FACULTY OF SCIENCES

SYLLABUS FOR THE BATCH FROM THE YEAR 2022 TO YEAR 2025

Programme Code: BSHP

Programme Name: B.Sc. (Hons.) Physics

(Semester I-VI)

Examinations: 2022-25

Department of Physics

Khalsa College, Amritsar

(An Autonomous College)

S.No.	PROGRAMME OBJECTIVES
1.	To develop human resource with knowledge, abilities and insight in Physics and related fields required for career in academia and industry.
2.	To apply principles of basic science concepts in understanding, analysis and prediction of physical systems.
3.	To understand the concepts and significance of the various physical phenomena.
4.	To carry out experiments to understand the laws and concepts of Physics.
5.	To acquire a wide range of problem solving skills and to apply them.

S.No.	PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO-1	To Demonstrate knowledge of classical mechanics, electromagnetism and modern physics and be able to apply this knowledge to analyse a variety of physical phenomena.
PSO-2	To demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
PSO-3	To demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.
PSO-4	To analyse scientific reasoning for various things.
PSO-5	To enable students to be capable of analyzing the problems through different prospective and hence instill higher order thinking and learning.
PSO-6	To find ample career openings both in public as well as private sector enterprises. They can apply for all government jobs and find various opportunities in government organizations like DRDO, ISRO, BARC, IIT etc.

COURSE SCHEME							
SEMESTER - I							
Course Code	**Course Name**	**Hours/ Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
BHP-111	MECHANICS-I	4	56	-	19	75	5-6
BHP -112	ELECTRICITY AND MAGNETISM-I	4	56	-	19	75	7-8
MAP -111	MATHEMATICS –I	4	37	-	13	50	9-10
CHX -111	ORGANIC CHEMISTRY-I	4	37	-	13	50	11-13
BCEN-1123	COMMUNICATIVE ENGLISH	4	50	-	13	50	14-15
BHPB-1101	ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ –I	4	37	-	13	50	16
BPBI-1102 BPHC-1104	ਮੁੱਢਲੀ ਪੰਜਾਬੀ–I (In Lieu of Compulsory Punjabi) or PUNJAB HISTORY & CULTURE **(For those students who are not domicile of Punjab)**	6	37	-	13	50	17-20
BHP -113	PHYSICS LAB-I	6	-	37	13	50	21-22
CHP-112	ORGANIC CHEMISTRY LAB-I	6		37	13	50	23-24
ZDA-111	DRUG ABUSE	1.5	50	-	-	50	25-27

SEMESTER - II							
Course Code	**Course Name**	**Hours/ Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
BHP-121	ELECTRICITY & MAGNETISM-II	4	56	-	19	75	28-29
BHP-122	WAVES & OSCILLATIONS	4	56	-	19	75	30-31
MAP -121	MATHEMATICS –II	4	37	-	13	50	32-33
CHX -121	INORGANIC CHEMISTRY-II	4	37	-	13	50	34-35
BCEN-1223	COMMUNICATIVE ENGLISH	4	50	-	13	50	36-37
BHPB-1201	ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ –II	4	37	-	13	50	38
BPBI-1202 BPHC-1204	ਮੁੱਢਲੀ ਪੰਜਾਬੀ–II (In Lieu of Compulsory Punjabi) or PUNJAB HISTORY & CULTURE.**(For those students who are not domicile of Punjab)**	4	37	-	13	50	39-42

BHP -123	PHYSICS LAB-II	6	-	37	13	50	43-44
CHP-122	INORGANIC CHEMISTRY LAB-II	6		37	13	50	45-46
ZDA-121	DRUG ABUSE	1.5	50	-	-	50	47-48

SEMESTER - III							
Course Code	**Course Name**	**Hours/ Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
BHP-231	MECHANICS-II	4	56	-	19	75	49-50
BHP -232	STATISTICAL AND THERMAL PHYSICS	4	56	-	19	75	51-53
MAP -231	MATHEMATICS-III	4	37	-	13	50	54-55
CHX -231	PHYSICAL CHEMISTRY-III	4	37	-	13	50	56-57
ESL-221	ENVIRONMENTAL STUDIES-I	2	50	-	-	50	58-61
IDPSY-2331	INTERDISCIPLINARY COURSE ID-I (Psychology)	4	37	-	13	50	62-63
BHP -233	PHYSICS LAB-III	6	-	37	13	50	64-65
CHX -232	PHYSICAL CHEMISTRY LAB-III	6	-	37	13	50	66-67

SEMESTER - IV							
Course Code	**Course Name**	**Hours/ Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
BHP-241	OPTICS	4	56	-	19	75	68-69
BHP -242	MODERN PHYSICS	4	56	-	19	75	70-71
MAP -241	MATHEMATICS-IV	4	37	-	13	50	72-73
CHX -241	MOLECULAR SPECTROSCOPY-IV	4	37	-	13	50	74-75
ESL-222	ENVIRONMENTAL STUDIES-II	2	50	-	-	50	76-78
BGEO-2432	INTERDISCIPLINARY COURSE ID-II (Geography)	4	37	-	13	50	79-80
BHP -243	PHYSICS LAB-IV	6	-	37	13	50	81-82

CHX -242	PHYSICAL CHEMISTRY LAB -IV	6	-	37	13	50	83-84

SEMESTER - V							
Course Code	**Course Name**	**Hours/ Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
BHP-351	CONDENSED MATTER PHYSICS – I	4	56	-	19	75	85-86
BHP -352	NUCLEAR PHYSICS	4	56	-	19	75	87-88
BHP -353	**ATOMIC SPECTROSCOPY**	4	56	-	19	75	89-90
BHP -354	**QUANTUM MECHANICS**	4	56	-	19	75	91-92
BHP -355	PHYSICS LAB-V	6	-	37	13	50	93-94
BHP -356	SEMINAR AND ASSIGNMENT	6	-	37	13	50	95

SEMESTER - VI							
Course Code	**Course Name**	**Hours/ Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
BHP-361	PARTICLE PHYSICS	4	56	-	19	75	96-97
BHP -362	CONDENSED MATTER PHYSICS – II	4	56	-	19	75	98-99
BHP -363	ELECTRONICS	4	56	-	19	75	100-101
BHP -364	**MOLECULAR SPECTROSCOPY AND LASER**	4	56	-	19	75	102-103
BHP -365	PHYSICS LAB-VI	6	-	37	13	50	104-105
BHP -366	PHYSICS LAB-VII	6	-	37	13	50	106-107

ELIGIBILITY: A candidate who has passed 10+2 Science 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

B.SC. (HONS.) PHYSICS SEMESTER I
BHP-111
MECHANICS-I

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

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

Course Contents:

UNIT-I

Co-ordinate system and Motion of a Particle: Cartesian and Spherical polar co-ordinate systems; area, volume, displacement, velocity and acceleration in these systems. Solid angle, Symmetry principles and Laws of Conservation.

