NEP and Learning Outcome-based Curriculum Framework

For B.Sc. Physical Science

Scheme - UG A1 (Interdisciplinary) Programme

Academic Session (w.e.f. 2024-2025)

DEPARTMENT OF PHYSICS

GURUGRAM UNIVERSITY, GURUGRAM

(A State Govt. University Established Under Haryana Act17 of 2017)

1. Scheme of Programme

Scheme UG A1: Undergraduate Programmes (Course work only)

Semester I

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A1	Mechanics	240/PHYP/ CC101	3	0	2	3	0	1	4	25	50	5	20	100
CC-B1	Core course of Chem./ Math								4					100
CC-C1	Core course of Chem./ Math								4					100
Minor Course(s)														
MIC-1	One from Pool													
Multidisciplinary Course(s)														
MDC-1	One from Pool													
Ability Enhancement Course(s)														
AEC-1	One from Pool													
Skill Enhancement Course														
SEC-1	One from Pool													
Value-added Course(s)														
VAC-1	One from Pool													

*Student should select one major discipline (Out of three options A, b, & C studied during first three years of UG Programs) in which he/she wishes to pursue Honors.

Semester II

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A2	Electricity and Magnetism	240/PHYP/CC201	3	0	2	3	0	1	4	25	50	5	20	100
CC-B2	Core course of Chem./Math								4					100
CC-C2	Core course of Chem./Math								4					100
Minor Course(s)														
MIC-2	One from Pool													
Multidisciplinary Course(s)														
MDC-2	One from Pool													
Ability Enhancement Course(s)														
AEC-2	One from Pool													
Skill Enhancement Course														
SEC-2	One from Pool													
Value-added Course(s)														
VAC-2	One from Pool													

*Students exiting the program after second semester and securing 52 credits including 4 credits of summer internship will be awarded UG certificate in the relevant Discipline/Subject

Semester III

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A3	Quantum Mechanics	240/PHYP/ CC301	3	0	2	3	0	1	4	25	50	5	20	100
CC-B3	Core course of Chem./ Math								4					100
CC-C3	Core course of Chem./ Math								3					75
Minor Course(s)														
MIC-3	One from Pool													
Multidisciplinary Course(s)														
MDC-3	One from Pool													
Ability Enhancement Course(s)														
AEC-3	One from Pool													

Semester IV

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A4	Solid State Physics	240/PHYP/CC401	3	0	2	3	0	1	4	25	50	5	20	100
CC-B4	Core course of Chem./Math								4					100
CC-C4	Core course of Chem./Math								4					100
Vocational Course(s)														
VOC-1	One from Pool													
Ability Enhancement Course(s)														
AEC-4	One from Pool													
Value-added Course(s)														
VAC-3	One from Pool													

*Students exiting the program after forth semester and securing 92 credits including 4 credits of summer internship will be awarded UG Diploma in the relevant Discipline/Subject

Semester V

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A5	Electronics	240/PHYP/ CC501	3	0	2	3	0	1	4	25	50	5	20	100
CC-B5	Core course of Chem./ Math								4					100
CC-C5	Core course of Chem./ Math								4					100
Vocational Course(s)														
VOC-2	One from Pool													
Internship														
	Internship								4					100

Semester VI

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A6	Nuclear & Particle Physics	240/PHYP/CC601	3	0	2	3	0	1	4	25	50	5	20	100
CC-B6	Core course of Chem./Math								4					100
CC-C6	Core course of Chem./Math								3					73
Minor Course(s)														
MIC-6	One from Pool													
Vocational Course(s)														
VOC-03	One from Pool													
Skill Enhancement Course(s)														
SEC-3	One from Pool													

*Student will be awarded 3-year UG degree in the relevant Discipline/Subject upon securing 130 Credits

** Scheme and Syllabus for remaining semesters will be provided in due course of time

2. Core Courses

Scheme UG A1: B.Sc. in Physical Science (Physics)

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS				
										TI	TE	PI	PE	Total
Core Course(s)														
CC-A1	Mechanics	240/PHYP/CC101	3	0	2	3	0	1	4	25	50	5	20	100

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS				
										TI	TE	PI	PE	Total
Core Course(s)														
CC-A2	Electricity and Magnetism	240/PHYP/CC201	3	0	2	3	0	1	4	25	50	5	20	100

