Pandit Deendayal Upadhyaya Shekhawati University,Sikar

SYLLABUS : PHYSICS

(Three/Four Year Under Graduate Programme in Science)

I & II Semester

Examination – 2023-24

Dy. Registrar
Pandit Deendayal Upadhyaya
Shekhawati University,
Sikar(Rajasthan)

Name of University	PanditDeendayalUpadhyayaSekhawatiUniversity,Sikar
Name of Faculty	B.Sc. (Maths Group)
Name of Discipline	Physics

SEMESTER-WISE PAPER TITLES WITH DETAILS

UG0803-B.Sc. (Maths Group)								
PHYSICS								
#	Level	Semester	Type	Title	L	T	P	Total
1	5	I	MJR	Mechanics&Oscillations	4	0	0	4
2	5	I	MJR	Physics Lab- I	0	0	2	2
3	5	II	MJR	Electromagnetism	4	0	0	4
4	5	II	MJR	Physics Lab – II	0	0	2	2
5	6	III	MJR	Optics	4	0	0	4
6	6	III	MJR	Physics Lab – III	0	0	2	2
7	6	IV	MJR	Thermodynamics & Statistical Physics	4	0	0	4
8	6	IV	MJR	Physics Lab– IV	0	0	2	2
9	7	V	MJR	Electronics and Solid- State Devices	4	0	0	4
10	7	V	MJR	Physics Lab–V	0	0	2	2
11	7	VI	MJR	Quantum Mechanics and Spectroscopy	4	0	0	4
12	7	VI	MJR	Physics Lab–VI	0	0	2	2
13	8	VII	MJR	Solid State Physics	4	0	0	4
14	8	VII	MJR	Mathematical Physics	4	0	0	4
15	8	VII	MJR	Physics Lab–VII	0	0	2	2
16	8	VIII	MJR	Nuclear Physics	4	0	0	4
17	8	VIII	MJR	Numerical Methods and Computer Programming	4	0	0	4
18	8	VIII	MJR	Physics Lab–VIII	0	0	2	2

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Syllabus : UG0803- B.Sc.

I–Semester – Physics

(2023-2024)

Type	Paper Code and Nomenclature	Duration of Examination	Maximum Marks	Minimum Marks
Theory	Mechanics & Oscillations	3 Hrs.- EoSE	100 Marks-EoSE	40 Marks-EoSE
Practical	Physics Lab- I	4 Hrs.- EoSE	50 Marks-EoSE	20 Marks-EoSE

Semester	Code of the Course	Title of Course/Paper	NHEQF Level	Credits
I		Mechanics & Oscillations	5	4
Level of Course	**Type of the Course**	**Delivery Type of the Course**		
Introductory	Major/Minor	Lecture, Sixty Lecture Including diagnostic and formative assessments during Lecture hours.		
Prerequisites	Physics and Mathematics Courses of Central Board of Secondary Education or equivalent.			
Objectives of the Course	Objectives of the Course in Mechanics& Oscillations: The objective of the course is to provide students with a comprehensive understanding of classical mechanics, including the laws of motion, frames of reference, forces, motion of particles and rigid bodies, oscillations, and central forces. The Course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.			

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Detailed Syllabus

PHY – Mechanics & Oscillations

Unit-I

Physical Law and frame of Reference: (a) Inertial and non-inertial frames, Transformation of displacement, velocity. acceleration between different frames of reference involving translation. Galilean transformation and invariance of Newton's laws. (b) Coriolis Force: Transformation of displacement, velocity and acceleration between rotating frame, Pseudo forces, Coriolis force, Motion relative to earth, Focault's pendulum.(c) Conservative Forces: Introduction about conservative and non-conservative forces, Rectilinear motion under conservative forces, Discussion of potential energy curve and motion of a particle.**(15 Lectures)**

Unit -II

Centre of Mass: Introduction about Centre of Mass. Centre of Mass Frame: Collision of two particles in one and two dimensions (elastic and inelastic), Slowing down of neutrons in a moderator, Motion of a system with varying mass, Angular momentum concept, conservation and charge particle scattering by a nucleus.

