Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan
Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. I Sem.**
Name of teacher – **Dr. Ugendra Kumar Kurrey**
Course type: **Theory** Course Title: MATHEMATICAL PHYSICS

METHODS OF DELIVERY

- Chalk and talk method
- Problem Solving
- Collection of projects
- Group discussion
- Test
- Notes

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Vector space and Matrices, Linear independence, Bases, dimensionality, Inner product, Linear transformation, matrices, Inverse, Orthogonal and Unitary matrices, Independent element of a matrix, Eigen values and Eigen Vectors, Diagonalization, Complete orthonormal sets of functions.	10
August	Unit-2	Complex Variables: Cauchy- Riemann condition, analytic functions, Cauchy's theorem, Cauchy integral formula, Laurent series, singularities, residue theorem, contour integration, evaluation of definite integrals, problems.	20
September	Unit-3	Differential equations, first and second order with constant coefficients, second order linear ODEs with variable coefficients, series expansion, nonhomogeneous differential equations and Green's functions.	20
October	Unit – 4	Special functions, Legendre, Bessel, Hermite and Laguerre functions with their physical applications, generating functions, orthogonality conditions, recursion relations,	15
November	Unit - 5	Integral transforms, Fourier integral and transforms, inversion theorem, Fourier transform of derivatives, convolution theorem, Laplace Transform(LT), LT of Derivatives, Inverse LT, Fourier series; properties and applications, discrete Fourier transform.	15

Remark:–
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Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. I Sem.**

Name of teacher – **Mr. Manoj Sahu**

Course type: **Theory** Course Title: CLASSICAL MECHANICS

METHODS OF DELIVERY

- Chalk and talk method
- Problem Solving
- Collection of projects
- Group discussion
- Test
- Notes

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Preliminaries, Newtonian mechanics of one and many particle systems, Conservation laws, Constraints & their classification, Principle of virtual work, Generalized coordinates, D'Alembert's principle and Lagrange's equations, Velocity-dependent potentials and dissipation function, Simple applications of the Lagrangian formulation, Hamilton's principle, Lagrange's equations from Hamilton's principle, Conservation theorems and Symmetry properties, Energy function and the conservation of energy	10
August	Unit-2	The Hamiltonian formulation of mechanics, Legendre transformations and the Hamilton's equations of motion, Cyclic coordinates and Conservation Theorems, Hamilton's equations from Hamilton's principle, The principle of least action, Simple applications of the Hamiltonian formulation.	20
September	Unit-3	Canonical transformations with examples, The harmonic oscillator, Poisson's brackets, Equations of motion and conservation theorems in the Poisson Bracket formulation. Hamilton-Jacobi (HJ) theory: The HJ equation for Hamilton's principal function, Harmonic oscillator as an example of the HJ method, The HJ equation for Hamilton's characteristic function, The action□angle variables	20
October	Unit – 4	The Central force: Two-body central force problem and its reduction to the equivalent one-body problem, The equations of motion and first integrals, The equivalent one-dimensional problem and classification of orbits, The differential equation of the orbit, Closure and stability of orbits, The Kepler problem, Scattering in a central force field: Rutherford scattering.	15
November	Unit - 5	Rigid body dynamics, The Euler angles, Euler's theorem on the motion of a rigid body, Rate of change of a vector, The Coriolis force, Angular momentum and Kinetic energy of motion about a point, The Euler equations of motion of rigid bodies. Formulation of the problem of small oscillations, The Eigen-value equation and the principal axis transformation, Frequencies of free vibration and normal coordinates, Free vibration of linear triatomic molecule.	15

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Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. I Sem.**

Name of teacher – **Mr. Manoj Sahu**

Course type: **Theory** Course Title: ELECTRODYNAMICS & PLASMA PHYSICS

METHODS OF DELIVERY

- Chalk and talk method
- Problem Solving
- Collection of projects
- Group discussion
- Test
- Notes

