHY-201
Advanced Quantum Mechanics

Credit-04

Unit-I

Variational method, Wentzel Kramer Brillouin (WKB) approximation, Time-dependent perturbation theory, Harmonic perturbation, Fermi's golden rule, Adiabatic and sudden approximation.

Unit-II

Collision in 3-D and scattering, Laboratory and CM reference frames, scattering amplitude, differential scattering cross section and total scattering cross section, scattering by spherically symmetric potentials, partial waves and Phase shifts, scattering by perfectly rigid sphere and by square well potential and absorption. Born approximation for scattering. Scattering by coulomb potential.

Unit-III

Identical particles, symmetric and antisymmetric wave functions, Collision of identical particles, Spin angular momentum, Spin function for a many electron system.

Unit-IV

Relativistic theory, The Klein-Gordan equation, The Dirac equation, Covariance of Dirac equation, Gamma matrices, Energy level of hydrogen atoms, Hole theory and positrons.

Text and Reference Books:

1. L I Schiff, Quantum Mechanics (Mc Graw Hill)
2. S Gasiorowiez, Quantum Physics (Wiley)
3. B Craseman and J D Powell, Quantum Mechanics (Addison Western)
4. A P messiah, Quantum Mechanics
5. J J Sakurai, Modern Quantum Mechanics
6. Mathews and Venktesan, Quantum Mechanics

M.Sc. (Physics) Second Semester
PHY-202
Condensed Matter Physics

Credit-04

Unit-I Crystal Physics

Crystalline solids, unit cell and direct lattice, Miller indices of planes and axes, two and three dimensional Bravais lattices, closed packed structures, Braggs law, experimental diffraction techniques, construction of reciprocal lattice, reciprocal lattice vector, Brillouin zone and atomic factor.

Unit-II Point Defect and Imperfection

Point defect, line defect and planer stacking fault, the role of dislocation in plastic deformation and crystal growth, the observation of imperfection in crystal, X-ray and electron microscopic techniques.

Unit-III Electronic Energy Bands

Electrons in periodic lattice, Bloch theorem, Band theory, classification of solids, effective mass, tight binding, cellular and pseudo potential method.

Unit-IV Superconductivity

Superconductivity: Critical temperature, persistent current, Meissner effect, type I and type II superconductors, heat capacity, energy gap, isotopic effect, London's equation, coherent length.

Text and Reference Books:

1. Verma and Shrivastava: Crystallography for Solid State physics
2. Aschroff and Mermin: Solid State physics
3. Kittel: Solid State physics
4. Chaikin and Lubensky: Principles of Condensed Matter Physics
5. Dekker: Solid State physics

M.Sc. (Physics) Second Semester
PHY-203
Atomic and Molecular Physics

Credit-04

Unit-I Atomic Physics

Quantum states of one-electron atoms, atomic orbital, hydrogen spectrum, Pauli's principle, spectra of alkali elements, spin orbit interaction and fine structure in alkali spectra-equivalent, non-equivalent electrons. interaction energy in LS and JJ coupling,

Unit-II Atomic Spectra

Normal and anomalous Zeeman effect, Paschen Back effect, stark effect, hyperfine structure (qualitative).

Unit-III Diatomic-Molecular Spectra

Rotational spectra of diatomic molecules as a rigid rotator, Energy levels and spectra of non-rigid rotator, Intensity of spectral lines.

Unit-IV Energy of Molecules

Vibrational energy of diatomic molecules, diatomic molecules as a simple harmonic oscillator, Energy level and spectrum, Mores potential energy curve, Molecules as vibrating rotator, vibrational spectrum of diatomic molecules, PQR branches.