Rigid body: Equation of a motion of a rotating body. Inertial coefficient.Case of J not parallel to ω. The kinetic energy of rotation and the idea of principal axes. The processional motion ofthe spinningTop.**(15 Lectures)**

Unit –III

Motion under Central Forces: Introduction aboutCentralForces, Motion under central forces, gravitational interaction. inertia und gravitational mass, General solution under gravitational interaction. Kepler'slaws, Discussion of trajectories, Cases of elliptical and circular orbits, Rutherford scattering.

Damped Harmonic Oscillations: Introduction about oscillations in a potential well, Damped force and motion under damping.Damped Simple Harmonic Oscillator, Power dissipation, Anharmonic oscillator and simple pendulum as an example.**(15 Lectures)**

Unit-IV

Driven Harmonic Oscillations: Driven harmonic oscillator with damping, Frequency response. Phase factor,Resonance, Series and parallel of LCR circuit, Electromechanical Galvanometer.

Coupled Oscillations: Equation of motion of two coupled Simple Harmonic Oscillators, Normal modes and motion in mixed modes. Trust behavior, Dynamics of a number of oscillators with neighbor interactions.**(15 Lectures)**

Suggested Books and References –

1. Mechanics, Berkeley Physics, Vol.-I, Kittel, Knight, et.al. 2007, Tata McGraw-Hill
2. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
3. Feynman Lectures, Vol.-I, R.P. Feynman, R.B. Leighton, M. Sands, 2008,Pearson Education.
4. Course of Theoretical Physics, Vol.-I Mechanics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann.

5. Mechanics, D.S. Mathur, S. Chand and Company Limited,
6. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw-Hill.
7. Introduction to classical Mechanics with problems and solutions David M.
8. Classical Mechanical: Herbert Goldstein
9. Classical Mechanics: John R. Taylor.
10. Mechanics: Keith R. Symon
11. The Physics of Waves & Oscillations, Bajaj
12. Waves, A.P. French

Suggested E-resources:

1. Online Lecture Notes and Course Materials:

- MIT OpenCourseWare: Classical Mechanics - This resource provides lecture notes, problem sets, and solutions for a complete course on classical mechanics: https://ocw.mit.edu/courses/physics/8-01sc-classical-mechanics-fall-2016/
- HyperPhysics - This online resource provides concise explanations and interactive simulations for various topics in mechanics: http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand the concept of inertial and non-inertial frames of reference and their implications on the laws of motion.
2. Apply transformations of displacement, velocity, and acceleration between differentframes of reference involving translation.
3. Explain the Galilean transformation and the invariance of Newton's laws.
4. Analyze the motion in rotating frames, including the transformation of displacement, velocity, and acceleration, and the effects of pseudo forces such as the Coriolis force.
5. Analyze the motion of a Focault pendulum and understand its relation to the rotation ofthe Earth.
6. Define conservative and non-conservative forces and analyze rectilinear motion under conservative forces.
7. Analyze potential energy curves and understand the motion of particles under conservative forces.
8. Explain the concept of the center of mass and its relevance in the motion of systems ofparticles.
9. Apply the concept of conservation of angular momentum and analyze particle scatteringby a nucleus.
10. Understand the equations of motion for rotating bodies and the concept of the moment of inertia.
11. Analyze the kinetic energy of rotation and the motion of spinning tops.
12. Understand the motion under central forces, including gravitational interaction and applyKepler's laws.

13. Analyze damped harmonic oscillations and understand the effects of damping on oscillatory motion.
14. Analyze driven harmonic oscillators with damping and understand frequency response andpower dissipation.
15. Explain the behavior of coupled oscillators and analyze systems of oscillators with neighbor interactions.

