FACULTY OF SCIENCES

SYLLABUS FOR THE BATCH FROM THE YEAR 2023 TO YEAR 2026

Programme Code: BSCS

Programme Name: B.Sc. Computer Science

(Semester I-II)

(PHYSICS SYLLABUS)

Examinations: 2023-24

Department of Physics

Khalsa College, Amritsar

(An Autonomous College)

S.No.	PROGRAMME OBJECTIVES
1.	To teach fundamental concepts of sciences and its societal applications through a 3-year program.
2.	To provide the key knowledge and laboratory resources to prepare students for careers as professionals in the field of science.
3.	To equip students with advanced knowledge, research training and experience in specific areas of science. These skills will prepare the successful graduate for careers in government, academia, or industry.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO-1	To understand the fundamental concepts in physics, computer & mathematics and develop ideas based on them.
PSO-2	To possess knowledge on the topics in pure physics, computer & mathematics, empowering students to pursue higher degrees at reputed academic institutions.
PSO-3	To demonstrate problem-solving skills, innovative thinking and creativity.
PSO-4	To be motivated towards research in physics, computer, mathematics and related fields.
PSO-5	To enable students to become eligible to serve in DRDO, defense, public sector and private Sector.

ELIGIBILITY: A candidate who has passed 10+2 Non-medical examination from recognized board or any other examination considered equivalent there to be by the GNDU with 40% marks is eligible to apply (subject to change).

COURSE DURATION: 3 Years

COURSE SCHEME											
SEMESTER - I											
Course Code	**Course Name**	**Hours /Week**	**Credits**			**Total Credits**	**Max. Marks**				**Page No.**
			L	**T**	**P**		**Th**	**Pr**	**IA**	**Total**	
PHY111A	MECHANICS	3	2	1	0	3	56	-	50	200	4-5
PHY111B	ELECTRICITY AND MAGNETISM	3	2	1	0	3	56	-			6-7
PHY111P	PRACTICAL	4	0	0	2	2	-	38			8-9

SEMESTER - II											
Course Code	**Course Name**	**Hours/Week**	**Credits**			**Total Credits**	**Max. Marks**				**Page No.**
			L	**T**	**P**		**Th**	**Pr**	**IA**	**Total**	
PHY121A	RELATIVITY AND ELECTROMAGNETISM	3	2	1	0	3	56	-	50	200	10-11
PHY121B	VIBRATION AND WAVES	3	2	1	0	3	56	-			12-13
PHY121P	PRACTICAL	4	0	0	2	2	-	38			14-15

B.Sc. SEMESTER–I
PHY111A
MECHANICS
(THEORY)

Teaching Hours (per week): 3
Total Credits: 3
Credits:LTP:210
Time: 3 Hours **Total Hours: 45**
Maximum Marks: 56
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 12 marks consisting of 8 short answer type questions carrying 2 mark each covering the whole syllabus. The answer should not exceed 50 words. The candidate will have to attempt any 6 questions in this section.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections. Each question in these sections should not have more than two subparts.**
4. **Non-programmable Scientific calculator is allowed.**

Course Objectives: The purpose of the course is to provide the basic information about co- ordinate system and motion of particles in it, to understand the conservation laws and also to determine the difference between elastic and inelastic collisions. It includes applications of central force to the stability of circular orbits, Kepler's laws of planetary motion, orbital precession and Rutherford scattering, dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia, the motion of rigid bodies and Euler equations. It also helps to understand the differences between types of forces and the inverse square force field.

Course Contents:

UNIT–I

Cartesian, **Plane polar** and spherical polar co–ordinate systems, **Position vector,** area, volume, velocity and Acceleration in these systems. **unit vectors in plane polar and spherical polar coordinates**, Solid angle, Properties of space and time, conservative force, **Homogeneity of space and time, isotropy of space and related** conservation laws.

UNIT-II

Various forces in Nature (Brief introduction), Centre of mass, **internal forces, central forces**, equation of motion under central force, reduction of two body problem to an equivalent one body problem, **Areal velocity, equation of motion of reduced mass in Plane polar coordinates, conservation of energy of particle in central force**, differential equation of the orbit and turning points.Kepler Laws of planetary motion.

