GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON

TEACHING PLAN

2022-2023

DEPARTMENT OF PHYSICS

Department of physics
Teaching Plan 2022-23
M.Sc. - 1st Semester
Subject :- Mathematical physics

S.No.	Month	Lecture
1.	July	**Vector space and matrices**: - Linear independence , Bases, Dimensionality, Inner product , Linear, transformation matrices, Inverse matrix , Orthogonal and Unitary matrices, Eigen values and Eigen Vector, Diagonalization , complete orthogonal sets of functions,
2.	August	**complex variable :** Analytic function, Cauchy-Riemann condition, Cauchy integral formula, analytic function, necessary and sufficient conditions, Cauchy- Reimann equation in polar, Laplace equation; Laplace equation; Harmonic function line integral of a complex function, Derivations analytic function, singularities of an analytic function with examples
3.	September	**Differential equation**: - second order linear ODEs with variable coefficients, Solution by series expansion ,non - homogeneous differential equation and solution by the method of Green's function with application, Solution of second order differential equation with constant coefficient, power series solution ; Frobeniu's method
4.	October	**Special function**: - Legendere , Bessel , Hermite and Laguerre function with their physical applications , Generating function, Orthogonality condition , Recursion relations
5.	November	**Integral Transforms**: - Laplace form integral transforms , Properties of Laplace transforms Laplace transforms , First and second shifting theorems with example , Inverse Laplace Transforms , LT of derivative and integral of a function . Fourier series , FS or arbitrary period , half wave expansions partial sums , Fourier integral and transforms, Laplace transform of periodic functions, inverse Laplace theorem: Fourier Mellin theorem: properties of inverse Laplace transform, Simple Applications of fourier transform; (i) Evaluation of integrals (ii) Solution of Boundary value problems
6.	December	revision

Department of physics

Teaching Plan 2022-23

M.Sc. 1st Semester

Subject:- Classical Physics

S.No.	Month	Lecture
1.	July	Newtonian mechanics of one and many Particle system , Conservation law , Constraints & their classifications , Work Energy theorem open system (with variable mass) Generalized coordinates
2.	August	generalized notations, Principle of vertual work , D' Alembert's Principle and Lagrange's equations Lagrangian for a charges particle in an electromagnetic field, deduction of Hamilton's principle from D' Alembert's Principle, Deduction of Newton's second law of motion from Hamilton's principle
3.	September	Deduction of a Lagrange's equation using variational principle for non-conservative system , Application of Lagrangian formulation , Simple pendulum , Jacobi Integral: Generalized coordinates and Moment Integrals of motion , symmetries of space and time with conservation law , Principle of least action , invariance under Galilean transformations rotating frames integral forces , astronomical applications of Coriolis force.
4.	October	Hamilton's canonical equation of motion, physical significance of H, advantage of Hamiltonian approach, deduction of canonical equation from a Variational principle ,Central force definition and characteristics , two body problem , closure and stability of circular orbits , general analysis of orbits , Kepler's law and equation , principle of least action ,Hamilton's principle and characteristic function. Condition for a transformation to be canonical, Infinitesimal contact transformations, Canonical transformations , example of canonical transformation, Generating function
5.	November	Poisson bracket , Poisson theorem Angular momentum PBs, Small oscillations , Normal modes and coordinates. Rigid body dynamics- the Euler's angles , Euler's equation of motion ,rate of change of vector,invariance of Poisson bracket with respect to canonical transformation, Equation of motion in Poisson bracket form, Lagrange's brackets ,Relation between lagranges and Poisson bracket, Liouville's theorem
6.	December	Revision

Department of physics

Teaching Plan 2022-23

M.Sc. 1st Semester

Subject : - Electrodynamics and Plasma Physics

S.No.	Month	Lecture
1.	July	Electrodynamics, plasma, Maxwell's equations, vector and scalar potentials and the wave equation, Gauge transformations
2.	August	Lorentz 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
3.	September	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
4.	October	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
5.	November	Plasma: definition, Debye shielding phenomenon and criteria for plasma, motion of charged particles in electromagnetic field ,Fundamental equations of magneto- hydrodynamics (MHD), Hydrodynamics Waves; Magneto sonic and Alfven waves, Magnetic viscosity and magnetic pressure, plasma confinement schemes
6.	December	Revision

Department of physics

Teaching Plan 2022-23

M.Sc. 1st Semester

Subject : - Electronic and photonic devices

S.No.	Month	Lecture
1.	July	**Unipolar device:** JFET , MESFET and MOSFET basic structure, working and device I-V characteristics,
2.	August	small signal equivalent circuit related field effect device, Microwave performance, charged coupled device (CCDs), basics structure and working , principal, MOSFET- basic device characteristics, types of MOSFET, UJT , SCR , triac operation VI characteristics of Triac, Triac rating , Application of Diac, Diac-operation, Diac V-I characteristics curve
3.	September	**Special Microwave Devices:** Quantum effect device, Resonant Tunneling diode, unipolar resonant tunneling transistor. Tunnel diode and backward diode-basic device characteristics, IMPATT diode and their statics and dynamic characteristics, Transfer electron device-transferred electron effect, Gunn diode, Negative differential resistance, Hot electron devices, Hot electron HBT, Real space Transfer Transistor.
4.	October	**Photonic Device:** Radiative transitions and optical absorption optical cavity and feedback, LEDs: Visible LED and infrared, SC laser; Photo detectors ; Photo conductor, & Photodiode , SOLAR cell , Solar radiation and ideal conversion efficiency, p-n junction solar cells, Hetero junction, Interface thin film solar cells, Basic laser structure, Threshold current density, Quantum well laser, Silicon and compound –semiconductor solar cell, Optical concentration
5.	November	**Optical Modulation and Display devices** :- Optical fiber waveguides, Introduction: Optical fiber, Numerical aperture, Pulse dispersion in step index fibers, First and second generation fiber optic communication, Magneto-Optic and Acoustic-Optic effect , Materials exhibiting these properties , Non-linear Optics(self focusing, second harmonic generation) **Display devices**: Luminescence, Photo- luminescence, Electroluminescence, Liquid crystal display (LCD), Numeric display . **Fiber -** wave guides and optical communication system and networking.
6.	December	revision