UNIT-II

Conservation of Momentum and Collisions: Internal forces and momentum conservation. Centre of mass. Elastic collisions in laboratory and center of mass systems; velocities, angles, energies in these systems and their relationships. Conservation of angular momentum and examples-shape of the galaxy, angular momentum of solar system. Torques due to internal forces, angular momentum about center of mass. Cross-section elastic scattering and impact parameter, Rutherford scattering.

UNIT-III

Inverse-Square-Law Force: Forces in nature (qualitative). Central forces, Potential energy and force between a point mass and spherical shell, a point mass and solid sphere, gravitational and electrostatic self energy. Two body problem and concept of reduced mass. Motion of a body under central force, equation of orbit in inverse-square force field. Kepler's laws and their derivation

UNIT-IV

Dynamics of Rigid Bodies: Equation of motion of a rigid body, rotational motion of a rigid body in general and that of plane lamina. Rotation of angular momentum vector about a fixed

axis. Angular momentum and kinetic energy of a rigid body about principal axis, Euler's equations. Precession and elementary gyroscope, Spinning top.

Tutorial: Relevant problem on the topics covered in the course.

Books Prescribed:

1. Mechanics-Berkeley Physics Course, Vol-I (second edition):C. Kittel, W. D. Knight, M. A. Ruderman, C. A. Helmholtz and R. J. Moyer-Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
2. Fundamentals of Physics: D. Halliday, R. Resnick and J. Walker (sixth edition)-Wiley India Pvt. Ltd.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand the basic information about co-ordinate system and motion of particles in it.
CO2	Understand the conservation laws and also to determine the difference between elastic and inelastic collisions.
CO3	Explain the applications of central force to the stability of circular orbits, Kepler's laws of planetary motion, orbital precession and Rutherford scattering.
CO4	Understand the dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia, the motion of rigid bodies and Euler equations.
CO5	Understand the differences between types of forces and also able to explain the inverse square force field.

B.SC. (HONS.) PHYSICS SEMESTER I
BHP-112
ELECTRICITY AND MAGNETISM-I

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: Objectives of this course are to understand vectors calculus. To understand the fundamental laws and concepts in electricity and magnetism and their applications. To understand electric current and related concepts. To understand dielectrics, resistors, capacitors, and inductors. To understand the relativistic approach in electricity and magnetism.

Course Contents:

UNIT-I

Calculus of Vectors: Basic Ideas of Vector Calculus**,** Introduction to gradient, divergence &curl; their physical significance. Rules for vector derivatives, useful relations involving gradient, divergence & curl. Solenoidal and irrotational fields, Fundamental theorem for gradients, Gauss's and Stoke's theorems, Helmholz and Greens theorem.

UNIT-II

Electrostatics: Electric charge and its properties, Coulombs law, Principal of Superposition The electric field due to a point charge and continuous charge distributions, Electric field due to finite and infinite lines of charges. Field due to electric dipole, field lines, flux, Gauss's law and its applications, Curl of electric field. Relation between potential and electric field. Poisson's and Laplace's equations. Electric potential due to different charge distribution Wire, Ring, Disc, Spherical Sheet, Sphere, dipole etc. The energy for a point and continuous charge distribution.

UNIT-III

Electric Currents and Fields of Moving Charges Conductors in the electrostatic field, Capacitors, Current and current density, drift velocity, expression for current density vector, Equation of continuity, electrical conductivity, limitations of Ohm's conductivity**,** Multipoles and multipole moments. Equipotential surface method of electrical images. Electric field in different frames of references, Transformation of Electric Field from one inertial Frame to another, Relation between electric force in two inertial frames, Interaction between moving charges, Electric field due to moving charges.

UNIT-IV

Electric Fields in Matter : Dielectrics, Non Polar and Polar Molecules, Polarisation of Dielectric, Polarization Vector, Atomic polarizability, Dielectric Constant, Capacity of a Capacitor, Electric Susceptibility, Free and Bound Charges, Gauss Law in Dielectric, and

Displacement Vector, Energy stored in Capacitor having Dielectric Medium, Energy Density of a Dielectric Medium.

Tutorial: Relevant problem on the topics covered in the course.

Books Prescribed:

1. Introduction to Electrodynamics -D.J. Griffiths, Pearson Prentice Hall, New Delhi.
2. Electricity & Magnetism-T.S. Bhatia and Gurpreet Singh, Vishal Publications.
3. Berkeley Physics Course Vol. II (Electricity & Magnetism)- E.M.Purcell, Mc Graw hill, New York.
4. Fundamental of Physics -D. Halliday, R. Resnick and J. Walker (6th edition)-John Wiley, India Pvt. Ltd.
5. Electricity and Magnetism – A. K. Sikri, Pradeep Publications

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand vectors calculus.
CO2	Understand the fundamental laws and concepts in electricity and magnetism and their applications.
CO3	Understand electric current and related concepts.
CO4	Understand dielectrics, resistors, capacitors, and inductors.
CO5	Understand the relativistic approach in electricity and magnetism.

B.SC. (HONS.) PHYSICS SEMESTER I
MAP-111
MATHEMATICS –I

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Practical Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS

1. The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit) Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & Section-C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from Section-B & Section-C. Each question carries six marks.
4. Teaching time for this paper would be six periods per week.

Course Objectives:

- To acquire the knowledge of differential calculus.
- To have an idea about the functions of two and three variable.
- To get familiar with the concept of Reimann integrability and beta-gamma functions.

