

**GOVT. NAGARJUNA PG COLLEGE OF SCIENCE,
RAIPUR**

DEPARTMENT OF PHYSICS

SYLLABUS AND MARKING SCHEME

M.Sc. Physics
(1 Year Programme)

2026-2027

M.Sc. PHYSICS (One Year Programme)

SEMESTER - I (Jul-Dec 2026)

Paper I (COURSE CODE- PHY 301)

(NUCLEAR & PARTICLE PHYSICS)

Unit	Topics
I	1.1 Nuclear Decay : Introduction, determination of q/M for α particles (Rutherford and Royd's experiment), Range of particle, energy of particle, energy velocity-energy-life time relation,
	1.2 Alpha particle spectra, some decay schemes, Gamow's theory of particle, its advantages in theory of alpha decay, Geiger Nuttal law, properties of particle.
	1.3 Decay: Introduction, general theory of decay (Flat type spectrometers, Lanse type spectrometer), The neutrino hypothesis and its indirect method, Fermi theory of decay (Coulomb correction, screening by atomic electron,
	1.4 Kurie plot, mass of neutrino, Life time of decay) classification of transitions (selection rules), parity violation of decay, decay schemes of some important nuclides.
II	2.1 Nuclear Reactions and Energy: Introduction, types, Conservation laws, kinematics and general solution of the Q equation, binding energy, nuclear transformations by particles, protons, neutrons, deuterons
	2.2 particle of mass three, radiation, heavy ions with examples), nuclear cross section (partial wave analysis of reaction cross section)
	2.3 Compound Nucleus : Mechanics (formation and breakup), Energy level of nuclei and level width, De-excitation, compound nucleus cross-section (Briet Wigner dispersion formula)
	2.4 Nuclear fission and fusion : Introduction, Neutrons released in fission process; cross sections, nuclear chain reactions, nuclear reactor, four factor formula, critical size of reactor, , fusion, thermonuclear energy, prospect of controlled fusion energy.
III	3.1 Counters: Types of counter, Gas filled counter, Solid State counter, scintillation counter with their principle, working method, applications and advantages & disadvantages.
	3.2 Neutron detection :- introduction, different types, principle, experimental detail with applications.
	3.3 Accelerators : Types of accelerator, Cyclotron, linear accelerators, betatron,
	3.4 Electron synchrotron, proton synchrotron with their principle, working method and applications.
IV	4.1 Elementary Particles : Classification of elementary particles, basic particle interactions, conservation laws, invariance under parity, CP, time, CPT,
	4.2 Electron and positron, proton and antiproton, neutrino and antineutrino, mesons and hyperons: (their masses, decay modes and reactions)
	4.3 Eementary particle symmetry : unitary and eightfold way symmetries.
	4.4 Quark theory: experimental evidence, masses, numbers, mesons and baryons.

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M.Sc. PHYSICS (One Year Programme)

