B.Sc Pass Course under Choice Based Credit System
Department of Physics

Proposed Scheme of Examination

SEMESTER	COURSE OPTED	COURSE NAME	Credits	Marks	Internal Assessment	Total Marks
I	Ability Enhancement Compulsory Course – I	(English/Hindi/MIL Communication)/ Environmental Science	4	-	-	100
	Core Course –I (Theory) DSC 1A	Mechanics	4	80	20	100
	Core Course –I (Practical) DSC 1A	Mechanics	2	-	-	50
	Core Course –II DSC 2A	DSC 2A	6	-	-	150
	Core Course –III DSC 3A	DSC 3A	6	-	-	150
II	Ability Enhancement Compulsory Course – II	Environmental Science/ (English/ Hindi/ MIL Communication)	4	-	-	100
	Core Course –IV (Theory) DSC 1B	Electricity, Magnetism and EMT	4	80	20	100
	Core Course –IV (Practical) DSC 1B	Electricity, Magnetism and EMT	2	-	-	50
	Core Course -V DSC 2B	DSC 2B	6	-	-	150
	Core Course -VI DSC 3B	DSC 3B	6	-	-	150
III	Skill Enhancement Course –1 SEC-1	Physics Workshop Skills	4	80	20	100
	Core Course –VII (Theory) DSC 1C	Thermal Physics and Statistical Mechanics	4	80	20	100
	Core Course –VII (Practical) DSC 1C	Thermal Physics and Statistical Mechanics	2	-	-	50
	Core Course –VIII DSC 2C	DSC 2C	6	-	-	150
	Core Course –IX DSC 3C	DSC 3C	6	-	-	150
IV	Skill Enhancement Course –2 SEC-2	Computational Physics Skills	4	80	20	100
	Core Course –X (Theory) DSC 1D	Waves and Optics	4	80	20	100

	Core Course –X (Theory) DSC 1D	Waves and Optics	2	-	-	50
	Core Course –XI DSC 2D	DSC 2D	6	-	-	150
	Core Course –XII DSC 3D	DSC 3D	6	-	-	150
V	Skill Enhancement Course –3 SEC-3	Electrical circuits and Network Skills	4	80	20	100
	Discipline Specific Elective -1 (Theory) DSE -1A	Solid State Physics	4	80	20	100
	Discipline Specific Elective -1 (Practical) DSE -1A	Solid State Physics	2	-	-	50
	Discipline Specific Elective -2 (Theory) DSE -2A	Quantum Mechanics	4/5	80/120	20/30	100/150
	Discipline Specific Elective -2 (Tutorial) DSE -2A	Tutorial	1	50	-	50
	Discipline Specific Elective -3 (Theory) DSE -3A	Elements of Modern Physics	4	80	20	100
	Discipline Specific Elective -3 (Practical) DSE -3A	Elements of Modern Physics	2	-	-	50
VI	Skill Enhancement Course –4 SEC-4	Weather Forecasting	4	80	20	100
	Discipline Specific Elective -4 (Theory) DSE -1B	Atomic, Molecular & Laser Physics	4	80	20	100
	Discipline Specific Elective -4 (Practical) DSE -1B	Atomic, Molecular & Laser Physics	2	-	-	50
	Discipline Specific Elective -5 (Theory) DSE -2B	Nuclear &Particle Physics	4/5	80/120	20/30	100/150
	Discipline Specific Elective -5 (Tutorial) DSE -2B	Tutorial	1	50	-	50
	Discipline Specific Elective -6 (Theory) DSE -3B	Mathematical Physics	4	80	20	100
	Discipline Specific Elective -6 (Practical) DSE -3B	Mathematical Physics	2	-	-	50

A. CORE COURSES

1. Mechanics (4) + Lab (2)
2. Electricity, Magnetism and EMT (4) + Lab (2)
3. Thermal Physics and Statistical Mechanics (4) + Lab (2)
4. Waves and Optics (4) + Lab (2)

B. DISCIPLINE SPECIFIC ELECTIVE COURSES

a) Discipline Specific Elective-1 (Fifth Semester)
(Select any one of the three options)

1. Solid State Physics (4) + Lab (2)
2. Quantum Mechanics (5) + Tutorial (1)
3. Elements of Modern Physics (4)+ Lab (2)

b) Discipline Specific Elective-4 (Sixth Semester)
(Select any one of the three options)

1. Atomic, Molecular & Laser Physics (4)+ Lab (2)

c) Discipline Specific Elective-5 (Sixth Semester)

2. Nuclear &Particle Physics (5)+ Tutorial (1)

d) Discipline Specific Elective-6 (Sixth Semester)

3. Mathematical Physics (4)+ Lab (2)

C. SKILL ENHANCEMENT COURSES

1. Physics Workshop Skills
2. Computational Physics Skills
3. Electrical circuits and Network Skills
4. Weather Forecasting

Programme Objectives:

1. To produce graduates who are excel in the competencies of Physics and have the ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the physical problems in nature and to create new skills and tools for their possible solutions.
2. To produce young graduates having broad and balanced knowledge and understanding of Physical concepts, principles and theories of Physics so that they persue PG courses and research in reputed institutes.

Programme Outcomes:

1. The main outcomes of this three year degree program to provide a firm foundation in every aspect of all discipline of Physics and to explain abroad spectrum of modern trends in Physics and to develop experimental, computational and mathematical skill to the young graduates.
2. To inculcate the habit of critical thinking, scientific knowledge to design, draw logical conclusion and develop scientific temperament among the young graduates.

B.Sc.Ist Year (Ist Semester)CBCS

Semester I

PHYSICS- Core Course-I: DSC 1A MECHANICS

Max. Marks: 80

(Theory)

Int. Asst. : 20

Credits : 4

Time: 3 Hrs.