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Maxwell's equations, vector and scalar potentials and the wave equation, Gauge transformations, Lorenz gauge, Coulomb gauge, Green function for the wave equation, four-vectors, mathematical properties of the space-time in special relativity, matrix representation of Lorentz transformation, covariance of electrodynamics, transformation of electromagnetic fields.	10
August	Unit-2	Radiation by moving charges, Lienard-Wiechert potential and fields for a point charge, total power radiated by an accelerated charge- Larmor's formula and its relativistic generalization, angular distribution of radiation emitted by an accelerated charge, radiation emitted by a charge in arbitrary extremely relativistic motion, distribution in frequency and angle of energy radiated by accelerated charge.	20
September	Unit-3	Bremsstralung: emission from single-speed electrons, thermal Bremsstralung emission and absorption, Synchrotron radiation: spectrum of synchrotron radiation, spectral index for power law electron distribution, transition from Cyclotron to Synchrotron emission, Cherenkov radiation	20
October	Unit – 4	Plasma: definition, Debye shielding phenomenon and criteria for plasma, motion of charged particles in electromagnetic field; Uniform E & B fields, Electric field drift, Non-uniform magneto static field, Gradient B drift, Parallel acceleration and magnetic mirror effect, Curvature drift, adiabatic invariants.	15
November	Unit - 5	Elementary concepts of plasma kinetic theory, the Boltzmann equation, the basic plasma phenomena, plasma oscillations. Fundamental equations of magneto□hydrodynamics (MHD), Hydrodynamics Waves; Magneto sonic and Alfven waves, Magnetic viscosity and magnetic pressure, plasma confinement schemes.	15

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Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. I Sem.**

Name of teacher – Dr. Ugendra Kumar Kurrey & Kavita Verma

Course type: **Theory** Course Title: ELECTRONICS

METHODS OF DELIVERY

- Chalk and talk method
- Problem Solving
- Collection of projects
- Group discussion
- Test
- Notes

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Operational Amplifier- Basic Op.Amp. Differential amplifier, the emitter coupled Difference Ampl, Transfer characteristics of a Diff. Ampl., an example of an IC Op.-Amp., off set error voltage and currents, measurement of Op.-Amp. Parameters, frequency response of Op-amp.Linear analog systems: Basic Op.-Amp. Applications, Analog integration and differentiation, Electronic analog computation, Non-linear analog systems: Comparators, Waveform generators.	10
August	Unit-2	Combinational Logic –Basic logic gates: OR, AND and NOT gates, NOR and NAND gates, Boolean algebra, DeMorgan's theorems, exclusive OR gate, characteristics of logic families, saturated logic families: RTL, DCTL, non□saturated logic families: TTL and ECL, Unipolar logic families.	20
September	Unit-3	Sequential Logic, Flip-flops: RS Flip-flop, level clocking, Edge triggered Flip Flops, D Flip flops. JK Flip-flops, J.K.master slave Flip-flops, Registers: buffer, shift and control shift registers, counters: ripple synchronous & ring counters, tri-state registers, Buffer: controlled buffer Register, Bus organized structure, Latch, multiplexer, Demultiplexer, decoder, ALU Memories: RAM, ROM, PROM, EPROM, A/D and D/A converters..	20
October	Unit – 4	Microprocessors –basic introduction, pin diagram, working and instruction , Interfacing I/O devices, Introducing Interrupt lines :Stack, Push, Pop operation ,delay in servicing interrupts, multiply interrupts, location for interrupts .Introducing slow and fast data transfer, Status of microprocessor, interrupt pins, General purpose Register, flag Register, Increment/decrement register. Features of 8085 microprossor. Pin diagram of 8085, block diagram of 8085. CPU of a microprocessor, timing and control, system timings and interrupt timings of 8085, registers in 8085, interfacing memory and I/O devices- a preliminary ideas. Number system, Floating Point notation.	15
November	Unit - 5	Instructions set of 8085, types of instructions- Data transfer group, Arithmetic logic, branch group, stack I/O machine control group, addressing mode of Intel 8085, examples of Assembly language programs of 8085, summing of two 8-bit numbers to result a 16-bit number, summing two 16-bit number, multiplying two 8-bit number to result a 16-bit product, block transfer of data from one memory block to other, BCD to hexadecimal data, finding the largest number in a series	15

