B.Sc. (Hons.) Physics

Course Structure and Syllabus

(Based on Choice Based Credit System)

Batch 2021 onwards

For

University Main Campus, Constituent Campuses and Affiliated colleges

Department of Academics

I.K. Gujral Punjab Technical University

PROGRAM EDUCATIONAL OBJECTIVES: At the end of the program, the student will be able to:

PEO1	Apply principles of basic science concepts in understanding, analysis and prediction of physical systems.
PEO2	Develop human resource with knowledge, abilities and insight in Physics and related fields required for career in academia and industry.
PEO3	Engage in lifelong learning and adapt to changing professional and societal needs.

PROGRAM OUTCOMES: At the end of the program, the student will be able to:

PO1	Apply the knowledge gained to solve the scientific problems.
PO2	Identify, formulate, and analyze scientific problems reaching substantiated conclusions using first principles of mathematical, physical, and chemical sciences.
PO3	Design solutions for physics problems that meet the specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal consideration.
PO4	Use research-based knowledge and methods including design of experiments, analysis, interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Create, select, and apply appropriate techniques, resources, and modern scientific tools to physics problems with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional scientific practice.
PO7	Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to the norms of scientific practice.
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communicate effectively on scientific activities with the Scientific/Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Demonstrate knowledge and understanding of the scientific principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of scientific and technological change.

PROGRAM SPECIFIC OUTCOMES: At the end of the program, the student will be able to:

PSO1	Understand the concepts of different branches of physics.
PSO2	Demonstrate expertise to conduct wide range of scientific experiments.
PSO3	Apply the concepts of physics in areas of mechanics, electromagnetism, solid state, nuclear, etc., in industry, academia, and day-to-day life.

SEMESTER FIRST

Course Code	Course Title	Type of course	Load Allocation			Marks Distribution		Total Marks	Cr
			L	T	P	Internal	External		
BSHP-111-21	Optics	**Core Course Theory and Practical**	**3**	**1**	**-**	**40**	**60**	**100**	**4**
BSHP-112-21	Mechanics		**3**	**1**	**-**	**40**	**60**	**100**	**4**
BSHP-113-21	Physics Lab-I		**-**	**-**	**4**	**30**	**20**	**50**	**2**
BSHM-104-21	Calculus	**General Elective and Practical**	**4**	**1**	**-**	**40**	**60**	**100**	**4**
BHCL-103-21	Inorganic Chemistry		**3**	**1**	**-**	**40**	**60**	**100**	**4**
BHCP-109-21	Chemistry Lab-I		**-**	**-**	**4**	**30**	**20**	**50**	**2**
BHHL-105-21	Communicative English -I	**Ability Enhancement Compulsory Course**	**2**	**-**	**-**	**20**	**30**	**50**	**2**
BHHL-106A-21 BHHL-106B-21	Punjabi Compulsory-I or Mudhli Punjabi-I		**2**	**-**	**-**	**20**	**30**	**50**	**2**
TOTAL			**17**	**4**	**8**	**260**	**340**	**600**	**24**

L: Lectures T: Tutorial P: Practical Cr: Credits

SEMESTER SECOND

Course Code	Course Title	Type of course	Load Allocation			Marks Distribution		Total Marks	Cr
			L	T	P	Internal	External		
BSHP-121-21	Waves and Vibrations	**Core Course Theory and Practical**	**3**	**1**	**-**	**40**	**60**	**100**	**4**
BSHP-122-21	Electricity and Magnetism		**3**	**1**	**-**	**40**	**60**	**100**	**4**
BSHP-123-21	Physics Lab-II		**-**	**-**	**4**	**30**	**20**	**50**	**2**
BSHM-204-21	Vector Algebra & Vector Analysis	**General Elective and Practical**	**4**	**1**	**-**	**40**	**60**	**100**	**4**
BHCL-114-21	Organic Chemistry		**3**	**1**	**-**	**40**	**60**	**100**	**4**
BHCP-116-21	Chemistry Lab-II		**-**	**-**	**4**	**30**	**20**	**50**	**2**
BHHL-115-21	Communicative English -II	**Ability Enhancement Compulsory Course**	**2**	**-**	**-**	**20**	**30**	**50**	**2**
BHHL-116A-21 BHHL-116B-21	Punjabi Compulsory -II or Mudhli Punjabi-II		**2**	**-**	**-**	**20**	**30**	**50**	**2**
TOTAL			**17**	**4**	**8**	**260**	**340**	**600**	**24**

L: Lectures T: Tutorial P: Practical Cr: Credits

Examination and Evaluation

Theory			
S. No.	**Evaluation criteria**	**Weightage in Marks**	**Remarks**
1	Mid term/sessional Tests	24	Internal evaluation (40 Marks) MSTs, Quizzes, assignments, attendance, etc., constitute internal evaluation. Average of two mid semester test will be considered for evaluation.
2	Attendance	6	
3	Assignments	10	
4	End semester examination	60	External evaluation
5	Total	100	Marks may be rounded off to nearest integer.
Practical			
1	Evaluation of practical record/ Viva Voice/Attendance/Seminar/ Presentation	30	Internal evaluation
2	Final Practical Performance + Viva-Voce	20	External evaluation
3	Total	50	Marks may be rounded off to nearest integer.

Instructions for Paper-Setter in B. Sc (Hons.) Physics

A. Scope

1. The question papers should be prepared strictly in accordance with the prescribed syllabus and pattern of question paper of the University.

2. The question paper should cover the entire syllabus with proper distribution and Weightage of marks for each question.

