Govt. College for Women,
Parade Ground, Jammu
Autonomous College under University of Jammu

Learning outcome based curriculum

B.Sc. Programme (CBCS)

With Physics as a subject

(Session 2020, 2021and 2022)

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Govt. College for Women Parade Ground, Jammu
(Autonomous College)

B.Sc. Programme curriculum (CBCS)

Title: Mechanics, Oscillations and Theory of Relativity

(Session 2020-21, 2021-22, 2022-23)

Semester-I

UPHTC-101

(Credits: Theory-04, Practicals-02) **Theory: 60 Lectures**

Internal Examination: 20 Marks
External Examination: 80 Marks

Course Objective

The objective of framing this course is to bridge the gap between the plus two and post graduate levels of Physics by providing a more complete and logical framework in almost all areas of basic Physics.

It plays an important role in achieving basic knowledge of Physics which include basic laws, principles, phenomenon, theories, techniques and concepts.
Aim of framing the syllabus is to make students aware of the physical world and understanding connectivity of Physics with other disciplines and to develop experimental, computational and mathematical skills of students.
Our aim is to provide an intellectually stimulating environment to develop skills and enhance the capabilities of the students to the best of their potential.

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Course learning outcomes

By the end of B.Sc. Semester I, the students would be expected to achieve a common level in basic mechanics, a secure foundation in mathematics. Students will be able to read, understand and interpret physical information – verbal, mathematical and graphical. They must have developed their experimental and data analysis skills through experiments at Laboratories. They will be able to perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties. They would be in a position to use information communication technology to gather knowledge at will.

UNIT-I

INTRODUCTION TO MECHANICS

Unit Vectors, displacement, area element, volume element, velocity and acceleration in Cartesian, Plane polar and Spherical polar coordinate systems. Intertial and non inertial frames of references, Galilean Transformations, uniformly rotating frame; Coriolis force and centrifugal force, effect of centrifugal force due to rotation of the earth, Coriolis force acting on a freely falling body**.** **(12 Hrs)**

UNIT-Il
MECHANICS-II
Concept of center of mass, Elastic collision in Laboratory and Centre of mass system, relationship between displacements, velocities, kinetic energies and angles in lab and centre of mass system.
Inverse square law of force: Concept of central and non-central forces, Reduction of two body problem into one body problem with examples, angular momentum and its conservation in central force field. Differential equation of orbit in a central force field, Keplers Laws and its derivations **(12 Hrs)**

UNIT-Ill
INTRODUCTION TO OSCILLATIONS,
Differential equation and its solution, energy of simple harmonic oscillator examples, Compound pendulum, torsional pendulum bifiller oscillations, LC circuit.
Nature of damping force, Damped simple harmonic oscillator its differential equation and solution. Energy, power dissipation, logarithmic decrement, Relaxation time, quality factor, resistance and electromagnetic damping.

(12 Hrs)

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UNIT-IV

DRIVEN OSCILLATIONS AND PROPERTIES OF MATTER

Driven harmonic oscillator, transient and steady State behavior, solution of differential equation, velocity of the mechanical forced oscillator in the Steady state, behavior of displacement with driving force frequency.

Elasticity:- Review of Hook's Law and Stress-Strain diagram, Elastic moduli, Relations between elastic constants and Poison's Ratio, Expression for Poison's ratio in terms of elastic constants, bending of beams, Determination of Young modulus of a bar by bending beam method. **(12 Hrs)**

UNIT-V

THEORY OF RELATIVITY

Michelson- Morley experiment and its outcome, Postulates of special theory of relativity, Lorentz Transformations, Consequences of Lorentz transformations, Length contraction. time dilation, twin paradox, relativistic addition of velocities, variation of mass with velocity, mass-energy equivalence, energy-momentum relation, Illustrative examples in support of mass-energy equivalen

(12 Hrs)

Text & Reference Books

1. Mechanics by Hans and Puri.
2. Mechanics by. Sikri
3. Mechanics by D.S. Mathur
4. Mechanics by B. S Aggarwal
5.Classical Mechanics by Kumar and Gupta.
6. Waves and Vibrations by S.P. Puri.
7. Waves and oscillation by Brij Lal and Subramanum.
8. Waves and oscillation by A.P. French.
9. Waves and oscillation by S.L. Kakani.
10. Theory of Relativity by IL Resnick.
11. Theory of Relativity by French.
12. Theory of Relativity by Patharia

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TEACHING LEARNING PROCESS

Lectures, tutorials, power point presentations, group discussion, seminars, projects etc.