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

CLASS: **M.Sc. II Sem.** Name of teacher –Mr. Manoj Sahu

Course type: **Theory** Course Title: QUANTUM MECHANICS-I

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Inadequacy of classical mechanics, Planck's quantum hypothesis and radiation law, Photoelectric effect, De-Broglie's theory. Schrödinger equation, continuity equation, Ehrenfest theorem, admissible wave functions, stationary states, one-dimensional problems; potential well and barriers, Schrödinger equation for harmonic oscillator and its solution, uncertainty relations, states with minimum uncertainty product	10	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
February	Unit – 2	Superposition principle, general formalism of wave mechanics, representation of states and dynamical variables, commutation relationship, completeness and normalization of Eigen functions, Dirac-delta function, Bra & Ket notation, matrix representation of an operator, harmonic oscillator and its solution by matrix method, Heisenberg equation of motion.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
March	Unit – 3	Angular momentum in quantum mechanics, commutation relationships, Eigen values, Spin angular momentum, Pauli`s matrices, addition of angular momentum, Clebsch-Gordon coefficients	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
April	Unit –4, 5	Central force problem, spherically symmetric potentials in three dimensions, separation of wave equation, parity, three-dimensional square-well potential and energy levels, the hydrogen atom; solution of the radial equation, energy levels and stationery state wave functions, discussion of bound states, degeneracy. Time- independent perturbation theory, non-degenerate case, first order and second perturbations with the example of an oscillator, degenerate cases, removal of degeneracy in second order, Zeeman effect without electron spin, first-order Stark effect in hydrogen, perturbed energy levels, correct Eigen function, occurrence of permanent electric dipole moments.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

CLASS: **M.Sc. II Sem.** Name of teacher –**Mr. Manoj Sahu**

Course type: **Theory** Course Title: STATISTICAL MECHANICS

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Foundation of statistical mechanics: macroscopic and microscopic states, contact between statistical and thermodynamical quantities, physical significance of Ω(N, V, E), the classical gas, entropy of mixing and Gibb's paradox, phase space of classical system, Liouville`s theorem and its consequences, quantum states and phase space	10	• Use of ICT • Chalk and talk method • Test • Notes
February	Unit – 2	Elements of ensemble theory – A system in micro canonical, canonical, and grand canonical ensembles, partition functions, physical significance of statistical quantities, example of classical system, energy and energy-density fluctuations and mutual correspondence of various ensembles.	20	• Use of ICT • Chalk and talk method • discussion • Test • Notes
March	Unit – 3	Formulation of quantum statistics – Quantum mechanical ensemble theory, density matrix, statistics of various quantum mechanical ensembles, system composed of indistinguishable particles. Theory of simple gases –Ideal gas in various quantum mechanical ensemble, Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac distributions, statistics of occupation number	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
April	Unit –4, 5	Ideal Bose and Fermi gases -Thermodynamic behavior of an ideal Bose gas, Bose-Einstein condensation and, elementary excitations in liquid helium II, Thermodynamic behavior of an ideal Fermi gas, the electron gas, nonrelativistic and relativistic degenerate electron gas, theory of white dwarf stars. Statistical Mechanics of interacting systems – the method of cluster expansion for a classical gas, Virial expansion of the equation of state. Theory of phase transition – general remark on the problem of condensation, Fluctuations: thermodynamic fluctuations, Spatial correlation in a fluid Brownian motion: Einstein Smoluchowski theory of Brownian motion.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

CLASS: **M.Sc. II Sem.** Name of teacher – **Kavita Verma**

Course type: **Theory** Course Title: ELECTRONIC & PHOTONIC DEVICES AND OPTICAL MODULATORS