Department of physics

Teaching Plan 2022-23

M.Sc.2nd Semester

Subject :- Quantum Mechanics – I

S.No.	Month	Lecture
1.	July	Inadequacy of classical mechanics. Equation of motion of matter waves, physical interpretation of the wave function, Expectation value of dynamic quantities, probability current density: particle flux, Ehrenfest theorem
2.	August	physical Applications of Schrodinger's equation the free particles, particle in a Box, potential step, Rectangular potential barrier, Application of barrier penetration (α- decay).Schrodinger equation , one-dimensional Infinitely deep potential well , Schrodinger equation for Linear Harmonic oscillator and its solution,Eigen values, Zero point energy, Uncertainty relations
3.	September	Super position principle , general formalism of wave function , commutation relationship, representation of states and dynamical variable , Completeness 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
4.	October	Angular Momentum in quantum mechanics , commutation relationship, Eigen value addition of angular momentum , Clebsch-Gordon coefficient , spherically symmetric potential in three dimensional , separation of wave equation , three dimensional square well potential and energy level the Hydrogen atom , solution of the radial equation energy level and stationary state wave function ,.
5.	November	Time-independent perturbation theory , non-degeneracy case, first order and second perturbation with the example of perturbation of an oscillation , degeneracy case ,removal of degeneracy of second order , first order stark effect in hydrogen perturbed energy level , Zeeman effect without electron
6.	December	**revision**

Department of physics

Teaching Plan 2022 -23

M.Sc.2nd Semester

Subject :- Statistical Mechanics

S.No.	Month	Lecture
1.	January	**Foundation of statistical mechanics** , contact between statistical and thermodynamics , the classical ideal gas , entropy of mixing and Gibb's paradox , phase space of classical systemLiouville's theorem and its consequence quantum state and phase space .Elements of ensemble theory: micro canonical and grand canonical ensemble , partition functions , physical significance of statistical quantities , example of classical system energy and energy density , fluctuation and mutual correspondence of various ensembles
2.	February	**Formulation of quantum statistics** : Quantum mechanical ensemble theory , Density matrix , statistics of various quantum mechanical ensemble , Ex: An electronic magnetic field, System compose of indistinguishable particles. Density matrix and the partition of a system of a free particles. theory of simple gases-ideal gas in various quantum mechanical, ensembles, Maxwell-Boltzmann , Bose- Einstein , Fermi-Dirac distributions ,statistical of occupation number
3.	March	. **Ideal Bose and Fermi gases**: Thermodynamics of black body radiation, the field of sound waves, Inertial density of sound field. Thermodynamics behavior of an ideal Bose and Fermi gas of elementary particle , degenerate Bose gas , Bose-Einstein condensation and elementary excitations in liquid helium II ,Thermodynamic behavior of an ideal Fermi gas , Magnetic behaviors of an ideal Fermi gas, the electron gas , theory of Whit Dwarf Stars
4.	April	Statistical mechanics of interaction system the method of cluster expansion classical gas . viral expansion of the equation of the state. Evaluation of viral coefficient, Landan theory of phase transition-general remark on the problem of condensation Fluctuation , thermodynamic fluctuation . Brownian motion, Einstein and Langevin theory of Brownian motion ,
5.	May	. fluctuation dissipative theory. The Onsager relations., Unreal remark on cluster expansion Exact treatment of second viral coefficient

Department of physics
Teaching Plan 2022 -23
M.Sc.2nd Semester
Subject :- Electronic

S.No.	Month	Lecture
1.	January	***Operational amplifier*** **:-**Basic Op-amp. Ideal operational Amplifier Differential amplifier, Practical inverting Op-amp , the emitter coupled . difference amplifier , transfer characteristics of a diff. Amplifier , An example of an AC Op-amp , offset error voltage and currents, measurement of Op-Amp . Parameters, frequency response of an Op-Amp, Dominant-pole compilation. Linear analogsystem : basic Op-Amp Application , Analog integration and differentiation ,Electronic Analog computation . Non-linear analogsystem , comparators ,wave form generator Schmitt Trigger.
2.	February	***Combinational Logic***– Basic Logic gate : OR ,AND , NOT gates, NOR and NAND gates Boolean algebra , De-Morgan's theorem , exclusive OR gate , Decoder / Demultiplexer , Date Selector/multiplexer –.encoder , TTL circuit. Arithmetic-Logic units , adder , **Sequential Logic** flip-flop : R-S Flip-Flop, J-K Flip-Flop level clocking, Edge triggered Flip flop D Flip flop JK , Flip flop J.K master slave Resisters buffer shift and control shift resisters , ripple synchronous & ring counter , tri-resisters Memories: RAM , ROM , PROM , EPROM .
3.	March	***Microprocessors*** **:-** Evolution of microprocessor , organization of a microcomputer , programming of microprocessor , Basic concept ,data representation , binary number system , Floating point notation , organization of Intel 8085 . instruction set of 8085. Programming with 8085 . Assembly language programming , the stack , subroutines CPU of a microprocessor ,timing and control , system timing and interrupt timing of 8085 ,resistor in 8085 , interfacing memory and I/O device a preliminary ideas.
4.	April	Instruction set of 8085 type of instructions- Data transfer group ,Arithmetic Logic , branch group , stack I/O machine control group , addressing mode of Intel 8085 , example of Assembly language programs in 8085 , summing of two 8-bit number to result a 16-bit number , summing two 16-bit number.
5.	May	8085 interrupt. 8085 recorded interrupts, microprocessor application designing scanned display, interfering a matrix keyboard, Memory design

