CORE COURSE (HONOURS IN PHYSICS)

Semester I

– **Time – 3hrs F.M.: 100 [60(End sem)+15(Int)+25(Pr)] Credit- 6**

PHYSICS-CC I: MATHEMATICAL
PHYSICS-I (Credits: Theory-04, Practicals- 02)
Theory: 40 Classes (1 hr duration)

The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

UNIT-I

Calculus:

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Calculus of variation: Euler equation, Constrained Maxima/ minima using Lagrange Multipliers. **(4 Lectures)**

Dirac Delta function and its properties:

Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function **(3 Lectures)**

UNIT-II

Orthogonal Curvilinear Coordinates:

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. Comparison of velocity and acceleration in cylindrical and spherical coordinate system. **(7 Lectures)**

UNIT-III

Vector Calculus:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its in variance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. **(5 Lectures)**

UNIT-IV

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities, **(8 Lectures0**

UNIT-V

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). **(13 Lectures)**

Reference Books:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013,7th Edn., Elsevier.
- An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning.
- Calculus of variations: Eulers equation, Constrained Maxima/Minima using Langragian Multipliers
- Differential Equations, George F. Simmons, 2007, McGraw Hill.
- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ. Press
- Mathematical Physics and Special Relativity --M. Das, P.K. Jena and B.K. Dash (Sri Krishna Prakashan) 2nd Edition 2009
- Mathematical Physics--H. K. Dass, Dr. Rama Verma (S. Chand Higher Academics) 6th Edition 2011.
- Mathematical Physics –C. Harper, (Prentice Hall India) 2006.
- Mathematical Physics-Goswami (Cengage Learning) 2014
- Mathematical Method for Physical Sciences -- M. L. Boas (Wiley India) 2006

PHYSICS LAB- CC - I LAB:
20 Classes (2 hr duration)

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- *Highlights the use of computational methods to solve physical problems*
- *The course will consist of lectures (both theory and practical) in the Lab*
- *Evaluation done not on the programming but on the basis of formulating the problem*
- *Aim at teaching students to construct the computational problem to be solved*
- *Students can use any one operating system Linux or Microsoft Windows*

Topics	Description with Applications
Introduction and Overview	Computer architecture and organization, memory and Input/output devices.
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow emphasize the importance of making equations in terms of dimensionless variables, Iterative methods.
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (*If---statement. If---else Statement. Nested if Structure. Else---if Statement. Ternary Operator*.
	Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (*1D & 2D*) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs:	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, value of π.

Referred Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5thEdn. , 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw---Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rdEdn. 2007, Cambridge University Press.
- A first course in Numerical Methods, U.M. Ascher& C. Greif, 2012, PHI Learning.
- Elementary Numerical Analysis, K.E. Atkinson, 3 r dEdn. , 2 0 0 7 , Wiley India Edition.
- Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
- An Introduction to computational Physics, T. Pang, 2nd Edn., 2006,Cambridge Univ. Press.

CORE COURSE (HONOURS IN PHYSICS)

Semester I

PHYSICS-CC II: MECHANICS

(Credits: Theory-04, Practicals-02) Theory: 40 Classes (1hr duration)

Time – 3hrs F.M.: 100 [60(End sem)+15(Int)+25(Pr)] Credit- 6

UNIT-I

Rotational Dynamics: Centre of Mass and Laboratory frames. Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Perpendicular and parallel axis thermo. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

(10 Lectures)

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Lawsof Physics in rotating coordinate systems. Centrifugal force .Coriolis force and its applications.

(3 Lectures)

UNIT-II

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

(3 Lectures)

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube. **(2 Lectures)**

UNIT-III

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.

(3 Lectures)

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness .Basic idea of global positioning system (GPS).Physiological effects on astronauts. **(6 Lectures)**

UNIT-IV

Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and itssolution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. **(5 Lectures)**

UNIT-V

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy-Momentum Four Vector.