3. The language of questions should be simple, direct, and documented clearly and unequivocally so that the candidates may have no difficulty in appreciating the scope and purpose of the questions. The length of the expected answer should be specified as far as possible in the question itself.

4. The distribution of marks to each question/answer should be indicated in the question paper properly.

B. Type and difficulty level of question papers

1. Questions should be framed in such a way as to test the students intelligent grasp of broad principles and understanding of the applied aspects of the subject. The Weightage of the marks as per the difficulty level of the question paper shall be as follows:
   - i) Easy question 30%
   - ii) Average questions 50%
   - iii) Difficult questions 20%
2. The numerical content of the question paper should be upto 25%.

C. Format of question paper

1. Paper code and Paper-ID should be mentioned properly.
2. The question paper will consist of three sections: Sections-A, B and C.
3. Section-A is COMPULSORY consisting of TEN SHORT questions carrying two marks each (total 20 marks) covering the entire syllabus.
4. The Section-B consists of FOUR questions of eight marks each covering the entire PART-A of syllabus (Taking two questions from every unit).
5. The Section-C consists of FOUR questions of eight marks each covering the entire PART-B of syllabus (Taking two questions from every unit).
6. Attempt any five questions from Section-B and Section-C, selecting at least two questions from each of the two sections.

Question paper pattern for MST:

Roll No:	**No of pages:**

IK Gujral Punjab Technical University- Jalandhar	
Department of Physical Sciences	
Academic Session:	
Mid-Semester Test: I/II/III (Regular/reappear)	**Date:**
Programme: B.Sc. (Hons.) Physics	**Semester:**
Course Code:	**Course:**
Maximum Marks: 24	**Time: 1 hour 30 minutes**

- Note: Section A is compulsory; Attempt any two questions from Section B and one question from Section C.

Section: A		**Marks**	**COs**
1		2	
2		2	
3		2	
4		2	
Section: B			
5		4	
6		4	
7		4	
Section: C			
8		8	
9		8	

Details of Course Objectives

CO1	
CO2	
CO3	
CO4	
CO5	

SEMESTER-I

BSHP-111-21	**Optics**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: The objective of the course is to develop basic understanding of Interference, Diffraction and Polarization among students. They also learn about the LASER and its applications. Students will be equipped with knowledge to measure wavelength, refractive index and other related parameters, which will act as a strong background if he/she chooses to pursue physics as a career.

Course Outcomes: At the end of the course, the student will be able to

CO1	Identify and illustrate physical concepts and terminology used in optics and other related wave phenomena
CO2	Analyze and understand coherence and phenomenon of interference and their applications
CO3	Acquainted with Fresnel's and Fraunhofer's diffraction and their applications.
CO4	Get thorough knowledge of the polarization of light, changes upon reflection and transmission and will learn to analyze the polarization in optical systems.
CO5	Describe the different types of lasers, its principle, properties and applications of laser beam.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	1	2	1	2	3	2	2
CO2	2	2	1	2	1	1	1	1	1	3	1	1
CO3	3	2	2	2	1	1	2	1	1	3	1	1
CO4	2	2	2	2	1	1	2	1	1	3	1	1
CO5	2	2	2	2	1	1	2	1	1	3	1	1

Detailed Syllabus:

PART-A

UNIT I

Interference: Definition and properties of wave front, Temporal and Spatial Coherence, Young's double slit experiment, Lloyd's single mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Newton's Rings: Measurement of wavelength and refractive index, Interferometer: Michelson Interferometer-(1) idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, Fabry-Perot interferometer. (11 Lectures)

UNIT-II

Diffraction: Huygens Principle, Huygens-Fresnel Diffraction theory, Fraunhofer diffraction: Single slit. Circular aperture, Rayleigh criterion of resolution, Resolving Power of a telescope, Double slit, Multiple slits, Diffraction grating, Resolving power of grating. Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light, Theory of a Zone Plate: Multiple Foci of a Zone Plate, Fresnel diffraction pattern of a straight edge and circular aperture. (11 Lectures)

PART-B

UNIT-III

Polarization: Plane polarized light, Representation of Unpolarized and Polarized light, Polarization by Reflection, Brewster's law, Malus Law, Polarization by Selective absorption by Crystals, Polarization by Scattering, Polarization by Double Refraction, Nicol Prism, Huygen's theory of Double Refraction, Polaroid, Elliptically and Circularly polarized lights, Quarter and Half wave plates. (11 Lectures)

UNIT-IV

Laser and Application: Lasers, Spontaneous emission, Stimulated absorption, Stimulated emission, Einstein coefficients, Einstein relations, Conditions for Laser actions, Population inversion, Different types of Laser Pumping mechanism: Optical Pumping, Electric Discharge and Electrical pumping, Resonators, Two, Three and Four level laser systems, Ruby laser, He-Ne gas Laser, Semiconductor laser, CO2 laser, applications of laser: Holography, Principle of Holography.

(11 Lectures)

Text and Reference Books:

1. Optics: A.K. Ghatak (Tata-McGraw Hill), 1992.
2. Fundamentals of Optics: F.A. Jenkins and H.E. White (McGraw Hill), 1981.
3. A Textbook of Optics: Subrahmaniyam N. & et al., S. Chand Publishing, 2006.
4. O. Svelto: Principles of Lasers, Springer Science & Business Media, 2010.