Department of physics
Teaching Plan 2022 -23
M.Sc.2nd Semester

Subject :- COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING

S.No.	Month	Lecture
1.	January	Method of determination of zeroes of linear and non linear algebraic equation and transcendental equation , convergence of solution , Solution of simultaneous linear equations , Gaussian elimination , pivoting , iterative method matrix inversion , Eigen value and Eigen vector of matrices , power and Jacobi method. factorization method, givens method, house holders methods partition method
2.	February	Finite differences , interpolation with equally spaced and unevenly spaced point , Gauss Interpolation, curve fitting , polynomial least squares and cubic spline fitting , Numerical differentiation and integration , Newton-cotes formulae , Gauss method, Sterling formula, Law containing three constant. Error-error estimate.
3.	March	Numerical solution of ordinary differential equation , Run's method , Modified Euler method, Euler and Runga-Kutta methods , predictor-corrector method, Milne's and Adam's predictor and Picard's method ,corrector method, taylor series method , stability analysis.
4.	April	Elementary information about digital computer principle , compilers , interpreters ,subroutine ,Computer Representations of number, Floating points presentations of number ,computer calculations ,Numerical method using C language , An overview of C features ,Example ;-Multiplications of matrices ,Gauss-Eliminations method ,Gauss –Jordan method ,Factorizations method ,Gauss –Seidal iterations method ,Power method ,Method of Least squares, Method of averages ,
5.	May	Method of moments Newton forward interpolations method , Langranges interpolations formula ,Derivatives using forward differences formula

Department of physics
Teaching Plan 2022 -23
M.Sc.3rd Semester

Subject :- Quantum Mechanics -II

S.No.	Month	Lecture
1.	January	Variation method; WKB approximation; approximation solution, solution near a turning point, turning point, connection at the turning point, Expectation value of energy; Application to excited states; Ground state of He-atom; Vander walls interactions energy level of a potential well and quantization rule ,Adiabatic and sudden approximations
2.	February	differential scattering cross section and total scattering cross section; Wave mechanical picture of scattering . Scattering amplitude; Green functions and formal expression for Scattering, amplitude Scattering by spherically symmetric potentials; Partial waves analysis, asymptotic behaviors of Partial waves and phase shifts; Scattering by a perfectly rigid sphere and by square well potential; Scattering by Coulomb potential,. Parabolic coordinate confluent hyper geometric function
3.	March	Time dependent perturbation theory, interaction picture, first order perturbation; Harmonic perturbation; Fermi's golden rule; Ionization of a H atom, density of final state, Transition probability for absorption and induced emission; Electric dipole and forbidden transitions; selection rules Symmetric and ant symmetric wave functions Relativistic quantum mechanics , Relativistic quantum theory the Klein - Gorden equation ,plain wave solution, The Dirac equation for a free particle ,matrices alpha and beta, charge density and current density, Lorentz covariance of the Dirac equation, Spin angular momentum; Dirac equation for central field; Dirac particles in electromagnetic fields and significance of the negative energy state.
4.	April	Relativistic quantum mechanics , Relativistic quantum theory the Klein - Gorden equation ,plain wave solution, The Dirac equation for a free particle ,matrices alpha and beta, charge density and current density, Lorentz covariance of the Dirac equation, Spin angular momentum.
5.	May	Dirac equation for central field; Dirac particles in electromagnetic fields and significance of the negative energy state.

Department of physics
Teaching Plan 2022 -23
M.Sc.3rd Semester
Subject :- Atomic &Molecular Physics

S.No.	Month	Lecture
1.	July	Somerfield theory of hydrogen atom, application of quantization, quantization of elliptical orbits, Somerfield elliptical orbits, relativistic correction to Somerfield elliptical orbits,
2.	August	. fine structure of H alpha line, fine structure of He^+ line, selection rule for azimuthally quantum number, magnetic moment of atom and land's g factor, Larmour's theorem, Quantum States of one electron atoms; Atomic orbital; Hydrogen Spectrums Spin-orbit (1-s) interaction energy, fine structure 0f Hydrogen Spectrums including (l-s) interaction and relativistic correction, Spectra of Alkali element , doublet fine structure in alkali Spectra , intensity rules
3.	September	. Pauli Exclusion principle , quantum mechanical treatment of fine structure, Pauli's principle Ground state(basic level of different element) two electron system, interaction energy in L-Sand J-Jcoupling . fine structure, Hyper fine structure, line broadening mechanisms (general ideas), Normal and anomalous Zeeman Effect, relativistic correction, interpretation of hyper fine structure, quantum mechanical treatment of hyper fine structure
4.	October	. Vector models of one electron system in a week magnetic field, magnetic moment of a bound electron , magnetic interaction energy selection rules , Zeeman effect of principle series doublet. Zeeman effect , Paschen Back effect , Stark effect in Hydrogen ,orbital model, weak and strong effect in Hydrogen, landau's factor for two valence electron system, (in L-S and JJ coupling) linear stack effect (hydrogen atom) Zeeman effect in two electron system
5.	November	Types of molecules; Diatomic linear symmetric top; asymmetric top and spherical top molecules; Rotational spectra of diatomic molecules as a rigid rotator- Energy levels and spectra of non rigid rotator, determination of the inter nuclear distance (bond length) and momentum of inertia, isotopes effect in rotational spectra, isotope effect in vibrational bands, application of vibrational spectroscopy, Vibrational energy of diatomic molecule; Diatomic molecule as a simple harmonic oscillator, P,Q and R branches (qualitative) .
6.	December	revision

