



ASSAM UNIVERSITY, SILCHAR

SYLLABUS UNDER

**CHOICE BASED CREDIT
SYSTEM**

PHYSICS

(as GENERAL ELECTIVE (GE))

Semester wise list of Physics Generic Elective papers for students taking honours in other disciplines

SEMESTER	COURSE OPTED	COURSE NAME	CREDITS
I	PHSGEC101T	Mechanics	4
	PHSGEC101P	Mechanics Lab	2
II	PHSGEC201T	Electricity, Magnetism and EMT	4
	PHSGEC201P	Electricity, Magnetism and EMT Lab	2
III	PHSGEC301T	Thermal Physics and Statistical Mechanics	4
	PHSGEC301P	Thermal Physics and Statistical Mechanics Lab	2
IV	PHSGEC401T	Waves and Optics	4
	PHSGEC401P	Waves and Optics Lab	2

SEMESTER-I

PHSDSC101T: MECHANICS / PHSGEC101T: MECHANICS

Contact Hours: 60

Full Marks = 70 [ESE (50) CCA(20)]

Pass Marks = 28 [ESE (20) CCA (08)]

(Two questions of 10 marks will be set from each unit, one needs to be answered from each unit)

Unit 1:

Vectors: Vector algebra. Scalar and vector triple products. Derivatives of a vector with respect to a parameter. **(4 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. **(6 Lectures)**

Unit 2:

Momentum and Energy: Conservation of momentum, Conservation of energy. Work energy theorem, Centre of Mass and centre of gravity. Motion of rockets. **(6 Lectures)**

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. Moment of inertia and radius of gyration. Calculation of moment of inertia of rectangular bar, cylinder and shell. **(5 Lectures)**

Unit 3:

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. Weightlessness. Basic idea of global positioning system (GPS). **(10 Lectures)**

Unit 4:

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, Torsional pendulum. **(10 Lectures)**

Unit 5:

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

Special Theory of Relativity: Frames of reference, Galilean transformation, Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities. **(6 Lectures)**

Reference Books:

- i. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison Wesley.
- ii. Mechanics Berkeley Physics course, v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
- iii. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley.
- iv. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.
- v. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHSDSC101P: MECHANICS / PHSGEC101P: MECHANICS

Contact Hours: 60

Full Marks = 30 Pass Mark = 12 ESE Time = 3 hours

(One experiment to be performed at the time of ESE)

1. Measurements of diameter of a thick wire using Vernier Calliper, screw gauge and travelling microscope.
2. To determine the Moment of Inertia of a regular body by torsional pendulum.
3. To determine the Young's Modulus of a Wire by Searle's Method.
4. To determine the Modulus of Rigidity of a Wire by Statistical method.
5. To determine g by Bar Pendulum.
6. To determine g by Kater's Pendulum.
7. To determine g and velocity for a freely falling body using Digital Timing Technique.
8. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g .
9. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).

Reference Books:

- i. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- ii. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- iii. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
- iv. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SEMESTER-II

PHSDSC201T: ELECTRICITY AND MAGNETISM

/ PHSGEC201T: ELECTRICITY AND MAGNETISM

Contact Hours: 60

Full Marks = 70 [ESE (50) CCA(20)]

Pass Marks = 28 [ESE (20) CCA (08)]

(Two questions of 10 marks will be set from each unit, one needs to be answered from each unit)

Unit 1:

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(12 Lectures)**

Unit 2:

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. Electric potential as line integral of electric field, potential due to a point charge, electric dipole. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. **(15 Lectures)**

Unit 3:

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

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials. **(13 Lectures)**

Unit 4:

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. Transformer, Auto Transformer, different losses of transformer. **(10 Lectures)**

Unit 5:

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. **(10 Lectures)**

Reference Books:

- i. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- ii. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- iii. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- iv. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- v. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

PHSDSC201P: ELECTRICITY AND MAGNETISM / PHSGEC201P: ELECTRICITY AND MAGNETISM

Contact Hours: 60

Full Marks = 30 Pass Mark = 12 ESE Time = 3 hours

(One experiment to be performed at the time of ESE)

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. To determine the specific resistance by metre bridge.
3. To determine the strength of the magnetic field produced at the centre of the tangent galvanometer coil due to a current flowing in it and hence to determine horizontal component of earth's magnetic field.
4. To determine the self induction of a coil and its internal resistance in an L-R circuit
5. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
6. To determine the resistance of a galvanometer by half deflection method.
7. To determine a resistance per unit length of metre bridge wire by Carey Foster's method.
8. To verify the Thevenins theorem.
9. To verify the Norton's theorem.
10. To verify series and parallel laws of resistance by Post office Box.
11. To compare the emf of two cells by potentiometer.