Course contents:

Unit- I

The algebra of derivatives: Continuity , differentiability for one variable, standard theorems on differentiability, Chain rule, Proof of Rolle's theorem, Langrange's mean value theorem, Cauchy's theorem and Taylor's theorem, Applications of mean value theorem, L'Hospital rule, Leibnitz theorem on higher order derivative of product of two smooth functions.

Several Variable Calculus: Function of two and three variables, Rigorous treatment of limit, continuity, and differentiability of functions of two variables, Directional derivative, Partial derivatives, chain rule, statements of the inverse function theorem and implicit function theorem and their applications and Euler's theorem for homogenous functions.

Unit-II

Integral Calculus: Anti-derivatives, Standard techniques and formulae for anti derivatives of elementary functions. Reduction formulae, Rule of "smaller inder +1" , Partitions, Upper and Lower integrals, Riemann integrability, Conditions of existence of Riemann integrability of continuous functions and of monotone function, Beta and Gamma functions.

Books prescribed:

1. EarkCoddington, Theory of ordinary differential equations, 1984.
2. Tom M.Apostol, Calculus I & II, John-Willey, 1967.
3. Shanti Narayan, Differential Calculus, New Delhi, Shyam Lal,1983.
4. Shanti Narayan, Integral Calculus, Delhi, S.Chand,1968.
5. Rajinder pal kaur, calculus , ludhiana, first world publication

Course outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Deal with the problems based on differential calculus.
CO2	Understand the concepts of partial differentiation.
CO3	Solve the problems related to integration using Reimann integrability and Beta Gamma functions.

B.SC. (HONS.) PHYSICS SEMESTER I
CHX-111
ORGANIC CHEMISTRY-I

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Instructions for paper setters and students:

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section I carries 9 marks and is compulsory consisting of eight short answer type questions of 1.5 marks each covering the whole syllabus. The candidate will have to attempt six questions in section I.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

Course Objectives: The objective of Organic Chemistry-I course is to enhance the knowledge of students on the topics of Stereochemistry especially in reference to the OPTICAL ISOMERISM. The course is also targeted to increase the knowledge of students for the various methods of preparation and properties of Alkanes, Alkenes, Alkynes, arenes, aromaticity and Nucleophilic addition and Substitution reactions.

Course Contents:

UNIT-I

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiaral structures, chiral centresin chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration, the Cahn-Ingold Perlog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, inversion and retention of configuration, Resolution of enantiomers, chiral centres other than carbon.

UNIT-II

Chemistry alkanes and alkenes: Conformations of alkanes and cycloalkanes: conformational analysis of ethane and n-butane; conformational analysis of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivative. Difference between configuration and conformation. Stereochemistry of alkenes, naming stereo isometric alkenes by the E-Z system, Mechanism of hydrogenation of alkenes, stereochemistry of hydrogenation of alkenes, Dehydration of alcohols and regioselectivity of these reactions. Acid catalysed dehydration of alcohols with complete mechanistic discussion, Mechanism of dehydrohalogenation of alkylhalides (E mechanism), stereoselective and antielimination in E reactions, the E Mechanism, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism, free radical addition of hydrogen

bromide to alkenes, acid catalysed hydration of alkene with mechanism stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.

Alkynes: Acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkynes, with detailed discussion of mechanism of these reactions.

UNIT-III

Nucleophilic substitution and addition reaction:

(a) Functional group transformation by nucleophilic substituion, mechanism of nucleophilic substitution (SN^1/SN^2), stereochemistry of SN^1/SN^2 reactions, steric effect in SN^2 reactions, nucleophiles and nucleophilicity, carbocation stability and the rate of substitution, by the SN^1 mechanism, stereochemistry of SN^1 reactions, carbocation rearrangements in SN^1 reactions, solvent effects, substitution and elimination as competing reactions.

(b) Principles of nucleophillic addition to carbonyl groups : Hydration acetal formation, cyanohydrin formation ; reactions with primary and secondary amines, Wittig reaction, steroselective addition to carbonyl groups mechanism of halogenation, aldol condensation

UNIT-IV

Arenes and Aromaticity

: Nomenclature of benzene derivatives.The aryl group. Aromatic nucleus and side chain.Structure of benzene: Molecular formula and Kekule structure. Stability and carbon carbon bondlengths ofbenzene, resonance structure, MO picture. Aromaticity : the Huckel's rule, aromatic ions.Aromatic electrophilic substitution–general pattern of the mechanism, role of σ and π complexes.Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction.Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/pararatio. Side chain reactions of benzene derivatives.

Books Prescribed:

1. R.T. Morison and R.N. Boyd, Organic Chemistry.
2. I.L. Finar, Organic Chemistry, Vol. I IV ed.
3. Advanced Organic Chemistry, Reactions Mechanisms and Structure by J. March.
4. Schaum's Outlines Series Theory and Problems of Organic Chemistry by Herbert Meislick and Jacob Sharefkin
5. Problems and their solution in Organic chemistry by I.L. Finar, Modern Organic Chemistry by J.D. Robbert and M.C. Caserio.
6. Organic Chemistry by D.J. Cram and G.S. Hammond.
7. J.E. Banks, Naming Organic Compounds – Programmed Introduction to Organic Chemistry.
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F.A. Carey, Organic Chemistry.

