GOBI ARTS & SCIENCE COLLEGE (AUTONOMOUS) : GOBICHETTIPALAYAM

SCHEME OF EXAMINATIONS - M.Sc.(PHYSICS) (16 BATCH)

No.	Code	Subject Title	Hrs	CIA	EOSE	Total	Credit
		SEMESTER : 1					
1	16P3PH01	CLASSICAL MECHANICS & STATISTICAL MECHANICS	3	30	70	100	5.0
2	09P3PH02	MATHEMATICAL PHYSICS	3	30	70	100	5.0
3	09P3PH03	QUANTUM MECHANICS - I	3	30	70	100	5.0
4	09P3PH04	SPECIAL ELECTRONICS-I (ANALOG & DIGITAL ELECTRONICS)	3	30	70	100	5.0
		SEMESTER : 2					
5	16P3PH05	QUANTUM MECHANICS - II	3	30	70	100	5.0
6	16P3PH06	ELECTROMAGNETIC THEORY AND ELECTRODYNAMICS	3	30	70	100	5.0
7	09P3PH07	SPECIAL ELECTRONICS - II (MICROWAVE & DIGITAL COMMUNICATION)	3	30	70	100	5.0
8	09P3PH08	ELECTIVE - I	3	30	70	100	5.0
9	09P3PHPA	PRACTICAL - I GENERAL EXPERIMENTS	4	30	70	100	4.0
10	09P3PHPB	PRACTICAL - II ELECTRONICS EXPERIMENTS	4	30	70	100	4.0
		SEMESTER : 3					
11	16P3PH09	CONDENSED MATTER PHYSICS	3	30	70	100	5.0
12	09P3PH10	NUCLEAR AND PARTICLE PHYSICS	3	30	70	100	5.0
13	09P3PH11	SPECIAL ELECTRONICS - III (OPTO ELECTRONICS, MICROPROCESSOR AND EMBEDDED SYSTEMS)	3	30	70	100	5.0
14		SUPPORTIVE PAPER	3	30	70	100	4.0
		SEMESTER : 4					
15	09P3PH12	APPLIED SPECTROSCOPY	3	30	70	100	5.0
16	11P3PH13	ELECTIVE-II	3	30	70	100	5.0
17	09P3PHPC	PRACTICAL - III ADVANCED EXPERIMENTS	6	30	70	100	4.0
18	09P3PHPD	PRACTICAL - IV SPECIAL ELECTRONICS EXPERIMENTS	6	30	70	100	4.0
19	08P3PHV1	PROJECT VIVA-VOCE			100	100	5.0

TOTAL CREDITS : 90

LIST OF ELECTIVE PAPERS:

1. PLASMA PHYSICS
2. THIN FILM PHYSICS & NANO SCIENCE
3. CRYSTAL GROWTH TECHNIQUES
4. NUMERICAL METHODS AND PROGRAMMING

SEMESTER - I
PAPER - I
CLASSICAL MECHANICS AND STATISTICAL MECHANICS

Instructional Hrs: 90
Objectives: 1. Learn to use Newton's Laws of motion to solve advanced problems involving the dynamic motion of classical mechanical system.

2. Know to use conservation of energy and linear angular momentum to solve dynamic problems.

3. Study to use the equation of motion for complicated mechanical systems using Lagrangian and Hamiltonian formulation.

Unit – I 18Hrs
Lagrangian Formulation:

Basic concepts of Generalized Co-ordinates; D'Alembert's principle and Lagrangian equation – Velocity dependent potential and Dissipiation function – Application of Lagrangian formulation (single particle in space)

Motion under central force:

Equivalent one body problem – Linear feature of central force motion – Lagrangian equation of motion – Expression for r(t) and θ(t) –Equivalent one dimensional problem – General features of the orbit –Stationary states and condition for closure – Kepler's problem: Inverse square law of force – Virial theorem.

Unit – II 18 Hrs
Rigid Body Dynamics and small oscillations:

Independent co-ordinates of a Rigid body – Orthogonal transformations – Euler angels – Angualr velocity and momentum of a Rigid body – Moments and products of Inertia – Principle axes transformation – Rotational kinetic energy – Moment of inertia of a Rigid body – The motion of a Symmetric top under action of gravity.

Small Oscillations:

Formulation of the problem – The Eigen value equation and the principle axis transformation – Frequencies of free vibration and normal co-ordinates – Linear triatomic molecule.

Unit – III 18Hrs

Hamiltonian Formulation:

Cyclic co-ordinates and conservation theorem (linear momentum, angular momentum) – Significance of translation and rotation cycle co-ordinates – Hamiltonian function (H) – Conservation of energy – Hamilton's equation of motion, applications (Harmonic oscillator, Motion of particles in a central force field) – Canonical Transformation – Generating function –

Four forms – Condition for canonical Transformation – Poisson bracket – Equation of motion in Poisson bracket form – Angular momentum and Poisson brackets – Invariance of Poissons brackets under canonical transformation.

Hamilton Jacobi equation – Solution of simple Harmonic oscillator problem using H – J method – Hamilton's characteristic function – Conservation systems – Physical significance of Hamilton's characteristic function.

UNIT – IV 18Hrs

Classical Statistics:

Introduction:

Phase space - volume in phase space - volume occupied by a quantum state - number of cells in a given energy range of Harmonic oscillator- numbers of phase cells in the given energy range - constraints and accessible states -Boltzmann entropy relation.

Maxwell - Boltzmann Distribution:

Microstates and Macro states - Number of microstates accessible to macroscope system (eg. Particle in one dimensional box) - Maxwell-Boltzmann distribution law - Evaluation of constants - Condition for the applicability of M-B statistics -Limitations of M-B statistics.

Applications

Total internal energy and specific heat at constant volume - M-B speed distribution law - Most probable, Mean and Root mean square speeds - Entropy and Equation of state of an ideal gas.

UNIT-V 18Hrs

Quantum Statistics

Bose-Einstein Statistics

Bose-Einstein distribution law - Energy distribution for energies in the range E and E+dE - Condition for the B-E distribution to approach classical M-B distribution –
B-E condensation-Derivation of Plank's law from B-E distribution.

Fermi- Dirac Statistics

Fermi-Dirac distribution law -F-D law for energies in the range E and E+dE -Fermi energy- Effect of temperature - Energy distribution curve - Fermi energy for free electron in a metal - Expression for mean kinetic energy of electrons in a metal at absolute zero.

Books for study:

UNIT- I & II

1. Classical Mechanics - Herbert Goldstein, Charles Poole & John Safko 3rd Edition, Pearson Education in South India
2. Classical Mechanics -Gupta, Kumar and Sharma, 21St Edition, Pragati pragasan, Meerut.

UNIT - III

1. Classical Mechanics - J.C.Upadhyaya, lst Edition, Himalaya publishing House.

UNIT - IV& V

1. Elements of Statistical Mechanics by Miss Kamal singh and S.P.Singh 3rd Edition, S.Chand & Company
2. Statistical Mechanics - Gupta, Kumar, Pragati pragasan, Meerut.

Books for reference:

1. Classical Mechanics - Satya Prakash, Kedar Nath Ram Nath & co
2. Classical Mecanics - K.Sankara Rao

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SEMESTER -I
PAPER-II
MATHEMATICAL PHYSICS

Instructional Hrs: 90

Objectives: 1. To understand the fundamental concepts in Vector calculus and Linear vector space.
2. To lay a strong foundation in Fourier & Laplace transforms.
3. To know the need and the use of numerical methods in solving Physics problems.

Unit-I

Vector Calculus and Linear Vector Space 18 Hrs

Line, surface and Volume integrals - Important vector Identities - Gauss divergence theorem - proof- Stoke's theorem -proof-Green's theorem proof-Green theorem in a plane - Classification of vector fields.

Orthogonal curvilinear Co-ordinates - Gradient, divergence, Curl, Laplacian in curvilinear Co-ordinates - Differential operators in spherical Polar Co-ordinates & Cylindrical Co-ordinates.

