SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

SEMESTER I

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	Mathematical Methods-I	20	80	100
2.	Classical Mechanics	20	80	100
3.	Numerical Methods and C Programming	20	80	100
4.	Electronics-I	20	80	100
LAB I	General	-	-	100
LAB II	Computer Programming	-	-	100
			TOTAL	**600**

SEMESTER II

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	Mathematical Methods-II	20	80	100
2.	Quantum Mechanics-I	20	80	100
3.	Electrodynamics	20	80	100
4.	Electronics-II	20	80	100
LAB I	Electronics (Devices)	-	-	100
LAB II	Electronics (Circuits) Power supply, Amplifier, Oscillators, Modulation, Detection etc.	-	-	100
			TOTAL	**600**

SEMESTER III

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	Quantum Mechanics II	20	80	100
2.	Statistical Mechanics	20	80	100
3.	Condensed Matter Physics I	20	80	100
4.	Electronics III	20	80	100
LAB I	Condensed Matter Physics	-	-	100
LAB II	Digital Electronics	-	-	100
			TOTAL	**600**

SEMESTER IV

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	Condensed Matter Physics II	20	80	100
2.	Nuclear Physics	20	80	100
3.	Atomic and Molecular physics	20	80	100
4.	Electronics IV	20	80	100
5.	Project	-	-	200
			TOTAL	**600**
			GRAND TOTAL	**2400**

SEMESTER-I
PAPER – I
MATHEMATICAL METHODS-I

UNIT - I

Vector Spaces and Matrices linear independence Bases; Dimensionality; Inner product; linear transformations; Matrices; Inverse; Orthogonal and unitary matrices; Independent elements of a matrix; Eigen values and eigenvectors; Diagonalization; Complete orthonormal set of functions.

UNIT - II

Special Functions; Solution by series expansion; Legendre Polynomial Generating function, recursion relations; Rodrique formula, orthogonal properties, Associated Legendre polynomials; Recurrence formulae and orthogonal properties,
Laguerre Polynomial Generating function, recursion relations; Rodrique formula, orthogonal properties, Associated Lagueree differential equation and polynomial.

UNIT - III

Bessel's Differential equations, First and Second kind, Recurrence formulae and generating function for J_n (x), Jacob! Series Bessel's Integrals, orthonormality of Bessel's functions, spherical Bessel's function: Recurrence relation and orthogonality.
Hermite Differential equation and polynomials, generating function, Recurrence relation, Rodrigue formula, orthogonality.

UNIT-IV

Integral Transforms, Laplace transform; first and second shifting theorems; Inverse LT by partial fractions; LT of derivative and integral of a function.
Fourier series; FS or arbitrary period; Half-wave expansions; Partial sums; Fourier integral and transforms; Dirac delta function, three dimension delta function.

Text and Reference Books:

1. Mathematical Methods or Physics, by G Arfken
2. Matrices and Tensors for Physicists, by AW Joshi
3. Advanced Engineering Mathematics, by E Kreyszig
4. Special Functions, by ED Rainville
5. Special Functions, by W W Bell
6. Mathematical Method for Physicists and Engineers. By KF Reilly, M P Hobson and S J Bence
7. Mathematics for Physicists, by Mary L Boas

SEMESTER I
PAPER II
CLASSICAL MECHANICS

UNIT-I

Conservation Principles, Mechanics of particle conservation Principles for system of particles. Constrained motion constraints and degrees of freedom generalised coordinates, Generalised Notations (i) Generalised Displacement , velocity , Acceleration, momentum force and potential , [imitations of Newton's laws.

D'Alemberts Principle, Lagranges equations form D'Alemberts principle. Application of Lagrange's equation of motion (i) Linear Harmonic oscillator (ii) Simple pendulum (iii) spherical pendulum (iv) Isotropic oscillator (v) Atwood's Machine, conservation of linear momentum angular momentum and energy in Lagrangian formulation Lagrange's equation for nonholonamic system procedure to eliminate consideration of Ignorable coordinates the Routhian function.

UNIT - II

Variational Principle, calculus of variation, some techniques of calculus of variables , Euler Lagrange differential equation. Hamilton variational principle Deduction of Hamilton's Principle from D'Alemberts principle. Deduction of Newton's second law of motion from Hamilton's Principle. Deduction of Lagrange's equations of motion from Hamilton's Principle for conservation and for non conservative systems Non conservative forces. Dissipative system, Rayleigh's Dissipation function, Lagrangian for a charged particle in an electromagnetic field.