(8 Lectures)

Reference Books:

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
- Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Books for Reference

- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
- Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A.Serway, 2010, Cengage Learning
- Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.
- Mechanics - J. C. Slater and N. H. Frank (McGraw-Hill)

PHYSICS LAB-CC- II LAB
20 Classes (2hr duration)

1. To study the random error in observations.
2. To determine the height of a building using a Sextant.
3. To study the Motion of Spring and calculate (a) Spring constant, (b) **g** and (c) Modulus of rigidity.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine **g** and velocity for a freely falling body using Digital Timing Technique
6. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
7. To determine the Young's Modulus of a Wire by Optical Lever Method.
8. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
9. To determine the elastic Constants of a wire by Searle's method.
10. To determine the value of g using Bar Pendulum.
11. To determine the value of g using Kater's Pendulum

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash& Ramakrishna, 11th Edn, 2011, KitabMahal

CORE COURSE (HONOURS IN PHYSICS)

Semester II

Time – 3hrs F.M.: 100 [60(End sem)+15(Int)+25(Pr)] Credit- 6

PHYSICS-CC- III: ELECTRICITY AND MAGNETISM
(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

UNIT-I

Electric Field and Electric Potential

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. **(3 Lectures)**

Conservative nature of Electrostatic Field. Electrostatic Potential .Laplace's and Poisson equations. he Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. **(3 Lectures)**

UNIT-II

Electrostatic energy of system of charges .Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere. **(4 Lectures)**

Dielectric Properties of Matter: Electric Field in matter. Polarization, Polarization Charges .Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector **D**. Relations between **E**, **P** and **D**. Gauss' Law in dielectrics. **(4 Lectures)**

UNIT-III

Magnetic Field: Magnetic force between current elements and definition of Magnetic Field **B**.Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field. Ballistic Galvanometer**:** Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping.CDR. **(12 Lectures)**

UNIT-IV

Magnetic Properties of Matter: Magnetization vector (**M).** Magnetic Intensity (**H).** Magnetic Susceptibility and permeability .Relation between **B, H, M**. Ferromagnetism. B-H curve and hysteresis. **(4 Lectures)**

Electromagnetic Induction: Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. **(2 Lectures)**

UNIT-V

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit. **(4 Lectures)**

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems:
Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits. **(4Lectures)**

Reference Books:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J.H.Fewkes&J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

PHYSICS LAB-CC - III LAB
20 Classes (2hr duration)

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.
8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Antiresonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.
14. To determine self-inductance of a coil by Rayleigh's method.
15. To determine the mutual inductance of two coils by Absolute method.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, KitabMahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani

Pub.

CORE COURSE (HONOURS IN PHYSICS)
Semester II

PHYSICS-CC - IV: WAVES AND OPTICS
(Credits: Theory-04, Practicals-02) Theory:
40 Classes (1hr duration)

Time – 3hrs F.M.: 100 [60(End sem)+15(Int)+25(Pr)] Credit- 6

UNIT-I

Geometrical optics: Fermat's principle, reflection and refraction at plane interface, Matrix formulation of geometrical Optics. Idea of dispersion. Application to thick lenses, Ramsden and Huygens eyepiece. **(4 Lectures)**

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. **(4 Lectures)**

UNIT-II

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses. Superposition of N harmonic waves. **(2 Lectures)**

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front Huygens Principle. Temporal and Spatial Coherence.**(3 Lectures)**

UNIT-III

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. **(8 Lectures)**

UNIT-IV

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2)Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry -Perot interferometer. **(5 Lectures)**

UNIT-V

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope .Double-slit. Multiple slits. Diffraction grating. Resolving power of grating. **(7 Lectures)**

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. **(7 Lectures)**

Reference Books

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill

- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
- Optics – Brijlal &Subramaniam- (S. Chand Publication) 2014.
- Geometrical and Physical Optics – R.S. Longhurst, Orient Blackswan, 01-Jan-1986
- Vibrations and Waves -- A. P. French, (CBS) Indian print 2003
- Optics, E. Hecht (PearsonIndia)

PHYSICS LAB- CC- IV LAB
20 Classes (2hr duration)