(Credits: Theory-04, Practicals-02)

MECHANICS (Theory60 Hours)

Note: Examiner will set Nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing eight short answer type questions covering the entire syllabus and will be of 2 marks each.

Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions carry equal marks i.e. sixteen. Internal assessment comprises of 5 marks for attendance, 5 marks for assignments and 10 marks for class tests.

Course Objectives (CO):

(i) This course helps the Students to understand the basics and fundamentals of vector algebra, Newton's laws of Motions and their applications to various dynamical situations in daily life.

(ii) This course helps the students to understand the different concepts of differential equations and learn conservation of energy, momentum, angular velocity, angular momentum and apply them to basic problems in daily life.

(iii) This course helps the students to understand the Newton's law of Gravitation, Kepler's laws to describe the orbital motion of Planets and Satellite in circular motion,concept of Simple Harmonic Motion and properties of system executing such motion.

(iv) This course helps the students to understand the concept of Elasticity, different Elastic constants, relation between them and special relativistic effects on mass and energy of moving objects and special theory of relativity.

Unit 1

Vectors: Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter.

Laws of Motion: Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass.**(14Hours)**

Unit 2

Ordinary Differential Equations: 1^{st} order homogeneous differential equations, 2^{nd} order homogeneous differential equations with constant coefficients.

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

Motion of rockets.
Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum. **(17Hours)**

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 application, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).
Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions,Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.**(14 Hours)**

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 - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method.
Special Theory of Relativity: Constancy of speed of light, Postulates of Special Theory of Relativity, Length contraction,Time dilation, Relativistic addition of velocities.**(15Hours)**

Skilled to be learned after reading this Course:

1. Learn basics of the kinematics and dynamics linear and rotational motion.
2. Develop skills to understand and solve the equations of Newtonian Gravity and central force problem
3. Acquire basic knowledge of oscillation
4. Learn the concepts of Elasticity and different elastic constant of solids.
4. Learn about inertial and non-inertial systems and essentials of special theory of Relativity.

Reference Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison- Wesley.
2. Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw- Hill.
3. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd. edn., 2015, Oxford University Press.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

B.Sc. Ist Year (Ist Semester) CBCS

Core Course-I DSC 1A (Mechanics Practicals)

Max. Marks : 50

Credits : 2

Time : 4 Hours

PHYSICS LAB: Coure course I: Mechanics Practicals

Course Objectives(CO):

(i) Students would be able making to use of Vernier calipers, screw gauge, sextent.

(ii) Students would be able to determine the moment of Inertia of fly wheel.

(iii) Students would be able to determine the Elastic constants of different materials by different methods.

(iv) Students would be able to determine the value of g by different methods.

List of Practicals

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextent.
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 determine g and velocity for a freely falling body using Digital Timing Technique.
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g.

Reference Books:

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

Skilled to be learned after reading this Course :

After performing the Experiments in laboratory, the students understand the theoretical and experimental concepts related to mechanics such as rotational dynamics (Flywheel), elastic properties (Young Modulus

and Modulus of Rigidity) and (compound pendulum),etc and apply these concepts in solving theoretical and numerical problems.

B.Sc. Ist Year (Semester II) CBCS

PHYSICS- Core Course-IV: DSC 1B Electricity, Magnetism and EMT

(Theory)

Max. Marks: 80

Int. Asst. : 20

Credits : 4

Time: 3 Hrs.

(Credits: Theory-04, Practicals-02)

Electricity, Magnetism and EMT (Theory 60 Hours)

Note: Examiner will set Nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing eight short answer type questions covering the entire syllabus and will be of 2 marks each.

Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions carry equal marks i.e. sixteen. Internal assessment comprises of 5 marks for attendance, 5 marks for assignments and 10 marks for class tests.

Course Objectives(CO):

(i) This course helps the Students to understand the basics of vector algebra, concepts of curl and Divergence, Gauss Divergence theorem and Stoke's theorem.

(ii) This course helps the Students to understand the basics and fundamentals of Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges and Apply Gauss's law of electrostatics to solve a variety of problems

(iii) This course helps the students to understand the concept of Magnetostatics, Ampere's Circuital law, Different types of Magnetic materials and phenomena of electromagnetic induction.

(iv) This course helps the students to understand the different forms of Maxwell's equations and Propagation of EM Waves through different media.

Unit I

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).

Unit II

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. 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.

Unit III

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.

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.

Unit IV

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.

Skilled to be learned after reading this Course:

1. This course will help in understanding basic concepts of electricity and magnetism and their applications.
2. Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.

Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.12
5. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

PHYSICS LAB- DSC 1B LAB: ELECTRICITY, MAGNETISM AND EMT

Max. Marks : 50
Credits : 2
Time : 4 Hours

Course Objectives(CO):

(v) Students would be able making to use of Multimeter

(vi) Students would be able to use the Ballastic Galvanometer

(vii) Students would be able to determine Quality factor of LCR Series and Parallel circuits.

(viii) Students would be able to verify the Thevenin's theorem,Norton's theorem, Superposition and Maximum Power transfer theorems of the different electrical circuits..

List of Practicals

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 the a series 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 theorem

10. To verify the Superposition, and Maximum Power Transfer Theorem

Reference Books

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

Skilled to be learned after reading this Course :

1) After performing the Experiments in laboratory, the students understand the theoretical and experimental concepts related to Electricity and Magnetism such as , AC an DC vottage and current, , series and parallel resonant circuits and different theorems of Electrical circuits ,etc and students competent enough to apply the concepts in solving theoretical, numerical and practical problems of electromagnetics.