**SEMESTER - I (July-Dec 2020)
Paper II (COURSE CODE- PHY 302)
(STATISTICAL MECHANICS)**

Unit	Topics
I	1.1 Phase space, Volume in Phase space, Boltzmann entropy relation, Liouville's Theorem, Postulate of equal a priori probability. Different types of equilibrium (statistical, thermal, mechanical, Particle). Connection between statistical and thermodynamic quantities.
	1.2 Ensembles, Microcanonical ensemble, perfect gas in microcanonical ensemble, Gibbs paradox, partition function and its correlation with thermodynamic quantities
	1.3 Canonical ensemble as approximation to microcanonical ensemble. partition function for canonical ensemble, Thermodynamic quantities for canonical ensemble.
	1.4 Grand canonical ensemble: Partition function and thermodynamic function for grand canonical ensemble.
II	2.1 Classical Maxwell Boltzmann distribution law, Transition from classical statistical mechanics to quantum statistical mechanics, indistinguishability and quantum statistics. Bose Einstein distribution law, Fermi Dirac distribution law. Planck's radiation formula from Bose Einstein Distribution law.
	2.2 Magnetic behaviour of an ideal Fermi gas, Pauli paramagnetism, Landau diamagnetism.
	2.3 Ideal Bose Einstein gas, Gas degeneracy, Bose Einstein condensation.
	2.4 Ideal Fermi Dirac gas, Energy and pressure of the gas, case of slight degeneracy and strong degeneracy.
III	3.1 Theory of imperfect gases –Cluster expansion for a classical gas. Virial expansion of equation of state, evaluation of virial coefficients.
	3.2 Phase transition, phase transition of first and second kind, Ginzburg Landau Theory, Phase transition in ferromagnetic materials.
	3.3 The Ising model, Bragg William Approximation; The standard mean field approximation, exact solution of Ising model in one dimensions.
	3.4 Irreversible Process: Onsager relation, Proof of Onsager Reciprocal relations.
IV	4.1 Fluctuations – Fluctuation in Energy and pressure. Probability of one dimensional random walk.
	4.2 Langevin theory of the Brownian motion. Einstein relation for mobility.
	4.3 Approach to equilibrium: Fokker Planck equation,
	4.4 Spectral analysis of fluctuations: the Wiener –Khinchine theorem

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M.Sc. PHYSICS (One Year Programme)

SEMESTER - I (July-Dec 2026) Paper III (COURSE CODE- PHY-303) (CONDENSED MATTER PHYSICS – I)

Unit	Topics
I	1.1 Crystalline and amorphous solids:-Unit cells and direct lattice. Bravais Lattice Types of lattice:-Two and three dimensional Bravais lattices.
	1.2 Fundamental elements of symmetry(Translation, Rotation, Reflection ,Inversion), Symmetry groups(Point Groups, space Groups) concept of point group and space groups, crystal planes and Miller indices, simple crystal structure : closed packed structures (Hexagonal closed packed Structure, Face centered cubic Structure), Loose packed Structures: (Body Centered Cubic Structure, Simple cubic Structure)
	1.3 X-Ray Diffraction(Laue's Equation, Bragg's law), Interaction of X rays, electrons and neutrons with matter, Electron Elastic scattering from an perfect lattice, Reciprocal lattice Vectors, Reciprocal lattice vectors to SC lattice, Reciprocal lattice to BCC lattice, Reciprocal lattice vectors to FCC Lattice, Properties of Reciprocal Lattice
	1.4 Brillouin Zones :- Brillouin Zone for Simple cubic lattice, Brillouin Zone for Body centered cubic lattice, Brillouin Zone for Face Centered Cubic Lattice
II	2.1 Defects or imperfections in crystals and their classification Defects : Introduction, Classification of Defects ,Point defects,
	2.2 Line Defect, Plane Defect, Schottky and Frenkel defects, vacancies, interstitial Colour center & their production:- Introduction, classification of Colour centre, Formation of F-centre, in ionic crystals, their types and production,
	2.3 Deformation (Plastic Deformation-Slip & Yield, Shear strength of Single Crystal
	2.4 line defects or Dislocations:-Introduction to Dislocation, Edge and Screw dislocations, Burger Vectors, the role of dislocations in Plastic deformation and crystal growth.
III	3.1 Electron's in a periodic lattice, The Periodic potential ,Block theorem, First Proof of Bloch theorem The Born Von Karman boundary condition, second Proof of Bloch theorem, General remarks of Bloch theorem
	3.2 Kroning-Panny model, Band theory, Origin of the energy Gap, magnitude of energy Gap, Band gap, holes , Width of bands, Constant energy curve & surfaces, Classification of solids, Distinction between metal semiconductors & insulators, effective mass, equation of motion, velocity of electron, E-K curve, k-space, negative effective mass & holes, physical interpretation of effective mass , effective mass in semiconductors,
	3.3 Tight bonding:-general formulation remarks on calculating the band Structure, cellular and pseudo potential methods,
	3.4 Fermi surface and its construction, de Haas von Alfen effect, cyclotron resonance, magnetoresistance , quantum Hall Effect, Hall coefficient , hall resistance, Bloch Wave.
IV	4.1 Magnetism, Ferromagnetism, Weiss theory of ferromagnetism, curie's temperature, Paramagnetic region nature & Origin of weiss molecular field
	4.2 Exchange interaction, Heisenberg model and molecular field theory, Curie-Weiss law for susceptibility, concept of Domains & hysteresis ,Domains, Bloch wall energy origin of domains single domain particle, magnetic bubble domain, curie temperature & suscepibility of ferrimagnets from garnets,.
	4.3 Antiferromagnetic order, Antiferromagnetic magnons, Antiferromagnetic resonance, Doman's and Block wall energy.
	4.4 Quantization of Spin waves, Neutron magnetic scattering magnons , susceptibility below Neel temperature