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Special Bipolar devices: Thyristors- the four-layer diodes and their basic characteristics, Schottky diode, three terminal thyristor, Diac & Triac, SCR, UJT, Field controlled Thyristors.	10	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
February	Unit – 2	Unipotar Devices : JFET, MESFET and MOSFET, basic structure, working and device I-V characteristics, small signal equivalent circuit for Microwave performance Introduction to MIS and MOS diodes, charge coupled devices (CCDs), basic structure and working principle , MOSFET-basic device characteristics, types of MOSFET.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
March	Unit – 3	Special Microwave Devices: Tunnel diode and backward diode- basic device characteristics, IMPATT diodes and their static and dynamic characteristics, Transfer electron devices- transferred electron effect, Gunn diodes.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
April	Unit –4, 5	Photonic Devices: Radiative transitions, LEDs, Visible and infrared SC lasers; Photo detectors; Photo conductor, & Photodiode, Solar cells, Solar radiation and ideal conversion efficiency, p-n junction solar cells, Hetero junction. Interface thin film solar cells. Optical Modulators and Display Devices: Modulation of light- Birefringence, Optical activity, Electro-optic, Magneto-optic and Acoustic- optic effects, Materials exhibiting these properties, Non-linear optics. Display devices: Luminescence, Photo-luminescence, Electro-luminescence, Liquid crystal displays, Numeric displays.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan
Academic Year: 2023-2024

CLASS: **M.Sc. II Sem.** Name of teacher – **Dr. Ugendra Kurrey**
Course type: **Theory** Course Title: COMPUTATIONAL METHODS AND PROGRAMMING

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Methods for determination of zeroes of linear and nonlinear algebraic equations and transcendental equations, convergence of solutions. Solution of simultaneous linear equations, Gaussian elimination, pivoting, iterative method, matrix inversion.	10	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
February	Unit – 2	Finite differences, interpolation with equally spaced and unevenly spaced points, curve fitting, polynomial least squares and cubic spline fitting. Numerical differentiation and integration, Newton-Cotes formulae, error estimates, Gauss method.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
March	Unit – 3	Numerical solution of ordinary differential equations, Euler and Runge□Kutta methods, predictor-corrector method, elementary ideas of solutions of partial differential equations.	20	• Use of ICT • Chalk and talk method • Test • Notes
April	Unit –4, 5	Elementary information about digital computer principles, compilers, interpreters and operating systems (Windows/Linux) Fortran programming, flow charts, integers and floating point arithmetic, expressions, built in functions. Executable and non-executable statements, assignments, control and input□output statements, subroutines and functions; The statement functions, main features of functions and subroutines, subprogram, function subprogram, overall structure of FORTRAN program, external statement, subroutine subprogram, common statement, equivalence statement, operations with files-open and close statement, Format statements, field specifications.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan
Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. III Sem.**
Name of teacher –**Mr. Manoj Sahu**
Course type: **Theory** Course Title: QUANTUM MECHANICS –II

METHODS OF DELIVERY

1. Chalk and talk method
2. Problem Solving
3. Collection of projects
4. Group discussion
5. Test
6. Notes

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Variational method, expectation value of energy, application to excited states, ground state of He-atom, Zero point energy of one dimensional harmonic oscillator, Vander-waals interaction, the W.K.B. approximation, approximate solutions, asymptotic nature of the solution, solution near turning point, connection formulae, energy levels of a potential well and quantization rule.	10
August	Unit-2	Theory of scattering: differential and total scattering cross section, wave mechanical picture of scattering & the scattering amplitude, Green's functions and formal expression for scattering amplitude, The Born approximation and its validity, Partial wave analysis, asymptomatic behavior of partial waves and phase shifts, optical theorem, scattering by a square well potential, scattering by a hard sphere, scattering by a Coulomb potential.	20
September	Unit-3	Time-dependent perturbation theory, first order perturbation, Harmonic perturbation, Fermi`s Golden rule, Ionization of a H-atom, absorption and induced emission, Selection rules. Identical particles, symmetric and anti□symmetric wave function	20
October	Unit – 4	Relativistic quantum mechanics, formulation of relativistic quantum theory, the Klein-Gordon equation; plane wave solutions, charge and current densities, The Dirac equation for a free particle, matrices alpha and beta, Lorentz covariance of the Dirac equation, free particle solutions and the energy spectrum, charge and current densities.	15
November	Unit - 5	The spin of the Dirac particle, Dirac particle in electromagnetic fields and the significance of the negative energy state, Dirac equation Spin angular momentum, approximate reduction, spin –orbit energy, separation of equation, the hydrogen atom, classification of energy levels and negative energy states.	15