Course Outcomes:

Sr. No.	On completing the course, the outcomes will be as under:
CO1	Learn about SN1, SN2 and SNi Mechanism and the related stereochemistry.
CO2	Understand the concept, principle and applications of UV, IR and NMR Spectroscopy and the problems pertaining to the structure elucidation of simple organic compounds.
CO3	Solve the elimination reaction problems
CO4	Distinguish between type of addition, elimination and substitution reaction.
CO5	Learn E and Z nomenclature ,Stereo chemical principal, enantiomeric relationship R and S

B.SC. (HONS.) PHYSICS SEMESTER I
BCEN-1123
COMMUNICATIVE ENGLISH
For B.Sc. (Hons.) Physics, Chemistry, Botany, Maths and Computational Statistics and Data Analytics

Credit Hours (per week):4
Total Hours: 60
Time: 3 Hours **Maximum Marks:50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Suggested paper pattern:-

1. Practical Question on Paragraph Writing with internal choice as prescribed in *The Written Word* **(8 marks)**
2. Short answer type questions from Unit 1 and 2 of *Making Connections : A Strategic Approach To Academic Reading* **(12 marks)**
3. Essay type question with internal choice from Unit 1 and 2 of *Making Connections: A strategic Approach to Academic Reading* **(8 marks)**
4. Practical question on Letter Writing from *The Written Word* **(5 marks)**
5. The question will carry 08 words out of 30 prescribed words from the "Word List" in *The Written Word.* The student will attempt any four (4) out of the eight (08). **(4X1= 4 marks)**

Course Objectives:
I: To develop competence in written communication.
II: To inculcate innovative and critical thinking among the students.
III: To enable them to grasp the application of communication theories.
IV: To acquire the knowledge of latest technology related with communication skills.
V: To provide knowledge of multifarious opportunities in the field of this programme.

Course Contents:

1. Reading and Comprehension Skills:

The Students will be required to read and comprehend the essays in Unit 1 and 2 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Third Edition. They will be required to answer the questions given after each essay.

2. Developing Vocabulary and using it in the Right Context:

The students will be required to give the meaning of the words from the "Word List" from the Chapter "Vocabulary" in the book *The Written Word* .The question will be set from the following words :

Acute, Arrogant, Apathy, Bliss, Brevity, Cease, Chronic, Dearth, Discontent, Effigy, Fastidious, Giddy, Hamper, Guile, Inauspicious, Juxtapose, Kinetic, Laudable, Meticulous, Mundane, Naive, Opaque, Peevish, Proficient, Prolific, Remedial, Strife, Verbose, Woe, Zenith.

3. Writing Skills

The Students will be required to write a Paragraph and a Letter as in the book *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

Course Outcomes:

Sr. No.	**On Completing the Course, the Students will be able to:**
CO1	Identify common errors in language and rectify them.
CO2	Develop and expand writing skills through controlled and guided activities.
CO3	Develop coherence, cohesion and competence in written discourse through intelligible pronunciation.
CO4	Develop the ability to handle the interview process confidently and learn the subtle nuances of an effective group discourse.
CO5	Communicate contextually in specific and professional situations with courtesy.

B.SC. (HONS.) PHYSICS SEMESTER I
BHPB-1101
lwzmI pMjwbI

B.Sc. Hons. (Physics, Chemistry, Mathematics), B.Sc. Bio-Tech./IT/Fashion Designing/Food Sc., BCA, B.A. JMC, B.Sc. (Computational Statistics and Data Analytics, Artificial Intelligence and Data Science), B.Voc. (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology)

ਸਮਾਂ : 3 ਘੰਟੇ

ਕ੍ਰੈਡਿਟ ਪ੍ਰਤੀ ਹਫਤਾ : 04
ਕੁੱਲ ਘੰਟੇ : 60
ਕੁੱਲ ਅੰਕ : 50
ਥਿਊਰੀ ਅੰਕ : 37
ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ : 13

ਅੰਕ-ਵੰਡ ਅਤੇ ਪ੍ਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

- ਸਿਲੇਬਸ ਦੇ ਚਾਰ ਭਾਗ ਹਨ ਪਰ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੇ ਪੰਜ ਭਾਗ ਹੋਣਗੇ। ਪਹਿਲੇ ਚਾਰ ਭਾਗਾਂ ਵਿਚ 02-02 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰੇਕ ਭਾਗ ਵਿਚੋਂ 01-01 ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੋਵੇਗਾ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ (08) ਅੰਕ ਹੋਣਗੇ। ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਪੰਜਵੇਂ ਭਾਗ ਵਿਚ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ 01-01 ਅੰਕ ਦੇ ਛੇ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ 05 ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ ਦੇਣਾ ਲਾਜ਼ਮੀ ਹੋਵੇਗਾ। ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।
ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ 13 ਅੰਕਾਂ ਦੀ ਹੈ, ਜੋ ਕਾਲਜ ਵੱਲੋਂ ਨਿਰਧਾਰਿਤ ਦਿਸ਼ਾ ਨਿਰਦੇਸ਼ਾਂ ਅਨੁਸਾਰ ਥਿਊਰੀ ਅੰਕਾਂ ਤੋਂ ਵੱਖਰੀ ਹੋਵੇਗੀ। ਇਸ ਪੇਪਰ ਦੇ ਕੁੱਲ ਅੰਕ 37+13 = 50 ਹਨ।

ਕੋਰਸ ਦਾ ਉਦੇਸ਼ ਕੋਰਸਦੇ ਬਜਏਚਟਵਿਏ

- ਵਿਦਿਆਰਥੀਆਂ ਵਿਚ ਸਾਹਿਤਕ ਰੁਚੀਆਂ ਪੈਦਾ ਕਰਨਾ।
- ਆਲੋਚਨਾਤਮਕ ਰੁਚੀਆਂ ਵਿਕਸਤ ਕਰਨਾ।
- ਮਾਤ ਭਾਸ਼ਾ ਦੀ ਸਮਝ ਨੂੰ ਵਿਕਸਤ ਕਰਨਾ

ਪਾਠ-ਕ੍ਰਮ

ਭਾਗ-ਪਹਿਲਾ

ਸਾਹਿਤ ਦੇ ਰੰਗ, ਡਾ. ਮਹਿਲ ਸਿੰਘ (ਸੰਪਾ.), ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
ਭਾਗ ਪਹਿਲਾ - ਕਵਿਤਾ ਅਤੇ ਕਹਾਣੀ, ਡਾ. ਮਹਿਲ ਸਿੰਘ ਅਤੇ ਡਾ. ਆਤਮ ਰੰਧਾਵਾ (ਸਹਿ ਸੰਪਾ.)
(ਕਵਿਤਾ ਭਾਗ ਵਿਚੋਂ ਪ੍ਰਸੰਗ ਸਹਿਤ ਵਿਆਖਿਆ/ਵਿਸ਼ਾ-ਵਸਤੂ। ਕਹਾਣੀ ਭਾਗ ਵਿਚੋਂ ਸਾਰ/ਵਿਸ਼ਾ-ਵਸਤੂ)

