M.Sc. APPLIED PHYSICS (1st YEAR)

Total Contact Hours = 28 Total Marks = 600 Total Credits = 22

1st SEMESTER		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MPHY1-101	Classical Mechanics	4	0	0	40	60	100	4
MPHY1-102	Statistical Physics	4	0	0	40	60	100	4
MPHY1-103	Mathematical Physics	4	0	0	40	60	100	4
MPHY1-104	Electronics	4	0	0	40	60	100	4
MPHY1-105	Electronics Lab	0	0	6	60	40	100	3
MCAP0-192	Computer Programming Lab	0	0	6	60	40	100	3
Total	**Theory = 5 Labs = 2**	**16**	**0**	**12**	**280**	**320**	**600**	**22**

M.Sc. APPLIED PHYSICS (1st YEAR)

Total Contact Hours = 29 Total Marks = 700 Total Credits = 23

2nd SEMESTER		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
MPHY1-207	Quantum Mechanics –I	4	0	0	40	60	100	4
MPHY1-208	Electrodynamics	4	0	0	40	60	100	4
MPHY1-209	Atomic & Molecular Physics	4	0	0	40	60	100	4
MPHY1-210	Condensed Matter Physics-I	4	0	0	40	60	100	4
MPHY1-211	Advanced Optics and Spectroscopy Lab	0	0	6	60	40	100	3
MPHY1-212	Condensed Matter Lab	0	0	6	60	40	100	3
MPHY1-213	Technical Presentation-I	1	0	0	60	40	100	1
Total	**Theory = 4 Lab = 2**	**17**	**0**	**12**	**340**	**360**	**700**	**23**

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	700	23
Total	**1300**	**45**

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CLASSICAL MECHANICS

Subject Code - MPHY1-101 **L T P C 4 0 0 4** **Duration: 48 Hrs**

UNI-I (12 Hrs)

Lagrangian and Hamilton's Formulation: Mechanics of a system of particles; constraints of motion, generalized coordinates, D'Alembert's Principle and Lagrange's velocity dependent forces and the dissipation function, Applications of Lagrangian formulation, Calculus of variations, Hamilton's principle, Lagrange's equation from Hamilton's principle, extension to non-holonomic systems, advantages of variational principle formulation, symmetry properties of space and time and conservation theorems.

UNIT-II (12 Hrs)

Rigid Body Motion: Independent co-ordinates of rigid body, orthogonal transformations, Eulerian Angles and Euler's theorem, infinitesimal rotation, Rate of change of a vector, Coriolis force, angular momentum and kinetic energy of a rigid body, the inertia tensor, principal axis transformation, Euler equations of motion, Torque free motion of rigid body, motion of a symmetrical top.

UNIT-III (12 Hrs)

Small Oscillations and Hamilton's Equations: Small Oscillations: Eigen value equation, Free vibrations, Normal Coordinates, Vibrations of a Triatomic Molecule (small oscillation). Legendre Transformation, Hamilton's equations of motion, Cyclic-co-ordinates, Hamilton's equations from variation principle, Principle of least action.

UNIT-IV (12 Hrs)

Canonical Transformation and Hamilton-Jacobi Theory: Canonical transformation and its examples, Poisson's brackets, Equations of motion, Angular momentum, Poisson's Bracket Relations, Infinitesimal Canonical Transformation, Conservation Theorems. Hamilton-Jacobi Equations for Principal and Characteristic Functions, Action-Angle Variables for Systems with One-Degree of Freedom.

Recommended Books

1. H. Goldstein, C. Poole and J. Safko, 'Classical Mechanics', 3rd Edn., Addison Wesley.
2. K.C. Gupta, 'Classical Mechanics of Particles and Rigid Bodies', Wiley Eastern, New Delhi, **1988**.
3. L.N. Hand and J.D. Finch, 'Analytical Mechanics', Cambridge University Press, Cambridge, **1998**.
4. L.D. Landau and E.M. Lifshitz, 'Mechanics', Volume1, 2nd Edn., Pergamon, Oxford, **1969.**
5. N.C. Rana and P.J. Joag, 'Classical Mechanics', Tata McGraw Hill, New Delhi, **1991**.

STATISTICAL PHYSICS

Subject Code: MPHY1-102 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

Statistical Basis of Thermodynamics: Foundation of statistical mechanics, macroscopic and microscopic states, contact between statistics and thermodynamics, classical ideal gas, Entropy of mixing and Gibbs Paradox, Phase space and Liouville's Theorem.