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. III Sem.**

Name of teacher – **Kavita Verma**

Course type: **Theory** Course Title: ATOMIC AND MOLECULAR PHYSICS

METHODS OF DELIVERY

1. Chalk and talk method
2. Problem Solving
3. Collection of projects
4. Group discussion
5. Notes
6. Test

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Quantum states of one electron atoms-atomic orbitals, Hydrogen spectrum, spin□orbit(l-s) interaction energy, fine structure of hydrogen spectrum including l-s interaction and relativistic correction, spectra of alkali elements, fine structure in alkali spectra, penetrating and non-penetrating orbits, intensity rules.	10
August	Unit-2	Pauli's principle, equivalent and non-equivalent electrons, ground state (basic level of different elements), two electron systems, interaction energy in L-S. and J-J. Coupling, Hyperfine structure, line broadening mechanisms (general ideas).	20
September	Unit-3	Normal and anomalous Zeeman effect, early discoveries and developments, vector models of one electron system in a weak magnetic field, magnetic moment of a bound electron, magnetic interaction energy, selection rules, intensity rules, Paschen - Back(PB) effect – principal series effect, Zeeman and PB effects in hydrogen, Stark effect- discovery, Stark effect in Hydrogen, orbital model, weak and strong effect in Hydrogen.	20
October	Unit – 4	Types of molecules: linear and diatomic molecules, symmetric top, asymmetric top and spherical top molecules. Rotational spectra of diatomic molecules: rigid rotator model, energy levels, Eigen functions, spectrum, comparison with observed spectrum and non-rigid rotator model, Intensities of spectral lines, microwave spectrometer, Raman spectrum; classical and quantum theory of Raman Effect, pure rotational Raman spectrum.	15
November	Unit - 5	Vibrational spectra of diatomic molecules: simple harmonic model, energy levels and spectrum, comparison with observed spectrum and anhormonic model, Vibrating rotators, Interaction of rotations and vibrations, fine structures and P-Q-R branches, IR spectrometer, Vibrational Raman spectrum, Vibrational rotational Raman spectrum.	15

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Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. III Sem.**