Reference Books

- i. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- ii. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- iii. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
- iv. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

SEMESTER-III

PHSDSC301T: THERMAL PHYSICS AND STATISTICAL MECHANICS / PHSGEC301T: THERMAL PHYSICS AND STATISTICAL MECHANICS

Contact Hours: 60

Full Marks = 70 [ESE (50) CCA(20)]

Pass Marks = 28 [ESE (20) CCA (08)]

(Two questions of 10 marks will be set from each unit, one needs to be answered from each unit)

Unit 1:

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermo dynamical Processes, Applications of First Law: General Relation between C_P & C_V , Work Done during Isothermal and Adiabatic Processes, Reversible & irreversible processes, Second law & Entropy, Entropy changes in reversible & irreversible processes. Carnot's theorem (Statement only).

(15 Lectures)

Unit 2:

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

(12 Lectures)

Unit 3:

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.

(12 Lectures)

Unit 4:

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of a. Wien's distribution law b. Rayleigh-Jeans Law, c. Stefan Boltzmann Law and d. Wien's displacement law from Planck's law.

(10 Lectures)

Unit 5:

Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law, Bose-Einstein distribution law and comparison of three statistics.

(11 Lectures)

Reference Books:

- i. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- ii. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- iii. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- iv. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill.
- v. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa.
- vi. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- vii. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

PHSDSC301T: THERMAL PHYSICS AND STATISTICAL MECHANICS**/ PHSGEC301T: THERMAL PHYSICS AND STATISTICAL MECHANICS**

Contact Hours: 60

Full Marks = 30 Pass Mark = 12 ESE Time = 3 hours

(One experiment to be performed at the time of ESE)

1. To determine Mechanical Equivalent of Heat, J, by Joule's method.
2. To determine the specific heat of a liquid by the method of cooling.
3. To verify Stefan's law by electrical method.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the coefficient of linear expansion by suitable method.
6. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
7. To study the variation of thermo emf across two junctions of a thermocouple with temperature.

Reference Books:

- i. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- ii. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- iii. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- iv. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

SEMESTER-IV

PHSDSC401P: WAVES AND OPTICS / PHSGEC401P: WAVES AND OPTICS

Contact Hours: 60

Full Marks = 70 [ESE (50) CCA(20)]

Pass Marks = 28 [ESE (20) CCA (08)]

(Two questions of 10 marks will be set from each unit, one needs to be answered from each unit)

Unit 1:

Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). **(5 Lectures)**

Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequency and their uses. **(5 Lectures)**

Unit 2:

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity. **(5 Lectures)**

Sound: Simple harmonic motion - forced vibrations and resonance. 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. **(7 Lectures)**

Unit 3:

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. **(4 Lectures)**

Interference: Interference: Division of amplitude and division of 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. **(10 Lectures)**

Unit 4:

Interferometers: Michelson's Interferometer: Idea of formation of fringes, Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes. **(6 Lectures)**

Diffraction: Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & 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. **(8 Lectures)**

Unit 5:

Polarization: Transverse nature of light waves. Polarised and unpolarised light, Nicol Prism, Production and analysis of Plane Polarised light by Nicol Prism. Zone Plate, Half wave and quarter wave plate, Babinet Compensator. **(10 Lectures)**

Reference Books:

- i. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
- ii. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- iii. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- iv. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley

PHSDSC401P: WAVES AND OPTICS

/ PHSGEC401P: WAVES AND OPTICS

Contact Hours: 60

Full Marks = 30 Pass Mark = 12 ESE Time = 3 hours

(One experiment to be performed at the time of ESE)

1. To determine the frequency of tuning fork by Sonometer.
2. To determine the refractive index of a given liquid by travelling microscope.
3. To determine the R. I. of the material of a given lens by suitable method.
4. To determine the focal length of convex mirror with the help of a convex lens by optical bench.
5. Familiarization with Schuster's focussing; determination of angle of prism.
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a given Prism using Mercury Light
8. To determine wavelength of sodium light using Newton's Rings.

Reference Books:

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