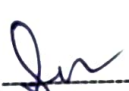
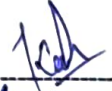
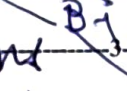
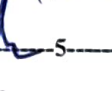
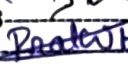
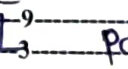
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Departmental Members _____

Student Members: _____

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M.Sc. PHYSICS (One Year Programme)

**SEMESTER - I (July-Dec 2026)
Paper IV (COURSE CODE- PHY 304)
Special Paper II (ELECTRONICS)
(Photonics & Op Amp)**

Unit	Topics
I	1.1 Radiative and non-radiative transitions , Optical Absorption, bulk and thin film, photoconductive devices (LDR) , Emission spectra , Luminescent efficiency , method of excitation
	1.2 Light emitting diode (LED) : high frequency limit, effect of surface and indirect combination current , operation of LED,
	1.3 Visible LEDs and Infrared LEDs.
	1.4 Diode Laser (Condition for population inversion in active region, light confinement factor , optical gain and threshold current for lasing, Fabry-Perrot Cavity Length for lasing and the separation.
II	2.1 Photo detectors: Photoconductor, equivalent circuit of photoconductor. Solar cells, Solar radiation
	2.2 Phototransistor. Bipolar phototransistor, photo – Darlington transistor, V-I characteristic of bilateral hetero structure phototransistor,
	2.3 solar spectrum, ideal conversion efficiency, Energy band diagram of solar cell, IV characteristics of solar cell
	2.4 PN junction solar cells, Hetero junction, Interface thin film solar cells.
III	3.1 Basic Op-amp. Differential amplifier – circuit configurations, dual input, balanced output, differential amplifier –DC analysis, Ac analysis,
	3.2 inverting and non-inverting inputs, CMRR, Constant current bias level transistor. Block diagram of a typical Op-amp. Analysis,
	3.3 open loop configuration, inverting and non-inverting amplifier, Op-amp. With negative feedback, Voltage series feed back, effect of feed back on closed loop gain input persistence output , resistance bandwidth and output offset voltage , voltage follower
	3.4 Practical Op-amp. Input offset voltage, Input offset current, total output offset voltage, CMRR frequency response
IV	4.1 DC and AC amplifier - summing scaling and averaging amplifiers instrumentation amplifier, integrator and differentiator
	4.2 Oscillators - principles, oscillator types, frequency stability response, The phase shift oscillator
	4.3 Wein bridge oscillator, LC tunable oscillators – Multivibrators - Monostable and Astable
	4.4 Comparators, square wave and triangle wave generators.

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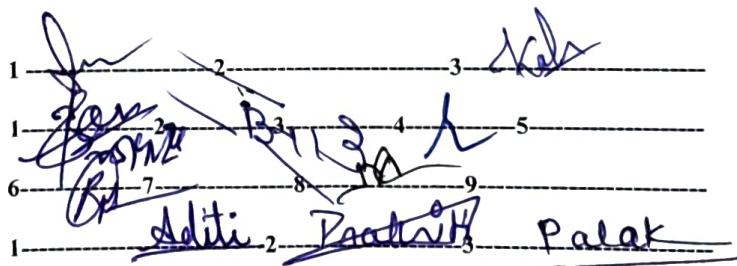
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Departmental Members