Linear Vector space - Linear independence of Vectors & Dimensions - Basis and Expansion theorem - Inner product and unitary spaces - Orthonormal sets - Schmidt Orthogonalization method

Unit-II 18Hrs

Laplace Transforms and Fourier Series

Definition of Laplace transform - properties of Laplace transforms -Linearity property -Translation property - Inverse Laplace Transformation -properties of inverse Laplace Transform - Solving Simple Second order differential equation.

Fourier series - Dirichlet's theorem - change of interval - Complex form - Fourier series the interval (O, T), uses of Fourier series.

Unit-III 18Hrs

Complex Variable Theory

Functions of a complex variable - Single and multivalued functions- The Cauchy - Riemann differential equation- analytical -Line integrals of complex function-Cauchy's integral theorem and integral formula - Derivatives of an Analytic function - Taylor's variable - Residue and Cauchy's residue theorem - Application to the equation of definite integral - Conformal transformation.

Unit-IV **18Hrs**

Special Functions and their Properties

Legendre's polynomials and functions - Differential equations and solutions - Rodrigue's formula - Generating functions - Orthogonality - Relation between Legendre polynomial and their derivatives - Recurrence relations - Bessel's functions - Differential equation and solution-Generating functions-Recurrence relations.

Unit-V

Numerical Methods

18Hrs

Bisection and Newton- Raphson method of finding roots of the equations - solution of simultaneous linear equation by Guass elimination method- solution of ordinary differential equation by Euler method and Runge -Kutta second and fourth order method - Evaluation of integral by means of Simpson's one third rule - Giraffe's root squaring method for solving algebraic equation.

Books for study:

1. Unit I, II, III & IV - Mathematical physics - Sathya Prakash - Sultan Chand & Sons - 2000.

2. Unit - V - Numerical methods - P.Kandasamy, K.Thilagavathy, K.Gunavathy. (First edition). S. Chand & Company Ltd.

Books for Reference:

1. Mathematical Physics - B.D.Gupta (Second Revised Edition), Vikas Publishing house (P) Ltd.
2. Mathematical Physics - B.S.Rajput - Pragati Prakashan - Meerut - 1996.
3. Mathematical Physics - H.K.Dass - S.Chand & Co.
4. Essential Mathematical methods for Physicists - Hans. J. Weber and George B. Arfken Academic Press (ELSEVIER)
5. Mathematics for Physicists -Susan M. Lea, Thomson Brooks / Cole.
6. Mathematical methods of Physics (second edition) - Jon Mathews, R.L. Walker Pearson Education.

7. Mathematical Methods in the Physical sciences (Third Edition) - Mary L. Boas Wiley India Pvt. Ltd., New Delhi.
8. Mathematical methods for Physics and Engineering (Second Edition) K.F. Riley, M.P. Hobson, S.J. Bence, Cambridge University press.
9. Applied Mathematics for Engineers &Physicists -Pipes and Harvill McGraw Hill International Book company.
10. Higher Engineering Mathematics (37^{th} Edition) - Dr. B.S. Grewal, Khanna Publishers, New Delhi. .
11. Advanced Engineering Mathematics -R.K.Jain and S.R.K Iyengar Narosa Publishing house, New Delhi.
12. Advanced Engineering Mathematics - Erwin Kreyszig, Willey Eastern Ltd.
13. Numerical Methods - A. Singaravelu, Meenakshi Publishing - 2000.
14. Numerical Methods in Science & Engineering - M.K.Venkataraman National Publishing Co., Chennai.

SEMESTER - I
PAPER -III
QUANTUM MECHANICS – I

Instructional Hrs: 75

Objectives: 1. To appreciate the development of Wave Mechanics for the description of particles.

2. To apply Wave Mechanics to simple systems.

3. To understand approximation methods and apply them to complex problems.

Unit –I

Application of Schroedinger Equation to Three Dimensional Problems: 15Hrs

The free particle -Particle in a box- Free axis Rigid rotator - Quantum numbers - Spherically symmetric system -The hydrogen atom (Hydrogen like atoms) -The normal state of Hydrogen atom - Hydrogen like wave functions and their discussion - Total angular momentum and Spherical harmonics - Three dimensional Square well potential - Free particle in Spherical Polar Co-ordinates -Expansion of a plane wave in spherical harmonics - Three dimensional harmonic oscillator - Solution in spherical Co-ordinates.

Unit -II

Matrix Formulation of Quantum theory: 15Hrs

Linear Vector spaces (Hilbert space) - Linear operators – Matrix form of an operator - Column representation of the wave function - Normalization & Orthogonality of wave functions in matrix form - Dual space - Dirac's bra & ket notation - Change of basis, Unitary and Similarity transformations - Schroedinger equation and the eigen value problem - Quantum Dynamics - Schroedinger picture- Heisenberg picture -Interaction picture- One dimensional harmonic oscillator in Matrix mechanics**.**

Unit - III

Angular Momentum: 15Hrs

Commutation rules for Angular momentum- Eigen values of L_z - Generation of Eigen functions of L_z & L^2 - Eigen values of the Total Angular momentum - Eigen functions of L^2 & L_z - Angular momentum in general - Allowed values of Angular momentum; J- Eigen values or matrix elements of J_+ and J_- - Matrix elements of J_x &J_y in the representation in which J^2 and J_z are diagonal -Angular momentum matrices - Addition of angular momentum & Clebsch Gorden Coefficients - Clebsch Gorden Co-efficients for $J_1 = 1$ & $J_2 = ½$.

Unit -1V

Time independent perturbation theory and approximate methods: 15Hrs

Time independent perturbation theory for Non-degenerate levels - Perturbed harmonic oscillator - Normal Helium atom - First order peturbation theory for degenerate level- First order Stark effect in Hydrogen - W.K.B approximation - Validity of W.K.B approximation - Turning points & Connection formulae - Variation method - its application to the ground state energy of the hydrogen atom.

Unit - V
Time dependent perturbation theory **15Hrs__**

Time dependent perturbation theory - First and Second order transitions -Transition to continum (Fermi Golden Rule) - Harmonic perturbation - Emission and Absorption of radiation - selection rules for simple harmonic oscillator - Adiabatic & Sudden perturbations -Scattering by a potential & inelastic scattering.

Books for study:

1. Quantum Mechanics – Gupta Kumar Sharma, Jai Prakash Nath & Co.

Books for Reference:

1. Quantum Mechanics - Satya Prakash, Kedar Nath Ram Nath & Co.
2. Quantum Mechanics - Leonard I Schiff, McGraw - Hill Book Company.
3. Quantum Mechanics - Merzbacher 1966
4. A Text book of Quantum Mechanics - P.M. Mathews & K. Venkatesan, 1600 Tata Mc Graw Hill.

SEMESTER -I
PAPER-IV
SPECIAL ELECTRONICS - I

(Analog and Digital Electronics)

Instructional Hrs: 75

Objectives: 1. To gain the knowledge of applications of transistor at low & high frequencies.

2. To have strong foundation in designing analog circuits.

3. To be familiar with various uses of Op-Amps.

Unit - I

Transistor at Low Frequencies: 15Hrs

The hybrid parameters - Determination of h-parameters - h-parameter equivalent circuit - performance of a linear circuit in h- parameters - The h-parameters of a transistor - Nomenclature for transistor h- parameters- Transistor circuit performance in h-parameters- Experimental determination of h- parameters- Limitations of h-parameters.

Transistor at High Frequencies:

The Hybrid - pi (**π**) Common - emitter Transistor model - Hybrid (**π**) conductances hybrid (**π**) capacitances - Validity of hybrid (**π**) model - Variation of hybrid (**π**) parameters - CE short circuit current gain- Single stage CE Transistor Amplifier Response.

Unit -II

Feedback Amplifier: 15Hrs

Feedback concept - General characteristics of negative - Feedback amplifiers - Input and output resistance - Method of analysis of a feedback amplifier - Voltage - Series feed back - Current - Series feedback - Current - Shunt feedback - voltage - Shunt feedback.