UNIT - III

Hamiltonian formulation of mechanics: Phase space and the motion of the system, Hamiltonian function, Hamilton's canonical equation of motion. Physical significance of H Deduction of Canonical equation from variational principle.Hamilton's canonical equations of motion in different coordinate systems. Application of Hamilton equation of motion (i) Simple pendulum (ii) compound pendulum (iii) Two dimensional Isotropic Harmonic oscillator (iv) Linear Harmonic oscillator (v) Particle in central field of force. Hamiltonian for a charged particle in an electromagnetic field .Principle of least action statement and its proof.

UNIT - IV

Canonical or constant transformation, its advantage example of canonical transformation, necessary and sufficient condition for a transformation to be canonical, Infinitesional contact transformations. Hamilton-Jacobi partial differential equation for Hamilton's Principle function. Solution of Harmonic oscillator problem by Hamilton-Jacobi method. Hamilton- Jacoby theory. Poisson Bracket: Definition and properties. Invariance of Poisson-Brackets with respect to canonical transformation, Equations of motion in Poisson bracket form Jacoby identity. Infinitesimal contact transformations interpretation in terms of Poisson Brackets. The angular momentum and Poisson Bracket Lagrange's Brackets: definition & Properties, Relation with Poisson Brackets.

Text and Reference Books:

1. Classical mechanics. H. Goldstein
2. Principle of mechanics - Synge and Griffith
3. Classical mechanics - Gupta Kumar, Sharma
4. Classical mechanics of particles and rigid body- Kiran C. Gupta

SEMESTER I
PAPER III
NUMERICAL METHOD AND C-PROGRAMMING

UNIT-I

Problem analysis and solving scheme. Computational procedure, programming outline, flow chart. Branching and looping writing. Character set, constants, (numeric string) variables (numeric string) rules for arithmetic expressions and hierarchy of operators, rational expressions, logical expressions, and operators, library functions. Identifiers, qualifiers, define statements, value Initialized variables, operators, and expressions. Operator precedence and associativity. Scan with specifier, search set arrangements and suppression Character, format specifier for scan.

UNIT-II

Control structure, If statement, if else statement, multi-way decision, compound statement.

Loops: for loop, while loop, do while loop, break statement, compound statement continue statement, go to statement

Function: function main , function accepting more than one parameter, user defined and library function concept associatively with functions, function parameter, return value, recursion comparison.

Arrays, strings, multidimensional array, array of strings function in string

UNIT-III

(Without Programming)

Method for determination of zeroes of linear, non linear, algebraic equations, and transcendental equations and their convergence.

Solution of simultaneous linear equations, Gaussian elimination pivoting, iterative method matrix inversion.

Eigen values and Eigen vectors of matrices. Power and Jacobi method, curve fitting polynomial least squares

UNIT-IV

(Without Programming)

Finite deference interpolation with equally spaced and unequally spaced points, Numerical differentiation and Integration, Newton cote's formula, Monte Carlos evaluation of Integral

Numerical solution of ordinary differential equation. Euler and Runga Kutta methods. Predictor corrector method.

Text and Reference Books:

1. Sastry: Introductory methods of numerical analysis
2. Vetterming, Teukolsky press and Flannery: Numerical Recipes
3. Let Us C: Yashwant Kanitkar
4. Programming in C: E. Balaguruswami.
5. Numerical Methods: P.Kandasamy
6. Computer oriented numerical methods: Rajaraman

SEMESTER I
PAPER IV
ELECTRONICS - I

UNIT- I

Transistors: Bipolar Junction transistor (BJT) - Different methods of b'astng. Thermal stabilization, stability factor, h- parameters, Feedback in amplifiers. Advantages of negative feedback, Principle of oscillators.

Junction Field Effect Transistor (FET) - N channel and P channel FET, Working principle, static and dynamic characteristic curves, pinched off voltage, Coefficient of FET, and relation between different coefficients.

Metal Oxide Field Effect Transistor (MOSFET) - DE MOSFET and E-MOSFET-construction and working principle, static and dynamic characteristics.

Uni-junction transistor (UJT) - basics structure, working principle. Voltage - Current characteristics and important parameters.

UNIT -II

MIS Diode: Introduction, Energy band diagram, accumulation, depletion and inversion condition concept of surface space charge, surface potential, surface capacitance, Ideal MIS curves.

MOS diode: structure, Ideal MOS, surface depletion region, Ideal MOS curves, Si-$Si0_2$ MOS diode-(real case) interface trapped charge, oxide charges.