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2 –T law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster`s focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash& Ramakrishna, 11th Ed., 2011, KitabMahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition,reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D .P. Khandelwal, 1985, Vani

Semester I / III
Generic Elective (GE) (for other Departments / Disciplines☺
Time – 3hrs F.M.: 100 [60(End sem)+15(Int)+25(Pr)] Credit- 6

PHYSICS, GE:-I : MECHANICS
(Credits: Theory-04, Practicals-02)

Theory: 40 Classes (1hr duration)

UNIT-I

Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to time, Gradient, Divergence and Curl.**(2 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd orderhomogeneous differential equations with constant coefficients. **(2 Lectures)**

Laws of Motion: Frames of reference. Newton's Laws of motion .Dynamics of a system of particles. Centre of Mass. **(4 Lectures)**

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy .Motion of rockets. **(2 Lectures)**

UNIT-II

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. **(3 Lectures)**

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only).Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS).Weightlessness.

(7Lectures)

UNIT-III

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions .Kineticand Potential Energy, Total Energy and their time averages .Damped oscillations. **(6 Lectures)**

UNIT-IV

Elasticity: Hooke's law- Stress-strain diagram - Elastic moduli -Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searle's method. **(8 Lectures)**

UNIT-V

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities. **(6 Lectures)**

Note: *Students are not familiar with vector calculus. Hence all examples involved differentiation either in one dimension or with respect to the radial coordinate*

Reference Books:

- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, Vol..1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

• Properties of Matter - D.S. Mathur (S.Chand publication) 2013
• Mechanics- D.C.Tayal (Himalaya Publication) 2013
• Classical Dynamics of Particles and Systems –S. T. Thornton (Cengage Learning) 2012
• Analytical Mechanics-Fowles (CengageLearnings) 2014
•Classical Mechanics-M.Das,P.K.Jena, M.Bhuyan and R.N.Mishra (Srikrishna Publication)

PHYSICS LAB: GE –I LAB: MECHANICS 20 Classes (2hr duration)

1. Measurements of length (or diameter) using verniercaliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

Reference Books:

• Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
• Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
• A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

PHY. DSC-I OF SEM-I IS SAME AS PHY.GE-I, OF SEM-I / III

Semester II

PHYSICS- GE-II : ELECTRICITY , MAGNETISM AND EMT (Credits: Theory-04, Practicals-02)

Theory: 40 Classes (1hr duration)

Time – 3hrs F.M.: 100 [60(End sem)+15(Int)+25(Pr)] Credit- 6

UNIT-I

Vector Analysis: 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 (statement only). **(4 Lectures)**

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor **(4 Lectures)**

UNIT-II

Electrostatic Potential, Potential energy and Dielectrics

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. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector .Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. **(8 Lectures)**

UNIT-III

Magnetism:

Magnetostatics : Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field .Magnetic vector potential. Ampere's circuital law.

(4 Lectures)

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.

(4 Lectures)

UNIT-IV

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**. (4 Lect)**

Growth and decay of currents in LR, LC and RC circuits, Reactance and impedance in AC circuits, Series and parallel LCR Circuits, Resonance and Band Width, Q-factor and Power factor. **(4 Lectures**)

UNIT-V

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. **(8 Lectures)**

Reference Books:

• Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education

• Electricity & Magnetism, J.H. Fewkes&J.Yarwood. Vol. I, 1991, Oxford Univ. Press
• Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
• D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
•Electricity and Magnetism- K.K Tewari (S. Chand Higher Academics)2013

--**PHY. DSC-II OF SEM-II IS SAME AS PHY.GE-II OF SEM-II / IV**

GE LAB: ELECTRICITY, MAGNETISM AND EMT
20 Classes (2hr duration)

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
(i) Measurement of charge and current sensitivity
(ii) Measurement of CDR
(iii) Determine a high resistance by Leakage Method
(iv) To determine Self Inductance of a Coil by Rayleigh's Method. 3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx) 5. To study the Characteristics of a Series RC Circuit.
6. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorems
10. To verify the Superposition, and Maximum Power Transfer Theorems

Reference Books

• Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
• Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
• A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed.2011, KitabMahal

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Semester III

PHYSICS-C V: MATHEMATICAL PHYSICS-II
(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)
Lectures – 60 [40(Th.) + (Pr.)