Waveform Generator:

Waveform generator and wave shaping - Sinusoidal oscillators - Phase shift oscillator - Wein bridge oscillator - Crystal oscillator - Multivibrators - comparators - Schmitt Trigger - Square wave and Triangular wave generators - Pulse generators.

Unit -III
Operational Amplifier and its Applications: 15Hrs

Parameters of OP - AMP- Sign changer - Phase shifter- Adder - Subtractor - Differential Amplifier - Integrator – Differentiator- Active filters - solving linear simultaneous equation - Solving linear differential equations.

Log amplifier - Antilog amplifier - Voltage to Current - Current to Voltage converter - Instrumentation Amplifier.

Unit -IV
Counters, Registers and Memory: 15Hrs

Counters: Asynchronous counter operation - Mod 3, Mod 5, Mod 4 counters - synchronous counter operation - Up / Down synchronous counters - Cascaded counters.
Registers: Basis shift register functions - serial in / serial out shift registers- serial in / parallel out shift registers - Bidirectional shift registers - shift register counters.
Memory and storage: Random access memories - Read only Memories - Programmable ROMs (PROMs and EPROMs) - Flash Memories - Memory Expansion.

Unit – V
Data Processing and Data Acquisition: 15Hrs

555 IC Timer and its applications - Digital Timer - Multiplexer and Demultiplexer - Sample and Hold system - Binary Weighted Resistor D/A converter - R-2R Resistive ladder D/A converter - Parallel comparator A/D converter- Any two specific methods.

Books for Study:

1. Integrated Electronics - Milliman & Halkias
2. Principles of Electronics - V.K.Mehta & Rohit Mehta
3. Digital Fundamentals - Floyd
4. Introduction to Integrated Electronics - V.Vijayendran
5. Fundamentals of Digital Electronics - Malvino & Leach

SEMESTER -II
PAPER - V
QUANTUM MECHANICS-II

Instructional Hrs: 90
Objectives: 1. To understand the theory of Scattering.

2. To appreciate the relativistic of Schroedinger's equation.

3. To analyse the consequence of quantization.

UNIT-I
Quantum Theory of Scattering: 18Hrs

Scattering amplitude - Definitions of cross-sections: Differential scattering cross-section- Total scattering cross-section - Scattering by Spherically Symmetric Potentials: Partial wave analysis - Born approximation - Validity of Born Approximation - Applications of Born Approximation: Scattering by square well potential - Scattering by a screened Coulomb potential- Scattering by a Gaussian potential.

UNIT – II
Many Electron Systems: Atoms and Molecules: 18Hrs

Introduction - Central field approximation - Thomas Fermi Statistical model - Hartree's self-consistent field model - Simple Diatomic Molecules - Molecular orbital theory: Hydrogen molecule ion (H) - Valence bond theory: Heitler-London Theory of Hydrogen molecule.

UNIT – III
Identical Particles and Spin: 18Hrs

The Indistinguishability of identical particles - Principle of Indistinguishability of identical particles - Exchange symmetry of wave functions: Symmetric and Anti symmetric wave functions - Construction of Symmetric and Anti symmetric wave functions - Distinguishability of identical particles - Pauli exclusion principle -Collision of identical particles - Pauli spin operators.

UNIT – IV
Relativistic Quantum Mechanics: 18Hrs

Schroedinger's relativistic equation (Klein Gorden equation for free particle) - Probability and Current densities - Application of Klein Gorden equation of Hydrogen atom - Dirac's relativistic equation for a free electron - Free particle solutions - Negative energy states - Dirac's equation in Electromagnetic Field - Dirac's Equation in central field (the electron spin) -spin orbit energy.

UNIT - V

Quantization Field Theory 18Hrs

Quantization of wave fields – Quantization procedure for particles - Classical Lagrangian equation - Classical Hamiltonian Equation - Quantization Field Equations - Second quantization - Quantization Schroedinger equation (Non - Relativistic case) - Creation – Destruction and operators- Occupation number representation.

Books for Study:

1. Advanced Quantum Mechanics - Sathya Prakash
2. Quantum Mechanics - Gupta Kumar Sharma

Books for Reference:

1. A text book of Quantum Mechanics - P.M.Mathews and K.Venkatesan (Tata McGraw Hill).
2. Quantum Mechanics -Merzbacher (John Willey and Sons)
3. Quantum Mechanics - A.K.Ghatak and S.Loganathan (Mcmillar & Co)
4. Quantum Mechanics and Field theory - B.K.Agarwal
5. Quantum Physics of atoms, molecules, solids, nuclei and particles (second edition) - Robert Eisberg, Robert Resnick - John Wiley and Sons.
6. Physics of atoms & molecules - J.C.Jochain & Bransden.
7. Quantum Chemistry - Irain Levine.
8. Quantum Mechanics - Schiff McGraw Hill Book Company.
9. Introductory Quantum Chemistry - A.K.Chandra - Tata Mcgraw Hill.

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PAPER-VI
ELECTROMAGNETIC THEORY AND ELECTRODYNAMICS

Instructional Hrs: 90

Objectives: 1. To gain an insight into the physical nature of eletric &magnetic phenomena.

2. To understand the relationship between electric & magnetic fields.

3. To appreciate the study of Electromagnetic wave propagation.

Unit – I

Electrostatics and Magnetostatics 18Hrs

Potential and field due to an electric dipole - Dielectric Polarization - External field of a dielectric medium - Gauss's theorem in a dielectric - The electric displacement vector (D) - Linear dielectrics - relations connecting electric susceptibility and dielectric constants.

Electrostatic energy and energy density - Biot - Savart's law statement -Applications: Magnetic field due to a Long straight wire, Circular coil, Solenoid - Ampere's circuital law - Applications: Magnetic field due to a Long straight wire, Solenoid, Toroid - Divergence and curl of B - Magnetic scalar potential (derivation of expression only) - Equivalence of a small current loop and a magnetic dipole - Magnetic vector potential.

Unit - II

Field Equation and Conservation laws 18Hrs

Equation of continuity - Displacement currents - The Maxwell's equation derivation - Physical significance - Poynting vector - Momentum in electromagnetic field - Electromagnetic potentials - Maxwell's equation in electro magnetic potentials - Concept of gauge - Lorentz gauge - Coulomb gauge - Radiation produced by a low velocity accelerated charged particle (Larmour formula) .

Unit - III

Propagation of Electromagnetic waves 18Hrs_____

Electro Magnetic waves in free space- poynting vector of free space (energy flow) –plane electromagnetic waves in matter - Isotropic dielectric - Anisotropic dielectric - in conducting media - Poynting vector in conducting media - Propagation in ionized gases.

Interaction of Electromagnetic waves with matter on Macroscopic scale & Microscopic scale:

Boundary conditions at interfaces - reflection and refraction - Frenel's law - Brewster's law and degree of polarization - Total internal reflection and critical angle.

Unit - IV
The fields of Moving charges and Radiations 18Hrs

Retarded potentials - Lienard - Wiechert potentials - field of a point charge in uniform rectilinear motion - Radiation from an accelerated charged particle at low velocity - Radiation from an accelerated charged particle at high velocity.
Radiating system

Oscillating electric dipole - Radiation from an oscillating dipole - Radiation from small current element.

Unit - V
Relativistic Electrodynamics 18Hrs_____

Four Vectors and Tensors - Transformation equation for charge density δ and current density J - Transformation equation for A and φ - The Electromagnetic field Tensor - Transformation equations for field vector E and B - Covariance of Maxwell equations in 4 - vector from - Covariance and Maxwell equations in 4 tensor form - Covariance and transformation law of Lorentz force.

Book for study:
1. Electromagnetic theory - Chopra & Agawal (K.nàth & Co)

Book for Reference:
1. Foundations of Electro magnetic theory - Reitz Milliford & Christy - Narosa Publishing house
2. Introduction to Electrodynamics - David J. Griffiths - Pearson education, Prentice Hall of India.
3. Electrodynamics - Gupta Kumar Singh (Pragati Prakashan, Meerut)
4. Electromagnetic theory & Electrodynamics - Satya Prakash - Kedar Nath Ram Nath & Co.
5. Classical Electrodynamics - J.D.Jackson - Willey - Eastern Ltd.