Text and Reference Books:

1. Introduction to atomic spectra by H E White (T)
2. Fundamental of molecular spectroscopy by C W Banwell (T)
3. Atoms, Lasers and Spectroscopy by S.N.Thakur and D.K.Rai
4. Introduction to molecular spectroscopy, G M Barrow
5. Spectra of diatomic molecules, Herzberg
6. Atomic and Molecular Spectroscopy by Rajkumar

M.Sc. (Physics) Second Semester
PHY-204
Statistical Mechanics

Credit-04

Unit-I Basics of Statistical Mechanics

Foundation of statistical mechanics, specification of states of a system, contact between statistics and thermodynamics, classical ideal gas, entropy of mixing and Gibb's paradox, phase space, Liouville's theorem.

Unit-II Ensemble Theory

Micro-canonical, canonical and grand canonical ensembles, partition functions, calculation of statistical quantities.

Unit-III Statistics

Statistics of ensembles, statistics of indistinguishable particles, Maxwell Boltzmann, Fermi-Dirac and Bose Einstein statistics, properties of ideal Bose and Fermi gases, Bose-Einstein condensation.

Unit-IV Phase Transitions

First and Second Order Phase Transition, Phase Equilibria, Critical Point Ising model, Bragg-Williums Approximation, Mean field theories of the Ising model, Exact solutions in one dimension, Landau theory of phase transition, Critical indices.

Text and Reference Books:

1. F Rief: Statistical and Thermal physics
2. K Huang: Statistical mechanics
3. R K Patharia: Statistical mechanics
4. R Kubo: Statistical mechanics
5. Landau and Lifshitz: Statistical mechanics

M.Sc. (Physics) Third Semester
PHY-301
Nuclear and Particle Physics

Credit-04

Unit I

Basic facts about nuclei, Mass and binding energy, Semi-empirical mass formula, Simple theory of deuteron, Spin dependence and noncentral feature of nuclear forces, Charge symmetry and charge independence of nuclear forces, Meson theory of nuclear forces. Nuclear models, Evidence of shell structure, magic numbers and spin-orbit coupling, extreme single particle model. Predictions of spin, parity and electromagnetic moments, Collective model-Vibrational and rotational spectra.

Unit II

Alpha decay, Theory of alpha decay. Fermi's theory of beta decay, Parity violation in beta-decay, Gamma emission, Multipolarity of gamma rays, Fermi-Golden rule, Selection rules for alpha-, beta- and Gamma decay, Internal conversion, Nuclear isomerism, Mossbauer Effect.

Unit III

Nuclear reactions, Conservation laws, The Q-equation and deduction of nuclear energy levels, Compound nucleus, Bohr hypothesis, Resonance phenomena, Breit- Wigner one level formula, Optical model, Simple discussion of direct reactions, Nuclear fission, Bohr-Wheeler theory of nuclear fission, Controlled chain reaction, Nuclear reactors.

Unit IV

Classification of elementary particles, Exact conservation laws, Approximate conservation laws: isospin ,strangeness, parity, time reversal and charge conjugation, CP violation, Gellmann-Nishijima formula. Baryons, Mesons, Quarks, Eight fold way, relativistic kinematics.

Reference Books:

1. Nuclear Physics by R.R. Roy and B.P. Nigam (Wiley-Eastern-1979)
2. The Atomic Nucleus by R.D. Evans (McGraw Hill - 1955)
3. Element of Nuclear Physics by W.E. Burchema (El.B.S. Longman - 1988)
4. Structure of Nucleus by M.A. Preston and R.K. Bhaduri (Addision Wesley - 1975)
5. Introductory Experimental Nuclear Physics by R.M. Singru
6. Concept of Nuclear Physics by B.L. Cohen (Tata McGraw Hills -1988)
7. Introductory Nuclear Physics by Kenneth S. Krane (Willey-2022)
8. Introduction to Elementary Particles by David J. Griffiths (Willey VCH-2004)
9. Nuclear Physics by D.C. Tayal

M.Sc. (Physics) Third Semester
PHY-302 (S1)
Electronics-I

Credit-04

Unit-I Linear Wave Shaping

High Pass and Low Pass RC Networks, Response to Sinusoidal, Step, Pulse, Square wave, Exponential and Ramp Inputs. High pass RC circuit as a differentiator, Criterion for good differentiation, Double Differentiation, Low Pass RC circuit as an Integrator. Laplace Transforms and their application to circuit elements.