UNIT-II (12 Hrs)

Ensemble Theory: Micro-canonical ensemble theory and its application to ideal gas of monatomic particles; Canonical ensemble and its thermodynamics, partition function, classical ideal gas in canonical ensemble theory, energy fluctuations, equipartition and virial theorems, a system of quantum harmonic oscillators as canonical ensemble, statistics of paramagnetism; The grand canonical ensemble and significance of statistical quantities, classical ideal gas in grand canonical ensemble theory, density and energy fluctuations

UNIT-III (13 Hrs)

Quantum Statistics of Ideal Systems: Quantum states and phase space, an ideal gas in quantum mechanical ensembles, statistics of occupation numbers; Ideal Bose systems: basic concepts and thermodynamic behavior of an ideal Bose gas, Bose-Einstein condensation, discussion of gas of photons (the radiation fields) and phonons (the Debye field); Ideal Fermi systems: thermodynamic behaviour of an ideal Fermi gas, discussion of heat capacity of a free-electron gas at low temperatures, Pauli Paramagnetism.

UNIT-IV (11 Hrs)

Theory of Phase Transition: First and Second order transition, Diamagnetism, paramagnetism and ferromagnetism, Ising model, Diffusion equation, random walk and Brownian motion, introduction to non-equilibrium processes.

Recommended Books

1. R.K. Pathria, 'Statistical Mechanics', 2nd Edn., Butterworth-Heinemann, Oxford.
2. K. Huang, 'Statistical Mechanics', 1st Edn., Wiley Eastern, New Delhi.
3. B.K. Agarwal and M. Eisner 'Statistical Mechanics', 1st Edn., Wiley Eastern, New
4. Delhi.
5. C. Kittel, 'Elementary Statistical Physics', 1st Edn., Wiley, New York.
6. S.K. Sinha, 'Statistical Mechanics', 1stEdn., Tata McGraw Hill, New Delhi.

MATHEMATICAL PHYSICS

Subject Code: MPHY1-103 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (13 Hrs)

Linear Algebra and Vector Space: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Rank of matrix, Gauss Jordan method to find inverse of matrix, reduction to normal form, Consistency and solution of linear algebraic equations, Eigenvalues and eigenvectors, Cayley-Hamilton theorem, Reduction to diagonal form, Contour Integration.

UNIT-II (12 Hrs)

Integral Transform: Fourier series of periodic functions, even and odd functions, half range expansions and Fourier series of different wave forms, Fourier transforms: Infinite

and Finite Fourier Transform (General, Sine, Cosine Fourier Transform).
Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms and Solve Differential Equation using Inverse Laplace.

UNIT-III (12 Hrs)

Partial Differential Equation: Formation of PDE, Linear PDE, Homogeneous PDE with constant coefficients, Classification of PDE, Application of PDE: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables, Gamma function, Beta Function

UNIT-IV (11 Hrs)

Special Functions: Ordinary and Singular points, Power series solution of differential equations, Frobenius Method. Bessel functions of first and second kind, Generating function, Integral Representation and recurrence relations for Bessel's functions of first kind, Orthogonality. Legendre functions: generating function, recurrence relations and special properties, Orthogonality.

Recommended Books

1. Anil Makkar, 'Abstract Algebra', 2nd Edn., Sharma Publications.
2. M.D. Raisinghania, S. Chand, 'Advanced Differential Equation', 3rd Edn.
3. M.L. Boas, 'Mathematical Methods in the Physical Sciences', 1st Edn., Wiley, NewYork.
4. E.D. Rainville, 'Special Functions', 1st Edn., MacMillan, New York.
5. B.S. Grewal, 'Higher Engineering Mathematics', 1st Edn., Khanna Publishers.

ELECTRONICS

Subject Code: MPHY1-104 | **L T P C 4 0 0 4** | **Duration: 48 Hrs**

UNIT –I (12 Hrs)

Electronic Devices: Semiconductor Devices (diode, transistors), MESFETs and MOSFETs, Charge Coupled (CCDs) devices, Unijunction transistor (UJT), four layer (PNPN) devices, construction and working of PNPN diode, Semiconductor controlled rectifier (SCR) and Thyristor, Transducers.

UNIT-II (12 Hrs)

Electronic Circuits: Multivibrators (Bistablemonostable and Astable), Differential amplifier, Operational Amplifier (OP-AMP), OP-AMP as Inverting and Non-Inverting, Scalar, Summer, Integrator, Differentiator. Schmitt Trigger and Logarithmic Amplifier, Electronic analog Computation Circuits.

