Annexure B(i)

FACULTY OF SCIENCES

SYLLABUS

of

Physics

FOR

for the award of the Degree in

Bachelor of Science (Non-Medical & Computer Science)/ Honours
(Semester I to II)
(Offered under 4-year UG Degree Programme)
under NEP 2020 Batch: 2024–28
(Under Credit Based Continuous Evaluation Grading System)

Session: 2024-25

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME

Bachelor of Science (Non-Medical & Computer Science)/ Honours

Session-2024-25

Semester -I									
Program Name	**Course Code**	**Course Type**	**Total Marks**	**Marks**					
				Course Name	**Credits**	**Ext.**		**CA**	**EXAM TIME In Hrs**
					L-T-P	**L**	**P**		
Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BSNL-1395 BCSL-1395	**DSC**	**100**	**Electricity and Magnetism**	**4-0-0**	**80**		**20**	**3**
	BSNP-1395 BCSP-1395		**50**	**Electricity and Magnetism Lab**	**0-0-2**		**40**	**10**	**3**

Semester -II									
Program Name	**Course Code**	**Course Type**	**Total Marks**	**Marks**					
				Course Name	**Credits**	**Ext.**		**CA**	**EXAM TIME In Hrs**
					L-T-P	**L**	**P**		
Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BSNL-2395 BCSL-2395	**DSC**	**100**	**Mechanics**	**4-0-0**	**80**		**20**	**3**
	BSNP-2395 BCSP-2395		**50**	**Mechanics Lab**	**0-0-2**		**40**	**10**	**3**
	SECV-2391	SEC	**75**	**Vibrations and Waves (Theory and Practical)**	**2-0-1**	**40**	**20**	**15**	**3**

Programme Specific Outcomes – B. Sc. Non Med (Phy. Chem. Maths.)
Upon successful completion of this course, students will be able to:

PSO1. Demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics and chemistry.

PSO2: Solve complex mathematical problems by critical understanding, analysis and synthesis. Student will also be able to provide a systematic understanding of the concepts and theories of mathematics and there application in the real world – to an advanced level, and enhance career prospects in a huge array of fields or suitable to succeed at an entry-level position in mathematics post graduate programme.

PSO3: demonstrate knowledge of mechanics, electromagnetism, quantum mechanics, optics & lasers, waves & vibrations, statistical physics, condensed matter physics, electronics, nuclear & particle physics and be able to apply this knowledge to analyse a variety of physical phenomena.

PSO4: demonstrate knowledge of organic, inorganic and physical chemistry and apply this knowledge to analyse a variety of chemical phenomena and will be able to interpret and analyse quantitative data.

PSO5: understand theoretical concepts of instruments that are commonly used in most physics and chemistry fields as well as interpret and use data generated in instrumental physical and chemical analyses.

PSO6: show that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyse the measurements to draw valid conclusions. They will also be able to employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in industry or a physics/chemistry postgraduate program.

PSO7: capable of oral and written scientific communication i.e. able to communicate effectively by oral, written, computing and graphical means.

Programme Specific Outcomes – B. Sc. C.Sc. (Phy. C.Sc. Maths.)
Upon successful completion of this course, students will be able to:

PSO 1. Demonstrate and communicate in regional and English language their understanding in mathematics and the mathematical concepts needed for a proper understanding of physics and computers.

PSO 2. Solve mathematical problems by critical understanding, analysis and synthesis.

PSO 3.Demonstrate and communicate their problems, understanding and knowledge of mechanics, electromagnetism, quantum mechanics, optics & lasers, waves & vibrations, spectroscopy, statistical physics, condensed matter physics, electronics, nuclear & particle physics in regional and english language and be able to apply this knowledge to analyse a variety of physical phenomena.

PSO 4.Demonstrate knowledge of various languages of Computer programming and apply this knowledge to interpret and analyse quantitative data.