Name of teacher – **Mr. Manoj Sahu**

Course type: **Theory** Course Title: SOLID STATE PHYSICS-I

METHODS OF DELIVERY

1. Chalk and talk method
2. Problem Solving
3. Collection of projects
4. Group discussion
5. Notes
6. Test

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Energy bands: nearly free electron model, origin of energy gap and its magnitude, Bloch function, Kronig-Penny model, Wave equation of electron in periodic potential, restatement of Bloch theorem, crystal moment of an electron, solution of Central equation, Kronig-Penny model in reciprocal space, empty lattice Approximation, approximate solution near zone boundary, Number of orbitals in a band, metals and insulators.	10
August	Unit-2	The Extension Principle- The Zadeh's Effect of temperature on F-D distribution, free electron gas in three dimensions. Different zone schemes, reduced and periodic zones, construction of Fermi surfaces, nearly free electrons, electron, hole, open orbits, Calculation of energy bands, Tight binding, Wigner-Seitz, cohesive energy, pseudo potential methods. Experimental methods in Fermi surface studies, quantization of orbits in a magnetic field, de Haas van Alphen Effect, External orbits, Fermi surface of copper	20
September	Unit-3	Lattice dynamics in monoatomic and diatomic lattice: two atoms per primitive basis, optical and acoustic modes, quantization of elastic waves, phonon momentum, inelastic neutron scattering by phonons, Anharmonic crystal interactions-thermal expansion, thermal conductivity, thermal resistivity of phonon gas, umklapp processes, imperfections.	20
October	Unit – 4	Experimental survey: occurrence of superconductivity, Destruction of superconductivity by magnetic field, Meissner effect, heat capacity, energy gap, MW, and IR properties, isotope effect. Theoretical survey : thermodynamics of superconducting transition, London equation, Coherence length, Cooper pairing due to phonons, BCS theory of superconductivity, BCS ground state, flux quantization of superconducting ring, duration of persistent currents, Type II superconductors, Vortex states, estimation of Hc1 and Hc2, single particle and Josephson superconductor tunneling, DC/AC Josephson effect, Macroscopic quantum interference	15
November	Unit - 5	High temperature superconductors, critical fields and currents, Hall number, fullerenes ring. Band gap, equation of motion, physical derivation of equation of motion, holes, effective mass, physical interpretation of effective mass, effective masses of semiconductors Si and Ge, intrinsic carrier concentration, intrinsic mobility, impurity conductivity, donor and acceptor states, thermal ionization of donors and acceptors, thermo-electric effects.	15

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Signature of teacher Signature of H.O.D Signature of principal

Government ChandulalChandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

Name of department – **Physics** CLASS: **M.Sc. III Sem.**

Name of teacher – **Mr. Ugendra Kumar Kurrey & Kavita Verma**

Course type: **Theory** Course Title: IV (B) ELECTRONICS (Communication)-I

METHODS OF DELIVERY

1. Chalk and talk method
2. Problem Solving
3. Collection of projects
4. Group discussion
5. Notes
6. Test

Month	Title unit	Topic of lecture	No. of lectures
July	Unit – 1	Klystron ,magnetron & traveling wave tubes ,velocity modulation ,basic principal of two cavity klystrons & relex klystrons ,principle of operation of magnetrons ,helix traveling wave tubes .	10
August	Unit-2	Microwave wave guides & components (Wave modes) rectangular wave guides: solution of wave equation in rectangular coordinates, TE modes in rectangular wave guides, TM modes in rectangular wave guides, excitations of modes in rectangular wave guides. Circular wave guides: solutions of wave equation in Cylindrical coordinates, TE modes in Circular wave guides, TM modes in Circular wave guides, TEM modes in Circular wave guides, excitations of modes in Circular wave guides .	20
September	Unit-3	rectangular cavity resonator, circular –cavity resonator &semi –circular –cavity resonators Q- factor of a cavity resonator. Transferred Electrons devices (TEDs) Gunn effect diodes, principle of operation, modes of operations, read diodes, IMPATT diodes, TRAPATT diodes. Microwave communications: advantages of microwave transmission, loss in free space, propagation of microwave, components of antennas used in MW communication system.	20
October	Unit – 4	Radar system: Radar block diagram & operation, radar frequencies ,pulse consideration, radar range equation ,derivation of radar range equation ,minimum detectable single receiver noise ,signal to noise ratio ,integration of radar pulses ,radar cross sections ,pulse reflections frequency ,antenna ,parameters ,systems losses & propagation losses ,radars transmitters receivers ,antennas displays.	15
November	Unit - 5	Orbital Satellite, geostationary satellite, orbital patterns ,look angles ,orbital spacing , satellite system ,link modules.	10

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Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