BSHP-112-21	**Mechanics**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: The aim and objective of the course on Mechanics is to introduce the students to the formal structure of vector mechanics, harmonic oscillators, and mechanics of solids so that they can use these in Engineering as per their requirement. This will act as a strong background if he/she chooses to pursue higher studies in physics.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the fundamentals of vector mechanics for a classical system.
CO2	Identify various types of forces in nature, frames of references, and conservation laws.
CO3	Know the inertial and non-inertial system.
CO4	Understand the Gravitation force as a Central Force Motion
CO5	Apply the knowledge obtained in this course to day-to-day problems.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	1	2	1	2	1	2	3	2	2
CO2	2	3	1	2	2	1	1	1	1	3	1	1
CO3	3	3	2	2	2	1	2	1	1	3	1	1
CO4	2	2	2	-	2	1	2	1	1	3	1	1
CO5	2	2	-	2	2	1	2	1	1	3	1	1

Detailed Syllabus:

UNIT I:

Fundamentals of Dynamics: Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Momentum of variable-mass system: motion of rocket. (12 Lectures)

UNIT II:

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Force as gradient of potential energy. Work done by non-conservative forces. Law of conservation of Energy.

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frame of references. (12 Lectures)

UNIT-III

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems. (12 Lectures)

UNIT-IV

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and fields due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). (12 Lectures)

Text and Reference Books:

1. Mechanics, Berkeley Physics, Vol.1,C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
2. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
3. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
4. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons
5. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
6. Physics for scientists and Engineers with Modern Phys., J.W.Jewett, R.A.Serway, 2010, Cengage Learning
7. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

BSHP-113-21	**Physics Lab-I**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisite (If any): High-school education

Course Objectives: The aim and objective of the lab course is to introduce the students to the formal structure of electromagnetism and phenomenon of wave optics so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify the theoretical concepts/laws learnt in theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Understand the methods used for estimating and dealing with experimental uncertainties and systematic "errors".
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Document a technical report which communicates scientific information in a clear and concise manner.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	2	1	2	3	2	3
CO2	3	3	1	-	2	2	1	1	1	3	2	3
CO3	3	3	2	-	2	1	2	1	1	3	2	3
CO4	3	2	2	2	-	2	2	1	1	3	2	3
CO5	2	2	2	2	-	2	2	1	1	3	2	3

Note: Students are expected to perform about 8-10 experiments from the following list, selecting minimum of 6-7 from the Physical Lab and 2-3 from the Virtual lab.

List of experiments:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the laser beam characteristics like; wave length, aperture, spot size, etc. using diffraction grating.
3. To study the diffraction using laser beam and thus to determine the grating element.
4. To study wavelength and laser interference using Michelson's Interferometer.
5. To find the refractive index of a material/glass using spectrometer.
6. To find the refractive index of a liquid using spectrometer.
7. To determine the angle of prism and resolving power of a prism.
8. To study the magnetic field of a circular coil carrying current using a Steward and Gees Tangent Galvanometer.
9. Determine the radius of circular coil using the Circular coil.
10. To study B-H curve using CRO.
11. To find out polarizability of a dielectric substance.
12. To find out the horizontal component of earth's magnetic field (B_h).

Text and Reference Books:

1. A Text -book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
2. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
4. Practical Physics, C L Arora. S. Chand & Company Ltd.
5. http://www.vlab.co.in

BSHM-104-21	**CALCULUS**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Mathematics

Course Objectives: The objectives of this course are to make the students understand the following:

1. The fundamental concepts of differential and integral calculus.
2. The geometrical meaning of functions, limits, continuity, derivatives, mean value theorems.
3. Applications of derivatives and integrals.
4. Limit, Continuity, partial derivatives and their applications in finding extreme values.
5. The utility of double and triple integrals in finding area and volume bounded by surfaces.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the basic concepts of Differential and Integral Calculus.
CO2	Visualize all concepts geometrically.
CO3	Apply the knowledge of derivatives in finding extreme values of the function and definite integrals to find area under the curve.
CO4	Explain the concept of Limit, Continuity, partial derivatives of functions of severable variables and their applications.
CO5	Utilize the concept of multiple integrals in finding areas and volumes of different geometrical shapes.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

UNIT-I

Functions of single variable, Simple examples of limit, continuity, differentiability, Derivative of elementary functions (t-ratios, logarithmic functions, exponential functions), Higher order derivatives, Statement of Mean value theorems and simple applications, Applications of derivative: increasing decreasing functions, extreme values of functions. **(Ref. 1)**

UNIT-II

Integration as an inverse process of differentiation, Finding integrals by partial fractions, by parts, Statement of fundamental theorem of calculus, Finding definite integrals by method of substitution, Applications of definite integral in finding length of an arc, area under simple curves, area enclosed between two curves. **(Ref. 1)**

UNIT-III

Introduction of Limit, continuity of functions of two variables with simple examples, partial derivatives, Total derivatives, Homogeneous functions, Statement of Euler's theorem, Simple examples of maxima-minima of functions of several variables, Lagrange's method of multipliers.

UNIT-IV

Double integrals, Change of order of integration, Jacobian, Double integral in polar coordinates, Triple integrals, Simple applications in finding area and volumes.

RECOMMENDED BOOKS:

- Mathematics, A Text book for Class XII (Parts I & II), New Delhi: NCERT, 2003. **(Unit I & II)**
- R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Pub., 4th Edition, 2015.
- James Stewart, Calculus, 5th Edition, Brooks/Cole (Thomson), 2003.

BHCL-103-21	**INORGANIC CHEMISTRY**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: To teach the fundamental concepts of Inorganic chemistry and their applications.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the fundamental concepts and postulates of various theories regarding the structure of atom.
CO2	Learn the periodicity of the s & p block elements
CO3	Understand the various types of bonding present in the different inorganic compounds
CO4	Learn about the various theories pertaining to the different types of boding
CO5	

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

UNIT-I

Atomic Structure:

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: deBroglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s, p, d* and *f* orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number

UNIT-II

Chemical Bonding-I:

lonic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution
process.

