COURSES OF STUDY FOR **GENERIC ELECTIVE 'B. Sc. Hons'** PROGRAMME IN

"PHYSICS"

SEMESTER I **GENERIC ELECTIVE** **1 Paper**

Total 100 x 1 = 100 Marks

I. GENERIC ELECTIVE (GE 1): (Credits: Theory-04, Practicals-02)

- All Four Generic Papers (One paper to be studied in each semester) of Physics to be studied by the Students of **Other than Physics Honours.**

Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100 **Pass Marks: Th ESE = 30 + PrESE =10**

End Semester Examination (ESE):

*There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer typeconsisting** of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive typesix** questions of fifteen marks each, out of which any four are to answer.*

MECHANICS **Theory: 60 Lectures**

Laws of Motion:
Frames of reference.Newton's Laws of motion.Dynamics of asystem of particles.Centre of Mass.

Momentum and Energy:
Conservation of momentum. Work and energy. Conservation of energy.

Rotational Motion:
Angular velocity and angular momentum.Torque.Conservationof angular momentum.

Gravitation:
Newton's Law of Gravitation. Motion of a particle in a central force field. Kepler's Laws, Weightlessness.

Oscillations:
Simple harmonic motion.Differential equation of SHM and itssolutions.Kinetic and Potential Energy, Total Energy and their time averages. Forced and Damped oscillations.

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 – Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion – Torsionalpendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method.

Speed Theory of Relativity:

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Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities. Michelson's Morley experiment.

Note: Students are not familiar with vector calculus. Hence all examples involvedifferentiation 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, v.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.
- A textbook of General Physics, Edser
- Oscillations and waves, Satya Prakash.
- A textbook of oscillation, waves and Acoustics, M. Ghosh and D. Bhattacharya

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GE 1 LAB: MECHANICS

60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge andtravelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Young's Modulus of a bar by method of bending.
4. To determine the Elastic Constants of a Wire by Searle's method.
5. To determine g by Bar Pendulum.
6. To determine g by Kater's Pendulum.
7. 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.

SEMESTER II **GENERIC ELECTIVE** **1 Paper**

Total 100 x 1 = 100 Marks

II. GENERIC ELECTIVE (GE 2)

(Credits: Theory-04, Practicals-02)

Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100 **Pass Marks: Th ESE = 30 + PrESE =10**

End Semester Examination (ESE):

*There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer typeconsisting** of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive typesix** questions of fifteen marks each, out of which any four are to answer.*

ELECTRICITY AND MAGNETISM

Theory: 60 Lectures

Vector Analysis:

Scalar and Vector product, gradient, divergence, Curl and theirsignificance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors.

Electrostatics:

Electric flux, Gauss's theorem of electrostatics.Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, solid sphere, plane charged sheet. Electric potential as line integral of electric field, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.Capacitance of an isolated spherical conductor. Parallel plate, spherical condenser. Energy per unit volumein electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Magnetism:

Magnetostatics: Biot-Savart's law and its applications- straight conductor, solenoid carrying current. Divergence and curl of magnetic field.Magneticvector potential.Ampere's circuital law.Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.

Electromagnetic Induction:

Faraday's laws of electromagnetic induction, Lenz'slaw, self and mutual inductance, L of single coil, M of two coils. Energy stored inmagnetic field.

Maxwell's equations and Electromagnetic wave propagation:

Equation ofcontinuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, transverse nature of EM waves.

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, Chattopadhyaya and Rakshit
Electricity and Magnetism, Mahajan and Rangwala
Electricity and Magnetism, K. K. Tewary.