PSO 5. Show and communicate their thoughts in regional and english language that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyse the measurements to draw valid conclusions.

PSO 6. Capable of oral and written scientific communication i.e. able to communicate effectively by oral, written, computing and graphical means.

Bachelor of Science (Semester System) (12+3+1 System of Education)

(Session-2024-25)

Bachelor of Science (SEMESTER–I)

Course Title: ELECTRICITY AND MAGNETISM

Course code: BSNL-1395 for Bachelor of Science (Non Medical)
BCSL-1395 for Bachelor of Science (Computer Science)

COURSE OUTCOMES:

After passing this course, students will be able to:

CO1: Understand vector calculus and vector algebra and its applications in electricity and magnetism. The students will be able to solve the electrostatic problems with the help of Gauss law and Coulomb's law.

CO2: understand the applications of scalar potential for the calculation of electric field and electric potential due to an arbitrary charge distribution.

CO3: They will be able to find the electric potential and electric field of various charge distributions with the help of methods of images. Students will understand the conduction of electric current in conductors by studying Ohm's law and equation of continuity.

CO4: They will be able to find the relationship between electric fields from two different inertial frames of reference. They will learn the origin of magnetism and properties of various kinds of magnetic materials.

Bachelor of Science (Semester System) (12+3+1 System of Education)

(Session-2024-25)

Bachelor of Science (SEMESTER–I)

Course Title: ELECTRICITY AND MAGNETISM

Course code: BSNL-1395 for Bachelor of Science (Non Medical)

BCSL-1395 for Bachelor of Science (Computer Science)

Time: 3 Hours	**Max Marks: 100**	**Ext Marks: 80**
Credits: 4-0-0	**CA: 20**	**Pass Mark: 28**

Instructions for the Paper Setters:

Eight questions of equal marks (specified in the syllabus) are to be set, two in each of the four sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

UNIT-I

Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges and continuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

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 and quadrupole moments, long uniformly charged wire, charged disc. Stokes' Theorem and its applications in the Electrostatic field, curl E=0. Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

UNIT-III

Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates. Concept of electrical images. Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet. Current and current density, equation of continuity. Microscopic form of Ohm's Law ($J=\sigma E$) and conductivity, Failure of Ohm's Law.

UNIT-IV

Interaction between moving charges and force between parallel currents. Behaviour of various substances in the magnetic field. Definition of M and H and their relation to free and bound currents. Permeability and susceptibility and their interrelationship. Orbital motion of electrons and diamagnetism, Paramagnetism and Ferromagnetism, Maxwell's equations, boundary conditions, electromagnetic induction and applications.

Books Suggested:

1. Fundamentals of Electricity and Magnetism: Arthur F. Kipp.
2. Electricity and Magnetism, Berkeley Physics Course: Vol. II, E.M. Purcell.
3. Introduction to Classical Electrodynamics: David Griffith.
4. EM Waves and Radiating System: Edward C. Jordan and K.G. Balmain.
5. Fields and Waves Electromagnetic: David K. Cheng.

Bachelor of Science (Semester System) (12+3+1 System of Education)

SEMESTER–I

(Session-2024-25)

Course Title: Electricity and Magnetism Lab

Course Code: BSNP-1395 for Bachelor of Science (Non Medical)
BCSP-1395 for Bachelor of Science (Computer Science)

COURSE OUTCOMES:

After passing this course, students will be able to:

CO1: Students will demonstrate the ability to conduct a specific experiment from a given list, applying theoretical knowledge and practical skills to accurately complete the procedure and obtain reliable results.

CO2: Students will be able to articulate the theoretical background and principles underlying the chosen experiment.

CO3: Students will demonstrate their understanding of the experiment through oral questioning and discussion.

CO4: Students will maintain a well-organized and accurate practical file documenting all experiments conducted.