Department of physics
Teaching Plan 2022-23
M.Sc.3rd Semester

Subject :- Solid State Physics-I

S.No.	Month	Lecture
1.	July	**Electrons in Solid and Electronic properties -** Energy band : nearly free electron model ,origin of energy gap and its magnitude, Bloch function , Kronig-penny model
2.	August	Wave equation of electron in periodic potential restatement of Bloch theorem ,crystal moment of an electron , kronig-penny model in reciprocal space empty lattice Approximation , Approximation solution near zone boundary. Number of orbital in a band, metals and insulator.
3.	September	**Fermi surface and metals-**free electron Gas in three dimension ,construction of Fermi surface, nearly free electron, hole open orbits Calculation of energy bands. Tight binding, Wigner -Seitz, Cohesive energy, pseudo potential methods, Quantization of orbits in a magnetic field, de Hass van Alphen Effect, External orbits, Fermi surface of copper
4.	October	**Crystal vibration and thermal properties** Lattice dynamics in diatomic lattice: two atoms per primitive basis, optical and acoustic modes, quantization of elastic waves, phonon momentum, inelastic neutron scattering by phonon. , Anharmonic crystal interactions-thermal expansion, thermal conductivity, thermal resistivity of phonon gas, unklapp processes, imperfections
5.	November	**Electron-Phonon interaction-superconductivity** Experimental survey: occurrence of superconductivity, Meissener effect, heat capacity, energy gap, , isotope effect, 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, Vertex states, and Josephson superconductor tunnelling , DC/AC Josephson effect .
6.	December	revision

Department of physics
Teaching Plan 2022-23
M.Sc.3rd Semester

Subject :- Electronics-I

S.No.	Month	Lecture
1.	July	**Microwave devices:**klystron (reentrant cavities, velocity modulation, bunching process, output power and beam loading, efficiency of klystron, mutual conductance of klystron amplifier, power required to bunch the electron beam);
2.	August	magnetrons and traveling wave tube; velocity; modulation. Basic principles of two cavity Klystrons and reflex klystrons; principle of operation of magnetrons; helix travelling wave tube; wave modes, slow wave structure, amplification process convention current, axial electric field, wave mode, coupled cavity travelling-wave tube(physical description, principal of operation, microwave characteristic, high efficiency and collector voltage depression
3.	September	**Microwave guides and components (Wave Modes):-** **(A) Rectangular wave guides:** - power transmission in rectangular wave guide, power losses in rectangular wave guide, solutions of wave equation in rectangular coordinates, TE Modes; TM Modes; excitation of modes in rectangular wave guides, characteristic of standard rectangular wave guide. **(B) Circular wave guides:-**solutions of wave equations in cylindrical coordinates ; TE Modes; TM Modes; TEM Modes; excitation of modes in circular guides, power transmission in circular wave guide or coaxial line, power losses in circular wave guide or coaxial lines.
4.	October	**Transferred electron devices:-**Gunn effect Principle of operation; modes of operation; read diode; IMP ATT diode; TRAP ATT diode, baritt diode. **Computer Communications:-** Types of network ,design feature of a communication network; advantage and disadvantage **Example –**TRMNET,ARPANET ISDN LAN, FDMA, TDMA, CSMA.
5.	November	**RADAR:-**RADAR Block diagram and operation RADAR frequency; RADAR range equation and its derivation, minimum detectable signal; receiver noise; signal to noise ratio; Probability density function . Integration of RADAR pulse; **Satellite Communications:-**Orbital Satellite; Geostationary satellites; Orbital Pattern, look angle, satellite system; orbital spacing
6.	December	revision

Department of physics
Teaching Plan 2022 -23
M.Sc.4th Semester

Subject :- NUCLEAR AND PARTICAL PHYSICS

S.No.	Month	Lecture
1.	January	**NUCLEAR INTERACTION** :-Nucleon –nucleon interaction ; Two - Nucleon System of the Ground State of the Deuteron ; Tensor force; Nucleon-nucleon Scattering at Low Energies, Scattering length; Effective Range Theory in n-p Scattering ; Spin Dependence of Nuclear force; Charge independence and charge symmetry of nuclear force; Iso-spin formalism, exchange forces; meson theory of nuclear force and the Yukawa interaction. Saturation of Nuclear force, Isotopic spin formalism
2.	February	**NUCLEAR DECAY**:- **Beta decay**: Fermi's theory for Beta decay; shape of 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**: Measurement of Gamma ray energies Multipole transition in nuclei angular momentum and parity selection rules; Internal conversion, Nuclear isomerism. Internal pair creation
3.	March	**NUCLEAR MODEL**:- Liquid drop model , Semi-Empirical Mass Formula; Bohr-Wheeler theory of fission ; Shell Model; Experimental evidence for shell effects; Single particle shell model**:** Spin-Parity prediction, Prediction of ground state term , spin-orbit interaction and magic numbers; Analysis of shell model prediction; Magnetic moments and Schmidt lines; Collective model ..
4.	April	**ELEMENTARY PARTICAL PHYSICS**:- Classification of fundamental interaction ; Classification of Elementary particles; Symmetry , Conservation law :Exact and Approximate , Lepton's and Hadrons, Special Symmetries : SU(2) and SU(3) multiple and their properties; Quark model; Coloured Quarks ,
5.	May	Isospin of quarks, Heavy quark effective theory, properties of quarks, Q-equation and threshold energies; Direct and compound nuclear interaction

Department of physics
Teaching Plan 2022 -23
M.Sc.4th Semester
Subject :- LASER PHYSICS AND APPLICATIONS