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

UNIT-I

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only).Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity. **(10 Lectures)**

UNIT-II

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression ofIntegrals in terms of Gamma Functions. Error Function (Probability Integral).**(4 Lectures)**

Theory of Errors: Systematic and Random Errors. Propagation of Errors.Normal Law ofErrors. Standard and Probable Error. **(4 Lectures**

UNIT-III

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance, Frobenius method and its applications to differential equations: Legendre &Hermite Differential Equations. Properties of Legendre &Hermite Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations .Expansion of function in a series of Legendre Polynomials.**12 Lectures)**

UNIT-IV

Partial Differential Equations: Solutions to partial differential equations, using separation ofvariables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Conducting and dielectric sphere in an external uniform electric field. Wave equation and its solution for vibrational modes of a stretched string. **(10 Lectures)**

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books
- Mathematical Physics and Special Relativity --M. Das, P.K. Jena and B.K. Dash (Srikrishna Prakashan) 2nd Edition 2009
- Mathematical Physics--H. K. Dass, Dr. Rama Verma (S. Chand Higher Academics) 6th Edition 2011.
- Mathematical Physics –C. Harper, (Prentice Hall India) 2006.
- Mathematical Physics-Goswami (CENGAGE Learning) 2014
- Mathematical Method for Physical Sciences -- M. L. Boas (Wiley India) 2006
- Mathematics for Physicists, P. Dennery and A. Krzywicki Dover)
- Advanced Engineering Mathematics, E. Kreyszig (New Age Publication) 2011.

PHYSICS LAB-C V LAB

20 Classes (2hr duration)

The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem.

Topics	Description with Applications
Introduction to Numerical computation software Scilab	Introduction to Scilab, Advantages and disadvantages, Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays,Subarray,Specialvalues, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2), Branching Statements and program design, Relational & logical operators, the while loop, for loop, details of loop operations, break & continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function,

	Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program (2).
Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate spring constant
Solution of Linear system of equations by Gauss elimination method and Gauss Seidal	Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)

method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems	
Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kuttasecond order methods Second order differential equation. Fixed difference method	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Second order Differential Equation • Harmonic oscillator (no friction) • Damped Harmonic oscillator • Over damped • Critical damped • Oscillatory • Forced Harmonic oscillator • Transient and • Steady state solution • Apply above to LCR circuits also

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J.20 Bence, 3rd ed., 2006, Cambridge University Press
- Complex Variables, A.S. Fokas& M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
- Scilab(A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand& Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

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PHYSICS-C VI: THERMAL PHYSICS
(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

(*Include related problems for each topic*)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)
Lectures – 60 [40(Th.) + (Pr.)

UNIT-I

Introduction to Thermodynamics

Recapitulation of Zeroth and First law of thermodynamics:

Second Law of Thermodynamics: Reversible and Irreversible process with examples.

Conversion of Work into Heat and Heat into Work.Heat Engines.Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. **(7 Lectures)**

UNIT-II

Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics.Unattainability of Absolute Zero. **(7 Lectures)**

Thermodynamic Potentials: Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy.Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius-Clapeyron Equation and Ehrenfest equations **(6 Lectures)**

UNIT-III

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell'sRelations, Maxwell's Relations:(1) Clausius-Clapeyron equation, (2) Values of Cp-Cv, (3) Tds Equations,

(4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process. **(6 Lectures)**

Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal

Gas and its Experimental Verification.Stern's Experiment.Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases. **(4 Lectures)**

UNIT-IV

Molecular Collisions: Mean Free Path. Collision Probability.Estimates of Mean Free Path.Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance. **(4 Lectures)**

Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial

Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for

Real Gases. Values of Critical Constants. Law of Corresponding States.Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule- Thomson Cooling.