UNIT-III (12 Hrs)

Digital Principles Binary and Hexadecimal Number System, Binary Arithmetic, Logic Gates, Boolean Equation of Logic Circuits, Karnaugh Map Simplifications for Digital Circuit Analysis and Design, Encoders & Decoders, Multiplexers and Demultiplexers, Parity Generators and checkers, Adder-Subtractor Circuits

UNIT-IV (12 Hrs)

Sequential Circuits and Microprocessor: Flip Flops, Registers, Up/Down Counters, Basics of Semiconductor memories: ROM, PROM, EPROM and RAM, D/A Conversion Using Binary Weighted resistor Network, Ladder, D/A Converter, A/D Converter Using Counter, Successive Approximation A/D Converter, Microprocessor Intel 8085 Basic.

Recommended Books

1. Millman and Halkias, 'Electronic Devices and Circuits', 1st Edn., Tata McGraw Hill, **1983**. 2. Ben G. Streetman, 'Solid State Electronic Devices', Prentice Hall, New Delhi, **1995**.
2. A.P. Malvino and D.P. Leach, 'Digital Principles and Applications' Tata McGraw Hill, New Delhi, **1986**.
3. A.P. Malvino, 'Digital Computer Electronics', 4th Edn., Tata McGraw Hill, New Delhi, **1986**.
4. Millman, 'Microelectronics', 4th Edn., Tata McGraw Hill, London, **1979**.
5. W.H. Gothmann, 'Digital Electronics', 4th Edn., Prentice Hall, New Delhi, **1980**.

ELECTRONICS LAB

Subject Code: MPHY1-105 | **L T P C 0 0 6 3** | **Duration: 72 Hrs**

Note: Students will be required to perform at least ten experiments from the given list of experiments

1. Design of Regulated power supply and study of its characteristics.
2. To Study the various gates and verify their truth tables using IC's.
3. To study the Encoder and decoder circuits.
4. To study the INTEL 8085 Microprocessor and WAP to addition and subtraction of two 8 bit numbers.
5. WAP to addition and Subtraction of two 16 bit numbers.
6. WAP to multiply and divide of two 8 bit numbers.
7. To study the use of digital to analog and analog to digital converter.
8. Plot VI characteristics of depletion and enhancement type MOSFET.
9. Design 2:1 MUX circuit using basic gates and verify.
10. To study the construction of thyristor and plot VI characteristics of SCR.
11. Plot the frequency response of op-amp on semi-log graph paper.
12. Application of op-amp as inverting and non-inverting Amplifier.
13. To use the op-amp as summing, scaling and averaging amplifier.
14. Design differentiator and integrator using op-amplifier.

COMPUTER PROGRAMMING LAB

Subject Code: MPHY1-106 | **L T P C 0 0 6 3** | **Duration: 72 Hrs**

Note: 1. One Lab Class will be of 3 Hr duration in which theory concept will be cleared in 1 Hr and 2 Hr practice session to develop related program on PC.
2. The final external examination will be Lab exam only.

Section A

BASIC THEORY INTRODUCTION FOR DOING NUMERICAL PROBLEMS

1. **Introduction to Numerical methods:** Computer algorithms, Interpolations - Lagrange, Newton divided difference, system of linear equations- Gauss elimination & Gauss Jordan method, Numerical differentiation and integration by one third Simpson rule, Numerical solution of differential equations by Euler method, modified Euler's method, Runge-Kutta method.

2. **Programming with C++:** Introduction to the Concept of Object Oriented Programming; Advantages of C++ over conventional programming languages; Introduction to Classes, Objects; C++ programming syntax for Input/Output, Operators, Loops, Decisions, simple and inline functions, arrays, strings, pointers; some basic ideas about memory management in C++.

OR

Programming with Fortran 77: Computer hardware, software, programming languages, Fortran 77, classification of data, variables, dimension and data statement, input/output, format, branching, IF statements, DO statements, subprograms, operations with files.

Section B

LIST OF NUMERICAL PROBLEMS

Note: Students will be required to perform at least ten experiments from the below given list of programmes/ experiments.

1. Arithmetic operations of integers, mensuration (area of circle, rectangle).
2. Data handling: find standard deviation, mean, variance, moments etc. of at least 25 entries.
3. Choose a set of 10 values and find the least squared fitted curve.
4. Implementation of Lagrange's formula to find tabulated values.
5. 5.Implementation of newton's divided difference formula to find tabulated values.
6. To calculate solution of system of linear equations by Gauss elimination OR Gauss Jordan method
7. To evaluate the integrals by using Simpson methods.
8. To find differential equation using modified Euler method.
9. To compute the solution of ordinary differential equation by using Euler's method.

