FACULTY OF SCIENCES

SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028

Programme Code: BSCS

Programme Name
B.Sc. Computer Science (3 Years)/ B.Sc. Computer Science (Honours) (4 Years)

(Semester I-II)

(PHYSICS SYLLABUS)

Examinations: 2024-25

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/ 4 Years

Discipline Specific Course (DSC)											
SEMESTER - I											
Course Code	**Course Name**	**Credits**			**Total Credits**	**Max. Marks**				**Page No.**	**Syllabus Changed/ Same as 2023-24**
		L	**T**	**P**		**Th**	**Pr**	**IA**	**Total**		
PHY111A	VIBRATION AND WAVES	2	0	0	2	37	-	38	150	3-4	Changed
PHY111B	ELECTRICITY AND MAGNETISM	2	0	0	2	37	-			5-6	Changed
PHY111P	PRACTICAL	0	0	2	2	-	38			7-8	Changed

Discipline Specific Course (DSC)											
SEMESTER - II											
Course Code	**Course Name**	**Credits**			**Total Credits**	**Max. Marks**				**Page No.**	**Syllabus Changed/ Same as 2023-24**
		L	**T**	**P**		**Th**	**Pr**	**IA**	**Total**		
PHY121A	RELATIVITY AND ELECTROMAGNETISM	2	0	0	2	37	-	38	150	9-10	Changed
PHY121B	MECHANICS	2	0	0	2	37	-			11-12	Changed
PHY121P	PRACTICAL	0	0	2	2	-	38			13-14	Changed

B.Sc. SEMESTER–I
PHY111A
VIBRATION AND WAVES
(THEORY)

Credits: LTP
2 0 0

Time: 3 Hours **Maximum Marks: 37**
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 9 marks consisting of 8 short answer type questions carrying 1.5 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 7 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. Reflection and refraction of waves at boundary of a string. Reflection and transmission coefficients of energy. Impedance matching, mathematical analysis of formation of standing waves on a string of fixed length.

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–I
PHY111B
ELECTRICITY AND MAGNETISM
(THEORY)

Credits: LTP
2 0 0

Time: 3 Hours **Total Hours: 30**

Maximum Marks: 37

Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 09 marks consisting of 8 short answer type questions carrying 1.5 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 07 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 (definition), Coulomb's Law for point charges and continuous distribution of charges (Line, surface and volume), visual representation of electric field, electric dipole and dipole moment, Electric field due to dipole (located at origin) and sheet of charge, Electric flux, Gauss's Law and its applications, Gauss's divergence theorem and differential form of Gauss's Law, Laplacian and Poisson's Equations (Qualitative idea)

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

Magnetic field definition and units, Definition of Bio-Savart's Law and its application to infinite straight wire carrying current, magnetic line of force, magnetic field on the axis of the circular coil carrying steady current and its equivalence to magnetic dipole, magnetic field due to solenoid and its magnetic lines of force, Magnetic flux, Ampere's Circuital law and its generalized form, applications of Ampere's law due to symmetric current distributions (hollow cylinder, solenoid, toroid), Ampere's law in differential form, Divergence of magnetic field, Gauss law in magnetism.

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 theorem and Gauss Divergence theorem for solution of different physics problems.
CO3	find the electric potential due to various types of charge distributions
CO4	Understand about Dielectrics and their polarization.
CO5	Explain the concept of magnetic field due to various types of current distributions.

B.Sc. SEMESTER–I
PHY111P
(PRACTICAL)

Credits: LTP
0 0 2

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 : 7 **Marks**

iii) Viva–Voce: **10 Marks**

iv) Record (Practical file): 6 **Marks**

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 magnetic field, resonance in LCR circuits, determination of gravity using various types of pendulums, formation of standing waves, charging and discharging of capacitors.

Course Contents:

1. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
2. Study of phase relationships using impedance triangle for LCR circuit and calculate Impedance.
3. Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value.
4. To find the coefficient of self-inductance by Ray Leigh's Method.
5. To measure the charge sensitivity of a moving coil Ballistic galvanometer using a known capacitor.
6. To find the value of B_H the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
7. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.
8. 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.
9. Melde's experiment.
10. Find the value of g by Kater's pendulum.
11. Study the working of torsional pendulum.
12. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.

13. To measure obtain logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.
14. Exercise on fitting of given data to straight line and calculation of probable error.
15. **To study the RL and RC circuits.**
16. Energy meter.
17. **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 magnetic field using search coil & magnetometer.
CO2	Study the charging and discharging of capacitor.
CO3	Find the value of g using various types of pendulums.
CO4	Determine the resonance condition in series and parallel LCR circuit.
CO5	Understand the working of energy meter.