ਭਾਗ-ਦੂਜਾ

ਇਤਿਹਾਸਿਕ ਯਾਦਾਂ
ਸ. ਸ. ਅਮੋਲ (ਸੰਪਾ.), ਪੰਜਾਬੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
(ਨਿਬੰਧ 1 ਤੋਂ 6 ਤਕ ਸਾਰ/ ਵਿਸ਼ਾ-ਵਸਤੂ/ਸ਼ੈਲੀ)

ਭਾਗ-ਤੀਜਾ

(ੳ) ਪੈਰ੍ਹਾ ਰਚਨਾ (ਤਿੰਨਾਂ ਵਿਚੋਂ ਇਕ)
(ਅ) ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ

ਭਾਗ-ਚੌਥਾ

(ੳ) ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ : ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪ-ਭਾਸ਼ਾ ਵਿਚਲਾ ਅੰਤਰ, ਪੰਜਾਬੀ ਉਪ-ਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ-ਚਿੰਨ੍ਹ
(ਅ) ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ

ਪਾਠ-ਕ੍ਰਮ ਨਤੀਜੇ ਕੋਰਸਏਂਟਚੋਮਏਸ (ਕੋਸ)

- ਵਿਦਿਆਰਥੀ ਦੀ ਸਾਹਿਤਕ ਸੋਚ-ਸਮਝ ਵਿਕਸਤ ਹੋਵੇਗੀ।
- ਉਸ ਵਿਚ ਸਾਹਿਤ ਰੁਚੀਆਂ ਵਿਕਸਤ ਹੋਣਗੀਆਂ।
- ਉਸ ਵਿਚ ਸਾਹਿਤ ਸਿਰਜਣਾ ਦੀ ਸੰਭਾਵਨਾ ਵਧੇਗੀ।
- ਉਹ ਕਿਸੇ ਵੀ ਵਿਸ਼ੇ ਦਾ ਗਹਿਨ ਅਧਿਐਨ ਕਰਨ ਦੇ ਕਾਬਲ ਹੋਵੇਗਾ।
- ਉਹ ਮਾਤ ਭਾਸ਼ਾ ਦੇ ਵਿਕਾਸ ਵਿਚ ਵਿਸ਼ੇਸ ਯੋਗਦਾਨ ਪਾਉਣਗੇ।

B.SC. (HONS.) PHYSICS SEMESTER-I

BPBI-1102

muFlI pMjwbI

(In Lieu of Compulsory Punjabi)

B.Sc. (Hons. – Physics, Chemistry, Mathematics), B.Sc. Bio-Tech./IT/Fashion Designing/Food Sc./BCA, BA-JMC/ B. A., B. A. JMC, B. A. Social Science, B. Com. (Hons.), B. Com. (R), B. Sc. Computer Science, B. Sc. Economics, B. Sc. Medical, B. Sc. Non-Medical, B.Sc. Bio-Technology, B.Sc. Fashion Designing, B.Sc. Hons. Chemistry, B.Sc. Hons. Mathematics, B.Sc. Hons. Physics, B.Sc. in Computational Statistics and Data Analytics, B.Sc. IT, B.Sc. Food Science, BBA, BCA, B.Voc. (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology)

ਸਮਾਂ : 3 ਘੰਟੇ

ਕ੍ਰੈਡਿਟ ਪ੍ਰਤੀ ਹਫਤਾ : 04
ਕੁੱਲ ਘੰਟੇ : 60
ਕੁੱਲ ਅੰਕ : 50
ਥਿਊਰੀ ਅੰਕ : 37
ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ : 13

ਅੰਕ-ਵੰਡ ਅਤੇ ਪ੍ਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

- ਪਹਿਲੇ ਭਾਗ ਵਿਚੋਂ ਚਾਰ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਤਿੰਨ ਪ੍ਰਸ਼ਨਾਂ ਦਾ ਉੱਤਰ ਦੇਣਾ ਲਾਜ਼ਮੀ ਹੈ। ਹਰ ਪ੍ਰਸ਼ਨ ਦੇ ਚਾਰ-ਚਾਰ ਅੰਕ ਹਨ। ਭਾਗ ਦੂਸਰਾ ਵਿਚੋਂ ਦੋ-ਦੋ ਅੰਕ ਦੇ ਪੰਜ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹਨ। ਭਾਗ ਤੀਸਰਾ ਵਿਚੋਂ ਤਿੰਨ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ ਜਿਨ੍ਹਾਂ ਦੇ ਪੰਜ-ਪੰਜ ਅੰਕ ਹਨ। ਭਾਗ ਚੌਥਾ ਵਿਚ ਪੰਜ ਅਸ਼ੁੱਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਕੇ ਲਿਖਣਾ ਹੋਵੇਗਾ।

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ 13 ਅੰਕਾਂ ਦੀ ਹੈ, ਜੋ ਕਾਲਜ ਵੱਲੋਂ ਨਿਰਧਾਰਿਤ ਦਿਸ਼ਾ ਨਿਰਦੇਸ਼ਾਂ ਅਨੁਸਾਰ ਥਿਊਰੀ ਅੰਕਾਂ ਤੋਂ ਵੱਖਰੀ ਹੋਵੇਗੀ। ਇਸ ਪੇਪਰ ਦੇ ਕੁਲ ਅੰਕ 37+13 = 50 ਹਨ।

ਕੋਰਸ ਦਾ ਉਦੇਸ਼ ਛੋਰਸਣੋ ਬਜਣਚਟਵਿਣ

- ਵਿਦਿਆਰਥੀ ਨੂੰ ਸ਼ੁੱਧ ਪੰਜਾਬੀ ਪੜ੍ਹਨਾ-ਲਿਖਣਾ ਸਿਖਾਉਣਾ।
- ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਆਕਰਨਕ ਬਾਰੀਕੀਆਂ ਤੋਂ ਜਾਣੂ ਕਰਾਉਣਾ।
- ਸ਼ੁੱਧ ਸੰਚਾਰ ਨੂੰ ਵਿਕਸਤ ਕਰਨਾ।