   Or

   Study the charging and discharging of a capacitor in RC circuit with a DC source using Euler method. Graphically demonstrate the variation of charge with time for two values of time step size.
10. To compute the solution of ordinary differential equation by using Runge-Kutta method

    Or

    Study the growth and decay of current in RL circuit containing (a) DC source and (b) AC source using Runge Kutta method. Draw graphs between current and time in each case. Perform power analysis in the circuit for two values of time step size for the case.
11. Generation of waves on superposition like stationary waves and beats.
12. Fourier analysis of square waves.
13. Wave packet and uncertainty principle.
14. Modify the program to include AC source instead of D.C. Source.
15. Study graphically the path of a projectile with and without air drag, using FN method. Find the horizontal range and maximum height in either case. Write your comments on the findings.
16. Motion of artificial satellite.
17. Study of motion of a one-dimensional harmonic-oscillator without and with damping effect (use Euler method). Draw graphs showing the relations (a) velocity vs time (b) acceleration vs time (c) position vs time.

Recommended Books

1. J.B. Scarborough, 'Numerical Mathematical Analysis', 4th Edn., Oxford Book Co.
2. P.L. DeVries, 'A First Course in Computational Physics', 2nd Edn., Wiley, **2011**.

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3. S. Chandra, 'Computer Applications in Physics', 2nd Edn., Narosa, **2008**.
4. R.C. Verma, P.K. Ahluwalia and K.C. Sharma, 'Computational Physics', 1st Edn., New Age, **2005**.
5. Balagurusamy, 'Object Oriented Programming with C++', 2nd Edn., Tata McGraw Hill, **2002**.
6. B.S. Grewal, 'Numerical Methods in Engineering & Science', 40th Edn., Khanna Publishers, **2010**.

QUANTUM MECHANICS –I

Subject Code: MPHY1-207 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (11 Hrs)

Basic Formulation and quantum Kinematics: Stern Gerlach Experiment as a Tool To Introduce Quantum Ideas, Analogy of Two Level Quantum System With Polarisation States of Light. Complex Linear Vector Spaces, Ket Space, Bra Space and Inner Product, Operators and Properties of Operators, Eigenkets of an Observable, Eigenkets as Base Kets, Matrix Representations. Measurement of Observable, Compatible vs Incompatible Observable, Commutators and Uncertainty Relations, Change of Basis and Unitary Transformations, Diagonalization of Operators, Position, Momentum and Translation,

UNIT –II (11 Hrs)

Quantum Dynamics: Time Evolution Operator and Schrödinger Equation, Energy Eigenkets, Time Dependence of Expectation Values, Schrodinger vs Heisenberg Picture, Unitary Operator, Heisenberg Equations

UNIT-III (11 Hrs)

One Dimensional Systems: Potential Step, Potential Barrier, Potential Well. Scattering vs Bounds States Simple Harmonic Oscillator, Energy Eigen States, Wave Functions and Coherent States

UNIT-IV (15 Hrs)

Theory of Angular Momentum: Orbital Angular Momentum Commutation Relations. Eigen Value Problem for L^2, Angular Momentum Algebra, Commutation Relations Introduction to the Concept of Representation of the Commutation Relations in Different Dimensions. Eigen Vectors and Eigen Functions of J^2 and J_z. Addition of Angular Momentum and C.G. Coefficients.

Recommended Books

1. J.J. Sakurai, 'Modern Quantum Mechanics', 3rd Edn., Pearson Education Pvt. Ltd., New Delhi, **2002**.
2. L.I. Schiff, 'Quantum Mechanics', Tokyo McGraw Hill, **1968**.
3. 'Feynmann Lectures in Physics', Vol. III, 4th Edn., Addison Wesly, **1975.**
4. Powel and Craseman, 'Quantum Mechanics', 4th Edn., Narosa Pub. New Delhi, **1961**.
5. Merzbacher, 'Quantum Mechanics', 3rd Edn., John Wiley & Sons, New York, **1970**.