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

Credits: LTP
2 0 0

Time: 3 Hours **Maximum Marks: 37**
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 09 marks consisting of 8 short answer type questions carrying 1.5 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 07 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

Postulates of special theory of relatively; derivation of Lorentz transformations; Galilean transformations as special case of Lorentz transformation, observer and viewer in relativity, Relativity of simultaneity, Length **Contraction**, Time **dilation**; **Experimental evidence of time dilation; Velocity addition theorem**, Relativistic Doppler effect (transverse and Longitudinal), Variation of mass with velocity: mass variation formula; Mass–energy equivalence, Relativistic momentum & energy, Concept of Minkowski space.

UNIT–II

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.

UNIT–III

Electromagnetic induction, Faraday's Law of EM induction, Differential form of Faraday's law, Direction of induced emf (Lenz's Law), Self-inductance and mutual inductance, qualitative idea of Reciprocity theorem, magnetic energy density, Ampere's law for varying current (Modification of Ampere's law), Displacement current, Coupling of Electrical circuits, LCR series and parallel circuit, derivation of resonance conditions.

UNIT–IV

Maxwell's equations, their differential and integral forms, significance of Maxwell equations, E.M. waves, EM wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma=0$, absence of longitudinal components of EM waves, relation between electric and magnetic vectors in an EM wave, Poynting vector, EM waves in a conducting medium and Skin depth; dispersion of EM waves in a conductor and refractive index of the medium, Response of a conducting medium to EM waves (conductor or insulator), characteristic impedance of a medium to the EM wave, Reflection and transmission of EM waves at a boundary of two dielectric media for normal 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 phenomenon of magnetism, types of magnetic materials and their properties.
CO3	Describe the concept of electromagnetic induction and analysis of LCR circuits.
CO4	Describe the nature of electromagnetic wave and characteristics of EM waves.
CO5	Discuss the interaction of EM waves in different media.

B.Sc. SEMESTER–I
PHY121B
MECHANICS
(THEORY)

Credits: LTP
2 0 0

Time: 3 Hours **Maximum Marks: 37**
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A is compulsory and will be of 09 marks consisting of 8 short answer type questions carrying 1.5 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 07 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, 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, unit vectors, **orthogonally of unit vectors,** velocity and Acceleration in two and three dimensional **Cartesian co-ordinates, plane polar co-ordinates, spherical polar co-ordinates, relation between Cartesian and spherical polar coordinates,** line element, surface element, method to obtain area, volume in Cartesian and spherical polar co-ordinates, Solid angle, units, solid angle subtended by the sphere at the center of sphere. Properties of space (three dimensional, homogeneity, isotropy, reflection) and time (one dimensional, homogeneity, isotropy), conservative force, **Homogeneity and isotropy of space related** conservation laws. Homogeneity of time related conservation law,

UNIT-II

Various forces in Nature (Brief introduction), central forces, inverse square force, conservative force, Centre of mass, center of mass of two bodies, reduction of two body problem to an equivalent one body problem, Motion of reduced mass under central forces, angular momentum, energy of particle. Solution of the equation of motion, differential equation of the orbit, shape of the orbit, potential energy corresponding to central forces, effective potential energy and turning points, eccentricity of orbit, shape and size of elliptical orbit, graphical discussion on radial motion, types of motion under central force, Kepler Laws of planetary motion.

UNIT–III

Inertial and Non-Inertial frame of reference. Non Inertial frames and fictitious forces, rate of change of position vector in moving and rotating co-ordinate system, fictitious force in rotating frames: Coriolis and centrifugal force, axis of rotation, equator, latitude, colatitude, **Coriolis force acting on the freely falling body on the earth, Effect of Coriolis force on a particle moving on the surface of earth, geographical consequences of coriolis force, qualitative analysis of Foucault pendulum.**

UNIT–IV

Concept of collision, forces during collision, collision and law of conservation of momentum and energy, Elastic and inelastic collisions, elastic scattering in Laboratory frame (Lab) and Centre of Mass frame (C.M.), **concept of scattering, impact parameter, differential** cross section of elastic scattering, Rutherford scattering, relation between scattering angle and impact parameter in α particle scattering, scattering cross-section.

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	Derive the velocity and acceleration in different co-ordinates systems
CO2	Have the knowledge about various symmetries and associated conservation laws
CO3	Understand the application of central force, Kepler's laws of planetary motion,
CO4	Have information about non-inertial frames: pseudo forces, examples involving the centrifugal force and coriolis force
CO5	Have information about the elastic and inelastic scattering along with Rutherford scattering.

B.Sc. SEMESTER–II
PHY121P
(PRACTICAL)

Credits: LTP
0 0 2

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 : 7 **Marks**
iii) Viva–Voce: **10 Marks**
iv) Record (Practical file): **6 Marks**
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 evaluate the resistance by using Carey Fosters & Kelvin's double bridge experimentally. 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 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 Inductance using the 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 Poisson's Ratio of rubber or 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 induced e.m.f. as function of the velocity of the magnet.

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	Find the low resistance using Carey Foster's bridge
CO3	Learn the concept of distribution of mass using the Fly wheel
CO4	Learn the working of De Sauty's bridge.
CO5	Find the value of inductance using Anderson bridge.