ਪਾਠ-ਕ੍ਰਮ

ਭਾਗ-ਪਹਿਲਾ

(ੳ) ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ :
ਨਾਮਕਰਣ ਤੇ ਸੰਖੇਪ ਜਾਣ-ਪਛਾਣ: ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ, ਅੱਖਰ ਕ੍ਰਮ, ਸਵਰ ਵਾਹਕ (ੳ, ਅ, ੲ), ਲਗਾਂ-ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਨ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਨ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ
(ਅ) ਸਿਖਲਾਈ ਤੇ ਅਭਿਆਸ

ਭਾਗ-ਦੂਜਾ

ਗੁਰਮੁਖੀ ਆਰਥੋਗਰਾਫੀ ਅਤੇ ਉਚਾਰਨ :
ਸਵਰ, ਵਿਅੰਜਨ : ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ ਅਤੇ ਉਚਾਰਨ, ਮੁਹਾਰਨੀ, ਲਗਾਂ-ਮਾਤਰਾਂ ਦੀ ਪਛਾਣ

ਭਾਗ-ਤੀਜਾ

ਪੰਜਾਬੀ ਸ਼ਬਦ-ਜੋੜ : ਮੁਕਤਾ (ਦੋ ਅੱਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਤਿੰਨ ਅੱਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ), ਸਿਹਾਰੀ ਵਾਲੇ ਸ਼ਬਦ, ਬਿਹਾਰੀ ਵਾਲੇ ਸ਼ਬਦ, ਔਂਕੜ ਵਾਲੇ ਸ਼ਬਦ, ਦੁਲੈਂਕੜ ਵਾਲੇ ਸ਼ਬਦ, ਲਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਦੁਲਾਵਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਹੋੜੇ ਵਾਲੇ ਸ਼ਬਦ, ਕਨੌੜੇ ਵਾਲੇ ਸ਼ਬਦ, ਲਗਾਖਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) ਵਾਲੇ ਸ਼ਬਦ

ਭਾਗ-ਚੌਥਾ

ਸ਼ੁੱਧ-ਅਸ਼ੁੱਧ ਸ਼ਬਦ

ਪਾਠ-ਕ੍ਰਮ ਨਤੀਜੇ ਛੋਰਸਏੱਟਚੋਮਏਸ (ਛੋਸ)

- ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੀ ਸਿਖਲਾਈ ਵਿਚ ਮੁਹਾਰਤ ਹਾਸਿਲ ਕਰਨਗੇ।
- ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਚ ਮੁਹਾਰਨੀ, ਲਗਾਂ-ਮਾਤਰਾਂ, ਸਵਰ ਅਤੇ ਵਿਅੰਜਨ ਦੀ ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ ਦੁਆਰਾ ਉਨ੍ਹਾਂ ਦੀ ਸਮਝ ਨੂੰ ਵਿਕਸਿਤ ਹੋਵੇਗੀ।
- ਪੰਜਾਬੀ ਸ਼ਬਦ-ਜੋੜਾਂ ਦੀ ਜਾਣਕਾਰੀ ਹਾਸਿਲ ਕਰਕੇ ਉਹ ਸ਼ੁੱਧ ਪੰਜਾਬੀ ਲਿਖਣ-ਪੜ੍ਹਨ ਦੇ ਸਮਰੱਥ ਹੋਣਗੇ।
- ਉਹ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਨ ਪ੍ਰਬੰਧ ਦੀ ਜਾਣਕਾਰੀ ਹਾਸਿਲ ਕਰਨਗੇ।

B.SC. (HONS.) PHYSICS SEMESTER I
BPHC-1104
PUNJAB HISTORY & CULTURE (From Earliest Times to C 320)

(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

B. A.; B.A. (SS); B. A. (Hons. – English); B. Com. (Hons., R, Ac. & Finance); B. Sc. /Bio-Tech./Comp. Sc./Eco./FD/Food Sc./IT/Med./N.Med.; B.Sc. (Hons. –Botany, Chemistry, Mathematics, Physics, Zoology); B. of Mult.; B. in Int. & Mob. Tech.; BBA;BCA;BJMC; B. Voc. (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology)

Credit Hours (per week):4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Instructions for the Paper Setter:
The question paper consists of five units: I, II, III, IV and V. Units I, II, III andIV will have two questions each. Each question carries 8 marks. The students are to attempt one question from each unit approximately in 800 words. Unit-V consists of 7 short answer type questions to be set from the entire syllabus. Students are to attempt any 5 questions in about 20 words each. Each question carries 1 mark.
Note: The examiner is to set the question paper in two languages: English &Hindi.

Course Objectives: The main objective of this course is to educate the history and culture of the Ancient Punjab to the students who are not domicile of the Punjab. It aims to familiarize these students with the physical features of ancient Punjab and its impact on its history and culture. It also provides them information about the different sources to construct the history and culture of the ancient Punjab. The course intends to provide knowledge of social, economic, religious life of the Harrapan civilization, Indo-Aryans, teachings and impact of Jainism and Buddhism in the Punjab.

Unit-I

1. Physical features of the Punjab and impact on history.
2. Sources of the ancient history of Punjab.

Unit-II

3. Harappan Civilization: Town planning; social, economic and religious life of the Indus Valley People.
4. The Indo-Aryans: Original home and settlement in Punjab.

Unit-III

5. Social, Religious and Economic life during Rig Vedic Age.
6. Social, Religious and Economic life during later Vedic Age.

Unit-IV

7. Teachings and impact of Buddhism.
8. Jainism in the Punjab.

Books Prescribed:

1. L. Joshi (ed), *History and Culture of the Punjab*, Art-I, Patiala, 1989 (3rd edition)
2. L.M. Joshi and Fauja Singh (ed), *History of Punjab*, Vol.I, Patiala 1977.
3. Budha Parkash, *Glimpses of Ancient Punjab*, Patiala, 1983.
4. B.N. Sharma, *Life in Northern India*, Delhi. 1966.

Course Outcomes: After completion of the course, the students will be able to learn:
CO-1 The history and culture of the Ancient Punjab.
CO-2 Physical features of ancient Punjab.
CO-3 The sources of the history of the Punjab.
CO-4 Social, economic, religious life of the Harrapan civilization and Vedic-Aryans.
CO-5 Teachings and impact of Jainism and Buddhism in the Punjab.