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS				
										TI	TE	PI	PE	Total
Core Course(s)														
CC-A3	Quantum Mechanics	240/PHYP/CC301	3	0	2	3	0	1	4	25	50	5	20	100

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS				
										TI	TE	PI	PE	Total
Core Course(s)														
CC-A4	Solid State Physics	240/PHYP/CC401	3	0	2	3	0	1	4	25	50	5	20	100

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS				
										TI	TE	PI	PE	Total
Core Course(s)														
CC-A5	Electronics	240/PHYP/CC501	3	0	2	3	0	1	4	25	50	5	20	100

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS				
										TI	TE	PI	PE	Total
Core Course(s)														
CC-A6	Nuclear & Particle Physics	240/PHYP/CC601	3	0	2	3	0	1	4	25	50	5	20	100

*Students exiting the program after second semester and securing 52 credits including 4 credits of summer internship will be awarded UG certificate in the relevant Discipline/Subject

*Students exiting the program after forth semester and securing 92 credits including 4 credits of summer internship will be awarded UG Diploma in the relevant Discipline/Subject

*Student will be awarded 3-year UG degree in the relevant Discipline/Subject upon securing 130 Credits

** Scheme and Syllabus for remaining semesters will be provided in due course of time

Detailed Syllabus for 1st Year

Semester-I

Course ID - 240/PHYP/CC101
Subject: MECHANICS

Max. Marks: 50 **Credit 3 (45Hrs)**
Internal Assessment: 25 **Time: 3 hrs**

Note: *The paper setter is to set **Nine** questions. Question no. 1 (compulsory based on the entire syllabus) will consist of **five** short answer type questions, each of **two** marks. The rest of the **eight** questions will be set uniformly, with two questions from each unit selected. A student is required to attempt **five** questions, selecting one from each unit along with compulsory question no 1. The question paper shall contain 20 % numerical problems in the relevant papers.*

Course Objective: This course's objective is to teach the students the fundamentals of Newtonian Mechanics, rigid body dynamics, the concept of inverse square force, and the special theory of relativity.	**Course Outcome:** The student will be able to understand the concept and the applications of Newtonian mechanics. The origin and applications of the special theory of relativity should be clear to students.

Unit – I

Time derivative of a vector, Motion in Plane Polar coordinates, Newton's Law, Mechanics of single and system of particles, conservation of laws of linear momentum, angular momentum and mechanical energy, Central forces, fictitious forces, Centrifugal force, Coriolis force and its applications.

Unit - II

Centre of mass and equation of motion, Constrained motion, degrees of freedom, Generalised coordinates, displacement, velocity, acceleration, momentum, force and potential. Hamilton's variational principle, Lagrange's equation of motion from Hamilton's Principle. Linear Harmonic oscillator, simple pendulum, Atwood's machine.

Unit – III

Rotation of rigid body, moment of inertia, torque, angular momentum, kinetic energy of rotation. Theorems of perpendicular and parallel axes with proof. Moment of inertia of solid sphere, hollow sphere, spherical shell, solid cylinder, hollow cylinder and solid bar of rectangular cross-section. Acceleration of a body rolling down on an inclined plane.

Unit – IV

Inertial and Non-Inertial Frames and their examples, Invariance of Newton's Laws of motion under Galilean transformations.

Postulates of Special Theory of Relativity, Length Contraction, Time Dilation, Variation of Mass with Velocity, Mass-Energy Equivalence.

References:

1. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, McGraw-Hill.
2. Mechanics, Berkeley Physics, Vol.1, C. Kittel, W. Knight, et al., Tata McGraw-Hill.
3. Fundamentals of Physics, R. Resnick, D. Halliday and J. Walker, Wiley Publications.
4. Mechanics, D.S. Mathur, S. Chand and Company Limited.
5. Feynman Lecture Series, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, Pearson Education.

MECHANICS LAB

Marks (External) : 20 **Credits : 1 (30Hrs)**
Marks (Internal Assessment) : 05

1. Each student should perform at least five experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. Measurements of Length (or Diameter) using Vernier Caliper, Screw Gauge and Travelling Microscope.
2. To Study the Random Error in observations.
3. To determine the Height of a Building using a Sextant.
4. To determine the vertical distance between two given points using Sextant.
5. To determine the Moment of Inertia of a Flywheel.
6. M.I. of an irregular body using a torsion pendulum.
7. To determine g and velocity for a freely falling body using Digital Timing Technique
8. To determine the Young's Modulus of a Wire by Optical Lever Method.
9. Young's modulus by bending of beam.
10. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
11. To determine the elastic Constants of a wire by Searle's method.

References:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. BSc Practical Physics, Harnam Singh, S. Chand Publications, 2020.
3. BSc Practical Physics, Geeta Sanon, R. Chand Publications, 2020.
4. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

Semester-II

Course ID - 240/PHYP/CC201

ELECTRICITY AND MAGNETISM

Max. Marks: 50 **Credit 3(45Hrs)**

Internal Assessment: 25 **Time: 3 hrs**

Note: *The paper setter is to set* ***Nine*** *questions. Question no. 1 (compulsory based on the entire syllabus) will consist of* ***five*** *short answer type questions, each of* ***two*** *marks. The rest of the* ***eight*** *questions will be set uniformly, with two questions from each unit selected. A student is required to attempt* ***five*** *questions, selecting one from each unit along with compulsory question no 1. The question paper shall contain 20 % numerical problems in the relevant papers.*

Course Objective: The course on electricity and magnetism deals with Coulomb's law, the electric field, the potential formulation of electrostatic, capacitors, magnetism, and magnetic materials, and the application of these concepts. The physical context and derivation of Maxwell equations are covered.	**Course Outcome:** The student will be able to understand Gauss's Divergence theorem, Stokes's theorem in dielectrics, and materials' electrical and magnetic properties. The origin and applications of Maxwell's equations should be clear to students.

UNIT-I

Scalar and Vector fields, Differentiation of a vector, Gradient of a scalar and its physical significance, Integration of a vector (line, surface and volume integral and their physical significance), Gauss's divergence theorem and Stocks theorem.

Electric field, Electric field lines, Divergence and curl of electrostatic field, Derivation of field E from potential as gradient, derivation of Laplace and Poisson equations.

UNIT-II

Electric flux, Gauss's Law, and its application to the spherical shell, uniformly charged infinite plane and uniformly charged straight wire, the mechanical force of charged surface, and energy per unit volume.

Polarization, Dielectric materials, Electric displacement, Gauss's theorem in dielectrics, Electrical Susceptibility& Permittivity, and Dielectric constants.

UNIT-III

Lorentz force law, Magnetic forces, Biot-Savart's law and its applications (1) straight conductor (2) circular coil (3) solenoid carrying current, Divergence and curl of the magnetic field, Ampère's circuital law and its applications for simple current configurations.

Faraday's experiments on induction, Faraday's Law, Induced Electric field, Self and Mutual inductance, and Energy in magnetic fields.

UNIT-IV

Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Para-, Dia- and Ferro-magnetism, B-H curve and hysteresis.

Maxwell equation and its derivations, Displacement Current, vector and scalar potentials, boundary conditions at the interface between two different media, Poynting vector, and Poynting theorem.

References:

1. D.J. Griffith, Introduction to Electrodynamics, Pearson Publication
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. Electricity and Magnetism by Reitz and Milford (Prentice Hall of India)
5. Electricity and Magnetism by A.S. Mahajan and A.A. Rangwala (Tata McGraw-Hill).

ELECTRICITY AND MAGNETISM LAB

Marks (External) : 20 **Credits : 1(30Hrs)**
Marks (Internal Assessment) : 05 **Time : 3 Hrs**

1. Each student should perform at least five experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. To determine an unknown Low Resistance using Potentiometer.
2. To determine an unknown Low Resistance using Carey Foster's Bridge.
3. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
4. To determine self-inductance of a coil by Rayleigh's method.
5. e/m measurement by Thomson method
6. To determine the mutual inductance of two coils
7. B-H curves for soft and hard ferromagnetic materials.
8. Measurement of self-inductance of a coil by Owen's Bridge

References:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. BSc Practical Physics, Geeta Sanon, R. Chand Publications, 2020.
3. BSc Practical Physics, Harnam Singh, S. Chand Publications, 2020.
4. A Text Book of Practical Physics, I. Prakash& Ramakrishna, 11th Ed., 1511,Kitab Mahal
5. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
6. Engineering Practical Physics, S. Panigrahi and B. Mallick, 1515, Cengage Learning.