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M.Sc. (PHYSICS)
SEMESTER – M.Sc. I Sem. (JUL - DEC 2026)
PAPER – V (COURSE CODE – PHY307)
INDIAN KNOWLEDGE SYSTEM (IKS)

UNIT -1	Mathematics : Ritual Geometry, Numerals and the Infinite Series	No. of Lectures
1.1	Vedic Geometry :- Introduction to the Śulba Sūtras, specifically the work of Baudhāyana; analysis of the Pythagorean theorem, geometric algebra, and algorithmic construction of complex sacrificial altars. [c. 800 BCE – 500 BCE]	7
1.2	The Numeral System and Śūnya :- Development of the decimal place-value system from Brahmi numerals; Brahmagupta's formalization of zero as a mathematical entity and the definition of rules for negative numbers. [c. 3rd Century BCE – 7th Century CE]	
1.3	Classical Algebra and Trigonometry :- Āryabhaṭa I's introduction of sine tables (jyā) and the approximation of π ; Bhāskara II's advancements in indeterminate equations and early concepts of instantaneous motion. [c. 5th Century CE – 12th Century CE]	
1.4	The Kerala School :- Mādhava of Saṅgamagrāma's discovery of infinite power series for trigonometric functions; analysis of the Yuktibhāṣā by Jyeṣṭhadeva as a foundational text for pre-modern calculus. [c. 14th Century CE – 16th Century CE]	
UNIT -2	Physical Sciences : Matter, Metallurgy and Siddhāntic Astronomy	
2.1	Atomic Theory and Mechanics :- Study of the Vaiśeṣika school and Acārya Kaṇāda's theory of atoms (paramāṇu); conceptual frameworks for force, momentum, and the laws of motion (vega). [c. 6th Century BCE – 2nd Century BCE]	8
2.2	Applied Chemistry and Metallurgy :- History of high-carbon Wootz Steel production; the chemical engineering of the rust-resistant Iron Pillar of Delhi; and the world's first industrial-scale zinc distillation at Zawar, Rajasthan. [c. 4th Century BCE – 16th Century CE]	
2.3	Siddhāntic Astronomy :- Āryabhaṭa's rotation models and scientific explanations for eclipses; Nīlakaṇṭha Somayāji's revised planetary models and his semi-heliocentric theories. [c. 5th Century CE – 15th Century CE]	
2.4	Cosmology and Time-Measurement :- Mathematical scales of time ranging from the microscopic truṭi to the macro-cosmic kalpa; dimensions and structure of the universe in Siddhāntic texts. [Ancient – Medieval]	
UNIT -3	Modern Physics : Radio Waves, Light Scattering and Quantum Statistics	
3.1	Microwave Optics and Radio :- Jagadish Chandra Bose's pioneering experiments with millimeter-waves and the development of the "Mercury Coherer" and crystal detectors. [c. 1895 – 1920]	7
3.2	Light Scattering and Spectroscopy :- Sir C. V. Raman's investigation into molecular diffraction; the physics of the Raman Effect and the founding of the Indian Association for the Cultivation of Science (IACS). [c. 1921 – 1930]	
3.3	Quantum Statistics and Matter :- Satyendra Nath Bose's derivation	

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	of Planck's Law; the collaboration with Einstein leading to Bose-Einstein Statistics and the definition of Bosons. [c. 1924 – 1930]	
3.4	Thermodynamics and Astrophysics :- Meghnad Saha's development of the Saha Ionization Equation and its role in classifying stellar spectra and temperatures. [c. 1920 – 1940]	
UNIT -4	Post-1947 Physics : Nuclear Energy, Space, Biophysics and Computing	
4.1	Nuclear Physics and Energy :- Homi J. Bhabha's theoretical work on electron-positron scattering; the "Three-Stage Nuclear Program" and the strategic focus on Thorium-based cycles. [c. 1948 – 1966]	8
4.2	Space Physics and Satellite Technology :- Vikram Sarabhai's role in establishing ISRO; evolution of indigenous launch vehicle physics (PSLV/GSLV) and cosmic ray studies. [c. 1962 – Present]	
4.3	Structural Physics and Biophysics :- G. N. Ramachandran's discovery of the triple-helical structure of collagen and the development of the Ramachandran Plot as a standard in structural biology. [c. 1950 – 1970]	
4.4	Advanced Computing and Fiber Optics :- Narinder Singh Kapany's foundational contributions to the physics of fiber optics; development of the PARAM supercomputers by C-DAC. [c. 1980 – Present]	