Charged Couple Device (CCD): Basic structure, working principle, charge transfer with clock voltage.

UNIT - III

Microwave devices: Tunnel Diode - Introduction, Definition, Tunneling Phenomenon, Energy band Structure, Volt-Ampere Characteristics, Negative Resistance of tunnel diode (Characteristics of tunnel diode)

Transfer Electron Devices: Transfer Electron Effect, Gun Diode- Introduction and characteristics.

Backward Diode: Introduction and Characteristics.

IMPATT Diode: Introduction, Structure, Principle of operation, Static and Dynamic Characteristics.

UNIT - IV

Modulation : Definition , Types of Modulation, Mathematical expression of modulation, Percentage of modulation, Amplitude modulation, Generation of Amplitude modulation, Demodulation, Demodulation of Amplitude modulated wave, side bands, band width, DSBSC modulation, Generation of DSBSC waves. SSB modulation, Generation and Detection of SSB waves,

Multiplexing: Frequency division multiplexing (FDM)

Text and Reference Books:

1. Principles of Electronics - V.K. Mehta, Rohit Mehta (S.Chand & Company Ltd.)
2. Basic Electronics (Solid state) - B.L. Theraja (S. Chand & Company Ltd.)
3. Electronic Devices and Circuits - Jacob Millman, Christos C. Halkias (Tata McGraw Hill)
4. foundation of Electronics - D. Chattopadhyay, P.C. Rakshit, B. Saha, N. N. Purkait.
5. Hand Book of Electronics - Gupta Kumar (Pragati Prakashan)
6. Physics of semiconductor Devices - S.M. Sze (Wiley Eastern Ltd.)

SEMESTER I

LAB. – I

Time: 5 Hrs. **Total Marks – 100**

1.	**Experiment**	**60**
2.	**Viva Voce**	**20**
3.	**Sessional**	**20**

LAB.-II

Time: 5 Hrs. **Total Marks – 100**

1.	**Experiment**	**60**
2.	**Viva Voce**	**20**
3.	**Sessional**	**20**

SEMESTER II
PAPER I
MATHEMATICAL METHODS- II

UNIT- I

Tensors, Definition of Tensor, contra variant and covariant tensors, the algebra of tensor, Quotient law, Symmetric & antisymmetric tensors, invariant tensors, associate tensors, conjugate tensors, metric tensors, length of a vector, angle between tensors, Christophers symbol and their transformation law, equation of geodesies, Covariant differentiation of vectors and tensors of higher rank.

UNIT- II

Green's function: Non-homogeneous boundary value problem, Green's function for one dimensional problem, eigen function expansion of Green's function, method of constructing Green's function, Green's function for electrostatic boundary value problems and quantum mechanical scattering problem.

UNIT -III

Boundary value problems: Transverse vibration of a stretched string, D'Alembert solution, Two dimensional heat flow, rectangular membrane, Poisson's and Laplace equations, Solution of pde by Fourier and Laplace transform methods.

UNIT -IV

Function of Complex Variables, limit, continuity and differentiability , Analytic function, the necessary and sufficient condition for a function to be analytic , Cauchy-Riemann condition, Cauchy integral theorem, evaluation of line integral by indefinite integration, Cauchy's integral formula, Derivatives of an analytic function. Singularities of analytic functions, Residues and their Evaluation, Cauchy's residue theorem , Contour integration.

Text and Reference Books:

1. Mathematical Methods for Physics, by G. Arfken
2. Applied Mathematics for Engineers and Physicists by L.A. Pipes
3. Mathematical Physics by Gupta, Kumar, Rajput.
4. Advanced Engineering Mathematics, by E. Kreyszing.
5. Mathematics for Physicists, by Mary L. Boas
6. Differential Equations by Simmons.

SEMESTER II
PAPER-II
QUNATUM MECHANICS-I

UNIT - I

Inadequacy of classical mechanics; Schrodinger equation; Continuity equation; Ehrenfest theorem; Admissible wave functions; Stationary states.
One-dimensional problems, Potential wells and barriers; Schrodinger equation for Harmonic Oscillator

UNIT- II

Uncertainty relation of x and p, States with minimum uncertainty product; Representation of states and dynamical variables; Completeness of Eigen function; Direct delta function; bra and ket notation.
Matrix representation of an operator; unitary transformation. Harmonic Oscillator and its solution by Matrix Method.