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SEMESTER - II

PAPER - VII
SPECIAL ELECTRONICS II
(Microwave and Digital Communication)

Instructional Hrs: 75
Objectives: 1. To learn the operation of common microwave antennas.

2. To study the various methods about computer communication systems.

3. To appreciate the importance of communication in the modern world.

Unit - I
Antennas and Wave Propagation: 15Hrs

Terms and Definition - Antenna gain - Radiation measurement and field Intensity - Antenna Resistance - Band width- Beam width and polarization - Effects of ground on Antennas - Grounded λ /4 Antenna - ungrounded λ/2 Antenna - grounding systems - Antenna coupling at medium frequencies - Directional High frequency antennas - Dipole Arrays - parasitic elements - Broadside Array - End - fire array - Yagi - uda antenna - Non resonant Antennas - The Rhombic Antenna- Wideband and special purpose Antenna - Folded Dipole Antenna - Helical Antenna - Discone Antenna - Log - Periodic Antenna - Loop Antenna.

Propagation of waves:

Ground (surface) waves - Sky wave propagation - The ionosphere - space waves - Tropospheric scatter propagation - Extraterrestrial communication.

Unit-II
Microwave Tube and Circuits: 15Hrs

Microwave generation - Multicavity Klystron - Reflex Klystron - Magnetron - Traveling wave tube (TWT) - other microwave tubes - crossed field amplifiers - Backward - wave oscillator - Miscellaneous tubes.

Semiconductor Microwave Devices and Circuits:

Microwave transistor - Microwave Integrated circuits - Parametric Amplifiers - Basic principle - Narrowband amplifier - Travelling - wave diode amplifier - Tunnel diode and Negative Resistance amplifier - Gunn Diode - MASER - Fundamentals of Masers - operation -Ruby Maser - Solid State Maser.

Unit -III

Radar and Television **15Hrs**

Elements of a Radar system - Radar performance factors - Radar range equation - Factors influencing maximum range - Effects of Noise - Pulsed systems - Basic pulsed Radar system - Antennas and scanning - Display methods - Moving Target Indication - Radar Beacons - other Radar systems - CW Doppler Radar - Frequency Modulated CW Radar - Planar Array Radar - Black and white TV transmission - Black and White TV Reception - colour TV transmission and Reception.

Unit - IV

Pulse Communications **15Hrs**

Pulse Modulation - Pulse - amplitude modulation (PAM) - Pulse - width modulation (PWM) - Pulse - Position modulation (PPM) - Pulse code modulation (PCM) - Pulse systems - Telegraphy - Telemetry.

Digital communication

Fundamentals of data communication systems - The emergence of data communication system - Characteristics of data transmission circuits - Digital codes - Error detection and correction - Data sets and Interconnection requirements - modem classification - modem interfacing - Interconnection of data circuits to telephone loops - Network and control consideration - Network organizations - switching systems - Network protocols.

Unit – V

Broadband communication systems **15Hrs**

Multiplexing - Frequency Division multiplex(FDM) - Time Division multiplex (TDM) - Short and medium Haul systems - coaxial cables - Fibre optic links - Microwave links - Tropospheric scatter links - long Haul systems - submarine cables - Elements of Long Distance Telephony - Routing codes and signaling systems - Telephone exchanges and routing.

Computer Communication Systems

Types of Network - Circuit switching - Message switching - Packet switching - Design features of a computer communication Network - Topological design -Line capacity allocation - Routing procedures - Flow control procedure - Examples of Computer communication Networks - TYMNET, ARPANET, Integrated services Digital Network (ISDN) - Local area Network (LAN)

Books for Study:

1. Electronics Communication systems - George Kennedy - Tata McGraw Hill 4'' Edition, 1600, 1999.
2. Principle of communication system - 2 Edition- Taub Schilling - TMH 1994, 2001.

Books for Reference:

1. Hand book of Electronics - Gupta and Kumar.
2. Communication system - Garlson - McGraw Hill - 3rd Edition -600.
3. Communication systems - Simon Haykin 3rdedition - John Wilèy and Son INC 1994.

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PRACTICAL - I GENERAL EXPERIMENTS

(Examination at the End of II Semester)

Instructional Hrs: 40
Objectives: 1. To learn some basic experimental techniques.

2. To verify some fundamental laws of physics and to measure different physical quantities.

Any Twelve Experiments:

1. Young's Modulus - Elliptical Fringes by Cornu's Method.

2. Young's Modulus - Hyperbolic Fringes by Cornu's Method

3. Viscosity of liquids - Mayer's Oscillating Disc

4. Thermal Conductivity - Forbe's Method

5. Copper Arc Spectrum - Constant Deviation Spectrograph

6. Iron Arc Spectrum - Constant Deviation Spectrograph

7. Determination of the specific charge 'e/m' - Thomson's Method

8. B-H Curve - Vertical Solenoid

9. Temperature Co-efficient and Band gap energy of a Thermistor

10. Rotational Power of liquids using Polarimeter

11. Determination of λ and d λ of Sodium Light - Fabry -Perot Interferometer

12. Determination of Plank's Constant

13. Study of Laser Beam parameter

14. Laser Diffraction at a Circular Aperture

15. Characteristics of Geiger-Muller tube

PRACTICAL -II ELECTRONICS EXPERIMENTS

(Examination at the End of II Semester)

Instructional Hrs: 40

Objectives: 1. To construct different electronic circuits using Op – Amp.

2. To study the function of logic gates related experiments using digital IC's.

3. To construct the Monostable, Astable and Linear oscillator and study its output waveforms.

Any Twelve Experiments:

1. IC Regulated Dual Power Supply construction
2. Logic Gates related experiments using digital IC's
3. UJT Relaxation Oscillator
4. Parameters of Op-Amp
5. Frequency response of Op-Amp
6. Sign changer, Scale changer, Adder and Subtractor - Op-Amp
7. Half & Full wave, Pear value, Clipper, Clamper - Op-amp
8. Differential Amplifier - Op-Amp
9. Current Amplifier - Op-Amp
10. Wave form generators - Op-Amp
11. Phase Shift oscillator - Op-Amp
12. Wein's bridge oscillator - Op-Amp
13. Active Filters - Op-Amp
14. Schmitt Trigger - Op-Amp
15. Differentiating, Integrating, Clipping, Clamping - Op-Amp
16. Source Follower and Voltage follower- Op-Amp
17. Solving Simultaneous Equations - Op-Amp
18. Monostable, Astable and Linear Oscillator - IC 555
19. Parity Generator and Checking
20. Shift Register - Digital IC's

SEMESTER - III
PAPER - VIII
CONDENSED MATTER PHYSICS

Instructional Hrs: 75

Objectives: 1. To develop a clear concept of the crystal classes and know the relation between real & reciprocal lattices.

2. To analyse the crystal structure by X-ray diffraction.

3. To study the electrical conduction in Conductors, Semiconductors and understand the concept of Superconductivity.

UNIT – I

Crystal Structure, Reciprocal Lattice & Diffraction 15Hrs

Inter planar distance of lattice planes - Separation between lattice planes in simple, FCC, BCC, Cubic lattice - The Reciprocal Lattice: Properties of Reciprocal Lattice - Reciprocal Lattice to BCC and FCC lattice - Experimental methods in X-ray diffraction: Laue method, Rotating crystal method and Powder method - determination of unit cell dimensions - diffraction of electrons.

UNIT – II

Crystal Defects, Dislocations & Lattice Vibrations 15Hrs

Classification of imperfections - point defects: Schottky defect, Frenkel defect - Line defect: Shear strength of single crystal - edge dislocation - burger vector screw dislocation - stress field around dislocation - elastic strain energy of screw & edge dislocation - wave motion of one dimensional atomic lattice - group & phase velocity - brillouin zones - lattice with two atoms per primitive cell.