Seminar and Assignment Topics :-

1. Baudhāyana's Altar : To reconstruct one Śulba construction step by step and prove the theorem it encodes.
2. Brahmagupta on Zero : To set out his rules for zero and negative quantities and identify the one rule modern mathematics rejects.
3. Truṭi to Kalpa : To tabulate the Siddhāntic scale of time against SI seconds and years.
4. Mādhava and Leibniz : To compare the arctangent series of the Yuktibhāṣā with Leibniz's and assess the transmission argument.
5. Paramāṇu and Dalton : To identify the first prediction Dalton's atomic theory makes that Vaiśeṣika cannot.
6. Eclipse Prediction : To compare Siddhāntic and Ptolemaic predictions of one recorded eclipse against the modern computed value.
7. The Saha Equation : To derive the ionization equation and apply it to one stellar spectral class.
8. Bose's Derivation : To reconstruct Planck's Law from the counting of indistinguishable quanta.

Text Book and Reference :

1. Introduction to Indian Knowledge System : Concepts and Applications – B. Mahadevan, Vinayak Rajat Bhat and Nagendra Pavana R. N.
2. Mathematics in India – Kim Plofker.
3. A Concise History of Science in India – D. M. Bose, S. N. Sen and B. V. Subbarayappa.
4. The Crest of the Peacock : Non-European Roots of Mathematics – George Gheverghese Joseph.

Aditi, Palak, B-13, Pratik, and other signatures.

M.Sc. PHYSICS (One Year Programme)
SEMESTER - II (Jan – June 2027)
Paper I (COURSE CODE- PHY 401)
(ATOMIC AND MOLECULAR PHYSICS)

Paper I (COURSE CODE- PHY 401)
(ATOMIC AND MOLECULAR PHYSICS)

Page 1 (COURSE CODE- PHY 401)
(ATOMIC AND MOLECULAR PHYSICS)

Paper I (COURSE CODE- PHY 401)
(ATOMIC AND MOLECULAR PHYSICS)

Unit	Topics
I	1.1 Atomic spectra, Bohrs postulates, Bohrs model of one electron atom: explanation of spectra of hydrogen like atom, correction of finite nuclear mass, variation in rydberg constant due to infinite nuclear mass.
	1.2 Sommerfeld quantisation rules, de-Broglies interpretation of Bohr quantisation law, Bohrs correspondence principle, Sommerfelds extension of Bohrs model, sommerfeld relativistic correction.
	1.3 Orbital magnetic dipole moment: Bohrs magneton, Larmor precession, Space quantisation, electro spin, vector model of atom, coupling of orbital and spin angular momenta.
	1.4 L-S coupling, lande interval rule, determination of spectral terms for l-s coupling j-j coupling. Spectra of alkali elements: Broad feature of alkali spectra, Fine structure of alkali spectra. Intensity ratio of doublets.
II	2.1 Explation of normal zeeman effect and anomalous zeeman effect. Example of zeeman effect in some transition.
	2.2 Paschen- Back effect, weak field and strong field stark effect in Hydrogen.
	2.3 Hyperfine structure of spectral lines: Isotope effect, nuclear spin and hyperfine splitting, intensity ration and determination of nuclear spin.
	2.4 Zeeman effect of hyperfine structure, Back- Gouldsmit effect in Hyperfine struture. The breadth of spectral lines. Doppler effect.
III	3.1 Separation of electronic and nuclear motion: The Born –oppenheimer approximation. Types of molecular spectra. Types of molecular energy states and associated spectra.
	3.2 Pure rotational spectra. The molecule as a rigid rotator: Explanation of rotational spectra, The non-rigid rotator, Isotope effect on rotational spectrum.
	3.3 Vibrational- Rotational spectra, The molecule as a Harmonic oscillator, molecule as an hormanic oscillator.
	3.4 Vibration frequency and force constant for Anharmonic oscillator. Isotop effect on vibrational levels. Fine structure of infra-red boards.
IV	4.1 The Raman spectra: Classical Theory of Raman effect, quantum theory of Raman effect, Raman spectra and molecular structure.
	4.2 Electronic spectra: formation of electronic spectra, vibrational structure of electronic band system in emmission. Electronic band spectra in absorption.
	4.3 Fine structure in in electronic bands, Rotational structure of Three-branch bands.
	4.4 Franck –condon principle, Quantum mechnical formulation of franck condon principle. Explanation of intensity distribution in absorption bands and emmission bands from Franck- Condon Principle.