UNIT-III

Chemical Bonding-II:

Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

UNIT-IV

Chemistry of s and p Block Elements:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

Reference Books :-

1. Lee, J.D. *Concise Inorganic Chemistry*, ELBS, 1991.
2. Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. *Concepts & Models of Inorganic Chemistry 3rd Ed.*, John Wiley Sons, N.Y. 1994.
3. Greenwood, N.N. & Earnshaw. *Chemistry of the Elements*, Butterworth-Heinemann. 1997.
4. Cotton, F.A. & Wilkinson, G. *Advanced Inorganic Chemistry*, Wiley, VCH, 1999.
5. Miessler, G. L. & Donald, A. Tarr. *Inorganic Chemistry 4th Ed.*, Pearson, 2010.
6. Shriver & Atkins, *Inorganic Chemistry 5th Ed.*

BHCP-109-21	**CHEMISTRY LAB-I**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Chemistry

Course Objectives: The objective of this course is to provide practical knowledge and illustrative experiments about various types of inorganic titrations and preparation of simple inorganic compounds.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand to calibrate and run the instruments for analysis.
CO2	Learn to the quantitative analysis of various metal ions/cations and anions.
CO3	Understand the various principles of different techniques involved in the quantitative analysis.
CO4	Learn to prepare various inorganic compounds

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												

List of Experiments:

(A) Titrimetric Analysis

(i) Calibration and use of apparatus

(ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.

(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Reference text:

1. Vogel, A.I. *A Textbook of Quantitative Inorganic Analysis*, ELBS.

BHHL-105-21	**Communicative English -I**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Basic proficiency in Communication Skills

Course Objectives: The main objective of this course is:

- To help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills
- To help the students become the independent users of English language
- To develop in them vital communication skills, integral to their personal, social and professional interactions
- To teach them the appropriate language of professional communication
- To prepare them for job market

Course Outcomes: At the end of the course, the student will

CO1	acquire basic proficiency in reading &listening, writing and speaking skills
CO2	be able to understand spoken and written English language, particularly the language of their chosen technical field.
CO3	be able to converse fluently.
CO4	be able to produce on their own clear and coherent texts.
CO1	become proficient in professional communication, such as, interviews, group discussions, office environments, important reading skills as well as writing skills and thereby will have better job prospects.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	1	1	2	2	3	2	3	2	2
CO2	1	-	-	1	1	2	2	3	2	3	2	2
CO3	1	-	-	1	1	2	2	3	2	3	2	2
CO4	1	-	-	1	1	2	2	3	2	3	2	2
CO5	2	-	-	1	1	2	2	3	2	3	2	2

Detailed Syllabus:

Part –A

UNIT I-(Literature)

(A) ***The Poetic Palette*** **(Orient Black Swan, Second Edition, 2016)**

The following poems from this anthology are prescribed:

1. Pippa's Song: Robert Browning
2. Apparently With No Surprise: Emily Dickinson
3. Fool and Flea: Jeet Thayil

(B) ***Prose Parables*** **(Orient Black Swan, 2013)**

The following stories from the above volume are prescribed:

a. The Kabuliwallah : Rabindranath Tagore
b. The Eyes Are Not Here: Ruskin Bond
c. Grief: Anton Chekov

UNIT-II

Vocabulary: Word Formation Processes; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms

Grammar: Subject-verb agreement; Noun-pronoun agreement; Misplaced modifiers; Articles Determiners; Modals; Prepositions;

PART-B

UNIT-III

Reading and Understanding: Close Reading; Comprehension;

UNIT-IV

Mechanics of Writing & Speaking Skills

Essay Writing (Descriptive/Narrative/Argumentative); Business letters; Précis Writing; Self Introductions; Group Discussion

TEXT AND REFERENCE BOOK

1. John Eastwood, Oxford Practice Grammar, Oxford University Press, 2014
2. Michael Swan, Practical English Usage, OUP. 1995.
3. F.T. Wood, Remedial English Grammar, Macmillan. 2007.
4. William Zinsser, On Writing Well, Harper Resource Book 2001.
5. Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Communication Skills, Oxford University Press. 2011.
7. Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press. 2006.

BHHL-106A-21	**ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ (Punjabi Compulsory)-I**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Punjabi

Course Objectives: The objective of the course is:
1.To enhance the language ability of students.
2.To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.

Course Outcomes: At the end of the course, the student will be able to

CO1	Translate and transfer/broadcast the western scientific knowledge in the local language.
CO2	Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.
CO3	Understand the society through Punjabi language, literature and culture
CO4	Learning science and in developing science literacy.
CO5	Improve the internal communication.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

UNIT I : ਕਵਿਤਾ ਭਾਗ:

ਭਾਈ ਵੀਰ ਸਿੰਘ:

ਸਮਾਂ, ਚਸ਼ਮਾ

ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ :

ਪੰਜਾਬ ਨੂੰ ਕੂਕਾਂ ਮੈਂ, ਹੱਲ ਵਾਹੁਣ ਵਾਲੇ

ਪ੍ਰੋ.ਮੋਹਨ ਸਿੰਘ :

ਮਾਂ, ਕੋਈ ਆਇਆ ਸਾਡੇ ਵਿਹੜੇ, ਪਿਆਰ ਪੰਧ

ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ:

ਆਖਾਂ ਵਾਰਿਸ ਸ਼ਾਹ ਨੂੰ, ਅੰਨਦਾਤਾ *(Lecture 11)*

UNIT-II ਕਹਾਣੀ ਭਾਗ:

ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ :

ਪੇਮੀ ਦੇ ਨਿਆਣੇ

ਸੁਜਾਨ ਸਿੰਘ :

ਕੁਲਫੀ

ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ :

ਤੂੜੀ ਦੀ ਪੰਡ

ਗੁਰਦਿਆਲ ਸਿੰਘ :

ਸਾਂਝ *(Lecture 12)*

PART-B

UNIT-III

ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਤੇ ਉਪ-ਭਾਸ਼ਾ ਵਿਚ ਅੰਤਰ, ਪੰਜਾਬੀ ਦੀਆਂ ਉਪ-ਭਾਸ਼ਾਵਾਂ,ਪੰਜਾਬੀ ਭਾਸ਼ਾ:ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ।

ਭਾਸ਼ਾ ਤੇ ਲਿਪੀ, ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਗੁਰਮੁਖੀ ਲਿਪੀ: ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ।

(Lecture 11)

UNIT-IV

ਸੰਖੇਪ ਰਚਨਾ (ਪ੍ਰੈਸੀ)

ਪੈਰ੍ਹਾ ਰਚਨਾ

ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਪੈਰ੍ਹੇ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

(Lecture 11)

TEXT AND REFERENCE BOOK:

1. ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ, ਸਾਹਿਤ ਦੇ ਰੰਗ, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, 2016.

BHHL-106B-21	ਮੁਢਲੀ ਪੰਜਾਬੀ **(Mudhli Punjabi)-I**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: The objective of the course is to:
1. enhance the language ability of students.
2. enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.

Course Outcomes: At the end of the course, the student will be able to

CO1	Translate and transfer/broadcast the western scientific knowledge in the local language.
CO2	Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.
CO3	Understand the society through Punjabi language, literature and culture.
CO4	Learning science and in developing science literacy.
CO5	Improve the internal communication.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

UNIT I

ਪੈਂਤੀ ਅੱਖਰੀ (ਵਰਣਮਾਲਾ), ਅੱਖਰ ਕ੍ਰਮ

ਮਾਤਰਾਵਾਂ : ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ

ਲਗਾਖਰ :ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ

UNIT-II

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ: ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ

ਮੂਲ ਸ਼ਬਦ , ਅਗੇਤਰ, ਪਿਛੇਤਰ

ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ, ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ

ਸ਼ੁੱਧ- ਅਸ਼ੁੱਧ: ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿੱਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ (11 Lectures)

PART-B

UNIT-III

ਹਫਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ

ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ

ਰੁੱਤਾਂ ਦੇ ਨਾਂ

ਇਕ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ

UNIT-IV

ਸਧਾਰਣ ਸ਼ਬਦਾਂ ਦਾ ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

ਸਧਾਰਣ ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਤੋਂ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ

TEXT AND REFERENCE BOOK

1.ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ, ਸਾਹਿਤ ਦੇ ਰੰਗ, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, 2016.

SEMESTER -II

BSHP-121-21	**Waves and Vibrations**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level physics and Mathematics

Course Objectives: The objective of the course provides an exposure about simple harmonic motions, damped harmonic motions and forced oscillations. Students learns about the different waves, propagation of waves in various mediums and reflection/transmission of waves at the interface of mediums.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the simple and damped harmonic motion of an oscillator.
CO2	Understand Forced Vibrations and phenomenon of Resonance
CO3	Apply the Coupled oscillator to the real life problems.
CO4	Understand the transmission of signals and Electromagnetic Waves
CO5	Apply the knowledge obtained in this course to day-to-day problems.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	1	2	-	2	3	2	3
CO2	2	2	1	2	1	1	1	-	1	3	2	3
CO3	3	2	-	2	1	1	2	-	1	3	2	3
CO4	2	2	-	2	1	1	2	1	1	3	3	1
CO5	2	2	-	2	1	1	2	1	1	3	3	3

Detailed Syllabus:

PART-A

UNIT-I

Simple and Damped Harmonic Motion: Simple harmonic motion, energy of a SHO, Compound pendulum, Torsional pendulum, Electrical Oscillations, Lattice Vibrations, Transverse Vibrations of a mass on a string, Anharmonic Oscillations. Damped simple harmonic motion, Decay of free Vibrations due to damping, types of damping, Determination of damping coefficients: Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping.

(12 Lectures)

UNIT-II

Forced Vibrations and Resonance: Forced mechanical and electrical oscillator, Transient and Steady State Oscillations, Displacement and velocity variation with driving force frequency, Variation of phase with frequency resonance, Power supplied to forced oscillator by the driving force. Q-factor and band width of a forced oscillator, Electrical and nuclear magnetic resonances. (12 lectures)

PART-B

UNIT-III

Coupled Oscillations: Stiffness coupled oscillators, Normal coordinates and modes of vibrations. Inductance coupling of electrical oscillators, Normal frequencies, Forced vibrations and resonance for coupled oscillators, Masses on string-coupled oscillators.

Waves in Physical Media: Types of waves, wave equation (transverse) and its solution characteristics impedance of a string, Impedance matching, Reflection and Transmission of waves at boundary, Energy of vibrating string, wave and group velocity. (12 Lectures)

UNIT-IV

Transmission of signals and Electromagnetic Waves: Transmission of a non-monochromatic wave, Frequency range and Signal duration, Bandwidth theorem, Group and phase velocities, Electromagnetic theory of dispersion, Doppler effect, Electromagnetic (EM) Waves: Maxwell Equations, Wave equation, EM waves in a medium of finite ε, μ and σ. Energy flow due to a plane EM wave, EM waves in a conducting medium, Skin depth. (12 Lectures)

Text and Reference Books:

1. Text Book of Vibrations and Waves: S.P. Puri (Macmillan India), 2004.
2. The Physics of Vibrations and Waves: H.J. Pain (Wiley and ELBS), 2013.
3. N.K. Bajaj, The Physics of Waves and Oscillations, Tata McGraw Hill, 1998.