UNIT - III

Angular momentum ; Commutation relationship , Eigen values, Spin Angular Momentum , Paulis Matrices , Addition of Angular Momentum, Clebsch-Gordon coefficients.
Central force problem; Solution of Schrodinger equation for spherically symmetric potentials; Hydrogen atom. Three-Dimensional Square Well Potential and Energy levels.

UNIT- IV

Time-independent perturbation theory; Non-degenerate cases; first order Perturbation with the example of an Oscillator Degenerate cases, Applications such as Stark effect. Zeeman Effect without electron spin, first order Stark Effect in Hydrogen.

Text and Reference Books:

1. L I Schiff, Quantum Mechanics (McGraw-Hill)
2. S Gasiorowicz, Quantum Physics (Wiley)
3. B Craseman and JD Powell, Quantum Mechanics (Addison Wesley)
4. A P Messiah, Quantum Mechanics
5. J J Sakurai, Modem Quantum Mechanics
6. Mathews and Vertkatesan Quantum Mechanics

SEMESTER II
PAPER III
ELECTRODYNAMICS

UNIT - I

Equation of continuity, Maxwell's equations (SI unit) and its derivation, Integral form of equation, Maxwell's equations in some particular cases, Electromagnetic energy: Poynting Theorem. The wave equation. Plane electromagnetic waves in free space. Plane electromagnetic waves in a non-conducting isotropic medium (i.e. Isotropic dielectrics). Plane electromagnetic waves in Anisotropic Non-conducting medium (Anisotropic dielectric), Plane electromagnetic waves in conducting medium. A simple model for dynamic conductivity. Propagation of electromagnetic waves in ionized gases.

UNIT -II

Boundary conditions at the interface of two media, Reflection and Refraction of electromagnetic waves at the interface of Non-conducting media,. Fresne"s equations experimental verification of fresnel's equations.
Reflection and transmission coefficients at the interface between two non conducting media, Brester's law and degree of polarisation, Total internal reflection , Propagation of Electromagnetic waves between parallel conducting planes. Wave guides. TM modes and TE modes,

UNIT -III

Postulates of Einstein's special theory of relativity, Galilean transformations. Lorentz's transformations and it's consequence, Transformation of differential operator, Invariance of D'Alembertian operator, Invariance of charge, Transformation of charge density, Electric field measured in different frames of reference, Minkowski space, concept of four vector, Lorentz transformation of space and time in four vector form, Transformation for charge and current density, Transformation of electromagnetic potential A and *$.* Lorentz condition in covariant form, Covariance or Maxwell field equation in terms of four vectors.

UNIT -IV

Electromagnetic vector and scalar potential, Lorentz Gauge, Lienard Wiechart potentials, the electromagnetic field of a uniformly moving point charge, Radiation from an accelerated charge at low velocity - Larmer's formula, Angular distribution of radiation emitted by an accelerated charge, Radiation damping, Cherenkov radiation, Radiation due to an oscillating electric dipole, electric quadra pole radiation, Radiation due to small current element, Radiation from linear antenna,

Text and Reference Books:

1. Classical electrodynamics by -J.D. Jackson
2. Electromagnetic theory and electrodynamics by Satyaprakash.
3. Classical theory of fields - by Landau L.D. and lifshitz
4. Electrodynamics of continuous media- Landau L.D. and lifshitz
5. Electromagnetic theory - Chopra and Agrawal.

SEMESTER II
PAPER IV
ELECTRONICS - II

UNIT - I

Radiative and non radiative transitions , Optical Absorption, bulk and thin film, photoconductive devices (LDR) , Emission spectra , Luminescent efficiency , method of excitation. Light emitting diode (LED): high frequency limit, effect of surface and indirect combination current, operation of LED, Visible LEDs and Infrared LEDs. Diode Laser (Condition for population inversion in active region, light confinement factor, optical gun and threshold current for lasing, Fabry Perrot Cavity Length for losing and the separation.

UNIT - II

Photo detectors: Photoconductor, equivalent circuit of photoconductor. Phototransistor. Bipolar phototransistor, photo - Darlington transistor, V-I characteristic of bilateral hetero structure phototransistor, Solar cells, Solar radiation, solar spectrum, ideal conversion efficiency, Energy band diagram of solar cell, IV characteristics of solar cell, PN junction solar cells, Hetero junction, Interface thin film solar cells.

UNIT - III

Basic Op-amp. Differential amplifier - circuit configurations, dual input, balanced output, differential amplifier -DC analysis, Ac analysis, inverting and non-inverting inputs, CMRR, Constant current bias level transistor.
Block diagram of a typical Op-amp. Analysis, open loop configuration, inverting and non-inverting amplifier, Op-amp. With negative feedback, Voltage series feedback, effect of feedback on closed loop gain input persistence output; resistance bandwidth and output offset voltage, voltage follower.