Unit-II Amplifiers

Difference Amplifiers, Broadband Amplifiers, Methods for achieving Broadbanding, Emitter Follower at High Frequencies, Operational Amplifiers and its Applications, IC 741, Active Filters.

Unit-III Power Supplies

Electronically Regulated Power Supplies, Converters and Inverters, High and Low Voltage Supplies, Switched Mode Power Supply (SMPS).

Unit-IV Integrated Circuit Fabrication Technology

Basic Monolithic Integrated Circuits, Steps involved in the Manufacture of Monolithic ICs: Epitaxy, Masking, Etching, Diffusion, Metallization, Bonding, Assembling, Package types. Introduction to VLSI techniques.

Text and Reference Books:

1. Robert Boylested and Louis Nashdsky: Electronic devices and circuit theory, PHI, New Delhi
2. Ramakanth A Gayakwad: OP amps & linear integrated circuits, PHI second addition, 1991
3. Jacob Millman: Microelectronics, Mc-Hill international book co, New Delhi, 1990
4. Alien Chappal: Optoelectronics- theory and practice, Mc-Hill international book co, New York

M.Sc. (Physics) Third Semesters
PHY-303 (S1)
Electronics-II

Credit-04

Unit-I Logic Hardware

Transistor as a Switch, Switching times: Definition and Derivation, Storage Time, Delay Time, Turn On Time, Turn Off Time, Charge Control Analysis. Logic Specifications: Fan In, Fan Out, Noise Immunity, Noise Margin, Propagation Delay, Power Dissipation. Logic Families: DTL, DCTL, I2L, ECL, TTL, CMOSL, CML, HTL.

Unit-II Number Systems and Boolean Algebra

Binary, Octal and Hexadecimal Number Systems. Binary Arithmetic. Arithmetic Circuits. Binary Codes: Gray, 8421, 2421, 5211. Boolean Variables and Operations, Simplification of Boolean Expressions. Karnaugh Maps.

Unit-III Multivibrators

Astable, Monostable and Bistable Multivibrators. Schmitt Trigger. 555 Timer. SR, JK, T and D, J Master Slave Flip flops, Race problem and Edge Trigger JK Flip flop, Preset and Clear Functions.

Unit-IV Counters and Registers

Binary Counters:. Modulus of Counters: Asynchronous and Synchronous Counter Reset Method, Logic Gating Method. Ring Counter. Shift Registers: SISO, PIPO, SIPO, PISO. Universal Shift Register. Tristate Switches, Tristate Registers.

Text and Reference Books:

1. Barrey B Brey: The internal microprocessors 8086/8088, 80186, 80286, 80386, 80486 pentium andPentium processors architecture, programming interfacing, IVth edn. 1999.
2. Douglas V Hall: Microprocessors and interfacing, programming and hardware, IInd edn. Mc-GrawHill, 1992.
3. M A Maxidi and J G Mazidi: The 80x86 IBM PC and compatible comp. (Vol. I & II), IInd edn.Prentiee-Hall international, 1998.

M.Sc. (Physics) Third Semester
PHY-302 (S2)
Basics Space Physics

Credits: 04

Unit-I

Solar Phenomena: Structure of the Sun: Solar interior, solar atmosphere, photosphere, chromosphere, corona; Small & large scale Solar structures, Sun spots and their properties, Prominences, Solar Flare: classifications, phases & flare theory; Solar cycle, Solar magnetic field.

Unit -II

Solar Wind: Observed and derived properties of solar wind, Solar wind formation: Fluid theory for static as well as expanding isothermal solar atmosphere, Spatial configuration of magnetic field frozen into solar wind, Termination of solar wind flow: Heliosphere & Heliopause.

Unit-III

Magnetophere: Its structure, Bow shock, Magnetopause, Magnetopause current, Stand-off distance of stagnation point, Microstructure of magnetopause; Shape of magnetospheric cavity, Magnetotail; Planetary magnetospheres. VLF waves, Whistlers & its applications.