UNIT – III

Semiconductors 15Hrs

Forbidden , Valence & Conduction bands - Mobility, drift velocity and conductivity of intrinsic semiconductor - carrier concentration in intrinsic semiconductor: Calculation of electron & hole concentrations - density of electrons in conduction band and density of holes in valence band - Impurity semiconductor: Thermal ionization of impurities -energy band diagram and Fermi level - Hall effect.

UNIT – IV

Specific Heat of Solids and Superconductors 15Hrs

The Einstein's theory of specific heats - Debye approximation - Sommerfeld approximation - Electronic specific heat - Superconductivity: Critical field -Meissner effect -Type I & Type II superconductors - Thermodynamic effects - Entropy - Specific heat - Thermal conductivity - AC Josephson effect - DC Josephson effect - London equations - BCS theory.

UNIT – V

Magnetism 15Hrs

Paramagnetism: Classical theory of Paramagnetism (Langevin theory, Weiss theory) - Quantum theory of Paramagnetism - Adiabatic demagnetization - Ferromagnetism: Classical theory of Ferromagnetisim - Quantum theory of Ferromagnetism - Heisenberg's interpretation of weissfield - ferromagnetism domains - origin of domains - The domain wall (Bloch wall)- Antiferromagnetic - Molecular field theory of Anti ferromagnetism - Antiferromagnetic susceptibility in Neel temperature - above and below Neel temperature.

Books for Study:

Solid State Physics - Gupta, Kumar - K.Nath & Co Educational Publishers, Meerut, 9th reprint edition.

Books for Reference:

1. Introduction to Solid State Physics -C.Kittel, Wiley Eastern Ltd, New Delhi.
2. Fundamentals of Solid State Physics - Saxena, Gupta- Saxena, Pragati Prakashan, Meerut.
3.Solid State Physics - S.O.Pillai
4. Solid Slate Physics - A.J. Dekker, Macmillan India Ltd.
5. Materials Science - V. Raghavan.

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SEMESTER - III
PAPER - IX
NUCLEAR AND PARTICLE PHYSICS

Instructional Hrs: 75

Objectives: 1. To understand the concept of nuclear binding energy and calculate the binding energy for different nuclei.

2. To distinguish between the different types of radioactive decays and compute the daughter nuclei for these decays.

3. To appreciate nuclear interactions and interaction with matter.

Unit - I
General properties of Atomic Nucleus **15Hrs**

Distribution of Nuclear charge - Scattering of α particles (Rutherford's Scattering formula and its Experimental verification) - Nuclear size and its determination: life time of α emitters, Anomalous scattering of α particles, Scattering of neutrons - nuclear reaction by charged particles - Mass spectroscopy: Bainbridge & Jordan Mass spectrograph - Nier's Mass Spectrometer - Theories of Nuclear composition (Proton - electron, proton - neutron) - Binding energy (Nuclear Stability) - Semi empirical mass formula - Quantum numbers for Individual nucleons - Quantum properties of Nuclear states.

Unit - II
Radio Activity **15Hrs**

Alpha decay: Properties of α particles - velocity and energy of α particles - Gamow's theory of α decay - Geiger Nuttal law - α ray energies and fine structure of α rays.

Beta decay: Properties of α particles - General features of β decay spectrum - Pauli's hypothesis - Fermi's theory of β decay (neutrino's theory of β decay) - forms of interaction & selection rules - K capture.

Gamma decay: The absorption of gamma rays by matter - interaction of Gamma rays with matter - measurement of Gamma ray energies - Dumond bent crystal spectrometer method - Internal conversion.

Unit - III
Nuclear Models **15Hrs**

Introduction to nuclear models - The Degenerate gas model - The liquid drop model - Bohr Wheeler theory of fission - The Alpha particle model - The shell model - Optical model - Collective model.

Unit - IV
Nuclear Reaction **15Hrs**

Kinds of Nuclear reactions - Conservation laws - Nuclear reaction Kinematics - Nuclear cross section - cross section of a Nuclear reaction - continuum theory of Nuclear reactions - resonance: Breit - Wigner dispersion formula - different stages of Nuclear reaction - statistical theory of Nuclear reactions - Kinematics of stripping & pickup reactions.

Unit – V

Particle Physics **15Hrs**

Introduction to particle physics - classification of elementary particles - Fundamentals interaction - Properties of Elementary particles - Bosons - leptons - Mesons - π mesons - K. mesons - C.P. Violation in neutral k-meson decay - Baryons - Detection of Antiproton - The eight fold way - Quarks.

Books for Study:

1. Nuclear Physics - D.C.Tayal, Himalaya Publishing House.
2. Elements of Nuclear Physics - M.L.Pandya & R.P.S.Yadav, Kedar Nath & Ram Nath & Co.
3. Nuclear physics - R.C.Sharma - K.Nath & Co.

Book for Reference:

1. Concept of Nuclear physics - Bernard L.Cohen Tata McGraw Hill Publishing Company.
2. Nuclear Physics - Irving Kaplan - Narosa Publishing house.
3. Basic Nuclear physics - N.N.Srivasta - Pragati Prakashan - meerut.
4. Nuclear Physics Theory and Experiment - R.R.Roy & B.P.Nigam - New Age International (P) Limited, Publishers.
5. Modern Physics - R.Murugeshan - S.Chand & Company Ltd. New Delhi.

SEMESTER - III

PAPER - X

SPECIAL ELECTRONICS - III

Instructional Hrs: 60
Objectives: 1. To understand the concept of Fiber Optics.

2. To learn the internal architecture of Microprocessor with simple programs.

3. To study the concepts used in embedded systems.

Unit - I
Optical Fiber Wave Guides 12Hrs

Introduction - The optical fiber - The Numerical Aperture - Pulse Dispersion in step index Fibers - multimode Graded index Fibers - Single Mode Fibers - losses in Fibers - Bending Losses - Intrinsic Fibers Losses - Fiber joining - Single Fiber Connectors - Multi- Fiber Couplers - light sources and detectors

Unit - II
Microprocessor Interfacing Memory and I/O Devices 12Hrs

Introduction - Address space partitioning: The Address map - Address Decoding using the binary 1 of n decoder, Data transfer scheme programmed Data transfer - Synchronous Data transfer - Asynchronous Data transfer - Interrupt Driven Data transfer - multiple interrupts - Enabling, Disabling and masking of Interrupts - Direct memory Access Data transfer: Multiple DMA Devices - DMA transfer in 8085 Based system - serial Data transfer.

Unit - III
Architecture and Programming of 8086/8088 12Hrs

Introduction - Organization of 8086: Memory organization - Addressing Bytes and words - Register structure - Addressing modes in 8086 - organization of the 8088 - programming the 8086/8088 - Bus structure and timing of 8086: Bus interface and execution units - Bus cycles - indivisible instruction cycle - status signals - Bus structure and timing of 8088 - Exception handling in 8086/8088.

Unit - IV
Embedded System – I 12Hrs

Basis of embedded system - categories of Embedded systems - Requirements of Embedded systems - challenges and Issue in Embedded software development - Trends in Embedded software development, Application Market segments - consumer electronics - control systems and industrial automation - Biomedical systems - field instrumentation, Hand held computers - Data communication, Networked information appliances - Telecommunication- Wireless communication.

Unit - V
Embedded System - II **12Hrs**

Hardware Architecture - Processor - memory - Latches and Buffers - Crystal - Reset circuit - chip select logic circuit - ADC and DAC - Application - Specific control Circuitry - Display units - Keypads example: An 8051 Based control system, The smart card, case study: A Micro – controller Architecture - The 8051 Architecture - reduced power modes - Memory organization - 16 - Bit and 32 - Bit processors - DSP Architecture - Communication Interfaces standards - Development Tools - Hardware – Software Interaction.