Semester	Code of the Course	Title of Course/Paper	NHEQF Level	Credits
I		Physics Lab- I	5	2
Level of Course	**Type of the Course**	**Delivery Type of the Course**		
Introductory	Major/Minor	Practical, Sixty hours of practical Including diagnostic and formative assessments during practicalhours.		
Prerequisites	Physics and Mathematics Courses of Central Board of Secondary Education orequivalent.			
Objective of the Course	The objective of the physics lab- I with the mentioned experiments, is to provide students with hands-on experience in conductive experiments related to oscillations, damping, coupled oscillators, and properties of materials. The lab aims to reinforce theoretical concepts learned in the classroom, develop practical skills, and enhance the understanding of physics principles through experimentation.			

Physics Lab-I

The colleges are free to set new experiments of equivalent standards. This should be intimated and approved by the Convener, Board of Studies before the start of the academic session. It is binding on the college to have an experimental set-up of at least ten experiments listed below. In case the number of experiments performed by the student is less than eight, his marks shall be scaled down in the final examination on a pro-rata basis. Laboratory examination paper will be set by the external examiner out of eight or more experiments available at the centre

List of Experiments -

1. Study the variation of the time period with amplitude in large-angle oscillations using a compound pendulum.
2. To study the damping using a compound pendulum.
3. To study the excitation of normal modes and measure frequency splitting into two coupled oscillators.
4. To study the frequency of energy transfer as a function of coupling strength using coupled oscillators.
5. To study the viscous fluid damping of a compound pendulum and determine thedamping coefficient and Q of the oscillator.
6. To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficients with the assistance of a conducting lamina.

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7. Study of normal modes of a coupled pendulum system. Study of oscillations in mixed modes and find the period of energy exchange between the two oscillators.
8. To determine Young's modulus by bending of the beam.
9. To determine Y, σ and n by Searle's method.
10. To determine the modulus of rigidity of a wire using Maxwell's needle.
11. To determine the moment of Inertia of a fly-wheel.
12. To find the motion of a spring and calculate (a) Spring constant (b) Acceleration due to gravity (g) (c) Modulus of Rigidity.

Suggested Books and References -

Suggested E-resources.

Course Learning Outcomes:

Through these experiments, students will develop practical skills in experimental techniques, data collection, analysis, and interpretation. They will also enhance their understanding of fundamental concepts and principles in oscillations, damping, coupled oscillators, and material properties. The lab experiences will foster critical thinking, problem- solving abilities, and the application of theoreticalknowledge to real-world scenarios.

Syllabus : B.Sc.

II–Semester – Physics

(2023-2024)

Type	Paper Code and Nomenclature	Duration of Examination	Maximum Marks	Minimum Marks
Theory	Electromagnetism	3 Hrs.- EoSE	100 Marks-EoSE	40 Marks-EoSE
Practical	Physics Lab- II	4 Hrs.- EoSE	50 Marks-EoSE	20 Marks-EoSE

Semester	Code of the Course	Title of Course/Paper	NHEQF Level	Credits
II		Electromagnetism	5	4
Level of Course	**Type of the Course**	**Delivery Type of the Course**		
Introductory	Major/Minor	Lecture, Sixty Lecture Including diagnostic and formative assessments during Lecture hours.		
Prerequisites	Physics and Mathematics Courses of Central Board of Secondary Education orequivalent.			
Objectives of the Course	Objectives of the Course in Electromagnetism: The objective of the course is to provide students with a comprehensive understanding of the fundamental concepts and principles of electromagnetism. It aims to develop their knowledge and skills in analyzing scalar and vector fields, electric and magnetic fields, and their interactions, as described by Maxwell's equations. The course will also cover important topics such as electric potential, polarization, magneto statics and electromagnetic waves.			