S.No.	Month	Lecture
1.	January	**Laser characteristics** :- Spontaneous and stimulated emission; Einstein's quantum theory of radiation; **Beam characteristics** :- Directionality , intensity , coherence and mono chromaticity, kinetic of optical absorption, line broadening mechanism, Basic principle of lasers population inversion; laser pumping; two & three level laser system; resonator; Q-factor; losses in cavity; threshold condition ; quantum yield
2.	February	**Laser system** :- Solid state laser- the ruby laser; Nd :YAG Laser, ND-Glass laser, semiconductor laser; features of semiconductor laser; intrinsic semiconductor laser; Gas laser neutral; atom gas laser; He-Ne laser; molecular gas laser CO2 laser; Liquid laser; dye lasers and chemical laser. Electro ionization laser, Gas dynamic laser, Copper vapor laser, Ion laser, metal vapor laser.
3.	March	**Multi-Photon processes** :- multi quantum photoelectric effect; theory of two-photon process; three-photon process; second harmonic generation; parametric generation of light ; Parametric light Oscillator, frequency up conversion Laser spectroscopy; Rayleigh and Raman scattering Stimulated Raman effect; Hyper-Raman effect;(Classical treatment), Coherent anti-stokes Raman Scattering; Photo-acoustic Raman spectroscopy. Spin flip Raman laser, Brillouin scattering.
4.	April	**Laser application** :- isotope separation, thermonuclear fusion; laser application in chemistry , biology astronomy engineering and medicine, communication by laser; Ranging fiber optics communication optical fiber. Absolute rotation of earth. .
5.	May	**Advanced in laser physics** – production of giant pulse, Mechanical shutter, Electro optical shutter, shutter using saturable dyes .Q-switching, giant pulse dynamics, and laser amplification, mode locking and pulling

Department of physics
Teaching Plan 2022-23
M.Sc.4th Semester

Subject :- SOLID STATE PHYSICS – II

S.No.	Month	Lecture
1.	January	**Dielectric and ferroelectrics** – Polarization, dielectric constant macroscopic electric field, depolarization field ,E1; local electric field at an atom, Lorentz field E2, fields of dipoles inside cavity E3; dielectric constant polarizability and electronics Polarizability ; Ferro-electric crystal classification dissipative transition, Landau theory of phase transition, first and second order transition, anti ferro-electricity, ferro-electric domain , Piezoelectricity , Thermodynamic theory of the Ferro electric transition, second order transitions, first order transistion
2.	February	**Ferromagnetism and anti ferromagnetism** –Ferromagnetism order, curie point and exchange integral, temp. dependence of saturation magnetization at absolute zero; magnons, quantization of spin wave, thermal excitation of magnon; neutron magnetic scattering , ferromagnetic order, Curie temp and susceptibility of ferro- magnetic, iron garnets Anti ferromagnetic order , susceptibility below Neel temp , Anti ferromagnetic magnon, ferromagnetic domains. Magnon in ferro magnets, Neel model of ferrimagnetism, Neel model of Antiferrimagnetism .
3.	March	**Magnetism** – Diamagnetism, Langevin theory of paramagnetic, Langevin theory of Diamagnetism, quantum theory of paramagnetic rare earth ions, iron group ions. Paramagnetism ,temp. dependent paramagnetism , Pauli paramagnetism **Plasma optics** – transverse optical modes in plasma , longitudinal plasma oscillation **Plasmons**:- electrostatics screening and screened Coulomb potential , Mott metal insulator transition, screening and phonons in metal
4.	April	**Defects**- lattice vacancies Schottky and Frenkel point defect, colour center, f center, formation of F center, Energy level of F center and magnetic properties, F' center, V center, line defect Shear strength of single crystal. .
5.	May	**Dislocation** – edge and screw dislocation burger vector , Stress field of dislocation Low angle grain boundaries , Role of dislocation in plastic deformation and crystal growth mechanism of plastic deformation in solid

Department of physics
Teaching Plan 2022-23
M.Sc.4th Semester

Subject :- ELECTRONICS

S.No.	Month	Lecture
1.	January	**Digital Communication** – Pulse modulation system; Sampling theory- Low-Pass and Band-Pass signals; PAM Channel BW for a PAM signals; Natural Sampling ; Flat-top sampling; Signal Recovery through holding; Quantization of signal ;Quantization error; Differential PCM; Delta Modulation; Adaptive Delta Modulation; CVSD, pulse code modulation, electrical representation of binary digit, vocodes (voice codes), channel vocodes, linear prediction codes.
2.	February	**Mathematical Representation** of Noise-Source 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 power spectral; density of Noise; Super Position of Noise; Mixing involving Noise; Linear filtering; Noise Bandwidth, Quadrature Component of Noise; Power Spectral Density of ns(t), ns(t) and their time derivative, representation of noise using orthonormal co ordinates ,.irrelivant noise components
3.	March	**Digital Modulation Technique** – BPSK; DPSK; QPSK; PSK; FSK; **Data Transmission** – Base band receiver probability of error; Optimum filter white-noise; Matched filter and probability of error; Coherent reception; Correlation ; PSK; FSK; Non Coherent detection of FSK, duo binary encoding, A comparison of narrow band system FM system, partial response signaling, amplitude modulation of partial response signal.
4.	April	**Noise in pulse-code and 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 of Noise in DM ,Output signal power; DM output signal to Quantization Noise Ratio;.
5.	May	Effect of thermal Noise in Delta Modulation ; output signal to noise ratio in DM, comparison of PCM and DM , the space shuttle ADM

Head of The Physics Deptt.
Govt. Digvijay College
RAJNANDGAON (C.G.)