ELECTRODYNAMICS

Subject Code: MPHY1-208 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

Electrostatics and Magnetostatics: Review of basic concept of Electrostatics (Coulomb's law, Gauss's law, Poisson's equation, Laplace equation), Solution of boundary value problem: Green's function, method of images and calculation of Green's function for the image charge problem in the case of a sphere, Laplace equation, uniqueness theorem. Electrostatics of dielectric media, multipole expansion, Boundary value problems in dielectrics; molecular polarizability, electrostatic energy in dielectric media.

Magnetostatics: Review of basic concept of Magnetostatics and Electro Magnetic induction (Biot and Savart's law, Ampere's law, Gauss law, Faraday's Law) Boundary Conditions for the field vectors D, E, B, H.

UNIT-II (12 Hrs)

Time Varying Fields: Physical Significance of Maxwell's equations, vector and scalar potential, Gauge transformations; Lorentz Gauge and Coulomb Gauge. Poynting Theorem. Conservation Laws for a system of charged particles and electromagnetic field, continuity equation

UNIT-III (14 Hrs)

Electromagnetic Waves: Plane wave like solutions of the Maxwell equations. Polarisation, linear and circular polarisation. Superposition of waves in one dimension. Group velocity. Reflection and refraction of electromagnetic waves at a plane surface between dielectrics. Polarisation by reflection and total internal reflection. Fresnal Law, Waves in conductive medium. EM wave guides, TE, TM and TEM waves, Rectangular wave guides. Energy flow and attenuation in wave guides, Cavity resonators.

UNIT-IV (10 Hrs)

Relativistic Formulation of Electrodynamics: Postulate of Special theory of relativity, Review of Lorentz's transformations for length contraction and time dilation, Structure of space-time, four scalars, four vectors and tensors, Relativistic electrodynamics, Magnetism as a relativistic phenomenon and field transformations, Recasting Maxwell equations in the language of special relativity, covariance and manifest covariance, field tensor. Lagrangian formulation for the covariant Maxwell Equations

Recommended Books

1. J.D. Jackson, 'Classical Electrodynamics', 2nd Edn., John & Wiley Sons Pvt. Ltd. New York, **2004.**
2. D.J. Griffiths, 'Introduction to Electrodynamics', 2nd Edn, Pearson Education Ltd., New Delhi, **1991**.
3. J.B. Marion, 'Classical Electromagnetic Radiation', 1st Edn., Academic Press, New Delhi, **1995.**

ATOMIC AND MOLECULAR PHYSICS

Subject Code: MPHY1-209	**L T P C**	**Duration: 48 Hrs**
	4 0 0 4	

UNIT-I (12 Hrs)

One Electron Atom: Vector model of a one electron atom, Quantum states of an electron in an atom, Hydrogen atom spectrum, Spin-orbit Coupling, Relativistic correction, Hydrogen fine structure, Spectroscopic terms, Hyperfine structure.

UNIT-II (10 Hrs)

Two valance Electron Atom: LS coupling, Pauli Exclusion Principle, Interaction energy for LS coupling, Lande interval rule, JJ coupling, interaction energy for jj coupling.

UNIT-III (10 Hrs)

Atom in Magnetic and Electric Field: Zeeman Effect, Magnetic Moment of a Bound Electron, Magnetic Interaction Energy in Weak Field. Paschen-Back Effect, Magnetic Interaction Energy in Strong Field. Stark Effect, First Order Stark Effect In Hydrogen.

UNIT-IV (16 Hrs)

Molecular Spectroscopy: Rotational and Vibrational Spectra of Diatomic Molecule, Raman Spectra, Electronic Spectra, Born-Oppenheimer Approximation, Vibrational Coarse Structure, Franck-Condon Principle, Rotational Fine Structure of Electronic- Vibration Transitions. Spin Resonance Spectroscopy: Electron Spins Resonance and Nuclear Magnetic Resonance Spectroscopy.

Recommended Books

1. H.E. White, 'Introduction to Atomic Spectra', 5th Edn., McGraw Hill, **1934**,
2. C.N. Banwell and E.M. McCash, 'Fundamentals of Molecular Spectroscopy', 4th Edn., Tata McGraw Hill, **1994**.

CONDENSED MATTER PHYSICS-I

Subject Code: MPHY1-210 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (15 Hrs)

Crystallography and Defects in Solids: Crystal structure, Bravais lattices and its classification, Miller Indices, X-Ray Diffraction, Braggs law of Crystallography, Braggs spectrometer, Ordered Phase of matter: kinds of liquid crystalline order, Quasi Crystals.
Defects: Point defects, Impurities, Vacancies- Schottky and Frankel vacancies, Color centres and coloration of crystals, F-centres, Line defects (dislocations), Edge and screw dislocations, Berger Vector, Planar (stacking) Faults, Grain boundaries.