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Detailed Syllabus

Electromagnetism

Unit - I

Scalarand Vector Fields: Concept of Field, Scalar and Vector Fields, Gradient of scalar field,Physical significance and formalism of Gradient, Divergence and Curl of a vector field Cartesian co-ordinates system, Problems based on Gradient, Divergence and curl operators. Concept of Solid angle, Gauss divergence and Stoke's theorem. Gauss law from inverse square law. Differential form of Gauss law.

Electric Field and Potential Energy: Invariance of Charge, Potential energy of system of (i) Discrete N-charges (ii) Continuous charge distribution. Energy required to built a uniformly charged sphere, classical radius of electron, Electric field due to a short electric dipole, Interaction of electric dipole with external uniform and non-uniform electric field, potential due to a uniformly charged spherical shell.

Poisson's and Laplace equations in Cartesian co-ordinates and their applications to solve the problems of electrostatics.Electric field measured in moving frames, Electric field of a point charge moving with constant velocity.**(15 Lectures)**

Unit - II

Electric field in matter: Multiple expansion, definition of moments of charge distribution, Dielectrics, Induced dipole moments, polar non polar molecules, Free and bound charges. Polarization, Atomic polarizabilty, electric displacement vector, electric susceptibility, dielectric constant, relation between them.

Electric potential and electric field due to a uniformly polarized sphere (i) out side the sphere (ii) at the surface of the sphere (iii) inside the sphere, Electric field due to a dielectric sphere placed in a uniform electric field (a) out side the sphere (b) inside the sphere, Electric field-due to a charge placed in dielectric medium and Gauss law. Clausius-Mossotti relation in dielectrics.**(15 Lectures)**

Unit - III

Magnetostatics and Magnetic field in matter: Lorentz force, properties of magnetic field, Ampere's law, field due to a current carrying solid conducting cylinder (a) out side (b) at the surface and (ii) inside the cylinder. Ampere's law in differential form, Introduction of Magnetic Vector potential, Poisson's equation for vector potential, Deduction of Bio-Savart law using Magnetic Vector potentials, Differential form of Ampere's law, Atomic magnet, Gyromagnetic ratio, Bohr-magneton, Larmor frequency, induced magnetic moment and dia-magnetism, spin magnetic moment, Para and Ferromagnetism, Intensity of Magnetization, Magnetic permeability and Susceptibility, free and bound current densities, Magnetic field due to a uniformly magnetized material and Non-uniformly magnetized material.**(15 Lectures)**

Unit- IV

Maxwell's Equations and Electromagnetic waves: Displacement current, Maxwell's Equations, Electromagnetic waves, Electromagnetic waves in an Isotropic medium, Properties of electromagnetic waves, Energy density of Electromagnetic waves, Poynting vector, Radiation pressure of free space, Electromagnetic waves in Dispersive medium, Spectrum of Electromagnetic waves.**(15 Lectures)**

Suggested Book and References-

1.Electricity & Magnetism: A.S. Mahajan& Abbas A. Rangwala, Tata McGraw-Hill
2.Introduction to Electrodynamics-David J.Griffith,Prentice Hall
3. Berkley Physics Course, Vol.-II, Edward M. Purcell
4. Fundamental University Physics Vol.-II: Fields and Waves; M. Alonso and E.J. Finn: Addison-Wesley Publishing Company