CLASS: **M.Sc. IV Sem.** Name of teacher – Mr. Manoj Sahu

Course type: **Theory** Course Title: NUCLEAR AND PARTICLE PHYSICS

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Nuclear Interactions: Nucleon-nucleon interaction, Two-nucleon system, The ground state of the deuteron, Tensor forces, Nucleon-nucleon scattering at low energy, Scattering length, Effective range theory, Spin dependence of nuclear forces, Charge independence and charge symmetry of nuclear forces, Iso-spin formalism, Exchange forces, Meson theory	10	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
February	Unit – 2	Reaction energetics: Q-equation and threshold energies, Reactions cross sections, Resonance: nuclear reactions, Formal reaction theory: Partial wave approach and phase shifts, Scattering matrix, Reciprocity theorem,	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
March	Unit – 3	Beta decay, Femi's theory, Shape of the beta spectrum, Total decay rate, Angular momentum and parity selection rules, Comparative half-lives, Allowed and forbidden transitions, Selection rules, Parity violation, Two component theory of neutrino decay, Detection and properties of neutrino Gamma decay, multiple transitions in nuclei, Angular momentum and Parity selection rules, internal conversion, nuclear isomerism.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
April	Unit –4, 5	Nuclear models: Liquid drop model, Bohr-Wheeler theory of fission, Shell Model, Experimental evidence for shell effects, shell model, Spin-orbit interaction and magic numbers, Analysis of shell model predictions, Magnetic moments and Schmidt lines, Collective model of Bohr and Mottelson. The fundamental interactions, Classification of elementary particles, Leptons and Hadrons, Symmetries, groups and conservation laws, SU(2) and SU(3) multiples and their properties, Quark model, Properties of Quarks, the standard model.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

Remark:–

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Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan
Academic Year: 2023-2024

CLASS: **M.Sc. IV Sem.** Name of teacher – **Dr. Ugendra Kurrey**
Course type: **Theory** Course Title: LASER PHYSICS AND APPLICATIONS

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Spontaneous and stimulated emission, Einstein's quantum theory of radiation, theory of some optical processes, coherence and monochromacity, kinetics of optical absorption, line broadening mechanism, Basic principle of lasers, population inversion, laser pumping, two & three level laser systems, resonator, Q-factor, losses in cavity, threshold condition, quantum yield	10	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
February	Unit – 2	Solid state lasers- the ruby laser, Nd:YAG laser, ND: Glass laser, semiconductor lasers – features of semiconductor lasers, intrinsic semiconductor lasers, Gas laser - neutral atom gas laser, He-Ne laser, molecular gas lasers, CO2 laser, Liquid lasers, dye lasers and chemical laser.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes
March	Unit – 3	Production of giant pulse -Q-switching, giant pulse dynamics, laser amplifiers, mode locking and pulling, Non-linear optics, Harmonic generation, second harmonic generation, Phase matching, third harmonic generation, optical mixing, parametric generation and self-focusing of light.	20	• Chalk and talk method • Test • Notes
April	Unit –4, 5	Multi-photon processes; multi-quantum photoelectric effect, Theory of two-photon process, three- photon process, second harmonic generation, parametric generation of light, Laser spectroscopy: Rayleigh and Raman scattering, Stimulated Raman effect, Hyper-Raman effect, Coherent anti-stokes Raman Scattering, Photo-acoustic Raman spectroscopy. drift and absolute rotation of the Earth, isotope separation, plasma, thermonuclear fusion, laser applications in chemistry, biology, astronomy, engineering and medicine. Communication by lasers: ranging, fiber Optics Communication, Optical fiber, numerical aperture, propagation of light in a medium with variable index, pulse dispersion.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

Remark:–
Teaching will be online /offline according to government/university/local administration instruction, notified time to reference to covid-19 Pandemic situation.