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SEMESTER - II (Jan-June 2027)
Paper II

Elective Paper (60)

(PHYSICS OF NANOMATERIALS)

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Internal subject Experts

Departmental Members

Student Members

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M.Sc. PHYSICS (One Year Programme)

SEMESTER - II (Jan –June 2027)

Paper II

Elective Paper (COURSE CODE- PHY 402C)

(Characterization of Materials)

Unit	Topic
I	1.1 Thermal Analysis- Introduction–thermogravimetric analysis (TGA), instrumentation, determination of weightloss and decomposition products,
	1.2 Differential thermal analysis (DTA), and cooling curves,
	1.3 Differential scanning calorimetry (DSC), instrumentation, specific heat capacity measurements,
	1.4 Determination of thermomechanical parameters and determination of phase transitions.
II	2.1 Structural Analysis-X-rays Diffraction, Bragg's law, reciprocal lattice concept, Laue diffraction,
	2.2 Interpretation of diffraction patterns, cell parameter determination, Powder diffraction: Debye-Scherrer method, uses,
	2.3 SEM, FESEM, EDX, TEM: working principle and Instrumentation, sample preparation, Scanning probe microscopy,
	2.4 STM, AFM, working principle, Instrumentation and modes of operation.
III	3.1 Optical Characterization-Photoluminescence (PL), classification of photoluminescence, matter interaction, instrumentation,
	3.2 Electroluminescence (EL), instrumentation, applications,
	3.3 Thermoluminescence (TL): models, mechanism, methods of analysis: heating rate method, half width method, initial rise method and applications,
	3.4 Mechanoluminescence (ML) characteristics.
IV	4.1 Spectroscopy Techniques-Introduction, regions of spectrum, characterization of electromagnetic radiations,
	4.2 Quantization of energy, Principles and instrumentation for UV-visible spectroscopy,
	4.3 IR, FTIR spectroscopy, Raman spectroscopy,
	4.4 ESR, NMR and proton induced X-ray Emission spectroscopy (PIXE), applications, and spectroscopy.

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M.Sc. PHYSICS (One Year Programme)

SEMESTER - II (Jan - June 2027)

Paper III (COURSE CODE- PIHY 403)

Special Paper III

(CONDENSED MATTER PHYSICS - II)