(6 Lectures)

Reference Books:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
- A Treatise on Heat, MeghnadSaha, and B.N.Srivastava, 1958, Indian Press
- Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press
- Heat and Thermal Physics-Brijlal&Subramaiam (S.Chand Publication) 2014
- Thermal Physics-- C. Kittel and H. Kroemer (McMillan Education India) 2010

PHYSICS LAB- C VI LAB

20 Classes (2hr duration)

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.
8. To determine J by Caloriemeter.

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, KitabMahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes,D.P.Khandelwal,1985, Vani Pub.

PHYSICS-C VII: DIGITAL SYSTEMS AND APPLICATIONS
(Credits: Theory-04, Practicals-02)

Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)
Lectures – 60 [40(Th.) + (Pr.)

UNIT-I

Integrated Circuits (Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital lCs. **(3 Lectures)**

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal toBinary and Binary to Decimal Conversion.BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers. **(5 Lectures)**

UNIT-II

Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products .Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(5 Lectures)**

Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and FullAdders.Half & Full Subtractors, 4-bit binary Adder/Subtractor. **(5 Lectures)**

UNIT-III

Introduction to CRO: Block Diagram of CRO. Electron Gun, Deflection System and TimeBase .Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **(3 Lectures)**

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Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator. **3 Lectures)**

Introduction to Computer Organization: Input/ Output Devices. Data storage (idea of RAMand ROM).Computer memory .Memory organization & addressing. Memory Interfacing. Memory Map. **(6 Lectures)**

UNIT-IV

Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders. **(4 Lectures**

Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in Parallel-out Shift Registers (only up to 4 bits). **(2 Lectures)**

Counters(4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter. **(4 Lectures)**

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
- Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
- Concept of Electronics: D.C.Tayal (Himalay Publication) 2011
- Electronics-V. K. Meheta (S. Chand Publication)2013
- The Art of Electronics, P. Horowitz and W. Hill, CUP

PHYSICS PRACTICAL-C VII LAB
20 Classes (2hr duration)

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. To minimize a given logic circuit.
8. Half Adder, Full Adder and 4-bit binary Adder.
9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs
12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.
14. To design an astablemultivibrator of given specifications using 555 Timer.
15. To design a monostablemultivibrator of given specifications using 555 Timer.

Reference Books:

- Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
- Microprocessor 8085:Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.

Semester IV

PHYSICS-VIII: MATHEMATICAL PHYSICS-III
(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)

Lectures – 60 [40(Th.) + (Pr.)

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

UNIT-I

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables.Analyticity and Cauchy-Riemann Conditions .Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region .Laurent and Taylor's expansion. Residues and Residue Theorem.

Application in solving Definite Integrals. **(14 Lectures)**

UNIT-II

Integrals Transforms:

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions .Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.) 10 Lectures.

UNIT-III

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. 8 Lectures

UNIT-IV

Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations. **(4 Lectures)**

Application of Laplace Transforms to Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits. **(8 Lectures)**

Reference Books:

• Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press

• Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.

• Advanced Engineering Mathematics, E. Kreyszig (New Age Publication) 2011.

• Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications

• Complex Variables, A. S. Fokas& M. J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press

• Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill

• First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett.

• Mathematical Physics--H. K. Dass, Dr. Rama Verma (S. Chand Higher Academics) 6th Edition 2011.

•Mathematical Physics –C. Harper, (Prentice Hall India) 2006.

•Mathematical Physics-Goswami (Cengage Learning) 2014

•Mathematical Method for Physical Sciences -- M. L. Boas (Wiley India) 2006

•Introduction to the theory of functions of a complex variable- E.T.Copson (Oxford) Univ. Press, 1970