UNIT–III

Inertial and Non-Inertial frame of reference. Non Inertial frames, rate of change of position vector in moving and rotating co-ordinate system, Coriolis force, **Horizontal and Vertical components of Coriolis force on the surface of earth, Effect of Coriolis force on a freely falling body**, **geographical consequences of coriolis force qualitative analysis of Foucault pendulum.**

UNIT–IV

Elastic collision in Lab and C.M. system, velocities, angles and energies, **concept of scattering, differential** cross section of elastic scattering, Rutherford scattering. Rigid Body, **centre of mass of continuous bodies, qualitative analysis of translational and rotational motion of rigid body with fixed axis; principal axis of a rigid body**, equation of motion for rotating rigid body, elementary gyroscope.

Books Prescribed:

1. Mechanics, Berkeley Vol.–I by C. Kittle.
2. Mechanics, H.S. Hans & S.P. Puri.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Learn the laws of motion reference frames, and its applications
CO2	Understand the application of central force to the stability of circular orbits, Kepler's laws of planetary motion, Orbital Precession and Rutherford scattering.
CO3	Understand the dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia, parallel axis theorem, the inertia tensor, the motion of rigid bodies. non-inertial frames: pseudo forces, examples involving the centrifugal force and coriolis force
CO4	Develop understanding of special theory of relativity and its applications to understand length contraction, time dilation, and relativistic addition of velocities, conservation of momentum and variation of mass, relativistic momentum, relativistic energy, and mass energy relation.
CO5	Get information about the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends and loaded in the middle.

B.Sc. SEMESTER–I
PHY111B
ELECTRICITY AND MAGNETISM
(THEORY)

Teaching Hours (per week): 3
Total Credits: 3
Credits:LTP:210
Time: 3 Hours **Total Hours: 45**
Maximum Marks: 56
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 12 marks consisting of 8 short answer type questions carrying 2 mark each covering the whole syllabus. The answer should not exceed 50 words. The candidate will have to attempt any 6 questions in this section.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections. Each question in these sections should not have more than two subparts.**
4. **Non-programmable Scientific calculator is allowed.**

Course Objectives: The objective of this course is to apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances and use of calculus along with physical principles to effectively solve problems encountered in everyday life.

Course Contents:

UNIT–I

Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian and Poisson's Equations (Qualitative idea). Coulomb's Law for point charges and continuous distribution of charges. Electric field due to dipole and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law.

UNIT–II

Work and potential difference. Potential difference as line integral of field. Electric potential due to a point charge, a group of point charges, dipole, long uniformly charged wire and charged disc. Stoke's theorem, curl E=0, Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Concept of electrical images (Qualitative idea), Current and current density, equation of continuity. Microscopic form of Ohm's Law ($J=\sigma E$) and conductivity, Failure of Ohm's Law.

UNIT–III

Dielectrics, Polar and non-polar molecules, Polarization of Dielectric, Polarization vector, Atomic Polarizability, Dielectric Constant, Capacity of a capacitor with dielectric, Electric Susceptibility, Relation between Dielectric constant and Electric susceptibility, Gauss law in Dielectric, Displacement Vector, Relation between E, P and D. Energy stored in Capacitor having Dielectric Medium, Energy Density of a Dielectric Medium.

UNIT–IV

Field of a point charge moving with constant velocity. Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation to free and bound currents. Permeability and susceptibility and their interrelationship. Qualitative idea of diamagnetism, paramagnetism and ferromagnetism.

Books Prescribed:

1. Fundamentals of Electricity and Magnetism by Arthur F. Kipp.
2. Electricity and Magnetism, Berkeley Physics Course, Vol. II by E.M. Purcell.
3. Introduction to Classical Electrodynamics by David Griffith.
4. Electricity & Magnetism-T.S. Bhatia and Gurpreet Singh, Vishal Publications

Course Outcomes:

Sr. No.	**On completing the course, the students will be able to:**
CO1	Apply knowledge on electricity and magnetism to explain natural physical processes and related technological advances.
CO2	Understand the use of the Stoke's and Gauss Divergence theorems for solution of different physics problems.
CO3	Explain the concept of electric current and related concepts.
CO4	Understand about electric current and related concepts.
CO5	Explain the phenomenon of magnetism, types of magnetic materials and their properties.