UNIT	Topics
I	1.1 Superconductivity, critical temperature, persistent current, Destruction of Superconductivity by magnetic Field,
	1.2 Meissner effect, heat capacity, Isotopic effect, and flux penetration, type I and type II superconductors, single particle tunneling,
	1.3 thermodynamics of superconducting transitions, London's equations, Coherence length Interaction of electrons with acoustic and optical phonon, Cooper pairing due to phonons, BCS theory of superconductivity (qualitative). Flux quantization in superconducting ring.
	1.4 Manifestation of energy gap in superconductors, superconducting tunneling, A.C./D.C. Josephson effect, Microscopic quantum interference, high temperature superconductivity (elementary).
II	2.1 Polarization, depolarization field, local electric field at an atom, Lorenz field, dielectric constant and polarizability,
	2.2 Electronic polarizability, Ionic and orientational polarizability, Debye equation for gases, the complex dielectric constant, dielectric relaxation time,
	2.3 Normal and anomalous dispersion, classical theory of electronic polarizability.
	2.4 Ferro electric crystal, classification, ferro-electric domains, structural phase transition, Landau theory of phase transition, first and second order phase transition, anti Ferro electricity
III	3.1 Energy bands in semiconductor, Intrinsic and Extrinsic semiconductors
	3.2 Drift velocity, mobility, carrier concentration and Fermi level for intrinsic and extrinsic semiconductors
	3.3 Electrical conductivity of semiconductors, semimetals.
	3.4 P-N junction, junction transistors, The tunnel diode, Zener diode, Gunn diode, photovoltaic effect, Quantum wells and super lattices.
IV	4.1 Interatomic forces and lattice dynamics of simple metals
	4.2 ionic and covalent crystals, lattice dynamics of linear monoatomic and diatomic lattices, optical and acoustical modes.
	4.3 Quantization of elastic waves, phonons, momentum of phonons, inelastic neutron scattering by phonons,
	4.4 Anharmonicity, thermal expansion, lattice thermal conductivity

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External subject Experts

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M.Sc. PHYSICS (One Year Programme)

SEMESTER - II (Jan –June 2027)

Paper IV (COURSE CODE- PHY 404)

**Special Paper IV
(Microprocessor and Communication)**

UNIT	Topics
I	1.1 Microprocessor & Micro Computers :Evolution of Microprocessor, Internal Microprocessor, Architecture, Architecture of digital Computer
	1.2 Memory : - Semiconductor memories (RAM, ROM, PROM, EPROM, Shift register).
	1.3 Magnetic Memory : - Floppy disks, Hard disks, Optical Disks, Magnetic Bubble Memory.
	1.4 Networking : Types of network, Design features of a communication network ,Examples, TYMNET, ARPANET, ISDN, LAN, LAN topology (Bus, Star, Ring) .
II	2.1 Intel 8085 : ALU, Timing and Control Unit, Registers, Data and Address Bus, Pin Configuration. Instruction Cycle : Op-code and Operands, Fetch Operation, Execute Operation, Machine Cycle, Instruction and Data flow.
	2.2 Time Diagram : Opcode Fetch Cycle, Memory read, I/O Read, Memory write, I/O Write.
	2.3 Addressing Modes : Direct Addressing, Register addressing, Register Indirect Addressing, Immediate Addressing, Implicit Addressing. Instruction set of 8085 : Data transfer group, Arithmetic group, Logical group.
	2.4 Assembly Language Programs : Addition of Two 8-bit number, Sum 8-bit , Addition of Two 8-bit number, sum 16-bit, 8-bit subtraction, Find the largest number in a data array, To arrange a series of numbers in Descending order, Find the smallest number in a data array, To arrange a data array in ascending order,.
III	3.1 Digital Communications Pulse modulation system : Sampling theorem- Low pass and Band pass signals, PAM, Channel BW for a PAM signal
	3.2 Natural sampling, Flat top smapling. Signal recovery through Holding. Quantization of signals,
	3.3 Quantization, Differential PCM, Delta Modulation, Adaptive Delta Modulation, CVSD
	3.4 Digital Modulation Techniques : BPSK, DPSK, QPSK, PSK, QASK, BFSK, FSK, MSK
IV	4.1 Optical Fibers : Introduction, Structure, Classification, Refraction and Snell's law, Total internal refraction,
	4.2 Light propagation through and optical fiber, Acceptance angle for incident ray, Numerical Aperture, number of modes and cut-off parameter,
	4.3 single mode propagation, comparison of step and graded index fiber. Types of Optical Fiber : HPSUU, HPSIR, Halide fiber
	4.4 Optical fiber cables : Multifibre cable, Splicing and connectors. Advantage and Disadvantage of optical fiber.