BSHP-122-21	**Electricity and Magnetism**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Basic knowledge of Electricity and Magnetism at high school level.

Course Objectives: The objective of the course is to expose the students to the formal structure of electricity and magnetism so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand and describe the different concepts of electrostatics and magnetostatics
CO2	Apply the knowledge of Maxwell's equation and flow of electromagnetic waves in real problems.
CO3	Analyze the wave propagation in different media
CO4	Compare the different types of polarization
CO5	have a solid foundation in electromagnetism fundamentals required to solve problems

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	2	1	2	1	2	3	2	2
CO2	3	2	1	-	2	2	1	1	1	3	1	1
CO3	3	2	3	-	2	1	2	1	1	3	1	1
CO4	3	2	3	2	-	2	2	1	1	3	1	1
CO5	2	2	3	2	-	2	2	1	1	3	1	1

Detailed Syllabus:

PART-A

UNIT I

Review of Vector Analysis and Electrostatics: scalar and vector product; gradient, divergence and curl and their significance; Gauss-divergence theorem and Stoke's theorem (statement only); Electrostatic field; electric flux; Gauss's law of electrostatics; Applications of Gauss law-Electric filed due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charge sheet; Electric potential as line integral of electric field, potential due to point charge and electric dipole; calculation of electric field from potential; Poisson's equation and Laplace's equation(Cartesian coordinate); Capacitance; capacitance of a spherical conductor and cylindrical capacitor, Energy per unit volume in electrostatic field, Dielectric medium, dielectric polarization and its types, Displacement vector, Boundary conditions *(11 Lectures)*

UNIT-II

Magnetostatics: Magnetic flux; magnetic flux density; Faraday's law; magnetomotive force; Biot-Savart's law and its applications-straight conductor, circular coil, divergence and curl of magnetic field; Ampere's work law in differential form; Magnetic vector potential; ampere's force law; magnetic vector potential; Energy stored in a magnetic field, boundary conditions on magnetic fields. *(10 Lectures)*

PART-B

UNIT-III

Maxwell's Equations and Poynting Vector: Equation of continuity for time varying fields; Inconsistency of ampere's law; concept of sinusoidal time variations (Phasor notation); Maxwell's equations with physical significance; Maxwell equations in free space, static field and in Phasor notation; Difference between displacement current and conduction current; Concept of Poynting vector; Poynting Theorem. *(11 Lectures)*

UNIT-IV

Electromagnetic Waves: Wave equation in free space or non-conducting or lossless medium; wave equation for conducting medium; wave propagation in lossless and conducting medium (phasor form); Propagation characteristics of EM waves in free space, lossless and in conducting medium; Uniform plane waves and solution; relation between electric and magnetic fields of an electromagnetic wave; Linear, circular and elliptical polarization; depth of penetration, Reflection of waves by a perfect conductor: normal incidence and oblique incidence; Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence. *(12 Lectures)*

Reference Books:

1. David Griffiths, Introduction to Electrodynamics, Pearson Education India Learning Private Limited; 4 edition.
2. Edward C Jordan and Keith G Balmain, Electromagnetic waves and radiating systems, Prentice Hall
3. Kraus John D, Electromagnetics, McGraw-Hill Publisher
4. W. Saslow, Electricity, magnetism and light, Academic Press
5. A Textbook of Electricity and Magnetism, S K Sharma, Shalini Sharma, Publisher: S Dinesh & Co.

BSHP-123-21	**Physics Lab-II**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisites (if any): High-school education with Physics lab as one of the subject.

Course Objectives: The aim and objective of the Physics Lab course is to introduce the students of B. Sc. (Hons.) Physics to the formal structure of wave and vibrations and mechanics so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be

CO1	Able to understand the theoretical concepts learned in the theory course.
CO2	Trained in carrying out precise measurements and handling equipment.
CO3	Learn to draw conclusions from data and develop skills in experimental design.
CO4	Able to understand the principles of error analysis and develop skills in experimental design.
CO5	Able to document a technical report which communicates scientific information in a clear and concise manner.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	2	1	2	3	2	3
CO2	3	3	1	-	2	2	1	1	1	3	2	3
CO3	3	3	2	-	2	1	2	1	1	3	2	3
CO4	3	2	2	2	-	2	2	1	1	3	2	3
CO5	2	2	2	2	-	2	2	1	1	3	2	3

Note: Students are expected to perform about 8-10 experiments from the following list, selecting minimum of 6-7 from the Physical Lab and 2-3 from the Virtual lab.

List of experiments:

1. Measurements of length (or diameter) using vernier caliper and screw gauge.
2. Measurement of volume using travelling microscope. Use of Plumb line and Spirit level.
3. To determine the frequency of an electrically maintained tuning fork in a) Transverse mode of vibration b) Longitudinal mode of vibration.
4. To verify the law of vibrating string Using Melde's experiment.
5. To compare mass per unit length of two strings by Melde's experiment.
6. To find out the frequency of AC mains using electric-vibrator/sonometer.
7. To determine the horizontal and vertical distance between two points using a Sextant.
8. To determine the height of an inaccessible object using a Sextant.
9. To determine the angular diameter of the sun using the sextant.
10. To determine the angular acceleration α, torque τ, and Moment of Inertia of flywheel.
11. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of **g** and (c) Modulus of rigidity.
12. To determine the time period of a simple pendulum for different length and acceleration due to gravity.
13. To study the variation of time period with distance between centre of suspension and centre of gravity for a compound pendulum and to determine: (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of g in the laboratory.
14. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.