GE 2 LAB: ELECTRICITY AND MAGNETISM

60 Lectures

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. To study the Characteristics of a Series RC Circuit.
5. To study a series LCR circuit LCR circuit and determine its
   (a) Resonantfrequency, (b) Quality factor
6. To study a parallel LCR circuit and determine its
   (a) Anti-resonant frequency and (b) Quality factor Q
7. To verify the Thevenin and Norton theorems
8. 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 GENERIC ELECTIVE 1 Paper

Total 100 x 1 = 100 Marks

III. GENERIC ELECTIVE (GE 3)

(Credits: Theory-04, Practicals-02)

Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100 Pass Marks: Th ESE = 30 + PrESE =10

End Semester Examination (ESE):

*There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type**consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type**six questions of fifteen marks each, out of which any four are to answer.*

THERMAL PHYSICS AND STATISTICAL MECHANICS

Theory: 60 Lectures

Laws of Thermodynamics:

Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Reversible and irreversible processes,Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible &irreversible processes.

Thermodynamical Potentials:

Enthalpy, Gibbs, Helmholtz and Internal Energyfunctions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (C_P – C_V), C_P/C_V, TdS equations.

Kinetic Theory of Gases:

Derivation of Maxwell's law of distribution of velocitiesand its experimental verification, Mean free path (Zeroth Order), TransportPhenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) & its applications to specific heat of gases;mono-atomic and diatomic gases.

Theory of Radiation:

Blackbody radiation, Spectral distribution, Concept of EnergyDensity, 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.

Reference Books:

Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.

A Treatise on Heat, Meghnad Saha, 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.

Heat and Thermodynamics, A. B. Gupta and H. P. Roy.

Heat and Thermodynamics, P. K. Chakraborty.

Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.

Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill

Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall

Statistical Mechanics, K. Huang.

GE 3 LAB: THERMAL PHYSICS AND STATISTICALMECHANICS

60 Lectures

1. Measurement of Planck's constant using black body radiation.
2. To determine Stefan's Constant.
3. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
4. To determine the coefficient of thermal conductivity of a bad conductor by Leedise method.
5. To determine the temperature co-efficient of resistance by Platinum resistancethermometer.
6. To study the variation of thermo emf across two junctions of a thermocouple withtemperature.
7. To record and analyze the cooling temperature of an hot object as a function oftime using a thermocouple and suitable data acquisition system

Reference Books:

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

A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

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

Total 100 x 1 = 100 Marks

IV. GENERIC ELECTIVE (GE 4))

(Credits: Theory-04, Practicals-02)

Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100

Pass Marks: Th ESE = 30 + PrESE =10

End Semester Examination (ESE):

*There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer typeconsisting** of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive typesix** questions of fifteen marks each, out of which any four are to answer.*

WAVES AND OPTICS

Theory: 60 Lectures

Wave Optics:

Electromagnetic nature of light.Definition and properties of wave front.Huygens Principle.Temporal and Spatial Coherence.

Interference:

Division of amplitude and wave front. 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.

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 –theory and applications.

Fraunhofer diffraction:

Single slit.Circular aperture, Resolving Power of a telescope. Single slit. Double slit. Multiple slits. Diffraction grating.Resolving power of grating.

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.

Reference Books

Waves and Acoustics, P. K. Chakraborty and Satyabrata Chowdhury.
Introduction to Geometrical and Physical Optics, B. K. Mathur.
Optics, Singh and Agarwal.
Geometrical and Physical Optics, P. K. Chakraborty.

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, AjoyGhatak, 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.

GE 4 LAB: WAVES AND OPTICS

60 Lectures

1. Familiarization with: Schuster's focusing; determination of angle of prism.
2. To determine refractive index of the Material of a prism using sodium source.
3. To determine the dispersive power and Cauchy constants of the material of aprism using mercury source.
4. To determine wavelength of sodium light using Fresnel Biprism.
5. To determine wavelength of sodium light using Newton's Rings.
6. To determine the thickness of a thin paper by measuring the width of theinterference fringes produced by a wedge-shaped Film.
7. To determine wavelength of (1) Na source and (2) spectral lines of Hg sourceusing plane diffraction grating.
8. 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 Pub.

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