UNIT-II (12 Hrs)

Lattice Dynamics and Phonons: Concept of photons and phonons, Quantization of lattice vibrations, Energy and momentum of phonons, inelastic scattering of photons by phonons, Dispersion relation for lattice waves in monoatomic linear lattice, Vibration modes of diatomic linear lattice.

UNIT-III (12 Hrs)

Specific Heat for Solid: Molar Specific heat at constant pressure and volume, Dulong Petit's Law, Einstein model of specific heat-low and high temperature, Failure of Dulong Petit's Law at low temperature, Drawback of Einstein model, Debye model of specific heat and its comparison with Einstein model, Debye T^3 law, Drude Model of Electrical and Thermal Conductivity.

UNIT-IV (9 Hrs)

Diffusion Phenomenon in Solids: Diffusion in solids, Classification of diffusion process, Mechanism of atomic diffusion, Fick's law, Factor affecting diffusion and applications, Kirkendal law.

Recommended Books

1. C. Kittel, 'Introduction to Solid State Physics', 8th Edn., Wiley, **2004**.
2. N.W. Ashcroft and N.D. Mermin, 'Solid State Physics', Philadelphia, PA, Saunders College Publisher, **1976**.
3. J.M. Ziman, 'Principles of the Theory of Solids', Cambridge University Press, **1976**.
4. A.J. Dekker, 'Solid State Physics', Prentice-Hall Publisher, **1957**.
5. B.D. Cullity, 'Elements of X-Ray Diffraction', Prentice-Hall Publisher, **2001**.
6. L.V. Azaroff, 'Introduction to Solids', McGraw Hill, **1960**.

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ADVANCED OPTICS AND SPECTROSCOPY LAB

Subject Code: MPHY1-211 **L T P C** **Duration: 72 Hrs**
0 0 6 3

Note: Students will be required to perform at least ten experiments from the given list of experiments.

1. To find the wavelength of monochromatic light using Febry Perot interferometer.
2. To find the wavelength of sodium light using Michelson interferometer.
3. To calibrate the constant deviation spectrometer with white light and to find the wavelength of unknown monochromatic light.
4. To find the grating element of the given grating using He-Ne laser light.
5. To find the wavelength of He-Ne laser.
6. To verify the existence of Bohr's energy levels with Frank-Hertz experiment.
7. To determine the charge to mass ratio (e/m) of an electron with normal Zeeman Effect.
8. To determine the velocity of ultrasonic waves in a liquid using ultrasonic interferometer. Laboratory spectroscopy of standard lamps.
9. To study the Kerr effect using Nitrobenzene.
10. To study polarization by reflection - Determination of Brewester's angle.
11. To measure numerical aperture and propagation loss and bending losses for optical fibre as function of bending angle and at various wavelengths.
12. To study the Magneto restriction effect using Michelson interferometer.
13. Experiments with microwave (Gunn diode): Young's double slit experiment, Michelson interferometer, Febry-Perot interferometer, Brewester angle, Bragg's law, Refractive index of a prism.
14. To measure (i) dielectric constant of solid/liquid; (ii) Q of a cavity. Use of Klystron-Based microwave generator.

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CONDENSED MATTER LAB

Subject Code: MPHY1-212 **L T P C** **Duration: 72 Hrs**
0 0 6 3

Note: Students will be required to perform at least ten experiments from the given list of experiments

1. To study the characteristics of a LED and determine activation energy.
2. To study magneto-resistance and its field dependence.
3. To trace hysteresis loop and calculate retentivity, coercivity and saturation magnetization
4. To prepare the thin films of ferroelectric material/ composite films in laboratory by using solvent cast and spin cast method.
5. To prepare electrical contacts on thin films through vacuum/sputtering technique.
6. To study dielectric permittivity of different polymer/ composites as a function of frequency.
7. To study dielectric losses (Tan Delta) spectra of different polymer/ composites as a function of frequency.
8. To study the temperature dependence of dielectric losses (Tan Delta) of different polymer/ composites at different frequencies.
9. To study of ferro-electricity in a ferroelectric material/ composite film

10. To study the dielectric behavior of PZT ceramic by determining Curie temperature, dielectric strength & dielectric constant.
11. Determination of crystal structure & lattice parameters using X-rays diffraction technique.
12. Sizing nano-structures (UV-VIS spectroscopy).
13. DSC/DTA/TGA studies for thermal analysis of materials.

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