PHYSICS PRACTICAL-C VIII LAB

20 Classes (2hr duration)

Scilab based simulations experiments based on Mathematical Physics problems like

1. Solvedifferential equations:

$dy/dx = e^{-x}$ with $y = 0$ for $x = 0$

$dy/dx + e^{-x}y = x^2$

$d^2y/dt^2 + 2\ dy/dt = -y\ d^2y/dt^2$

$+ e^{-t}dy/dt = -y$

2. Dirac Delta Function:

Evaluate $\frac{1}{\sqrt{2\pi\sigma^2}} \int e^{\frac{-(x-2)^2}{2\sigma^2}} (x+3)$ d*xfor σ=1,0.1, 0.01 and show it tends to 5*

3. Fourier Series:

Program to sum$\sum_{n=1}^{\infty}(0.2)^n$)

Evaluate the Fourier coefficients of a given periodic function (square wave)

4. Frobenius method and Special functions:

$$\int_{-1}^{1} p_n(\mu) d\mu = \delta n, m$$

Plot $P_n(x)$, $J_v(x)$

Show recursion relation

5. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two).

6. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.

7. Evaluation of trigonometric functions e.g. *sin θ,* Given Bessel's function at N points find its value at an intermediate point. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with computer integration.

8. Integral transform: FFT of e^{-x2}

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. VandeWouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab(A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand& Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

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PHYSICS-C IX: ELEMENTS OF MODERN PHYSICS
(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)

Lectures – 60 [40(Th.) + (Pr.)

UNIT-I

Atomic Spectra and Models

Inadequacy of classical physics, Brief Review of Black body Radiation , Photoelectric effect, Compton effect, dual nature of radiation, wave nature of particles. **3 Lectures**

Wave Particle Duality

de Broglie hypothesis, Experimental confirmation of matter wave, Davisson Germer Experiment, velocity of de Broglie wave, wave particle duality, Complementarity. Superposition of two

waves, phase velocity and group velocity , wave packets ,Gaussian Wave Packet , spatial distribution of wave packet, Localization of wave packet in time. **5 Lectures**

UNIT-II

Atomic spectra, Line spectra of hydrogen atom, Ritz Rydberg combination principle. Alpha Particle Scattering, Rutherford Scattering Formula, Rutherford Model of atom and its limitations, Bohr's model of H atom, explanation of atomic spectra, correction for finite mass of the nucleus, Bohr correspondence principle, limitations of Bohr model, discrete energy exchange by atom, Frank Hertz Expt. Sommerfeld's Modification of Bohr's Theory. **(10 Lectures)**

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UNIT-III

Time development of a wave Packet ; Wave Particle Duality, Complementarity .

Heisenberg Uncertainty Principle ,Illustration of the Principle through thought Experiments of Gamma ray microscope and electron diffraction through a slit. Estimation of ground state energy of harmonic oscillator and hydrogen atom, non existence of electron in the nucleus. Uncertainty and Complementarities. **8 Lectures)**

UNIT-IV

Nuclear Physics

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).

(14 Lectures)

Reference Books:

• Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
• Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
• Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
• Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
• Quantum Mechanics: Theory & Applications, A.K.Ghatak&S.Lokanathan, 2004, Macmillan
• Modern Physics – Bernstein, Fishbane and Gasiorowicz (Pearson India) 2010
• Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles -- R. Eisberg (Wiley India) 2012

Additional Books for Reference

• Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2004, PHI Learning.
• Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
• Quantum Physics, Berkeley Physics, Vol.4. E.H.Wichman, 1971, Tata McGraw-Hill Co.
• Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of Physics Pub.
• Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, 2003, McGraw Hill
•Modern Physics-Serway (CENGAGE Learnings) 2014
•Modern Physics ---Murugesan and Sivaprasad–(S. Chand Higher Academics)
•Physics of Atoms and Molecules – Bransden (Pearson India) 2003

PHYSICS PRACTICAL-C IX LAB
20 Classes (2hr duration)

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuumdiode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunneling effect in tunnel diode using I-V characteristics.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal

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PHYSICS-C X: ANALOG SYSTEMS AND APPLICATIONS
(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)
Lectures – 60 [40(Th.) + (Pr.)