Evaluation

There will be an internal assessment test of 15 marks and 5 marks will be awarded to students as per their attendance in the class. Students have to attempt five questions each carrying 3.0marks. The External theory question paper shall be of 80 marks. There will be **3** sections in the question paper. Section **A,** contains 5 short answer type questions each of 3 marks, with one from each unit. Section **B** contains 5 medium type answer questions each of 7 marks with one from each unit. Section **C** contains 5 long answer type questions, each of 15 marks with one from each unit.

Note: - A Candidate has to attempt all the questions from sections **A** & **B** and any 2 questions from section C.

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B.Sc. Programme curriculum (CBCS)

Physics (Session 2020-21, 2021-22 and 2022-23)

PRACTICAL

UPHPC- 102 **External Examination: 25 marks**
Internal Examination: 25 marks

1. Measurement of length (or diameter) using vernier caliper, screw gauge and Travelling microscope.
2. To find the Value of g' by bar pendulum.
3. To find the value of `g' by Kater's pendulum.
4. To find the surface tension of water by capillary rise method.
5. To find Moment of Inertia of Fly-Wheel.
6. To find Moment of Inertia of Bifilar pendulum.
7. To find the Young Modulus by bending beam Method
8. To find rigidity of wire by Maxwell needle.
9. To find the frequency/velocity of sound wave by Sonometer.
10. To establish relation between torque and angular acceleration using flywheel.
11. To find young's modulus, modulus of rigidity and Poisson's ratio by Searle's method.

Reference Books

1. B. Sc Practical Physics by C. L. Arora.
2. Practical Physics by 0 L Squires Cambridge University Press
3. Advanced Practical Physics for Students by Worsnop and Flint
4. Practical Physics by R K Shulda
5. B.Sc Practical Physics by Harnam Singh.
6. Advanced level physics practicals by Michael Nelson and Jon M. Ogborn, 4th Edition, Heinenann Educational publishers.

Note: The candidates are required to complete at least 5 practicals. The Practicals can be added or deleted as per requirement.

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B.Sc. Programme curriculum (CBCS)

Physics (Session 2020-21, 2021-22 and 2022-23)

Semester-II

UPHTC-201

(Credits: Theory-04, Practicals-02) **Theory: 60 Lecture**

Internal Examination: 20 Marks
External Examination: 80 Marks

COURSE OBJECTIVES

The basic aim of teaching this syllabus is to empower the students to acquire engineering skills and practical knowledge which will be of great help to students in their day today life. Since electricity and electrodynamics play a key role in the development of modern technological world. This course will provide a theoretical basis for performing experiments in related areas and cater the basic requirements for their higher studies. The main objective of this course is to provide students with mathematical skills which will be of great help to them in solving electricity and magnetism related problem. This Course will provide a sound foundation in electricity and magnetism.

COURSE LEARNING OUTCOMES

By the end of B.Sc. Semester II, the students are expected to improve the basic concepts and to develop the techniques and mathematical skills. The students would have expected to achieve a common level in basic electricity, magnetism and a secure foundation in vector algebra. Students will be able to read, understand and interpret physical information – verbal, mathematical and graphical.

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They must have developed their experimental and data analysis skills through experiments at Laboratories. Students will be able to perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties. They will be able to use information communication technology to gather knowledge at will.

UNIT -I

INTRODUCTION TO VECTOR CALCULUS

Basic ideas of vector algebra, Scalar and vector fields, Gradient of a scalar field and its physical interpretation, Line, Surface and volume integrals, Divergence of a vector field and its physical significance, Solenoidal field , Gauss's divergence theorem.

Curl of a vector field and its physical significance, Stokes' theorem. Rotational and Irrotational vector fields with examples, Vector identities. **(12 Hrs)**

Unit-II

ELECTROSTATICS

Review of electrostatic field, Electric Flux, Gauss's law in integral and differential Forms, Line integral of electrostatic field, Conservative nature of electrostatic field, Electric field as the negative gradient of potential, Poisson's and Laplace's equations, Electric quadrupole, Electric potential due to a quadruple.

Dielectrics, Polar and non-polar molecule, Polarisation of dielectric, Polarisation vector P, Displacement vector D, Relation D= €o E+P, Atomic polarizability, Electric susceptibility, Relation $K=1+X_e$, Gauss's law in a dielectric medium (differential and integral forms), Energy in dielectric system.