Department of Physics

Teaching plan 2022-23

semester 1st and 2nd

PHYSICS-DSC 1 A: MECHANICS

Month	lecture
July	Cartesian, Cylindrical and Spherical Coordinate System. Inertial and non – inertial frames of reference ,uniformly rotating frames .Carioles force and its application .Motion under a central force , kapler's laws . Effect of centrifugal and carioles force due to earth rotation
August	. Center of mass lab and CM Farms Of Reference Motion of CM of system partial subject to external force elastic and inelastic collision in one and two dimension. Conservation OF Linear AND Angular Momentum conservation of energy. Rigid body motion, rotation motion, moment of inertia and their products, principal moments and axes Introductory idea of Euler's equations.
September	Potential well and periodic oscillation, case of harmonic small oscillations, differential equation and its solution, kinetic and potential energy, examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, tensional pendulum Bifilar oscillations, Helmholtz resonator, LC circuit, vibrations of a magnet, oscillations of two masses connected by a spring.
October	Superposition of two simple harmonic motions of the same frequency, Lisaajuous figures, case of different frequencies. Damped harmonic oscillator, power dissipation, quality factor, examples, driven (forced) harmonic oscillator, transient and steady states, power absorption, resonance. Elasticity, stress and strain, elastic limit, Hooke's law, modules of rigid body, Poisson ratio
November	bulk modules, relation connecting different classic constant , twisting couple of a cylinder (solid and hallow) , bending moments, , cantilever, young modules by banding of beam. Viscosity, Ponselle's equation of liquid flow through a narrow tube , equations of continuity. Euler's equation, Bernoulli's theorem, viscous fluids, streamline and turbulent flow. Ponselle's law. Coefficient of viscosity, stokes low, stokes law, surface tension and surface energy, molecular interpretation of surface tension, angle of contact wetting.

Head of The Physics Deptt
Govt. College
(C.G.)

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234977	07-08-2023	CHUNESHWAR KUMAR	SHRIRAM SAHU	1
234978	07-08-2023	UMESH KUMAR DEWANGAN	CHANDRABHUSHAN DEWANGAN	1
234979	07-08-2023	NAGESHWAR	RAJENDRA PRASAD	1
234980	07-08-2023	AARTI	SHAILENDRA GUPTA	1
234981	07-08-2023	POOJA VERMA	DUMAN LAL VERMA	1
234982	11-08-2023	NIRJALA VERMA	AWADH RAM	1
234983	11-08-2023	PRANAY TANDAN	KRISHNA KUMAR TANDAN	1
234984	12-08-2023	KETAN MESHRAM	DHANRAJ MESHRAM	1
234985	12-08-2023	AYUSH JAISWAL	PRADEEP JAISWAL	1
234986	14-08-2023	NIKHIL MANIKPURI	SARWESHVAR MANIKPURI	1
234987	14-08-2023	BHOOMIKA	PRATAP SAHU	1
234988	14-08-2023	MUSKAN YADAV	GHANSHYAM YADAV	1
234989	09-09-2023	AASMA KHAN	RASID KHAN	1
234990	06-09-2023	PANKAJ KUMAR SAHU	NUMESHWAR SAHU	1
234991	27-09-2023	AARYAN SHARMA	RAJESH KUMAR SHARMA	1

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PHYSICS-DSC 2A: ELECTRICITY AND MAGNETISM

Month	lecture
January	**Vector Analysis**: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss divergence theorem and Stoke's theorem of vectors, Network theorem. **Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem
February	Electric field due to point charge, infinite line of charge,uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser.
March	**Magnetism:** Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials.
April	**Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. **Maxwell's equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization

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234944	18-07-2023	YOGITA	LOKURAM	1
234945	19-07-2023	SHIVAKSH SHILARE	RAJENDRA SHILARE	1
234946	19-07-2023	AMAN BADGE	MOHAN BADGE	1
234947	19-07-2023	VANSHRAJ MARKANDE	TIKAMDAS MARKANDE	1
234948	19-07-2023	SAGAR SINGH	SANJU SINGH	1
234949	19-07-2023	DAKESHWAR KUMAR SAHU	SHIVRAM PRASAD	1
234950	22-07-2023	KESAR SAHU	BIHARI LAL SAHU	1
234951	22-07-2023	POONAM VERMA	DAKWAR VERMA	1
234952	22-07-2023	MAYANK PARAKH	RAVINDRA PARAKH	1
234953	22-07-2023	LUCKEY DHANKAR	SHANKAR BHAWANI	1
234954	22-07-2023	AJAY KUMAR VERMA	SEVAK RAM VERMA	1
234955	22-07-2023	PRAMOD NISHAD	NAND KUMAR NISHAD	1
234956	22-07-2023	DEMAN PATEL	LILARAM PATEL	1
234957	22-07-2023	VIKAS SAHU	VASUDEV SAHU	1
234958	22-07-2023	KALYANI	LAL JI	1
234959	22-07-2023	RAMNARAYAN NISHAD	DARASINGH NISHAD	1
234960	22-07-2023	ISHU KUMAR	DHANRAJ	1
234961	25-07-2023	MITHLESH SAHU	RUPENDRA SAHU	1
234962	25-07-2023	RENUKA VERMA	GOVARDHAN VERMA	1
234963	25-07-2023	HEMLATA SAHU	HEMANT KUMAR SAHU	1
234964	20-07-2023	MUSKAN GENDRE	KUNDAN GENDRE	1
234965	01-08-2023	DHEERAJ KUMAR SAHU	BIRENDRA SAHU	1
234966	01-08-2023	YOGESH KUMAR DEWANGAN	NARENDRA DEWANGAN	1
234967	01-08-2023	DEVENDRA KUMAR	MAHENDRA KUMAR	1
234968	01-08-2023	AMAN SONBOIR	MUKESH SONBOIR	1
234969	02-08-2023	PRIYA PARKAR	SIYARAM PARKAR	1
234970	02-08-2023	VANSH KUMAR RAMBHAD	MAROTI RAMBHAD	1
234971	03-08-2023	ADITI NIRMALKAR	MR. SACHIN KUMAR	1
234972	04-08-2023	TIJIL NIMJE	TRIBHUVAN NIMJE	1
234973	03-07-2023	GULSHAN KUMAR	DEVLAL	1
234974	07-08-2023	TAMANNA RAJPUT	SHIV KUMAR RAJPUT	1
234975	07-08-2023	KRISHNA VERMA	DHANUK RAM	1
234976	07-08-2023	TRIVENI SAHU	VISHNU	1