Unit-I

Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram.Conductivity andMobility, Concept of Drift velocity.PN Junction Fabrication (Simple Idea).Barrier Formation in PN Junction Diode.Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. **(5 Lectures)**

Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers.Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, (2) Zener Diode and Voltage Regulation.Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell. **(4 Lectures)**

Unit-II

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC

Configurations.Current gains α and β Relations between α and β. Load Line analysis of Transistors.DC Load line and Q-point.Physical Mechanism of Current Flow.Active, Cutoff and Saturation Regions. **(5 Lectures)**

Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network.h-parameter Equivalent Circuit. Analysis of a single-stage CE

amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers. **(5 Lectures)**

Unit-III

Coupled Amplifier: RC-coupled amplifier and its frequency response. **(4 Lectures)**

Feedback in Amplifiers: Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise. **(4 Lectures)**

Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators. **(4 Lectures)**

Unit-IV

Operational Amplifiers (Black Box approach): Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response .CMRR. Slew Rate and concept of Virtual ground. **(4 Lectures)**

Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor,(4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator. **(5 Lectures)**

Reference Books:

• Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
• Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
• Solid State Electronic Devices, B.G.Streetman&S.K.Banerjee, 6th Edn.,2009, PHI Learning
• Electronic Devices & circuits, S.Salivahanan&N.S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
• OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
• Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk,2008, Springer
• Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
• Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India
•Concept of Electronics: D.C.Tayal (Himalay Publication) 2011
•Electronic devices :Circuits and Applications :W.D. Stanley Prentice Hall
•.Electronics- V. K. Meheta (S. Chand Publication)2013
•.Electronic Circuits :L.Schilling and Velove: 3rd Ed McGraw Hill
• Electronics–Raskhit&Chattopadhyay (New age International Publication)2011
•Electricity and Electronic-D.C.Tayal (Himalaya Pub.)2011
•Electronic devices and circuits –R.L. Boylstad (Pearson India) 2009

PHYSICS PRACTICAL-C X LAB 20

Classes (2hr duration)

1. To study V-I characteristics of PN junction diode, and Light emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To study the various biasing configurations of BJT for normal class A operation.
6. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
7. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
8. To design a Wien bridge oscillator for given frequency using an op-amp.
9. To design a phase shift oscillator of given specifications using BJT.
10. To study the Colpitt`s oscillator.
11. To design a digital to analog converter (DAC) of given specifications.
12. To study the analog to digital convertor (ADC) IC.

13. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
14. To design inverting amplifier using Op-amp (741,351) and study its frequency response
15. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response
16. To study the zero-crossing detector and comparator
17. To add two dc voltages using Op-amp in inverting and non-inverting mode
18. To design a precision Differential amplifier of given I/O specification using Op-amp.
19. To investigate the use of an op-amp as an Integrator.
20. To investigate the use of an op-amp as a Differentiator.
21. To design a circuit to simulate the solution of a 1st/2nd order differential equation.

Reference Books:

• Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
• OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
• Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
• Electronic Devices & circuit Theory, R.L. Boylestad& L.D. Nashelsky, 2009, Pearson

Skills Enhancement Course (SEC)
SEC II– (Semester-IV

Time - 2 hrs. F.M. - 50 [40 (Sem.) + 10 (Int./Pr./Viva)] Credit - 2

3.RENEWABLE ENERGY AND ENERGY HARVESTING (Credits: 02)
Theory: 20 Classes (1hr duration)

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

Unit-I

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation,need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non platecollector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.**(10 Lectures)**

Unit-II

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electricalmachines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics andStatistics, Wave Energy Devices.

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact ofhydro power sources.**(10 Lectures)**

Reference Books:

• Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
• Solar energy - M P Agarwal - S Chand and Co. Ltd.
• Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
• Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
• Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
• J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
• http://en.wikipedia.org/wiki/Renewable_energy

Semester III

PHYSICS-DSC-III - 1C:THERMAL PHYSICS AND STATISTICAL MECHANICS

(Credits: Theory-04, Practicals-02)
Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)
Lectures – 60 [40(Th.) + (Pr.)