(12 Hrs)

Unit-III

ELECTRIC CURRENT AND MAGNETOSTATICS

Current and current density, Equation of continuity, Electrical conductivity, vector form of Ohm's law, Failure of Ohm's law.

Review of Biot-Savart's law, Ampere's circuit law (integral and differential forms), Modified form of Ampere's Circuit Law, Displacement current, Divergence of magnetic field, Magnetic scalar and vector potentials, Divergence of vector potential, Poisson’s equation for vector potential.

Current loop as a magnetic dipole, Relation between magnetic dipole moment and angular momentum, magnetization vector **M**, Magnetization current, Free and bound currents, Relation between **B, H** and **M**. Magnetic susceptibility and permeability. **(12 Hrs)**

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UNIT- IV

TIME VARYING FIELDS

Review of Faraday's laws of electromagnetic induction and its Integral and differential forms, Self inductance of a solenoid, Mutual inductance of two solenoids, Self inductance and mutual inductance of a current loop,Reciprocity theorem of mutual inductance, Relation between self and mutual inductances, Coefficient of coupling. Maxwell's equations (differential and integral forms) and their interpretation, Poynting vector, Poynting theorem. **(12 Hrs)**

UNIT-V

ELECTROMAGNETIC WAVES

Electromagnetic waves in vacuum: The wave equations for E and B, Monochromatic plane electromagnetic waves and their transverse nature. Characteristic impedance.

Electromagnetic waves in dielectric medium: Propagation in linear media, Reflection and transmission at normal incidence, Derivation of laws of reflection and refraction.

Electromagnetic waves in conductors: Modified wave equations, Skin Depth, and Characteristic impedance. **(12 Hrs)**

Text and Reference Books:

I. Vectors by Speigal
2. Electromagnetic by B.B. Laud
3. Electricity and Magnetism by K.K. Tiwari
4. Electricity, Magnetism and E. M. waves by K.K. Sharma
5. Introduction to Electrodynamics by David J. Griffiths
6. Electricity and Magnetism by A. E. Kip.
7. Electricity and Magnetism by D.C Tayal
8. Electricity and Magnetism by Retiz and Millford.
9. Electricity and Magnetism by AK. Sikri
10.Electricity and Magnetism by B.S. Aggarwal

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Evaluation

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Note: - A Candidate has to attempt all the questions from sections **A&B** and any 2 questions from section **C**.

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Physics (Session 2020-21, 2021-22 and 2022-23)

PRACTICAL

UPHPC- 202

External Examination: 25 marks
Internal Examination: 25 marks

1. To find Capacity of a Capacitor by Electrical vibrator.
2. To find frequency of AC supply by Electrical vibrator.
3. To find the variation of Magnetic field with distance along X-axis.
4. To find the Impedance of series LCR circuit.
5. To find low resistance by Carey Foster Bridge with Calibration.
6. To find low resistance by Carey Foster Bridge without calibration.
7. Compare the capacitance by De-Sauty's null Method.
8. Find Horizontal component of Earth's magnetic field by using vibration and deflection magnetometer.
9. To find the dielectric constant of a material by resonance method.
10. To find the value of high resistance by substitution method.

Reference Books

1. B. Sc Practical Physics by C. L. Arora.
2. Practical Physics by G L Squires Cambridge University Press
3. Advanced Practical Physics for Students by Woranop and Flint
4. Practical Physics by R. K Shukla
5. B.Sc Practical Physics by Harnam Singh

Note: The candidates are required to complete at least 5 practicals.
The Practicals can be added or deleted as per requirement.

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Scheme of Examination for B. Sc. Physics

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination(Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment Test	Upto 50% (after45 days)	1hour	15 % (15marks)
External EndSemester University Examination	Upto 100% (after90 days)	3hours	80% (80marks)
			Attendance= 5% (5marks)
Total			100

Scheme for Internal Assessment Test: The question paper would comprise of five short answer type questions of 3 marks each. Total marks for assignment test is 15.

Scheme for End Semester Examination: The question paper comprises of three sections , section A, B and C.

Section A contains 05 short answer type questions (one from each unit) carrying 3 marks each. All the questions in this section are compulsory.
15 Marks

Section B contains 05 medium answer type questions (one from each unit) and each question carries 7 marks.
35 Marks

Section C contains 05 long answer type questions each carrying 15 marks one from each unit and the candidate is required to attempt any two questions. **30 Marks**

Note:- In the End-Semester exam, Out of the total 80 marks, 10 % weightage (8 marks) will be given to numercial problems from all units.

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