B.Sc. SEMESTER–I
PHY111P
(PRACTICAL)

Teaching Hours (per week): 4
Total Credits: 2
Credits:LTP:002

Time: 3 Hours **Maximum Marks: 38**
Pass Marks: 35%

General Guidelines for Practical Examination:
I. The distribution of marks is as follows: **38 Marks**
i) One experiment: **15 Marks**
ii) Brief Theory : 8 **Marks**
iii) Viva–Voce: **10 Marks**
iv) Record (Practical file): **5Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment be allotted to more than three examinee in any group.

Course Objectives: Course objective of this subject is to follow the pragmatic way of learning and describe the basic experimental skills in the students. They will be able to demonstrate and able to evaluate the resistance, modulus of rigidity, torque and moment of inertia of body experimentally. They will also learn about the energy consumption by demonstrating the energy meter experiment.

Course Contents:

1. To determine low resistance with Carey Fosters Bridge.
2. To determine the resistance and specific resistance of copper with the help of Kelvin's double bridge.
3. To study the variation of resistance of a filament of a bulb with its temperature.
4. Capacitance by flashing and quenching of a neon lamp.
5. Measurement of Capacitance, determination of permittivity of a medium air and relative permitivity by de–Sauty's bridge.
6. To determined I using Anderson Bridge.
7. Exercise on fitting of given data to straight line and calculation of probable error.
8. To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
9. To establish relationship between torque and angular acceleration using fly wheel.
10. To find the moment of inertia of a flywheel.
11. Study of bending of beams and determination of young's Modulus.
12. Determination of Poissons or rubber plastic.
13. To find young's modulus, modulus of rigidity & Poisson ratio by Searle's method.
14. To study flow of water through capillary tubes of different length and area of cross section of (at least two each) and calculate coefficient of viscosity.
15. To determine energy transfer, coefficient of restitution and verify laws of conservation of linear momentum and kinetic energy in elastic collisions using one dimensional collisions of hanging spheres.
16. **To study the RL and RC circuits.**

17. Energy meter.
18. **To study the charging and discharging of capacitor.**

Books Prescribed:

1. Practical Physics Vol. I, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications.
2. Practical Physics, C.L. Arora, S. Chand & Co.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Determine low resistance with Carey Fosters Bridge.
CO2	Study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
CO3	Find Moment of Inertia and establish relationship between torque and angular acceleration using fly wheel.
CO4	Determine the resistance and specific resistance of copper with the help of Kelvin's double bridge.
CO5	Understand the measure of Capacitance, determination of permittivity of a medium air and relative permitivity by de–Sauty's bridge.

B.Sc. SEMESTER–II
PHY121A
RELATIVITY AND ELECTROMAGNETISM
(THEORY)

Teaching Hours (per week): 3
Total Credits: 3
Credits:LTP:210
Time: 3 Hours **Total Hours: 45**
Maximum Marks: 56
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 12 marks consisting of 8 short answer type questions carrying 2 mark each covering the whole syllabus. The answer should not exceed 50 words. The candidate will have to attempt any 6 questions in this section.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections. Each question in these sections should not have more than two subparts.**
4. **Non-programmable Scientific calculator is allowed.**

Course Objectives: The aim of course is to understand the key observations and events that led to the development of Einstein's theory of special theory of relativity, Minkowski space; to understand the basics and applications of electromagnetism, LCR Circuits, Maxwell's equations, E.M. Waves; to understand the fundamental principles of special theory relativity, applications and possibilities; to understand the experimental basis of these fundamental principles and how this contributed to the subsequent development of fundamental physics.