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Teaching plan BSc 2nd year

PAPER-I

THERMODYNAMICS, KINETIC THEORY AND STATISTICAL PHYSICS

Paper-II

WAVES, ACOUSTICS AND OPTICS

Month	Lecture
July	**Paper1-** The laws of Thermodynamics: The zeroth law, concept of path function & point function, various indicator diagrams, work done by & on the system, first law of thermodynamics, internal energy as a state function, reversible & irreversible change, carnot theorem & the second law of thermodynamics, different versions of second law, Clausius theorem inequality, **Paper2** Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density & energy transmission in waves, typical measurement, waves over liquid surface: gravity waves & ripples, Group & phase velocity, their measurement. Harmonics & the quality of sound ; examples: production & detection, ultrasonic & infrasonic waves applications.
August	**Paper1** Entropy, change of entropy in simple cases:(i)Isothermal expansion of an ideal gas, (ii)Reversible isochoric process, (iii)Free adiabatic expansion of an ideal gas. Entropy of the Universe, Principle of increase of entropy, the thermodynamic scale of temperature, it's identity with the perfect gas scale ,impossibility of attaining the absolute zero, third law of thermodynamics. **Paper2** Reflection, refraction & diffraction of sound: Acoustic impedence of a medium, percentage reflection & refraction at a boundary, impedence matching for transducers, diffraction of sound, principle of sonar system, sound ranging. Fermat's principle of extremum path, the aplantic points of a sphere & other applications. Cardinal points of an optical system, thick lens & lens combinations,
September	**Paper1** Thermodynamic relationship: Thermodynamic variables, extensive & intensive, Maxwell's general relationships, application to Joule-Thomson cooling & adiabatic cooling in a general system, Vander Waals gas, Clausius- Clapeyron heat equation. Thermodynamic potential & equilibrium of thermo dynamical system, relation with thermo dynamical variables, cooling due to adiabatic demagnetization, production & measurement of very low temperatures, **Paper2** Lagrange equation of magnification, telescopic combinations, telephoto lenses. Monochromatic aberrations & their reductions; aspherical mirrors & Schmidt corrector plates, aplanatic points, oil immersion objectives, meniscus lens. Optical instruments: Entrance & exit pupils, need for a multiple lens eyepiece, common types of eyepieces. (Ramsdon & Huygen's eyepieces)

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234911	13-07-2023	DIMPAL YADAV	SHATRUHAN RAM YADAV	1
234912	13-07-2023	JUGAL KISHOR	JAGDISH	1
234913	13-07-2023	DEVID DAS	DAMAN DAS	1
234914	13-07-2023	DUSHYANT VERMA	SANTOSH VERMA	1
234915	13-07-2023	HARSH KUMAR SONBOIR	CHETAN KUMAR SONBOIR	1
234916	13-07-2023	JAY KUMAR SONI	SHIV KUMAR SONI	1
234917	13-07-2023	OMESHWARI SAHU	NANHERAM SAHU	1
234918	13-07-2023	LEKHRAM	TUKARAM	1
234919	13-07-2023	FULCHAND	BEDAM RAM	1
234920	14-07-2023	JEET KUMAR SAHU	PATROHAN SAHU	1
234921	14-07-2023	MAYANK VERMA	MURLI MANOHAR VERMA	1
234922	14-07-2023	KARAN ALAKHRAM DHANKAR	ALAKHRAM DHANKAR	1
234923	14-07-2023	BHUMIKA SAHU	LUKESH SAHU	1
234924	14-07-2023	RAHUL KUMAR JADE	MIRGU RAM JADE	1
234925	14-07-2023	SIDDHARTH	HIRURAM SAHU	1
234926	15-07-2023	PUSHPAM KUMAR	DEVENDRA KUMAR	1
234927	15-07-2023	CHANCHAL SAHU	LEKHRAM SAHU	1
234928	15-07-2023	TUSHAR SINHA	MAHESH SINHA	1
234929	18-07-2023	NAMRATA	RADHECHARAN	1
234930	18-07-2023	BHUMIKA SAHU	KAMLESH SAHU	1
234931	18-07-2023	JAYA SAHU	KAMLESH SAHU	1
234932	18-07-2023	GOVIND KUMAR SONI	JAGDISH SONI	1
234933	18-07-2023	PRIYANSHU ROY	NARENDRA ROY	1
234934	18-07-2023	LOKESH KUMAR	DOMAN DEWAGAN	1
234935	18-07-2023	BHOOMI	VINOD KUMAR	1
234936	18-07-2023	ARYA SAHU	PILESH SAHU	1
234937	18-07-2023	ASHISH RATRE	ATMA RAM RATRE	1
234938	18-07-2023	SIJAL KUMAR SAHU	SURESH KUMAR SAHU	1
234939	18-07-2023	KUNAL	KRISHNA KUMAR	1
234940	18-07-2023	DHARAM	PITAMBER	1
234941	18-07-2023	DEMAN KUMAR	MUKESH KUMAR	1
234942	18-07-2023	DIGESHWAR SAHU	REWADAS SAHU	1
234943	18-07-2023	BEN KUMARI	NAROTTAM	1