UNIT - IV

Practical Op-amp. Input offset voltage, Input offset current, total output offset voltage, CMRR frequency response, DC and AC amplifier summing scaling and averaging amplifiers instrumentation amplifier, integrator and differentiator
Oscillators' principles, oscillator types, frequency stability response, the phase shift oscillator. Wein bridge oscillator, Multivibrators, Monostable and Astable , Comparators, square wave and triangle wave generators.

Text and Reference Books:

1. Semiconductor Devices - Physics and Technology - S.M. Sze, Wiley, 1985
2. Introduction to Semiconductor Devices - M.S.Tyagi, John Wiley & sons
3. Electronic Devices and circuit theory - Robert Baylested and louis Nashdsky, PHI, New Delhi, 1991
4. Electronic Fundamentals and applications - John D. Ryder PHI, New Delhi, 1987.
5. Operational Amplifier and their applications - Subir Kumar Sarkar, S.Chand & Sons, New Delhil999.
6. Op-amps & linear integrated circuits- Ramakanth A. Gayakward, PHI, 2 Ed. 1991

SEMESTER II

LAB.-I

Time: 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

LAB.-II

Time: 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

SEMESTER III
PAPER I
QUANTUM MECHANICS-II

UNIT - I
Variational method, principle, Application to problems like H atom, He atom, harmonic oscillator. WKB method, connection formula, energy levels of potential well quantization rule, tunneling through potential barrier, application to decay.

UNIT - II
Time dependent perturbation theory, harmonic perturbation theory, harmonic perturbation, constant perturbation, Fermi's Golden rule, absorption and induced emission forbidden transitions, selection rule.

UNIT - III
Collision in 3d., scattering, scattering amplitude scattering cross section, Born approximation and its validity scattering by spherically symmetric potential. Application to screened coulomb potential, square well potential, Partial wave, phase shift, scattering by rigid sphere and square well.

UNIT - IV
Identical particle symmetric anti symmetric wave function, spin angular momentum. Relativistic quantum mechanics, Klein Gorden equation, Dirac equation for free particle, a and J3 matrices, charge and current densities free particle solution existence of spin and magnetic moment theory of positron, y matrices Covariant formulation.

Text and Reference Books:
1. Davidow : Quantum Mechanics.
2. L.I. Schiff : Quantum Mechanics.
3. Powerll and Craseman : Quantum Mechanics.
4. Ghatak and loknathan : Quantum Mechanics.

E- Content
1. https://Youtu.be/935zjVTKjwA by H.C. Verma
2. https://youtu.be/TcmGYe39XGO by N.Patel

SEMESTER III
PAPER II
STATISTICAL MECHANICS

UNIT - I

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. Microcanonical ensemble, phase space, trajectories and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

UNIT-II

Statistics of ensembles, statistics of indistinguishable particles, density matrix, Maxwell ~ Boltzmann, Fermi Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose . Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

UNIT-III

Cluster expansion for a classical gas, viriai equation of state, mean field theory of Ising model in 3, 2 and 1 dimension. Exact solution in one-dimension.

UNIT-IV

Thermodynamics fluctuation, fluctuation in energy, pressure, volume and enthalpy, one dimensional random walk, Brownian movement, Langevin theory, fluctuation dissipation theorem, Fokker-Plank equation, Onsager reciprocfty relation.

References:

1. Fundamentals of Statistical Mechanics- B.B.Laud
2. Statistical Mechanics- B.K.Agrawal and Melvin Eisner
3. Statistical Mechanics- Gupta and Kumar
4. Statistical Mechanics- K.T. Thorpe

E- Content

1. https://youtu.be/XIXQ38JnFoK by N.Patel

SEMESTER III
PAPER III
CONDENSED MATTER PHYSICS - I

UNIT - I

Crystalline and amorphous solids, unit cells and direct lattice. Two and three dimensional Bravais lattices, fundamental elements of symmetry, concept of point group and space groups, crystal planes and Miller indices, closed packed structures . Interaction of X rays, electrons and neutrons with matter, Elastic scattering from an perfect lattice , Laue's equation, Bragg's Law, Reciprocal lattice, Ewald's construction, Brillolin Zones,

UNIT - II

Defects or imperfections in crystals and their classification, Point defects, Schottky and Frenkel defects, vacancies, interstitical and colour center in ionic crystals, their types and production, line defects or dislocations. Edge and Screw dislocations, Burger Vectors, the role of dislocations in Plastic deformation and crystal growth.