Unit-IV

Ionosphere: Its structure & formation; Ionospheric irregularities: Sporadic E and Spread-F irregularities and their distribution; Ionospheric Scintillations, Aurora Borealis: morphology of auroral region, distribution of auroral emissions.

Reference Books:

1. Basic Space Plasma Physics: W. Baumjohau and R. A. Treumann.
2. Introduction to Space Physics: Edited by M. G. Kevilson and C. T. Russell.
3. Space Plasma Physics: A.C. Das

M.Sc. (Physics) Third Semester
PHY-303 (S2)
Basics of Remote Sensing

Credits: 04

Unit-I

Concept and Foundations of Remote Sensing: Electromagnetic Radiation (EMR), interaction of EMR with atmosphere and earth surface, Application area of Remote Sensing.

Unit-II

Characteristics of Remote Sensing Platform & Sensors: Ground, Air & Space platforms, Return Beam Vidicon, Multi-spectral Scanner, Brief idea of Digital Image Processing.

Unit-III

Microwave Remote Sensing Tools: Radar Remote Sensing, Microwave Sensing, Lidar (Single and double ended system), (Radar & Lidar): Data Characteristics.

Unit-IV

Earth Resource Satellites: Brief description of Landsat and Indian remote sensing satellites (IRS) Satellites.

Reference books:

1. Introduction of Remote Sensing: J.B. Campbell.

2. Manual of Remote Sensing Vol I & II: (Ed. R.N. Colwell).

M.Sc. (Physics) Fourth Semesters
PHY-401
Laser and Nonlinear Optics

Credit-04

Unit-I

Laser theory, Einstein Coefficients, Light Amplification, threshold condition, Laser Rate Equations-two, three and four level systems.

Unit-II

Laser power around threshold, optimum output coupling, Line Broadening Mechanisms – Natural, Collision and Doppler, Optical Resonators – Modes of a rectangular cavity and open planar resonator, Modes of a Confocal resonator system, General Spherical resonator, Higher order modes.

Unit-III

Essential criterion to observe non linear optical effects. First experimental demonstration of non-linear phenomena. Classical theory of non-linear response in one dimension. Generalization to 3 dimensions.

Unit-IV

Non-linear coupling of 3 waves to produce sum and difference frequencies. Manley Rowe relations and their significance. Sum and difference frequency generation when both input frequencies are lasers. Parametric conversion and amplification.

Text and Reference Books:

1. Principles of Lasers by Orazio Svalto
2. Optical Electronics by Yariv
3. Non Linear Optics by Robert W. Boyd
4. Laser Physics by Marc Eichhorn
5. Lasers and Non Linear Optics by B. Laud
6. Fundamentals of Laser Physics by Kyungwon An

M.Sc. (Physics) Fourth Semester
PHY-402 (S1)
Advanced Electronics-I

Credit-04

Unit-I Amplitude Modulator

Amplitude Modulation, Spectrum of the modulated signal, Square law Modulator, Balanced Modulator, DSBSC, SSB and vestigial sideband modulation. Limitations of Amplitude Modulation. AM Receiver.

Unit-II Frequency Modulator

Analysis and frequency Spectrum, Generation and Detection of FM. Comparison of AM and FM. Pre-emphasis and De-emphasis. Reactance Modulator. Capture Effect. Varactor Modulator. Amplitude Limiter. FM Receiver. Foster Seely Discriminator. Ratio Detector.

Unit-III Radar & Television

Radar: Principle of radar, Elements of radar system, Peratind characteristics and maximum range of radar set, Duplexer, Radar beacons.
Television: General principle of image transmission scanning sequence and synchronization, Television camera tubes, elements of color television.

Unit-IV Microwave and Digital Communication

Microwave Generator: High frequency generation problems, Klystron amplifier and oscillators, Gunn oscillator and microwave components.
Digital Communication: Sampling theorem, Pulse Modulation: Pulse Code, Pulse Amplitude, Pulse Position Pulse Width Modulation. Differential PCM, Delta Modulation. Digital Communication System. Digital Carrier System. Frequency Shift Keying. Phase Shift Keying. Differential Phase Shift Keying. Division Multiplexing.