B.SC. (HONS.) PHYSICS SEMESTER I
BHP-113
PHYSICS LAB-I

Credit Hours (per week): 6
Time: 3 Hours **Maximum Marks: 50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Periods 8 Periods/week
General Guidelines for Practical Examination

I. The distribution of marks is as follows:
i) One experiment **15 Marks**
ii) Brief Theory **5 Marks**
iii) Viva–Voce **10Marks**
iv) Record (Practical file) **7 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and 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 purpose of the course isto understand the concept of moment of inertia, torque and angular acceleration with the help of fly wheel, conservation laws in elastic collision using one dimensional hanging spheres, modulus of rigidity, Young's modulus and Poisson's ratio. It includes experiments to calculate low resistance with Carey Foster's Bridge and also to find out the capacitance and permittivity of a medium by de-Sauty's bridge.

LIST OF EXPERIMENTS

1. To measure the time periods of oscillation for the objects of various geometrical shapes but of same mass.
2. To study rotational motion using a flywheel and hence show that toque is proportional to angular acceleration.
3. To find the moment of inertia of an irregular body about an axis through its centre of gravity with a torsion pendulum.
4. To determine the moment of inertia of a flywheel.
5. To determine the Young's modulus by bending.
6. Determination of Poisson's ratio for rubber.
7. To verify laws of conservation of (a) linear momentum, (b) kinetic energy in elastic collisions using one dimensional collisions of hanging spheres. (c) Also determine energy transfer and coefficient of restitution.
8. To determine modulus of rigidity of copper wire by Maxwell needle experiment.
9. To determine low resistance with Carey-Foster's Bridge.
10. To determine the resistance and specific resistance of a copper wire with the help of Kelvins double bridge.
11. To find the unknown capacitance of a capacitor by flashing and quenching of a neon lamp.
12. Measurement of capacitance, determination of permittivity of a medium air and relative

permittivity by de-Sauty's bridge.

13. To study the flow of water through a capillary tube as a function of pressure head using two tubes of same length but different radii.
14. To study the flow of water through a capillary tube as a function of pressure head using two tubes of different length but of same radii.
15. To study the variation in resistance of filament of a bulb with temperature.

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	Understand the concept of moment of inertia, torque and angular acceleration with the help of fly wheel.
CO2	Understand the conservation laws in elastic collision using one dimensional hanging sphere.
CO3	Determine modulus of rigidity, Young's modulus and Poisson's ratio.
CO4	Find out low resistance with Carey Foster's Bridge.
CO5	Find out the capacitance and permittivity of a medium by de-Sauty's bridge.

B.SC. (HONS.) PHYSICS SEMESTER I
CHP-112
ORGANIC CHEMISTRY LAB-I

Credit Hours (per week):6
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Practical Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will give one organic salt to the students.
II. Each student will get different salt and analyse it for elements, functional group and prepare
its derivatives.
III. The question paper will be 37 marks with split as under:
(Write up = 12, Performance = 12, Viva-voce = 8, Practical note book = 5)

Course Objectives: In organic chemistry practical students will learn about the Evaluation of organic compounds for the detection of element, functional group and preparation of their derivatives. It includes following functional groups:Acids, ketones, aldehyde, carbohydrates, aromatic hydrocarbons, aromatic amines and phenols.

Course Contents:

The preliminary examination of physical and chemical characteristics (physical state, colour, odour and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions, classification tests involving functional reactivity
other than acid-base test, preparation of derivatives for given pure organic compounds.

The following categories of compounds should be analyzed.
-phenols, carboxylic acids
-carbonyl compounds - ketones, aldehydes
-carbohydrates
-aromatic amines
-aromatic hydrocarbons

Books Prescribed:

Practical Organic Chemistry by F.G. Mann and B.C. Saunders

Course Outcomes:

S. No.	On completing the course, the outcomes
CO1	Perform functional group analysis
CO2	Understand the preparation of derivatives of organic compounds
CO3	Study the determination of physical constant: Melting point, Boiling point.
CO4	Understand different separation techniques.
CO5	Learn how to perform TLC

B.Sc. (HONS.) PHYSICS SEMESTER–I
Course Code: ZDA111
Course Title- Drug Abuse: Problem, Management and Prevention
PROBLEM OF DRUG ABUSE
(Compulsory for all Under Graduate Classes)

Credit Hours (per week): 1.5
Total Hours: 22.5
Time: 3 Hours **Maximum Marks: 50**

Instructions for the Paper Setters:
Section–A: (15 Marks): It will consist of five short answer type questions. Candidates will be required to attempt three questions, each question carrying 05 marks. Answer to any of the questions should not exceed two pages.
Section–B: (20 Marks) It will consist of four essay type questions. Candidates will be required to attempt two questions, each question carrying 10 marks. Answer to any of the questions should not exceed four pages.
Section–C: (15 Marks) It will consist of two questions. Candidate will be required to attempt one question only. Answer to the question should not exceed 5 pages.

Course Objectives
The course aims to:

CO-1.	Generate the awareness against drug abuse.
CO-2.	Describe a variety of models and theories of addiction and other problems related to substance abuse.
CO-3.	Describe the behavioral, psychological, physical health and social impact of psychoactive substances.
CO-4.	Provide culturally relevant formal and informal education programs that raise awareness and support for substance abuse prevention and the recovery process.
CO-5.	Describe factors that increase likelihood for an individual, community or group to be at risk of substance use disorders.

UNIT–I

- **Meaning of Drug Abuse**

  Meaning, Nature and Extent of Drug Abuse in India and Punjab.

UNIT-II

- **Consequences of Drug Abuse for:**

  Individual : Education, Employment and Income.

  Family : Violence.

Society : Crime.

Nation : Law and Order problem.

UNIT-III

- **Management of Drug Abuse**

  Medical Management: Medication for treatment and to reduce withdrawal effects.

UNIT-IV

- Psychiatric Management: Counseling, Behavioral and Cognitive therapy.
- Social Management: Family, Group therapy and Environmental Intervention.