UNIT - III

Electron's in a periodic lattice, Bloch theorem, Kron - Panny model, Band theory, Classification of solids, effective mass, Tight bonding, cellular and pseudo potential methods, Fermi surface and its construction, de Haas von Alfen effect, cyclotron resonance, magnetoresistance , quantum Hall Effect.

UNIT - IV

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Curie-Weiss law for susceptibility, Ferri and Antiferromagnetic order, Doman's and Bloch wall energy. Spin waves and magnoins , susceptibility below Neel temperature.

Text and Reference Books:

1. Kittel: solid state physics
2. Azroff: Introduction to solids
3. Varma and Shrivastava: Crystallography for solid state Physics
4. Singhal: solid state physics
5. Ziman: Principal of theory of solids
6. Ascrroff and mermin: solid state physics
7. Madelung : Introduction to solid state theory
8. Huong: Theoretical solid state physics
9. Omar: Elementary solid state physics
10. Kittel : Quantum theory of solids

E- Content

1. https://youtu.be/_Ckh-60B6LY by N.Patel

SEMESTER III
PAPER IV
ELECTRONICS - III

UNIT -I

Number system : Decimal, Binary, Octal and Hexadecimal Number System with mutual conversion, BCD addition and subtraction, 1's and 2's compliments, multiplication & division BCD code (8421), Excess -3 code, gray code, binary to gray code and gray code to binary code conversion.

Logic gates: Positive and negative logic, Basic gates, Universal building block. Basic laws of Boolean Algebra, De-Morgan's Theorem, two, three and four variable K-Map, mapping and minimization of SOP and POS expressions, pairs, quads, octet, overlapping, Rolling, concepts of Don't care condition.

UNIT - II

Ex-OR gate, Ex-NOR gate circuitry, Half adder, Full adder, binary parallel adder, Serial adder, Half Subtracter, Full Subtracter, 1's complements Subtracter circuit and 2's complements Subtracter circuit.

Digital logic Families: Introduction, Basic concepts of RTL, DTL, TTL, ECL and CMOS logic.

Decoder: 2 line to 4 line decoder, 1 of 16 decoder, BCD to decimal decoder, BCD to seven segment decoder, Encoder: decimal to BCD encoder.

Multiplexer: 2-input, 4-input, 16 input Multiplexer, DeMultiplexer : 1 line to 2 line , 1 line to 4 line and 1 line to 16 line DeMultiplexer.

UNIT - III

Flip-flop and timing diagram, RS flip-flop using NOR gate, RS flip-flop using NAND gate, Clocked RS flip-flop, D- latch flip-flop, Preset and Clear, JK flip-flop, Positive and negative edge triggered flop-flops., JK Master Slave flip-flop.

Counters: Binary ripple counter, up counter, down counter, decade counter and Ring counter and time diagram

Registers: Parallel and shift Register, Scaling, PIPO, SIPO, PISO, SCSI Bi-directional shift Register, Application of shift register.

UNIT - IV

Digital to analog converter and Analog to Digital converters : D/A converters using binary weighted resistor network and R-2R ladder Network; Counter type A/D converter, Successive approximation A/D converter and dual slope converters , applications of DACs and ADCs.

Intergraded Circuit: Introduction, Technology, Advantages and disadvantages, Basic technology of monolithic IC_r Basic processes used in monolithic technology, Fabrication of components on monolithic 1C, 1C packing, symbol and scale of Integration.

Text and Reference Books:

1. Digital Principles and applications - Malvino and Leach, Tata McGraw Hills, New Delhi,
2. Digital and Analogue Technique- Navneet Gokhale and Kale, Kitab Mahal
3. Hand Book of Electronics - Gupta and Kumar, Pragati Prakashan, Meerut, 2008
4. Digital integrated Electronics _Taub and Schilling, McGraw International Edition,
5. Fundamentals of Digital Circuits - A.Anand Kumar, Prentice Hall of India, New Delhi.

SEMESTER III

LAB.-I

Time: 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

LAB.-II

Time: 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

SEMESTER IV
PAPER I
CONDENSED MATTER PHYSICS - II

UNIT - I
Superconductivity, critical temperature, persistent current, Meissner effect and flux penetration, type I and type II superconductors, thermodynamics of superconducting transitions, London's equations, Interaction of electrons with acoustic and optical phonon, Cooper pairing due to phonons, BCS theory of superconductivity (qualitative).
Manifestation of energy gap in superconductors, superconducting tunneling, A.C./D.C. Josephson effect, high temperature superconductivity (elementary).