Text and Reference Books:

1. Wayne Tomasi: Advanced electronics communications systems, Phi. Edn.
2. Taub and Schilling: Principles of communication systems, second edition TMH, 1990
3. Simon Haykin: Communication systems, third edition, John Wiley and sons, Inc., 1994

M.Sc. (Physics) Fourth Semesters
PHY-403 (S1)
Advanced Electronics-II

Credit-04

Unit-I Combinational Logic Circuits

Pin out Diagrams, Truth Table and Working. Decoders: 1-of-4 IC 74AS139, 1-of-16 IC 74154 BCD to Decimal Decoder IC 7445, BCD to Seven Segment Decoder Driver: IC 7447A, 7448.Encoders: Decimal Priority Encoder IC 74147 Multiplexers, Implementation of Boolean Function using multiplexer, Demultiplexers: Demultiplexeral Decoder.

Unit-II Memories

Memory Devices: Read Only Memories, Masked Memory, ROM, Programmable ROM, EPROM. Random Access Memory: Static and Dynamic, Bipolar Ram Cell, Static RAM cell.

Unit-III A/D and D/A Converters

Binary weighted Resistor D/A Converter, Ladder Network D/A Converter. D/A Converter Specifications: Resolution, Accuracy, Linearity, Settling Time, Temperature Sensitivity. Flash A/D Converter, Ramp A/D Converter, Successive Approximation A/D Converter.

Unit-IV Microprocessors and Displays

LED Displays: Common Anode Display FND 507, FND 567.Common Cathode Display FND 500, FND 560. Flat Panel Displays (LCD, Plasmas etc.) and their addressing techniques. Smart Windows. Intel Microprocessors: Historical Perspective. Architecture of Microprocessor 8085: Addressing modes and Instruction Set of 8085. Programming examples.

Text and Reference Books:

1. Barrey B Brey: The internal microprocessors 8086/8088, 80186, 80286, 80386, 80486 pentium and Pentium processors architecture, programming interfacing, IVth edn. 1999.
2. Douglas V Hall: Microprocessors and interfacing, programming and hardware, IInd edn. Mc-Graw Hill, 1992.
3. M A Maxidi and J G Mazidi: The 80x86 IBM PC and compatible comp. (Vol. I & II), IInd edn.
4. Prentiee-Hall international, 1998

M.Sc. (Physics) Fourth Semester
PHY-402 (S2)
Introduction to Astrophysics and Cosmology

Credits: 04

Unit-I

Astronomical Measurements: Basic concepts of positional astronomy: celestial sphere, astronomical coordinate systems (Horizon and Equatorial systems of coordinates), Measurement of astronomical distances (stellar parallax, aberration, proper motion), measurement of brightness, radiant flux and luminosity (apparent and absolute magnitude scales; distance modulus); determination of stellar mass, Hertzsprung Russell Diagram

Unit-II

Telescopes: Electromagnetic spectrum and Atmospheric windows, ground based and space based telescope, estimation of magnification of a simple astronomical telescope, Cassegrain telescope, introduction to radio, infrared, optical, X-ray, gamma ray astronomy.

Unit-III

Galactic & Extragalactic Astronomy: Types of galaxies, Milkyway components: 21 cm line, rotation curve, dark matter; Black holes, Jeans instability and star formation, interstellar medium; cosmic rays. Galactic dynamics Active Galaxies; Extragalactic distance scale, classification of clusters, ICM, Virial theorem

Unit-IV

Introduction to Cosmology: Olber's paradox; Friedmann equation, FRW metric; geometry of universe, expansion of universe and Redshift, simple cosmological models, Cosmic Microwave Background.