Book for Study:

1. Optical Electronics - Ajoy Ghatak, K.Thyagarajan - Cambridge University press, New Delhi Reprint 2004.
2. Introduction to Microprocessors - Aditya P.Mathur (Third Edition) TATA McGraw Hill Company.
3. Programming for Embedded systems - Dreamtech Software team - Wiley Publishing India Private Ltd.

Books for Reference:

1. Advanced Microprocessors & Peripherals - A.K.Ray, K.M.Bhurchandi (Third Reprint 2002) Architecture, programming & Interfacing - Tata McGraw Hill Company
2. An Embedded Software primer - David E.Simon (Sixth Indian Reprint 2002)Pearson Education Asia.
3. Embedded Systems (Architecture, programming & Design) - Rajkamal Tata McGraw Hill company
4. The 8051 Microcontroller - Kenneth J. Ayala (Second Edition) Thomson Delman Learning.
5. Optical Fibre Communications - John M.Senior (Second Edition) - Eastern Economy Edition.
6. Opto Electronics & fibre optics communication - C.K.Sarkar, D.C.Sarkar (Reprint 2005) New Age International Publishers.

SEMESTER -IV
PAPER-XI
APPLIED SPECTROSCOPY

Instructional Hrs: 90

Objectives: 1. To understand the origin of spectral lines from an excited state of matters.

2. To study the rapid development of Spectroscopic techniques.

3. To introduce the different Spectroscopic instruments and its uses.

UNIT – I

Spectra of Alkali Elements 18Hrs

Broad features of alkali spectra - Ritz combination principle - Explanation of the broad features of alkali spectra, absorption spectra of resonance line, fine structure in alkali spectra- Intensity ratio for doublets.

Interaction with magnetic field and electric field

Experimental setup for Zeeman effect -explanation of normal and anomalous Zeeman effect - Lande's g-factor Pashen Back effect - Transition from weak to strong field - Stark effect -Weak field and strong field effect in Hydrogen.

Hyperfine structure

Isotope effects - Nuclear spin and Hyper splitting -Intensity ratio and determination of nuclear spin - Zeeman effect in Hyperfine structure - Back Goudsmit effect in Hyperfine structure.

UNIT – II

Microwave and Infrared Spectroscopy 18Hrs

The rotation of molecules - Types of molecules - rotational spectra -Theory of rigid diatomic molecule - Intensities of Spectral lines - Isotopic substitution - Polyatomic molecules - Linear molecules - Symmetric and Asymmetric top molecules - Techniques and Instrumentation - The microwave oven.

Vibrating diatomic molecule: Energy of a diatomic molecule - the simple harmonic oscillator - anharmonic oscillator - The diatomic vibrating rotator- Vibration rotation spectra of CO_2 - Interaction of rotation and vibrations - Fourier transform spectroscopy.

UNIT – III

Raman Spectroscopy and Structure Determination 18Hrs

Introduction - Quantum theory of Raman effect - Classical theory of Raman effect - Pure rotational Raman spectra: Linear Top molecules, Asymmetric top molecules - Vibrational Raman spectra - H_20 and CO_2 molecules - Rule of mutual exclusion overtone and combination vibrations - Vibrational Raman spectra, Rotational fine structure - Polarization of light and Raman effect - Structure determination from Raman and Infrared spectroscopy - Techniques and Instrumentation - Near Infrared FT Raman spectroscopy

UNIT – IV

Electronic Spectroscopy of Molecules and ESR Spectroscopy 18Hrs

Electronic spectra of diatomic molecules - Born-Oppenheimer approximation - vibration coarse structure - Progressions, Intensity of vibrational - electronic spectra- Franck Condon principle - Dissociation energy and its products - Rotational fine structure of electronic - vibration transitions - the fortrat diagram - pre-dissociation - Polyatomic molecules: $\sigma^* - \sigma$ transitions, $n - \sigma^*$ transitions, $\pi - \pi^*$ transitions and $n - \pi^*$ transitions

ESR Spectroscopy: Introduction - Basic principle of ESR - ESR Spectrometer - Hyperfine structure - ESR spectra of free radicals: Radicals with one unpaired electron, CH_3 radical, Benzene anion, C_6H_6, p-Nitrobenzoate Dianion.

UNIT – V

NMR, NQR and Mossbauer Spectroscopy 18Hrs

NMR: Magnetic properties of nuclei - NMR instrumentation -Relaxation processes -Bloch equations - Chemical shift.

NQR: Principle of NQR - Transitions for axially symmetric system and non-axially symmetric systems - NQR instrumentation - Regenerative continuous wave Oscillator Method - Chemical bonding.

Mossbauer Spectroscopy: Recoilness - Emission and Absorption - Mossbauer spectrometer - Isomer shift - Quadrupole interaction - Magnetic Hyperfine interaction.

Books for study:

1. Atomic & molecular spectra: Laser, Raj kumar, Kedar Nath Rain Nath publications, Meerut.

2. Fundamentals of Molecular Spectroscopy IV Edition - Colin N Banwell and E. McCash, Tata McGraw Hill Co.

3. Molecular Structure and Spectroscopy - G Arul Dass, Prentice Hall of India.

Books for Reference:

1. Introduction to atomic spectra - H.E.White McGraw Hill Book company.

2. Spectroscopy Vol I and II - B.P.Straughan and S.Walker Chapman and Hall John Willey and sons INC. Newyork.

3. Elements of Spectroscopy - Gupta, Kumar and Sharma, Pragati Prakasn, Meerut.

4. Spectroscopy (Atomic and molecular) - Gurdeep Chatwal, Sham Anand, Himalaya Publishing house.

5. Introduction to Spectroscopy - Pavia Lampman Kriz.Third edition.

6. Molecular Spectroscopy - K.V.Raman, Gopalan P.S.Raghavan. Thomson, Vijay Nicole (P) Ltd.

7. Atomic and molecular spectroscopy - Mool Chand Gupta New age international publishers.

8. Basic principles of spectroscopy - Raymond Chang McGraw H1l Book Company.

9. Introductory Raman Spectroscopy - JohnR. Ferraro, K. Nakamoto, C.W.Brown, Academic press (ELSEVIER).

10. Introduction to Molecular Spectroscopy - G.M. Barrow McGraw Hill Book Company.

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PRACTICAL – III ADVANCED EXPERIMENTS

(Examination at the End of IV Semester)

Instructional Hrs: 55

Objectives: 1. To perform some historically important experiments in the development of physics.

2. To design experiments and learn to extract meaningful physics principles from the experimental observation.

3. To verify some fundamental laws of physics and to measure different physical quantities.

Any Ten Experiments:

1. Susceptibility of Liquids - Quinke's Method
2. Susceptibility of Liquids - Guoy's Method
3. HaIl Effect in Semiconductors
4. Stefan's Constant
5. Determination of the charge 'e' - Millikan's Oil Drop Method
6. Brass Arc Spectrum - Constant Deviation Spectrograph
7. MO Band - Constant Deviation Spectrograph
8. CN Band - Constant Deviation Spectrograph.
9. Determination of λ and dλ of Sodium Light - Michelson Interferometer
10. Compressibility of Liquids - Ultrasonic Diffraction Method
11. Determination of the specific charge 'e/m' - Magnetron Method
12. Find the thickness of the wire by Air Wedge and Laser Diffraction
13. Find the wavelength of Laser Source using Double Slit
14. Verification of Inverse Square Law - G M Counter
15. Absorption Co-efficient of Aluminum- G M Counter
16. Half Life Period of Radiation Source - GM Counter
17. Resistivity of semiconductor thin film - Four Probe Method

PRACTICAL - IV SPECIAL ELECTRONICS EXPERIMENTS

(Examination at the End of IV Semester)

Instructional Hrs: 55

Objectives: 1. To create the students about the awareness of new developments in electronics.

2. To train the students in basic workshop practice to acquire the competence about design, fabricate and repair some basic devices and equipment.

3. To develop an in-depth understanding of the operation of Microprocessor machine language programming & interfacing techniques.