Course Contents:

UNIT–I

Galilean transformations; Applications of Galilean transformations to mechanics and electromagnetism; Postulates of special theory of relatively; Lorentz transformations; observer and viewer in relativity; Relativity of simultaneity; Length **Contraction**; Time **dilation**; **Experimental evidence of time dilation; Velocity addition theorem**; Relativistic Doppler effect; Variation of mass with velocity; Mass–energy equivalence; Relativistic momentum & energy, their transformations; E in different frames of reference; Transformation equation of E and B from one frame to another.

UNIT–II

Space-time continuum; Concepts of Minkowski space; **Events, Interval between events: Space-like interval, Time-like interval, Light-like interval; Light cone; Concept of world line;** Four vector formulation; **Some important four vectors: Position four-vector, velocity four-vector, Four force (Minkowski force) etc.**

UNIT–III

Lorentz's force; Definition of Bio-Savart's Law and its application to long straight wire, circular current loop and solenoid; Ampere's Circuital law and its applications; Divergence and curl of B; Vector potential–definition; current density–definition; Faraday's Law of EM induction; Displacement current; Mutual inductance; Reciprocity theorem; Self-inductance; L for solenoid; Coupling of Electrical circuits; LCR series and parallel circuit; Q–factor, Power consumed; Power factor.

UNIT–IV

Maxwell's equations their derivation and characterizations; E.M. waves; Wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma=0$; Poynting vector; Impedance of a dielectric to EM waves; EM waves in a conducting medium and Skin depth; EM wave velocity in a conductor and anomalous dispersion; Response of a conducting medium to EM waves; Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.

Books Prescribed:

1. A Primer of Special Theory of Relativity by P. L. Sardesai; New Age International Publisher.
2. EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain.
3. Fields and Waves Electromagnetic by David K. Cheng.
4. Electricity & Magnetism-T.S. Bhatia and Gurpreet Singh, Vishal Publishing Co.

Relativity and Electromagnetism, T.S. Bhatia, Vishal Publishing Co.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Discuss the key observations and events that led to the development of Einstein's theory of special relativity.
CO2	Explain the fundamental principles of special relativity and electromagnetism and the far-reaching connections between them.
CO3	Describe Maxwell equations and its physical consequences.
CO4	Describe the nature of electromagnetic wave and its propagation through different media and interfaces.
CO5	Discuss the experimental basis of these fundamental principles and how this contributed to the subsequent development of fundamental physics.

B.Sc. SEMESTER–II
PHY121B
VIBRATION AND WAVES
(THEORY)

Teaching Hours (per week): 3
Total Credits: 3
Credits:LTP:210
Time: 3 Hours **Total Hours: 45**
Maximum Marks: 56
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 12 marks consisting of 8 short answer type questions carrying 2 mark each covering the whole syllabus. The answer should not exceed 50 words. The candidate will have to attempt any 6 questions in this section.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections. Each question in these sections should not have more than two subparts.**
4. **Non-programmable Scientific calculator is allowed.**

Course Objectives: The purpose of the course is to understand the physical characteristics of SHM and obtaining solution of the oscillator using differential equations, to calculate logarithmic decrement relaxation time and quality factor of a harmonic oscillator. This course provides information to understand the difference between simple harmonic vibrations of same frequencies and different frequencies, wave equation and to understand the significance of transverse waves and longitudinal waves, coupled mechanical as well as electrical oscillators.

Course Contents:

UNIT–I

Simply harmonic motion, energy of a SHO, **Variation of Kinetic energy and potential energy**, Compound pendulum. Torsional pendulum Electrical Oscillations, Vibrations of a mass on string, superposition of two perpendicular SHM of same period and of period in ratio 1:2 **(Graphical and Analytical Method)**.

UNIT–II

Damped and undamped oscillations, Decay of free Vibrations due to damping. Differential equation of motion, types of motion, types of damping. Determination of damping co–efficient– Logarithmic decrement, relaxation time and Q-Factor. Electromagnetic damping (Electrical oscillator).