UNIT - II
Polarization, depolarization field, local electric field at an atom, Lorenz field, dielectric constant and polarizabflity, Electronic polarizability, Ionic and orientational poiarizability, Debye equation for gases, the complex dielectric constant, dielectric relaxation time, Normal and anomalous dispersion, classical theory of electronic polarizability.
Ferro electric crystal, classification, ferro-electric domains, structural phase transition, Landau theory of phase transition, first and second order phase transition, anti Ferro electricity.

UNIT - III
Energy bands in semiconductor, Intrinsic and Extrinsic semiconductors, Drift velocity, mobility, carrier concentration and Fermi level for intrinsic and extrinsic semiconductors. Electrical conductivity of semiconductors, semimetals.
Elementary ideas of nano structure: Defination, properties, different methods of preparation, applications.

UNIT - IV
Interatomic forces and lattice dynamics of simple metals, ionic and covalent crystals, lattice dynamics of linear monoatomic and diatomic lattices, optical and acoustical modes.
Quantization of elastic waves/ phonons, momentum of phonons, inelastic neutron scattering by phonons, Anharmonicity, thermal expansion, lattice thermal conductivity.

Text and Reference Books:
1. Kittel: solid state physics
2. Azroff: Introduction to solids
3. Varma and Shrivastava: Crystallography for solid state Physics
4. Singhal: solid state physics
5. Ziman: Principal of theory of solids
6. Ascrroff and mermin: solid state physics
7. Madelung : Introduction to solid state theory
8. Huong: Theoretical solid state physics
9. Omar: Elementary solid state physics
10. Kittel : Quantum theory of solids

SEMESTER IV
PAPER II
NUCLEAR PHYSICS

UNIT I

Nuclear Decay: α decay: Measurement of α particles energies, α particle spectra, Geiger Nuttal law, barrier penetration applied to α decay,

β decay: shape of β spectrum, neutrino hypothesis, detection of neutrino, Fermi theory of β decay (kurie plot, mass of neutrino, half lives), Allowed and forbidden transitions, selection rules.

UNIT II

Nuclear Reactions and Energy:

Conservation laws, Q equation, theories of nuclear reactions, partial wave analysis, compound nucleus: formation and breakup, resonance scattering and reactions.

Neutrons released in fission process; cross sections, nuclear chain reactions, nuclear reactor, four factor formula, critical size of reactor, General aspect of reactor design. Fusion, thermonuclear energy, prospect of controlled fusion energy.

UNIT III

Counters and Accelerators

Gas filled counter, solid state counter, scintillation counters, neutron detection.

Accelerators: Cyclotron, linear accelerators, betatron, electron synchrotron, proton synchrotron.

UNIT IV

Elementary Particles

Classification of elementary particles, basic particle interactions, conservation laws, invariance under parity, CP, time, CPT, Electron and positron, proton and antiproton, neutrino and antineutrino, mesons and hyperons: (their masses, decay modes and reactions) elementary particle symmetry [SU(2), SU(3)]. Quark theory.

Text and Reference Books:

1. Nuclear Physics, Ray and Nigam (Wiley Eastern ltd)
2. Nuclear Physics, I Kaplan (Narosa)
3. Introduction to nuclear Physics, H.A. Enge (Addison Wesley)
4. Concepts of Nuclear Physics, B.L.Cohen (TMGH)

E- Content

1. https://youtube.com/playlist?list=PLob6maW-5d1funUXykaaDoJpjEBOpTDF9

SEMESTER IV
PAPER III
ATOMIC AND MOLECULAR PHYSICS

UNIT-I

Spectra of hydrogen and hydrogen like atoms, Reduced mass of electron, Variation of Rydberg constant, Sommer feld's elliptic orbit, Relativistic corrections for energy levels of hydrogen atom, Space quantization, Pauli's Vector atom model, four quantum numbers, Spectral terms arising from *(s* coupling, s, p, d, f notation, selection rules.
Spectra of alkali atoms, Spin orbit interaction and fine structure in alkali spectra, screening constant for alkali spectra, penetrating and non penetrating orbits,

UNIT -II

Spectra of Helium, Alkaline earth atoms, Singlet -Triplet series, L S and J J coupling, Interaction energy.
Continuous X-ray spectrum, Dependence on voltage, Duane and Hunt's law, Characteristics X-ray, Mosle'y law, Doublet Fine structure of X-ray spectra.
Effect of magnetic field on energy levels (mono-valent atoms), Gyromagnetic ratio for orbital and spin motion, vector model, Lande g-factor, weak and strong field effect, (normal and anamolous zeeman effect, Paschen Back effect). Stark effects.