UNIT-I

Laws of Thermodynamics: Thermodynamic Description of system: Zeroth Law ofthermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle, Carnot's theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. **(10 Lectures)**

UNIT-II

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thomson Effect, Clausius- Clapeyron Equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations. **(10 Lectures)**

UNIT-III

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(10 Lectures**

UNIT-IV

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh- Jeans Law, Stefan

Boltzmann Law and Wien's displacement law from Planck's law.**(6 Lectures)**

Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics. **(4 Lectures)**

Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

•Thermal and Statistical Physics ---M. Das , P. K. Jena and others (Sri Krishna Prakashan)

•Heat and Thermal Physics-Brijlal&Subramaiam (S.Chand Publication) 2014

•Thermal Physics-- C. Kittel and H. Kroemer (McMillan Education India) 2010

•Thermodynamics & Statistical Physics-J.K.Sharma, K.K.Sarkar (Himalaya Pub.)2014

PHYSICS-DSC 1C LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

20 Classes (2hr duration)

- To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
- Measurement of Planck's constant using black body radiation.
- To determine Stefan's Constant.
- To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
- To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
- To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
- To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
- To study the variation of thermo emf across two junctions of a thermocouple with temperature.
- To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
- To calibrate Resistance Temperature Device (RTD) using Null Method/Off- Balance Bridge

Reference Books:

• Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.

• A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

•A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal,1985, Vani Publicatio

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Semester IV

PHYSICS-DSC-IV - 1D: WAVES AND OPTICS (Credits: Theory-04, Practicals-02) Theory: 40 Classes (1hr duration)

Time – 3 hrs. F.M. – 100 [60(Sem) +15 (Int.) + 25 (Pr.)] Credits: -04(Th.) +02(Pr.)

Lectures – 60 [40(Th.) + (Pr.)

UNIT-I

Fluids: Surface Tension: Synclastic and anticlastic surface - Excess of pressure - Application tospherical and cylindrical drops and bubbles - variation of surface tension with temperature - Jaegar's method.Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of liquid with temperature- lubrication.**(6 Lectures)**

Sound: Simple harmonic motion - forced vibrations and resonance -Fourier'sTheorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria. **(6 Lectures)**

UNIT-II

Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses. **(2 Lectures)**

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on astring. Normal Modes of a string. Group velocity, Phase velocity.Plane waves. Spherical waves, Wave intensity. **(2 Lectures)**

Wave Optics: Electromagnetic nature of light.Definition and Properties of wave front.HuygensPrinciple.**(2 Lectures)**

UNIT-III

Interference: Interference: Division of amplitude and division of wavefront. Young'sDoubleSlit experiment.Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. **(10 Lectures)**

Michelson's Interferometer: (1) Idea of form of fringes (no theory needed), (2) Determinationof wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes. **(2 Lectures)**

UNIT-II

Diffraction: Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.**(7 Lectures)**

Polarization: Transverse nature of light waves. Plane polarized light–production and analysis, half wave plate, quarter wave plate, Circular and elliptical polarization. **(3 Lectures)**

Reference Books:

- Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
- Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley

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PHYSICS-DSC 1D LAB: WAVES AND OPTICS
20 Classes (2hr duration)

- To investigate the motion of coupled oscillators
- To determine the Frequency of an Electrically Maintained Tuning Fork by

Melde's Experiment and to verify λ^2 – T Law.

- To study Lissajous Figures
- Familiarization with Schuster`s focussing; determination of angle of prism.
- To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
- To determine the Refractive Index of the Material of a Prism using Sodium Light.
- To determine Dispersive Power of the Material of a Prism using Mercury Light
- To determine the value of Cauchy Constants.
- To determine the Resolving Power of a Prism.
- To determine wavelength of sodium light using Fresnel Biprism.
- To determine wavelength of sodium light using Newton's Rings.
- To determine the wavelength of Laser light using Diffraction of Single Slit.
- To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
- To determine the Resolving Power of a Plane Diffraction Grating.
- To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Reference Books:

4. Advanced Practical Physics for students, B.L. Flint and H.T.Worsnop, 1971, Asia Publishing House.
5. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
6. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