Any Ten Experiments:

1. Simultaneous Addition and Subtraction - Op-amp
2. Voltage to Current and Current to Voltage Converters - Op-amp
3. Voltage to Frequency Converter - Op-amp
4. Zero Crossing Detector, Window Detector, Time Marker - Op-amp Comparator
5. Instrumentation Amplifier - Op-amp
6. A/D Converters any one method
7. D/A Converter - Binary Weighted, Ladder Methods
8. Multiplexer and Demultiplexer
9. Study of Flip-Flop
10. Microprocessor - LED interfacing
11. Microprocessor - Stepper Motor interfacing
12. Microprocessor -Traffic Control Simulation
13. Microprocessor - ADC interface Waveform Generation
14. Microprocessor - Hex Key board interfacing
15. Microprocessor - Musical Tone Generator interface

ELECTIVE – I

PLASMA PHYSICS

Instructional Hrs: 90

Objectives: 1. To know the motion of plasma particles in electric & magnetic field.

2. To produce and characterize hot dense magnetized plasmas and laser produced plasmas.

3. To develop ultrafast optical probing techniques for matter and plasma characterization.

Unit - I

Fundamental Concept about Plasma 18Hrs

Kinetic pressure in a partially ionized gas - Mean free path and collision cross section- Mobility of charged particles- Effect of magnetic field on the mobility of ions and electrons - Thermal conductivity- Effect of magnetic field, Dielectric constant of plasma - Quasineutrality of plasma - Debye shielding distance- optical properties of plasma.

Unit-II

Motion of Charged Particles in Electric and Magnetic Field 18Hrs__

Particle description of plasma; Motion of charged particle in an electrostatic field - Motion of charged particle in uniform magnetic field - Motion of charged particles in electric and magnetic fields- Motion of charged particles in homogenous magnetic field - Motion of charged particles in a magnetic mirror confinement - Motion of an electron in a. time varying electric field -Magnetohydrodynamics - Magnetohydrodynamic equations- Interpretation of the equations - Condition for magnetohydrodynamic behaviour

Unit - II

Plasma Oscillations and Waves 18Hrs

Introduction; theory of simple Oscillations- Electron Oscillations in a Plasma - Derivation of Plasma Oscillations by Utilising Maxwell's Equation - Ion Oscillations and Waves - Oscillations and waves in a magnetic field - Thermal effects on Plasma Oscillations - Landau damping - Hydromagnetic waves - Magnetosonic waves - Oscillations in electron beam.

Unit – III

Plasma Diagnostics Techniques: 18Hrs

Single probe method - Double probe method - Use of probe technique for measurement of plasma parameters in magnetic field - microwave method - spectroscopic

method - Laser as a tool for plasma diagnostics - X- ray diagnostics of plasma - Acoustic method - Conclusion.

Unit – V

Possible Applications of Plasma Physics 18Hrs

Magnetohydrodynamic generator - Basic Theory - Magnetohydrodynamic generator- Principle of working - The Fuel in M.H.D - Magnet in M. H. D generator - Generation of Microwaves Utilizing high density plasma - Plasma diode.

Book for Study:

1. Plasma Physics - Plasma State of Matter - S. N. Sen, Pragati Prakashan Meerut-I

Reference Books:

1. Introduction to Plasma Physics - FF Chen 1600 Plenum Press, London

2. Principles of Plasma Physics - Krvail and Trivelpiece 1976

3. Introduction to Plasma theory - DR Nicholson, 1600

4. The Plasma state - IL Shohet, 1600

5. Introduction to Plasma Physics - M.Uman

6. Principles of Plasma Diagnostic - IH Hutchinson, 2002

7. Plasma Diagnostic Techniques - RH Huddleston and SL Leonard, 1600

8. Plasma The fourth state of Matter - D.A.Frank - Kamenetskii - Macmillan Press Ltd, London.
9. Introduction to unmagnetized Plasmas - Chanchal Uberoi

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ELECTIVE -II

THIN FILM PHYSICS & NANO SCIENCE

Instructional Hrs: 75

Objectives: 1. To understand different methods in thin films.

2. To learn the different characterization studies.

3. To perform different application in thin films.

UNIT - I

Preparation of Thin film **15Hrs**

Nature of thin film - Deposition Technology - Distribution of Deposit - Thermal Deposition in Vacuo - Kinetic theory of Gas and Emission condition - Resistance heating - Thermal Evaporation - Flash Evaporation - Electron Beam method Cathodic sputtering Glow discharge sputtering - low pressure sputtering - Reactive sputtering - R F sputtering

UNIT - II **15Hrs**

Chemical Vapour Deposition (CVD): Thermal Decomposition or Pyrolysis - Vapour phase reaction - Vapour Transporation method - Disproportionation method - Chemical Deposition Electro Deposition -Anodic Oxidation - Electroless plating - Deposition by Chemical Reaction - Chemical Displacement - Spray Pyrolytic process - Characteristic features of the spray pyrolytic process. Mass methods Microbalance Technique - Crystal oscillator - Optical method Photometric - Ellipsometry - Interferometry - Other methods - Substrate cleaning.

UNIT – III

Thin Film Analysis **15Hrs**

Electron diffraction technique - High energy electron diffraction - Low energy electron diffraction - Electron microscopy - Scanning electron microscopy - X ray photoelectron spectroscopy - Mass spectroscopy - Film growth - Incorporation of defects, Impurities etc, in film - Deposition parameters and grain size.

UNIT - IV **15Hrs**

Epitaxy - Thin film structure - Substrate effect - Epitaxial deposit - Twinning and Multitwinning - Phase transition - Dissociation - Film thickness effect - Crystal growth process - Nucleation stage - Epitaxial stage - Intermediate stage - Final stage.

UNIT – V

Nano Science **15Hrs**

Nanomaterials - Properties of Nanomaterials - Quantum wells, wires & dots: Introduction - preparation of quantum nanostructures - Methods of measuring properties:

particle size determination - surface structure - Microscopy transmission electron microscopy - field ion microscopy - scanning microscopy - types of nanotubes - properties of carbon nanotubes - nanowires: types of nanowires - properties of nanowires - potential risks of nanotechnology health & environmental impact of nanoparticles & nanomatertals - Applications of nanotechnology plastic solar cells - carbon nanotubes in solar cells - nanotechnology: in textile developments - smart materials - Nano computers quantum computers - robots & nanobots - nano electronics - current research areas.

Books for study and Reference:

1. Thin film fundamentals - A.Goswami
   New age international (P) Ltd, - New Delhi - 1996
2. Thin film phenomena - K. L. Chopra, 1600
3. Hand book of thin, film technology L. T.Maissel and R. Glang - McGraw Hill
   International Publishers, 1600, 1978.
4. Nanotechnology Fundamentals and Application - Manasi Karkaie - I. K. International Publishing House (P) Ltd, - New Delhi - 2008
5. Introduction to Nanotechnology - Charles P. Poole Jr. and Frank J.Owens - A
   John Wiley & Sons, Inc, Publications - New Jersey - 2003.

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ELECTIVE –III

CRYSTAL GROWTH TECHNIQUES

Instructional Hrs: 90

Objectives: 1. To understand about the classification of crystal growth.

2. To study the different phases.

3. To learn the different characterization studies.

Unit - I
Crystal Growth Phenomena **18Hrs**

Introduction - Nucleation - Theories of Nucleation - Classical theory of nucleation - Gibbs Thomson equation for vapour - modified Thomson's equation for melt - Gibbs Thomson equation for solution - Energy of formation of a nucleus - spherical nucleus - Cylindrical nucleus - Heterogeneous nucleation - cap shaped nucleus - Disc shaped nucleus.

Unit -II
Kinetics of Crystal Growth **18Hrs**

Introduction - Singular and rough faces - models on surface roughness - The Kossel, Stranski, Volmer (KSV) Theory - The Burton, Cabrera and Frank (BCF) theory - Periodic Bond Chain theory.