UNIT -III

Line broadening mechanism.
Electron spin resonance, Nuclear magnetic resonance.
Types of molecules, Diatomic linear symmetric top, asymmetric top molecules, Energy levels, selection rules, spectra of symmetric top and asymmetric top molecules.
Rotational energy and spectra of diatomic molecules as rigid rotor and non rigid rotor, selection rule, internuclear distance, isotope effect.

UNIT -IV

Vibrational energy of diatomic molecule, Energy levels, spectrum, Anharmonicity of molecular vibration, Energy levels, spectrum, isotope effect, force constant, Morse potential energy curve, dissociation energy.
Molecule as vibrating rotor, vibration rotational spectra of diatomic molecule, selectio_n rules.
Electronic band system sequences, progression, Frank Condon principle, Born-Oppenheimer approximation, P, Q and R branches, I R spectrometer.

1. H.E. White Introduction to atomic physics
2. Barrow Introduction to molecular physics
3. G.Herz berg Molecular spectra and molecular structure
4. H.Kuhn Atomic spectra
5. Walker and straugh Spectroscopy Vol I,II,III.

E- Content

1. https://youtu.be/SCmtEhGVhsm by N.Patel

SEMESTER IV
PAPER IV
ELECTRONICS- IV

UNIT - I
Microprocessor & Micro Computers:-Evolution of Microprocessor, Internal Microprocessor, Architecture, Architecture of digital Computer: -
Memory: - Semiconductor memories (RAM, ROM, PROM, EPROM, Shift register). Magnetic Memory: - Floppy disks, Hard disks, Optical Disks, Magnetic Bubble Memory.
Networking: Local Area Networking (LAN) , LAM topology (Bus, Star, Ring) .

UNIT - II
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.
Time Diagram: Opcode Fetch Cycle, Memory read, I/O Read, Memory write, I/O Write.

UNIT - III
Addressing Modes: Direct Addressing, Register addressing, Register Indirect Addressing, Immediate Addressing, Implicit Addressing.
Instruction set of 8085 : Data transfer group, Arithmetic group. Logical group.
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, Shift of 8-bit number of left by one bit and two bit , Shift of 16-bit number left by one and two bit.

UNIT - IV
Optical Fibers: Introduction, Structure, Classification, Refraction and Snell's law, Total internal refraction, Light propagation through and optical fiber, Acceptance angle for incident ray, Numerical Aperture, number of modes and cut-off parameter, single mode propagation, comparison of step and graded index fiber.
Types of Optical Fiber : HPSUU, HPSIR, Halide fiber
Optical fiber cables: Multifibre cable, Splicing and connectors.
Advantage and Disadvantage of optical fiber.

Text and Reference Books:
1. Fundamental of microprocessor and microcomputer- B. Ram, Dhanpat Rai Publication, New Delhi
2. Introduction to microprocessor- Aditya Mathur, Tata McGraw Hills, New Delhi
3. Microprocessor Architecture, programming and application with 8085/8086- Ramesh S. Gaonkar Wiley Eastern Ltd. 1987.
4. Optical Fibres and Fibre Optic Communication Systems- Subir Kumar Sarkar (S.Chand & company Ltd.)
5. Optical Fiber Communications (Principle and Practice) John M. Senior Prentice Hall of India Pvt. Ltd.

SHAHEED NANDKUMAR PATEL VISHWAVIDYALAYA RAIGARH (C.G.)

SEMESTER SYLLABUS

M.sc. PHYSICS

SEMESTER IV

PROJECT WORK

TOTAL MARKS – 200

The project work should be related to the field of the physics. This may be either theoretical or experimental. In the theoretical project work, the student should submit dissertation on any scientific/natural event, contemporary development in the field of physics or any new idea for research work. The project report should include declaration by the candidate, certificate by supervisor, Acknowledgement, title and introduction along with the following points.

1. Introduction
2. Review of literature
3. Materials/content and methods
4. Results and discussion
5. Summary
6. Bibliography

Last date of submission of project report : as per ordinance.

Evaluation of project : Evaluation of the project work of semester system of all the candidates of colleges will be held at EXAMINTATION CENTER.