Signature of teacher Signature of H.O.D Signature of principal

Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan

Academic Year: 2023-2024

CLASS: **M.Sc. IV Sem.** Name of teacher – **Mr. Manoj Sahu**

Course type: **Theory** Course Title: SOLID STATE PHYSICS- II

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Dielectric function of the electron gas, Plasma optics, Dispersion relation for EM wave, Transverse optical modes in Plasma, Transparency of Alkali metals in the ultraviolet, Longitudinal Plasma oscillations, Plasmon, electrostatic screening and screened Coulomb potential, Mott metal-insulator transition, screening and phonons in metals, Polaritons, LST relation .	**10**	• Chalk and talk method • Test • Notes
February	Unit – 2	Maxwell's equations, polarization, macroscopic electric field, depolarization filed, E1;local electric field at an atom, Lorentz filed E2, fields of dipoles inside cavity E3; dielectric constant and polarizability, electronic polarizability; structural phase transition; ferro-electric crystals, classification; displacive transition, soft optical phonons, Landau theory of phase transitions, first and second order transition, antiferro-electricity, ferro□electric domain, piezoelectricity, ferro-elasticity, optical ceramics.	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test
March	Unit – 3	General ideas of dia- and para- magnetisms, quantum theory of paramagnetism, rare earth ions, Hund rule, iron group ions, crystal field splitting, quenching of orbital angular momentum, spectroscopic splitting factor, van vleck temperature dependent paramagnetism, Cooling by isentropic demagnetization, nuclear demagnetization, paramagnetic Susceptibility of conduction electrons	20	• Chalk and talk method • Test • Notes •
April	Unit – 4, 5	Ferromagnetic order, Curie point and exchange integral, temp dependence of saturation magnetization, saturation magnetization at absolute zero; magnons, quantization of spin waves, thermal excitation of magnons; neutron magnetic scattering, Ferrimagnetic order, Curie temp and susceptibility of ferrimagnets, iron garnets. Antiferromagnetic order, susceptibility below neel temp, antiferromagnetic magnons, ferromagnetic domains. Optical reflectance, excitons, Frenkel and Mott-Wannier excitons, Alkali Halides and Molecular crystals Defects: lattice vacancies, Schottkey and Frenkel point effects, colour centers, F and other centers, Line defect. Shear strength of single crystals, dislocations□edge and screw dislocations, Burger vectors, Stress fields of dislocations, low angle grain boundaries, dislocation densities, dislocation multiplication and slip, strength of alloys, dislocations and crystal growth, hardness of materials	20	• Use of ICT • Chalk and talk method • Collection of projects • Group discussion • Test • Notes

Remark:–

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Government Chandulal Chandrakar Art and Science College, Patan

DEPARTMENT OF PHYSICS

Teaching Plan
Academic Year: 2023-2024

CLASS: **M.Sc. IV Sem.** Name of teacher – Kavita Verma
Course type: **Theory** Course Title: IV (B) Electronics II (Communication)

Month	Title unit	Topic of lecture	No. of lectures	Methods of delivery
January	Unit – 1	Pulse modulation systems, Sampling Theorem, Low pass &Band pass signal, PAM- Channel BE for PAM signal, Natural Sampling, Plat-top sampling, Signal through holding, Quantization of signals, quantization error.	10	1. Chalk and talk method 2. Test 3. Notes
Februar y	Unit – 2	Digital modulation techniques PCM, Differential PCM, Delta modulation, Adaptive, delta modulation (CVSD). BPSK, DPSK, QPSK, PSK, QASK, BFSK, FSK, MSK	10	4. Chalk and talk method 5. Test 6. Notes
March	Unit – 3	Sources of noise, Frequency domain representation of noise, Effect of filtering on the probability density of Gaussian noise, Spectral component of noise, Effect of a filter on the power spectral density of noise, Superposition of noise, Mixing involving noise, binear filtering, Noise bandwidth, Quadrature component o f noise, Power spectral density of nc (t) ns (t) & their time derivatives.	10	1. Use of ICT 2. Chalk and talk method 3. Collection of projects 4. Group discussion 5. Test 6. Notes
April	Unit –4, 5	Data Transmission I Base band signal receiver, Probability of error optimum filter, White noise: Matched filter & probability of error, Coherent reception correlation, PSK, FSK, Non-Coherence detection on FSK, Differential PSK, QASK, Calculation of error probability for BPSK, BSFK, QPSK. Noise in pulse code & delta modulation system, PCM transmission, Calculation of quantization noise output signal power, Effect of thermal noise, output signal to noise ratio in PCM, DM, Quantization noise in DM, output signal power, DM output signal to quantization noise ratio, effect of thermal noise in delta modulation, output signal to niose ratio in DM	20	1. Use of ICT 2. Chalk and talk method 3. Collection of projects 4. Group discussion 5. Test 6. Notes

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