Reference book and suggested readings:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. Practical Physics, C L Arora. S. Chand & Company Ltd.
7. http://www.vlab.co.in

BSHM-204-21	**Vector Algebra & Vector Analysis**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Elementary calculus of matric level.

Course Objectives: The objectives of this course are to make the students understand the following:

1. The fundamental concepts of Scalars and Vector algebra.
2. The geometrical meaning of projections and orthogonality.
3. Applications of gradient, divergence and curl.
4. Geometric meaning of scalar and vector valued functions, gradient of scalar point function.
5. The utility of Gauss, Green and Stokes Theorem.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the basic concepts of Scalars and Vector algebra.
CO2	Visualize all concepts geometrically.
CO3	Apply the knowledge of dot product and cross product in finding projections, area and orthogonality.
CO4	Utilize the concept of scalar and vector valued functions, gradient of scalar point function, divergence and curl of vector point functions, their geometrical interpretation.
CO5	Acquire the knowledge of the concept of relation between cartesian, cylindrical and spherical polar coordinates, Gauss, Green and Stokes theorem.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

UNIT I

Definitions of Scalars, vectors, position vector, unit vector, types of vectors, Addition of vectors, direction ratios, direction cosines, multiplication by a scalar, dot product, cross product of vectors, projection of vectors on a line.

UNIT-II

Vector joining two points, section formula, angle between two vectors, Cauchy-Schwartz inequality, Solenoidal vectors, orthogonality, Area of triangle, area of parallelogram, Scalar and vector product of three vectors

PART-B

UNIT-III

Scalar valued point functions, vector valued point functions, Derivative along a curve, directional derivatives, Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors, Gradient, divergence and curl Gradient of a scalar point function. Geometrical interpretation of gradient of a scalar point function (grad φ).

UNIT-IV

Divergence and curl of a vector point function, Character of divergence and curl of a vector point function, relation between Cartesian and cylindrical or spherical coordinates, Statements of Theorems of Gauss, Green and Stokes (without proof).

TEXT AND REFERENCE BOOK

1. Mathematics, A Text book for Class XII (Parts I & II), New Delhi: NCERT, 2003. (Unit I & II)
2. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
3. H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons (Asia) P. Ltd. 2002.
4. P.C. Matthew's, Vector Calculus, Springer Verlag London Limited, 1998.

BHCL-114-21	**ORGANIC CHEMISTRY**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives:

1. To teach the basic principles, reaction mechanisms and stereochemistry of organic compounds.
2. To impart knowledge regarding physical properties and chemical reactions of alkanes, alkenes, dienes, alkynes, arenes, alkyl and aryl halides etc.
3. To predict and account for the most commonly encountered reaction mechanisms (substitution, addition, and elimination) in organic chemistry.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the fundamental concepts of organic chemistry i.e. structure, bonding and various effects in organic compounds.
CO2	To learn the stereochemistry viz. optical isomerism, stereoisomerism and conformational isomerism of organic compounds.
CO3	To study the various known reactive intermediate in organic synthesis.
CO4	To learn the fundamental and advanced concepts of reaction mechanisms along with the study of reaction mechanisms in various types of substitution addition and elimination reactions.
CO5	To predict the relationships between organic chemical structures and their reactivity.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

Unit-I

Basics of Organic Chemistry

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. *Electronic Displacements:* Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleo phlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

Unit-II

Stereochemistry:

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemicmixture and resolution. Relative and absolute configuration: D/L and R/S designations.

A. Carbon-Carbon sigma bonds formation:-

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

PART-B

Unit-III

Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ AntiMarkownikoff addition), mechanism of oxymercuration-demercuration, hydroboration oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation(oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene. *Reactions of alkynes:* Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Unit-IV

Cycloalkanes and Conformational Analysis

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

Aromatic Hydrocarbons

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

Text and Reference Books:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

BHCL-116-21	**CHEMISTRY LAB-II**	**L-0, T-0, P-2**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Chemistry

Course Objectives: which will act as a strong background if he/she chooses to pursue physics as a career.

Course Outcomes: At the end of the course, the student will be able to

CO1	
CO2	
CO3	
CO4	
CO5	

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

List of Experiments:

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents: a) Water b) Alcohol, and c) Alcohol-Water.
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100°C by distillation and capillary method)
6. Chromatography a) Separation of a mixture of two amino acids by ascending and horizontal paper chromatography b) Separation of a mixture of two sugars by ascending paper chromatography, c) Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009).
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012).

BHHL-115-21	**Communicative English-II**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Basic proficiency in communicative English

Course Objectives: This course is designed to

- help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills
- help the students become the independent users of English language
- develop in them vital communication skills, integral to their personal, social and professional interactions
- teach them the appropriate language of professional communication
- prepare them for job market

Course Outcomes: At the end of the course, the student will be able to

CO1	Students will acquire basic proficiency in reading &listening, writing and speaking skills.
CO2	Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.
CO3	They will be able to converse fluently.
CO4	They will be able to produce on their own clear and coherent texts.
CO5	Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills and thereby will have better job prospects.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	1	1	2	2	3	2	3	2	2
CO2	1	-	-	1	1	2	2	3	2	3	2	2
CO3	1	-	-	1	1	2	2	3	2	3	2	2
CO4	1	-	-	1	1	2	2	3	2	3	2	2
CO5	2	-	-	1	1	2	2	3	2	3	2	2

Detailed Syllabus:

Part –A

UNIT I-(Literature)

(A) *The Poetic Palette* (Orient Black Swan, Second Edition, 2016)