Bachelor of Science (Semester System) (12+3+1 System of Education)

SEMESTER–I

(Session-2024-25)

Course Title: Electricity and Magnetism Lab

Course code: BSNP-1395 for Bachelor of Science (Non Medical)
BCSP-1395 for Bachelor of Science (Computer Science)

Time: 3 Hours	**Max Marks: 50**	**Ext Marks: 40**
Credits: 0-0-2 (4 Hours/ week)	**CA: 10**	**Pass Mark: 14**

Instructions to Practical Examiner

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination

The distribution of marks is as follows :

i) One experiment 20 Marks

ii) Brief Theory 7 Marks

iii) Viva–Voce 7 Marks

iv) Record (Practical file) 6 Marks

II. There will be one session of 2 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. The number of candidates in a group for practical examination should not exceed 12.

IV. In a single group, no experiment should be allotted to more than three examinees.

LIST OF EXPERIMENTS

1. To determine low resistance with Carey-Foster's Bridge.
2. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
3. To study the induced e.m.f. as a function of the velocity of the magnet.
4. Study of phase relationships using impedance triangle for LCR circuit and calculate impedance.
5. Resonance in a series LCR circuits for different R–value and calculate Q–value.
6. Resonance in parallel LCR circuits for different R-value and calculate Q-value.
7. Capacitance by flashing and quenching a neon lamp.
8. To compare capacitance of two capacitors by de–Sauty's bridge.
9. To determine L using Anderson Bridge.
10. To find the value of BH, the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
11. To study the variation of the magnetic field with distance along the axis of a coil carrying current by plotting a graph.

Ba**chelor of Science (Semester System) (12+3+1 System of Education)**

SEMESTER-II
(Session-2024-25)
Course code: BSNL-2395 for Bachelor of Science (Non-Medical) BCSL-2395 for Bachelor of Science (Computer Science)

COURSE TITLE: MECHANICS

COURSE OUTCOMES:

After passing this course, students will be able to:

CO1: Understand the various coordinate systems and their applications. Students will be able to know the conservation laws and the symmetries of space & time. To understand the motion of an object under central forces, the nature of its trajectory, turning points. Students will understand planetary motion by solving differential equations of orbits and studying Kepler's laws.

CO2: They will understand the Galilean transformations and origin of fictitious forces in non-inertial frames and their consequences on acceleration due to gravity, the motion of a particle on earth. They will understand the elastic scattering in the lab and centre of mass systems. They will understand the physics of the rotational motion of a body by studying Euler's equations and the Moment of inertia tensor.

CO3: Learn the various experiments to understand the origin of the special theory of relativity and the relativistic phenomena such as Length contraction, Relativity of simultaneity, Synchronization and time dilation; Doppler effect of light and Twin paradox.

CO4: understand relativity as a bridge between electricity and magnetism. They will learn the concept of four-dimensional Minkowski space and Four vectors.

Bachelor of Science (Semester System) (12+3+1 System of Education)

SEMESTER-II
(Session-2024-25)
Course code: BSNL-2395 for Bachelor of Science (Non-Medical)
BCSL-2395 for Bachelor of Science (Computer Science)
COURSE TITLE: MECHANICS

Time: 3 Hours	**Max Marks: 100**	**Ext Marks: 80**
Credits: 4-0-0	**CA: 20**	**Pass Mark: 28**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 12 marks. There should be 20% numerical in each paper.

Note: There should be 20% numerical in each paper. Students can use Non-Scientific calculators or logarithmic tables.

Unit I

Cartesian and spherical polar co–ordinate systems, area, volume, velocity and acceleration in these systems. Solid angle, Relationship of conservation laws and symmetries of space and time.

Various forces in Nature (Brief introduction) centre of mass, equivalent one-body problem, central forces, equation of motion under a central force, equation of orbit and turning points. Kepler Laws. Concept of Ether and Michelson–Morley experiment.