Unit - III
Solution Growth **18Hrs**
Slow Evaporation Techniques

Low Temperature solution growth: Solution, Solubility and super solubility - Expression of Super saturation - methods of crystallization - crystallization by slow cooling of solutions - crystallization by solvent evaporation - Temperature gradient method - Crystal Growth system: Constant temperature bath - Crystallizer - filtration assembly - seed, seed mount plat form and crystal revolution unit - Seed preparation mounting and reasoning: Solution preparation and reasoning - Initial growth and cooling rate.

Gel Growth

Introduction - principle of gel growth various types of gel - structure of gel - Growth of crystals in gels - Importance of gel technique.

Unit –IV
Crystal Growth Techniques at high temperature **18Hrs**

Crystal Growth from the melt

Bridgeman Technique - Czochralski Technique, Verneuil Technique - Zone melting technique.

Vapour Growth

Physical Vapour deposition- Chemical Vapour deposition - MOCVD- Advantages of CVD - Disadvantages of CVD.

Unit - V
Characterization of Crystals **18Hrs_____**

UV-VIS - NIR - FTIR FT Raman - TGA - DTA-DSC - X-ray Spectrograph - EDAX - NLO studies.

Application: UV, VIS, IR filters - Optical and thermal sensors - Modulation in fibre optics

Book for study:

1. Crystal Growth processes and methods - Dr. P. SanthanaRaghavan
   - Dr. P. Ramasamy - KRV Publications

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ELECTIVE - IV

NUMERICAL METHODS AND PROGRAMMING

Instructional Hrs: 90
Objectives: 1. To understand the basic concept of mathematical modeling.

2. To understand the structure & concept of C- language with programs.

3. To study the basic concepts of object oriented programming with examples.

Unit – I
Numerical Methods **18Hrs**

Methods for determination of Zeroes of linear and non linear algebraic equations and transcendental equations convergence of solutions- Solutions simultaneous Linear equations - Gaussian elimination- pivoting- interactive method Matrix inversion.

Unit - II **18Hrs**

Eigen values and eigenvectors of matrices Power and Jaccobi Method Finite differences - interpolation with equally spaced and unevenly spaced points.Curve fitting - Polynomial least squares and cubic fitting - Spline fitting Numerical differentiation and integration, Newton - Cotes formulae -error estimates - Gauss method .

Unit –III **18Hrs**

Random variate Monte cario evaluation of integrals, Method of Importance sampling, Random walk and Metropolis method Numerical solution of ordinary differential equations Euler and Runge Kutta methods, Predictor and corrector methods - Elementary ideas of solutions of partial differential equations.

Unit - IV
C Programming **18Hrs**

C Programming, Flow Charts, Integer and Floating Point Arithmetic, Expression - Built - in functions executable and non executable statements, assignment control and input- output elements**,** Sub routines and functions, operation with files.

Unit V
Application of C Programming and physics **18Hrs**

Runge kutta method - Interpretation - Euler method Simpson's $1/3^{rd}$ rule - curve fitting - Ordinary Differential equation.

Reference books:

1. Sastry: Introductory Methods of Numeric Analysis, 1600 2000, 2032.
2.Rajaraman: Numerical Analysis.
3. Rajaraman: Fortran Programming. Vetterming, Teukolsuky, Press and Flannery; Numerical Recipes, 1600.

M.SC. PHYSICS & SUPPORTIVE PAPER

QUESTION PAPER PATTERN

Section - A (10 x 1 = 10)

Multiple Choice questions : 5

Definitions : 5

Section - B (5 x 4 = 20)

Medium Answer

Either or type

Two Questions from each unit

Section - C (5 x 8 = 40)

Long Answer

Either or type

Two Question from each unit

SEMESTER III
SUPPORTIVE PAPER
ENVIRONMENTAL PHYSICS

Instructional Hrs: 90

Objectives: 1. To study the universe system

2. To understand the concept of rocket launching and study its uses.

3. To appreciate the applications of low temperature physics

UNIT – I **18Hrs**

Universe

Introduction –solar system-Rotation of planets- space exploration and search for extra-terrestrial life-moon –Mercury-Venus-Mars –Outer planets-Asteroids-Comets-Meteorites. Sun: Surface –Temperature-Composition of the sun, surface energy, stars: Identification –magnitude of the stars –Distance an absolute brightness of stars - Physical properties of stars: Stellar spectra - Interpretation of stellar spectra - Radii of stars - Milky way.

Size and shape - Interstellar matter- star clusters- structure. Rotation and mass-expanding universe- Big Bang theory.

UNIT – II **18Hrs**

Rockets and Satellites

Rocket fuel-Shape of rocket-Take off the rocket –salvaging the various stage rockets- satellites - Condition for a satellite to be placed in a orbit - Launching of satellite-Weight and size of a satellite-Duration of satellite's existence –Return of artificial satellite.

Seismology

Introduction-seismic waves: Preliminary waves: Primary waves-secondary waves, surface waves: Rayleigh waves – love waves, seismography and seismographs, vertical & horizontal pendulum seismographs –Galitzins seismograph –Location of epicenter and the focus of seismic waves –Application of seismology.

UNIT – III **18Hrs**

Low Temperature Physics

Joule Thomson effect –Joule Kelvin porous plug experiment –Results –Temperature of Inversion –Theory of porous plug experiment-Relation connecting Boyle Temperature – Inversion temperature and critical temperature.

Definitions of critical constants –Liquefaction of Air Linde's process – Liquefaction of Helium – K.Onnes method –Properties of Liquid Helium- λ point-He I and He II – Adiabatic Demagnetization (Qualitative treatment only) Helium vapour pressure Thermometer- Production of low temperature Refrigeration.

UNIT - IV **18Hrs**

Electrical charges – kinds of electrical charges – Conductors and Insulators or Dielectrics – Voltmeter – Ammeter – Electrical power – Wattmeter to measure electrical power – Magnetic field and Magnetic flux – Magnetic field of the earth.

Magnetic elements of the earth – To measure the declination at a place – To locate the geographic meridian -To locate the magnetic meridian – Measure of the value of dip at a place on the earth using a dip circle – Magnetic charts – Variation of magnetic elements of the earth. Principle of A.C generator in dynamo – Three phase A.C. – Distribution of Three phase A.C. – Three phase four wire system.

UNIT –V **18Hrs**

Electromagnetic waves – Ground wave propagation – Space wave (or) Tropospheric propagation – Effect of Earth's imperfections on space wave propagation – Effect on obstacles on space wave propagation – Effect of Atmosphere on space wave propagation.

Modulation –AM & FM – Demodulation – Superheterodyne receiver – Principles of T.V. Transmission and Reception – Scanning – Block diagram of T.V. Transmitter and Receiver.

Books for Study:

UNIT – I
Properties of Matter – Brijlal & N.Subramaniam.

UNIT – II
Properties of Matter - Brijlal & N.Subramaniam.
Properties of Matter – R.Gulathi

UNIT – III
Heat & Thermodynamics - Brijlal & N.Subramaniam.

UNIT – IV
Electricity & Magnetism - Brijlal & N.Subramaniam.

UNIT – V
Electromagnetic Waves – Ajay sharma & Dr. R.K. Sinba, Dhanpat Rai Publishing Co.
Principles of Electronics – V.K.Metha.

Books for reference:

1. Properties of Matter – D.S.Mathur
2. Properties of Matter – J.C.Upadhyaya
3. Thermodynamics & Statistical Physics – Singhal, Agarwal & Prakash, Pragati Prakashan, Meerut.

4. Heat & Thermodynamics – D.S.Mathur, S.Chand & Co.
5. A Text Book of Heat & Thermodynamics – J.B.Rajam & C.L.Arora
6. Thermodynamics & Statistical Physics – D.P. Khandel Wal & S.Lokanathan.

M.SC. PHYSICS & SUPPORTIVE PAPER

QUESTION PAPER PATTERN

Section - A (10 x 1 = 10)

Multiple Choice questions : 5

Definitions : 5

Section - B (5 x 4 = 20)

Medium Answer

Either or type

Two Questions from each unit

Section - C (5 x 8 = 40)

Long Answer

Either or type

Two Question from each unit