The following poems from this anthology are prescribed:

1. The Soul's Prayer: Sarojini Naidu
2. I Sit and Look Out: Walt Whitman
3. Women's Rights: Annie Louise Walker

(B) *Prose Parables* (Orient Black Swan, 2013)

The following stories from the above volume are prescribed:

1. The Doctor's Word: R.K. Narayan
2. The Doll's House: Katherine Mansfield
3. Dusk: H.H. Munroe (Saki)

UNIT-II

Vocabulary: Standard abbreviations; One word substitution; Word Pairs (Homophones/ Homonyms)

Grammar: Sentence Structures; Use of phrases and clauses in sentences; Transformation of Sentences; Importance of proper punctuation

PART-B

UNIT-III

Reading and Understanding: Summary Paraphrasing; Analysis and Interpretation; Translation (from Hindi/Punjabi to English and vice-versa)

UNIT-IV

Mechanics of Writing & Speaking Skills: Report writing; Career Documents- Job applications, Resume/CV writing, Common Everyday Situations: Conversations & Dialogues, Formal Presentations

TEXT AND REFERENCE BOOK

1. John Eastwood, Oxford Practice Grammar, Oxford University Press, 2014
2. Michael Swan, Practical English Usage, OUP. 1995.
3. F.T. Wood, Remedial English Grammar, Macmillan. 2007.
4. William Zinsser, On Writing Well, Harper Resource Book 2001.
5. Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Communication Skills, Oxford University Press. 2011.
7. Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press. 2006.

BHHL-116A-21	**ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ (Punjabi Compulsory)-II**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Punjabi

Course Objectives: The objective of the course is to enhance the ability of via Learning science and developing science literacy through local language teaching with science subjects.

Course Outcomes: At the end of the course, the student will be able to

CO1	Translate and transfer/broadcast the western scientific knowledge in the local language.
CO2	Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.
CO3	Understand the society through Punjabi language, literature and culture
CO4	Learning science and in developing science literacy.
CO5	Improve the internal communication.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

UNIT I :

ਡਾ.ਹਰਿਭਜਨ ਸਿੰਘ:

ਅਪ੍ਰਮਾਣਿਕ, ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਰੀ ਦੀ ਦਾਸਤਾਨ

ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ:

ਕੰਡਿਆਲੀ ਥੋਰ੍ਹ, ਧਰਮੀ ਬਾਬਲ ਪਾਪ ਕਮਾਇਆ, ਰੁੱਖ

ਪਾਸ਼:

ਇਨਕਾਰ,ਸਭ ਤੋਂ ਖਤਰਨਾਕ,ਦਹਿਕਦੇ ਅੰਗਿਆਰਾਂ ‘ਤੇ

ਸੁਰਜੀਤ ਪਾਤਰ:

ਹੁਣ ਘਰਾਂ ਨੂੰ ਪਰਤਣਾ, ਕੁਝ ਕਿਹਾ ਤਾਂ..., ਪੁਲ *(Lecture 12)*

UNIT-II

ਕਹਾਣੀ ਭਾਗ:

ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ:

ਕੋਈ ਇਕ ਸਵਾਰ

ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼:

ਲੱਛਮੀ

ਮੋਹਨ ਭੰਡਾਰੀ :

ਘੋਟਣਾ

ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ :

ਆਪਣਾ ਆਪਣਾ ਹਿੱਸਾ *(Lecture 11)*

PART-B

UNIT-III

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਉਪਰ ਪਏ ਪ੍ਰਭਾਵ *(Lecture 12)*

UNIT-IV

ਰਿਪੋਰਟਿੰਗ, ਸਮਾਚਾਰ ਲਿਖਣ ਦੀ ਵਿਧੀ ਤੇ ਤੱਤ

ਪੰਜਾਬੀ ਪੈਰ੍ਹੇ ਦਾ ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ

ਦਫਤਰੀ ਚਿੱਠੀ ਪੱਤਰ

TEXT AND REFERENCE BOOK:

1. ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ, ਸਾਹਿਤ ਦੇ ਰੰਗ, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, 2016.

BHHL-116B-21	**ਮੁਢਲੀ ਪੰਜਾਬੀ (Mudhli Punjabi)-II**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: The objective of the course is:
1.To enhance the language ability of students.
2.To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.

Course Outcomes: At the end of the course, the student will be able to

CO1	Translate and transfer/broadcast the western scientific knowledge in the local language.
CO2	Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.
CO3	Understand the society through Punjabi language, literature and culture.
CO4	Learning science and in developing science literacy.
CO5	Improve the internal communication.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Detailed Syllabus:

PART-A

UNIT I

ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਤੇ ਵਰਤੋਂ-

ਨਾਂਵ

ਪੜਨਾਂਵ

ਵਿਸ਼ੇਸ਼ਣ

ਕਿਰਿਆ

ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ (12 Lectures)

UNIT-II

ਰੋਜ਼ਾਨਾ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ:

ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ ਤੇ ਕਿੱਤਿਆਂ ਸਬੰਧੀ। (12 Lectures)

PART-B

UNIT-III

ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ :

ਸਧਾਰਣ ਵਾਕ

ਸੰਯੁਕਤ ਵਾਕ

ਮਿਸ਼ਰਤ ਵਾਕ

(12 Lectures)

UNIT-IV

ਸਧਾਰਣ ਵਾਕਾਂ ਦਾ ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

ਸਧਾਰਣ ਵਾਕਾਂ ਦਾ ਪੰਜਾਬੀ ਤੋਂ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ (11 Lectures)

TEXT AND REFERENCE BOOK:

1. ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ, ਸਾਹਿਤ ਦੇ ਰੰਗ, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, 2016.