Reference Books:

1. An introduction to Modern Astrophysics: Carroll B. W. & Ostlie, D. A
2. Astrophysics for Physicists: Arnab Rai Choudhuri
3. An introduction to Modern Cosmology: Andrew Liddle
4. An invitation to Astrophysics: Padmanabhan, T.
5. Principles of Physical Cosmology: P.J.E. Peebles

M.Sc. (Physics) Fourt Semester
PHY-403 (S2)
Atmospheric Physics

Credits: 04

Unit-I

Earth's Atmosphere: Troposphere, Stratosphere, Stratosphere, Stratosphere, Exosphere, Atmospheric constituents.

Unit-II

Atmospheric Aerosols: Types of aerosols, sources of aerosols, aerosol parameters: Aerosol optical depth (AOD)**,** Angstrom Exponent (AE), Single Scattering Albedo (SSA), Asymmetric Parameters (AP), Impact on Climate (direct, semi direct and indirect effect).

Unit-III

General circulation and weather system: Earth's radiation budget, Greenhouse effect, Global warming, Precipitation, Cylcones, Indian monsoon

Unit-IV

Basics of cloud physics: Cloud formation, cloud condensation nuclei (CCN), types of clouds (Cumulus, Stratus, Cirrus, and Nimbus), Charge separation mechanisms in thunderstorms.

Reference Books:

1. Atmospheric Science: An Introductory Survey by Wallace & Hobbs

2. Atmospheric Aerosols: Properties and Climate Impacts by Olivier Boucher

M.Sc. Physics, Semesters I & II Practical

(List of Experiments)

1. Hysteresis Curve (a) by Ballistic method
   (b) by Oscillograph
2. FET/MOSFET Characteristics
3. Ultrasonic Interferrometer
4. Michelson Interferometer
5. Elastic constant by Newton's Ring
6. Hall Effect
7. Diffraction Grating by Lasers
8. Q of coil
9. Planck's constant
10. Richardson Equation
11. ESR (Electron Spin Resonance)
12. Energy band gap of semiconductor
13. Fourier analysis by CRO
14. Experiment on Laser
15. Transistor Characteristics

M.Sc. Physics, Semesters III & IV Practical

Electronics Group Practicals

1. Study of RC Coupled Amplifier
2. Negative Feedback Amplifier
3. Study of Multivibrator
4. Study of Oscillators
5. Amplitude Modulation & Demodulation
6. NAND and NOR gate as universal gate.
7. D/A and A/D Convertor
8. Characteristics of Operational Amplifier
9. Operational Amplifier as inverting, non-inverting, D-summing Amplifier
10. Study of time 555
11. Series regulated power Supply
12. Multiplex & Demultiplexs,
13. Study Incoders and decoders and BCD to saving segment.
14. Microprocessor
15. Verification of AND, OR, and NAND logic Gates.

M.Sc. Physics, Semesters III & IV Practical

(List of Experiments)

Space and Astrophysics Group Practicals

1. To verify Stefan's law
2. To determine the wavelength of a laser using the Michelson interferometer.
3. To determine the resolving power of telescope
4. To analyze aerosol's parameters using satellite based observation
5. To analyze aerosol's parameters using ground based observation
6. To compare satellite based and ground based observation
7. Analysis surface meteorological data like temperature, pressure, wind speed, rainfall etc using Automatic Weather Station
8. Characteristics of CCD camera
9. Experiments using photodiodes.
10. Estimating raltive magnitude by a group of stars by a CCD camera.
11. Polar Alignment of an astronomical telescope
12. Time variations of components of geomagnetic field using magnetometer
13. Analysis of cloud characteristics using ground based instruments; Ceilometer (LIDAR)
14. To study of global positiong system and its accessories to find out location of various points.
15. To find out location (planimetric coordinates and elevations) of various points using GPS.
16. Vibration of a suspended simple pendulum, coupled non-linear pendulum.
17. Study of Fabry Perot interferometer, for accurate measurement of tiny displacements.
18. Magneto-resistance studies.

Note:

- The institution may suggest a minimum number of experiments (say 05) to be performed by each student per semester from the Lab Experiment List.

- The institution may add / modify / change the experiments of the same standard in the subject.