Unit-II

Inertial frame of reference. Galilean transformation and Invariance. Non-Inertial frames, Coriolis force and its applications. Variation of acceleration due to gravity with latitude. Focault pendulum, Elastic collision in Lab and C.M. system, velocities, angles and energies, cross-section of elastic scattering, Rutherford scattering. Rigid Body Motion; Rotational motion, principal moments and Axes. Euler's equations, precession and elementary gyroscope.

Unit-III

The Lorentz Transformations: Newtonian relativity; Instances of its failure in electromagnetism; Attempts to locate the absolute frame of reference; Fizeau's experiment; Michelson-Morley experiment & Ether Drag Hypothesis; Lorentz-Fitzgerald contraction; Einstein's basic postulates of relativity and geometric derivation of Lorentz transformations; Length contraction; Relativity of simultaneity; Synchronization and time dilation; Einstein's velocity addition rule; Transformation of acceleration; Aberration (relativistic) of starlight and Relativistic Doppler effect; Twin paradox and its resolution.

Unit -IV

Relativistic Dynamics: Variation of mass with velocity; Mass energy equivalence; Relativistic formulae for momentum and energy; Transformation of momentum, energy and force; Transformation of electromagnetic fields; Magnetism as a relativistic phenomenon; Illustrative examples. Structure of Space-time and Principle of Equivalence: Concept of Minkowski space; Geometrical interpretation of Lorentz transformations of space & time; Geometrical representation of simultaneity, contraction and dilation; Space-like, time and light-like intervals; Four vectors; Concept of world lines.

Books Suggested

1. Mechanics-Berkeley Physics Course, by C. Kittel, W. D. Knight, M. A. Ruderman, C. A. Helmholtz and R. J. Moyer-Tata Mc Graw Hill Publishing Company.Vol-I (second edition).
2. Fundamentals of Physics by D. Halliday, R. Resnick and J. Walker (sixth edition)-Wiley India Pvt. Ltd., New Delhi, 2004.
3. Concepts of Modern Physics by Arthur Bieser, Tata Mc Graw Hill Publishing Company Ltd., 2003
4. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 2012, McGraw-Hill.
5. Analytical Mechanics by S. K. Gupta, Modern Publishers.
6. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.
7. Mechanics, H.S. Hans & S.P. Puri.

Bachelor of Science (Semester System) (12+3+1 System of Education)

SEMESTER–II

(Session-2024-25)

COURSE TITLE: Mechanics Lab

Course code: BSNP-2395 for Bachelor of Science (Non Medical)
BCSP-2395 for Bachelor of Science (Computer Science)

COURSE OUTCOMES:

After passing this course, students will be able to:

CO1: Students will demonstrate the ability to conduct a specific experiment from a given list, applying theoretical knowledge and practical skills to accurately complete the procedure and obtain reliable results.

CO2: Students will be able to articulate the theoretical background and principles underlying the chosen experiment.

CO3: Students will demonstrate their understanding of the experiment through oral questioning and discussion.

CO4: Students will maintain a well-organized and accurate practical file documenting all experiments conducted.

Bachelor of Science (Semester System) (12+3+1 System of Education)

SEMESTER–II

(Session-2024-25)

COURSE TITLE: Mechanics Lab

Course code: BSNP-2395 for Bachelor of Science (Non Medical)
BCSP-2395 for Bachelor of Science (Computer Science)

Time: 3 Hours	**Max Marks: 50**	**Ext Marks: 40**
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II. There will be one session of 2 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. The number of candidates in a group for practical examination should not exceed 12.

IV. In a single group, no experiment should be allotted to more than three examinees.

LIST OF EXPERIMENTS

1. 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).
2. To establish a relationship between torque and angular acceleration using a flywheel.
3. To find the moment of inertia of a flywheel.
4. Study of bending of beams and determination of Young's modulus.
5. Determination of Poisson's ratio for rubber.
6. 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.
7. To verify the laws of vibrating string by Melde's experiment.
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 to gravity.
9. Find the value of 'g' by Kater's pendulum.
10. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
11. To measure logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.