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October	**Paper1** Blackbody radiation: pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, special distribution of BB radiation, Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophe, Plank's quantum postulates, Plank's law, complete fit with experiment. Maxwellian distribution of speeds in an ideal gas: distribution of speeds & of velocities, experimental verification, distinction between mean, r.m.s. & most probable speed values, Doppler broadening of spectral lines. **Paper2** Interference of light: The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer, Localised fringes; thin films. Haldinger fringes: fringes of equal inclination,
November	**Paper1**Transport phenomena in gases :molecular collisions, mean free path & collision cross sections estimates of molecular diameter & mean free path ,transport of mass, momentum & energy & interrelationship, dependence on temperature & pressure. Liquification of gases: Boyle temperature & inversion temperature, principle of regenerative cooling & of cascade cooling, liquification of hydrogen & helium, refrigeration cycles, meaning of efficiency **Paper2** Michelson interferometer, its application for precision determination of wavelength, wavelength difference & the width of spectral lines, Twyeman- Green interferometer & its uses, intensity distribution in multiple beam interference, Tolansky fringes, Fabry-Parot interferometer & etalon.
December	**Paper1.** The statistical basis of thermodynamics: Probability & thermodynamic probability, principle of equal a priori probabilities, statistical postulates, concepts of Gibb's ensemble, accessible & inaccessible states, concept of phase space, canonical phase space, Gamma phase space & μ phase space, equilibrium before two systems in thermal contact, probability & entropy, **Paper2** Fresnel half-period zones, plates, straight edge, rectilinear propagation, fraunhofer diffraction: diffraction at a slit, half-period zones, phasor diagram & integral calculus methods, the intensity distribution, diffraction at a circular aperature & a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope & microscopic system. Diffraction gratings: diffraction at N parallel slits, intensity distribution,
January	**Paper1** Boltzmann entropy relation, Boltzmann canonical distribution law & it's applications, law of equipartion of energy, transition to quantum statistics: 'h' as a natural constant & it's implications, cases of particle in a one dimensional box & one dimensional harmonic oscillator. Indistinguishability of particles & it's consequences, Bose-Einstein & Fermi-Dirac conditions, concept of partition function **Paper2** plane diffraction grating, reflection grating & blazed gratings, Concave grating & different mountings, resolving power of a grating & comparison with resolving powers of prism & of Fabry-Parot etalon. Double refraction & optical rotation: refraction in uniaxial crystals, phase retardation plates, double image prism, rotation of plane of polarisation, origin of optical rotation in liquids & in crystals.

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234878	05-07-2023	TAMSHAN VERMA	LOKESH VERMA	1
234879	05-07-2023	VIVEK KUMAR SAHU	DAUVA RAM	1
234880	06-07-2023	NIKHIL KUMAR	ANAND RAM	1
234881	06-07-2023	DEEPAK KUMAR SAHU	RAJESH KUMAR SAHU	1
234882	08-07-2023	VARUN KUMAR	ALAKH RAM KUNJAM	1
234883	08-07-2023	HIRAMAN	SAHAJ RAM	1
234884	08-07-2023	YASHASWI VAISHNAV	NAGENDRA VAISHNAV	1
234885	08-07-2023	VIDHI DEWANGAN	YOGESHWAR PRASAD	1
234886	10-07-2023	KAJAL JAGDALLE	RAMESHWAR JAGDALLE	1
234887	10-07-2023	ANJU DEWANGAN	NANDKUMAR	1
234888	10-07-2023	PRAVIN KUMAR VERMA	RAMKUMAR VERMA	1
234889	10-07-2023	PRADEEP KUMAR	KRIPA RAM	1
234890	10-07-2023	NAVEEN KUMAR	DEVSHARAN	1
234891	11-07-2023	VEDPRAKASH SAHU	AKNATH SAHU	1
234892	11-07-2023	DEVWRAT	KHEMAN	1
234893	11-07-2023	TARIKA SAHU	DURGESH KUMAR SAHU	1
234894	11-07-2023	NIDA FATIMA	MOHAMMAD SALIM QURESHI	1
234895	12-07-2023	DIPTI	JITENDRA KUMAR	1
234896	12-07-2023	DEVIKA VERMA	PALTU RAM	1
234897	12-07-2023	ROHAN KUMAR	SUNIL KUMAR	1
234898	12-07-2023	DRAUPATI	LEELADHAR	1
234899	12-07-2023	PUSHPA	TRILOKI	1
234900	12-07-2023	MANISH KUMAR PATEL	HIRAMAN LAL PATEL	1
234901	12-07-2023	LAKESH SAHU	RAJENDRA KUMAR	1
234902	12-07-2023	PUSHPENDRA KUMAR SAHU	JAGRIT DAS SAHU	1
234903	12-07-2023	DISHANT SAHU	DANI DAS SAHU	1
234904	13-07-2023	VEDPRAKASH SAHU	PREMLAL SAHU	1
234905	13-07-2023	CHANDAN DEWANGAN	ANUP	1
234906	13-07-2023	KAMESH KUMAR JOSHI	JEETLAL JOSHI	1
234907	13-07-2023	KANHA YADAV	SANJU YADAV	1
234908	13-07-2023	REKHCHAND	CHOVA RAM	1
234909	27-06-2023	MUKTA DEWANGAN	RAJESH DEWANGAN	1
234910	13-07-2023	SUDHIR DEWANGAN	TILAK RAM DEWANGAN	1

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February	**Paper1** derivation of Maxwell-Boltzmann, Bose-Einstein & Fermi-Dirac statistics through canonical partition function, limits of B.E. & F.D. statistics to M.B. statistics, application of BE statistics to black body radiation , application of FD statistics to free electron in a metal. **Paper2** Laser system: purity of a spectral line, coherence length & coherence time, spatial coherence of a source, Einstein's A & B coefficient, spontaneous & induced emissions, conditions for laser action; population inversion, Types of Laser: Ruby laser, He-Ne & semiconductor lasers. Applications of laser: Application in communication, Holography & non linear optics. (polarization P including higher order terms in E & generation of harmonics).

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