Suggested E-resources-

1. MIT OpenCourseWare: Electricity and Magnetism - This resource offers lecture notes, assignments, and exams for a complete course on electricity and magnetism: https://ocw.mit.edu/courses/physics/8-02sc-physics-ii-electricity-and-magnetism-spring- 2011/
2. HyperPhysics - This online resource provides concise explanations and interactive simulations for various topics in electrostatics and electric fields: http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand the concept of scalar and vector fields and their physical significance.
2. Demonstrate knowledge of gradient, divergence, and curl operators and their applications in electromagnetism.
3. Apply Gauss divergence and Stoke's theorems to analyze electric and magnetic fields.
4. Explain the behavior of electric fields and potential energy in different charge distributions.
5. Analyze the interaction of electric dipoles with external electric fields and calculate the resulting potentials.
6. Solve problems related to Poisson's and Laplace's equations in electrostatics.
7. Describe the behavior of electric fields in different types of matter, including dielectrics and polarized spheres.
8. Understand the concept of electric displacement, susceptibility, and dielectric constant.
9. Analyze the behavior of magnetic fields in various materials and the effects of currents on magnetic fields.
10. Apply Ampere's law and the magnetic vector potential to calculate magnetic fields in different scenarios.
11. Explain the properties of electromagnetic waves and their behavior in isotropic and dispersive media.
12. Calculate the energy density and radiation pressure of electromagnetic waves.
13. Understand the spectrum of electromagnetic waves and its implications.

Semester	Code of the Course	Title of Course/Paper	NHEQF Level	Credits
II		Physics Lab- II	5	2
Level of Course	**Type of the Course**	**Delivery Type of the Course**		
Introductory	Major/Minor	Practical, Sixty hours of practical Including diagnostic and formative assessments during practical hours.		
Prerequisites	Physics and Mathematics Courses of Central Board of Secondary Education orequivalent.			
Objective of the Course	1.To provide hands-on experience in conducting experiments related toelectricity and magnetism. 2. To develop practical skills in using various electrical components and instruments. 3. To reinforce theoretical concepts learned in the corresponding lecture coursethrough practical applications. 4. To enhance problem-solving and analytical skills by analyzing experimental data and interpreting results. 5. To promote scientific inquiry, critical thinking, and the ability to design and execute experiments. 6. To foster teamwork and collaboration in conducting experiments and analyzing results. 7. To develop skills in accurately measuring and recording experimental data.			

Physics Lab-II

The colleges are free to set new experiments of equivalent standards. This should be intimated and approved by the Convener, Board of Studies before the start of the academic session. It is binding on the college to have an experimental set-up of at least ten experiments listed below. In case the number of experiments performed by the student is less than eight, his marks shall be scaled down in the final examination on a pro-rata basis. Laboratory examination paper will be set by the external examiner out of eight or more experiments available at the centre

List of Experiments -

1. To study the Faraday's Law of electromagnetic induction.
2. To study the variation of power transfer by two different loads by a D.C. source and toverify the maximum power transfer theorem.-
3. To study the variation of charge and current in an RC circuit with a different time constant (using a DC source).
4. To study the behavior of an RC circuit with varying resistance and capacitance ACmains as a power source and also to determine the impedance and phase relations.
5. To study the rise and decay of current in an LR circuit with a source of constant emf.
6. To study the voltage and current behavior of an LR circuit with an AC power source. Alsodetermine power factor, impedance and phase relations.

7. To study the magnetic field along the axis of a current-carrying circular coil. Plot thenecessary graph and hence find the radius of the circular coil.
8. To study the frequency response of a series LCR series circuit and to estimate the resonant frequency and find out Q-factor and band width.
9. To study the frequency response and to find resonant frequencies of L-C-R parallel circuits. Also to find the quality factor and band width in L-C-R series circuit.
10. To determine the specific resistance of a material and determine the difference between twosmall resistance using Carey Fosters Bridge.
11. To convert a galvanometer into an ammeter of a given range.
12. To convert a galvanometer into a voltmeter of a given range.

Suggested Books and Reference -

Suggested E-resources.

Course Learning Outcomes:

By the end of the course, students should be able to:
1. Demonstrate proficiency in using various electrical components and instruments required for conducting experiments.
2. Apply theoretical concepts of electricity and magnetism to design and executeexperiments.
3. Analyze experimental data using appropriate mathematical and statistical techniques.
4. Interpret experimental results and draw conclusions based on data analysis.
5. Develop skills in accurately measuring physical quantities and recording experimentalobservations.
6. Communicate experimental procedures, results, and conclusions effectively in written reports.