UNIT–III

Differential equation for forced mechanical and electrical oscillators. Transient and steady state behavior, Displacement and velocity variation with driving force frequency, variation of phase with frequency, resonance. Power supplied to an oscillator and its variation with frequency,Q-

value and band width, **Q-value as an amplification factor**. Stiffness coupled oscillators, Normal co–ordinates and normal modes of vibration. Inductance coupling of electrical oscillators.

UNIT–IV

Types of waves, wave equation (transverse) and its solution characteristic impedance of a string. Impedance matching. Reflection and Transmission of waves at boundary. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on astring of fixed length, **Progressive and Stationary waves**, Energy of vibration string, Wave and group velocity.

Books Prescribed:

1. Fundamentals of Vibrations and Waves by S.P. Puri.
2. Physics of Vibrations and Waves by H.J. Pain.
3. EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain.
4. Fields and Waves Electromagnetic by David K. Cheng.
5. Waves and Vibrations, T.S. Bhatia, Vishal Publishing Co.
6. Vibrations and Waves, Modern Publishers, Jalandhar.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand simple harmonic motion and will be able to solve the equations of motions for physical systems that undergo simple harmonic motion.
CO2	Understand the damped oscillator in the over damped, critically damped and under damped regimes.
CO3	Understand, derive and solve the equations for a forced oscillator, the concept of resonance and variation of displacement and velocity with driving force frequency.
CO4	Understand the concept of coupled oscillators will be able to derive and solve the equation of motion for simple systems and describe the motion of coupled oscillators in terms of normal mode solutions.
CO5	Understand about wave, differences between longitudinal and transverse waves, the concepts of phase and group velocities and be able to calculate these quantities.

B.Sc. SEMESTER–II
PHY121P
(PRACTICAL)

Teaching Hours (per week): 4
Total Credits: 2
Credits:LTP: 002

Time: 3 Hours **Maximum Marks: 38**
Pass Marks: 35%

General Guidelines for Practical Examination:

I. The distribution of marks is as follows: **38 Marks**
i) One experiment: **15 Marks**
ii) Brief Theory : 8 **Marks**
iii) Viva–Voce: **10 Marks**
iv) Record (Practical file): **5Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment be allotted to more than three examinee in any group.

Course Objectives: The Course objective of this subject is to follow the pragmatic way of learning and describe the basic experimental skills in the students. They will be able to demonstrate and able to evaluate the value of acceleration due to gravity g by using Cater's pendulum, Bar pendulum, experimentally and theoretically compare the results of Resonance in a series and parallel LCR circuit. They will also learn about the induced e.m.f. as function of the velocity of the magnet by demonstrating the Faraday's experiment.

Course Contents:

1. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
2. To study the induced e.m.f. as function of the velocity of the magnet.
3. Study of phase relationships using impedance triangle for LCR circuit and calculate Impedance.
4. Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value.
5. To find the coefficient of self-inductance by Ray Leigh's Method.
6. To measure the charge sensitivity of a moving coil Ballistic galvanometer using a known capacitor.
7. To find the angle of dip in the lab using an earth inductor.
8. To find the value of B_H the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
9. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.
10. Measure time period as a function of distance of centre of suspension (oscillation) from centre of mass, plot relevant graphs, determine radius of gyration and acceleration due togravity.

11. Melde's experiment.
12. Find the value of g by Caterer's pendulum.
13. To compare the M.I. of solid & hollow sphere of same mass using tensional pendulum.
14. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
15. To measure obtain logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.
16. **Computer based simulations of the formation of standing waves.**
17. **Computer based simulations of the formation of concept of phase.**

Books Prescribed:

1. Practical Physics Vol. I, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications.
2. Practical Physics, C.L. Arora, S. Chand & Co.

Course Outcomes:

Sr. No.	**On completing the course, the students will be able to:**
CO1	Study the induced e.m.f. as function of the velocity of the magnet.
CO2	Compare the results of Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value experimentally as well as theoretically.
CO3	Plot the graph of variation of magnetic field with distance along the axis of current carrying coil carrying.
CO4	Verify the laws of vibrating strings and compare the mass per unit length of string using Melde's experiment.
CO5	Find the value of acceleration due to gravity (g) by Kater's pendulum.