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M.Sc. (PHYSICS)

SEMESTER – II Sem.(Jan - June 2027)

PAPER – V (COURSE CODE – PHY406)

SKILL ENHANCEMENT COURSE (SEC)

UNIT -1	Electricity : Basic Quantities, Circuits and the AC Supply	No. of Lectures
1.1	Basic Electrical Quantities :- Charge, Current, Voltage, Resistance, Power, Energy – SI units and everyday quantities behind them. Ohm's law.	7
1.2	The Multimeter :- The multimeter as primary instrument – voltage, current, resistance, continuity and diode test; the meter in parallel for volts and in series for amps, and the one mistake that blows its fuse.	
1.3	Resistor Networks :- Series and parallel resistance, the voltage divider, Kirchhoff's current and voltage laws.	
1.4	AC – DC Supply System :- DC vs AC, Indian supply, RMS, peak value, three-phase supply.	
UNIT -2	Electricity : Domestic Installation, Protection and Safety	
2.1	Domestic Wiring :- Domestic wiring anatomy – Phase, Neutral, Earth; switch the phase; two-way switching.	8
2.2	Earthing and Electrical Protection :- Earthing and why it exists. Protection devices – fuse, MCB, RCCB/ELCB, Isolator – what each one protects and what none of them protect. The clamp meter and earth continuity check.	
2.3	Electrical Energy :- Energy in kWh, reading the meter, computing a month's bill from an appliance list and a slab tariff.	
2.4	Electrical Shock, Rescue and First Aid :- Electric shock – the physiological effect is set by current, not voltage; the rescue sequence and first aid.	
UNIT -3	Electronics : Components, Soldering and Instruments	
3.1	Electronic Components and their Characteristics :- Resistors – types and power rating. Capacitors – Ceramic and electrolytic.	7
3.2	Diodes and Rectification :- Diodes – PN junction, LED, Zener Diode. Half wave, full wave and bridge rectification.	
3.3	Soldering Techniques and Circuit Assembly :- Soldering – Iron selection and tip care, 60/40 solder, Desoldering; breadboard, Veroboard, PCB.	
3.4	Laboratory Instruments :- The Oscilloscope, function generator and bench power supply.	
UNIT -4	Electronics : Switching, Logic and Control	
4.1	Electronic Switches :- BJT as switch, Saturation and cut-off, base	8

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	resistor, MOSFET.	
4.2	Digital Logic and Logic Gates :- Analog vs Digital, Binary and hexadecimal counting. Gates – AND, OR, NOT, NAND, NOR, XNOR, XOR – Truth tables, TTL vs CMOS supply rules.	
4.3	The 555 Timer and Op-Amp Applications :- The 555 timer in astable and monostable mode – the RC timing equation used as a recipe, not derived; setting frequency and duty cycle by choosing R and C. The Op-Amp as a comparator – applications.	
4.4	Sensors and Actuators :- Sensors as variable resistance and voltage – LDR, Thermistor, Potentiometer, Ultrasonic module. Actuators – LED, Buzzer, Relay, DC Motor, servo – why a motor never runs straight off a logic pin.	

Laboratory Exercises :-

9. LED Flasher : To make an LED blink continuously using IC 555.
10. Burglar Alarm : To produce an alarm sound when unauthorized entry is detected.
11. Clap Switch : To switch an LED or Load ON/OFF using a clap sound.
12. Water level alarm : To produce an alarm when water reaches a certain level.
13. Police Siren : To generate a police siren like sound using IC 555.
14. Automatic Night lamp : To automatically switch ON a light in darkness.
15. Rain Alarm : To produce an alarm when rain droplets are detected.
16. Simple Timer : To generate a time delay using IC 555.

Text Book and Reference :

4. Basic Electrical Engineering – V.K. Mehta and Rohit Mehta.
5. Electronic Devices and Circuit Theory – Boylestad and Nashelsky.
6. Practical Electronics for Inventors – Scherz and Monk.

The bottom of the page contains several handwritten signatures and marks. From left to right, there is a large checkmark-like signature, a signature that appears to be 'Suditi', a signature that appears to be 'Bijoy', a signature that appears to be 'Rohit', a signature that appears to be 'Prakriti', a signature that appears to be 'Palak', and a signature that appears to be 'Kash'. There are also some other smaller, less legible signatures and marks scattered around.