References:

1. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. The Drug Crime Connection. Beverly Hills: Sage Publications. 23
4. Jasjit Kaur Randhawa & Samreet Randhawa, "Drug Abuse-Problem, Management & Prevention", KLS, ISBN No. 978-81-936570-6-5, (2018).
5. Jasjit Kaur Randhawa & Samreet Randhawa, "Drug Abuse Problem, Management & Prevention", KLS, ISBN No. 978-81-936570-8-9, (2019).
6. Jasjit Kaur Randhawa & Samreet Randhawa, "voZrI d[otos'A^(BPky'oh) ;wZf;nk, gqpzXB ns/ o'eEkw", KLS, ISBN No. 978-81-936570-7-1, (2018).
7. Jasjit Kaur Randhawa, "Drug Abuse -Management & Prevention", KLS, ISBN No. 978-93-81278-80-2, (2018).
8. Kapoor. T. (1985) Drug epidemic among Indian Youth, New Delhi: Mittal Pub.
9. Modi, Ishwar and Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.
10. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
11. Rama Gandotra& Jasjit Kaur Randhawa, "voZrI d[otos'A^(BPky'oh) gqpzXB ns/ o'eEkw", KLS, ISBN No. 978-93-81278-87-1, (2018).
12. Sain, Bhim 1991, Drug Addiction Alcoholism, Smoking obscenity New Delhi: Mittal Publications.
13. Sandhu, Ranvinder Singh, 2009, Drug Addiction in Punjab: A Sociological Study. Amritsar: Guru Nanak Dev University.

14. Singh, Chandra Paul 2000. Alcohol and Dependence among Industrial Workers: Delhi: Shipra.
15. Sussman, S and Ames, S.L. (2008). Drug Abuse: Concepts, Prevention and Cessation, Cambridge University Press.
16. World Drug Report 2010, United Nations office of Drug and Crime.
17. World Drug Report 2011, United Nations office of Drug and Crime.

Course Outcomes:

The students will be able:

CO-1.	To describe issues of cultural identity, ethnic background, age and gender in prevention, treatment and recovery.
CO-2.	To describe warning sign, symptoms, and the course of substance use disorders.
CO-3.	To describe principles and philosophy of prevention, treatment and recovery.
CO-4.	To describe current and evidenced-based approaches practiced in the field of addictions.

B.Sc. (HONS.) PHYSICS SEMESTER–II
BHP-121
ELECTRICITY & MAGNETISM-II

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: Objectives of this course are to understand the magnetic effects of electric current. To understand magnetic properties of matter. To understand the concept of diamagnetism, paramagnetism and ferromagnetism. To understand the concept and applications of electromagnetic induction. To understand science and applications of electromagnetic waves.

Course Contents:

UNIT-I

MAGNETIC EFFECTS OF ELECTRIC CURRENTS : Magnetic Effect of Electric Current, Direction of Field Lines due to current Flowing in a straight Conductor , Magnetic Field Density, Magnitude of Magnetic Flux, Magnetic and Lorentz Forces, Biot-Savart's Law, Magnetic Field Due to along Straight Conductor, Magnetic Field Intensity at point on the axis of a current loop. Variation of Field along the axis of the coil, Magnetic Field intensity inside a long Solenoid, Ampere's Circuital Law: Line Integral of Magnetic Field, Applications of Ampere's Circuital Law, Solenoid Nature of Vector Field, Properties of the Magnetic Field, Vector Potential and its expression, Surface Current Density, Changes in Magnetic Field at a current Sheet, Hall Effect, Comparison of Electrostatic Field and Magnetic Field, Transformation Equation For Electric and Magnetic Fields.

UNIT-II

MAGNETIC PROPERTIES OF MATTER : Some Important Terms associated with Magnetic Materials, Torque on current Loop, Magnetic Dipole in a Magnetic Field , Potential Energy of Magnetic Dipole, Force on Magnetic Dipole In Non-Uniform Magnetic Field, Magnetic Dipole Moment of an Atom, Expression of orbital Magnetic dipole moment of Electron, Electron Spin Magnetic Moment , Free and Bound Currents, Uniformly and Non Uniformly Magnetised Matte, Diamagnetism, Langevin's theory of diamagnetic behaviour, Paramagnetism and Langevin's Theory of Paramagnetic Susceptibility, Ferromagnetism,

Domain theory of Magnetism, Analysis of magnetisation Curves : Hystersis Curve, Energy Loss Due to Hystersis and its Importance

UNIT-III

ELECTROMAGNETIC INDUCTION : Electromagnetic Induction, Faraday's Induction Experiments, Faraday's Laws of Electromagnetic Induction (Integral And Differential Forms), Lenz's law, Self Induction, Expression for Self Induction: Neumann's Formula,Self Inductance of a Solenoid and a Torodial, Energy Stored in an Inductor, Mutual Induction, Expression for Coefficient of Mutual Induction and Reciprocity theorem, Mutual Inductance of two Solenoids, Inductive Coupling of Electrical Circuits, Modification of Ampere's Law and the Displacement Current, Maxwell's Equation of Electromagnetism, Series and Parallel LCR Circuits, Average Power Associated With LCR Circuit

UNIT-IV

ELECTROMAGNETIC WAVES: Production of em waves, EM wave spectrum, EM wave equation for a medium having finite μ and ε but $\sigma = 0$, Nature of em waves, Wave equation for plane polarized em waves and their solutions, Relation between electric and magnetic field vectors an anem wave, Impedence of a dielectric to em waves, The Poynting vector and flow of energy in an em wave, Equation of continuity, EM waves for a medium having finite values of μ and ε but $\sigma \neq 0$, Solution of wave equation for a conducting medium, Skin depth, EM wave velocity and wave dispersion in a conductor, Behaviour of a medium as a conductor or dielectric, Characteristic impedance of a conducting medium to em waves, magnetic and electric energy densities, Poynting vector and Equation of Continuity for a Conducting medium, Reflection and transmission of em waves at the boundary (Normal and Oblique incidence).

TUTORIAL: Relevant problem on the topics covered in the course.

Books Prescribed

1. Electricity & Magnetism-T.S. Bhatia and Gurpreet Singh, Vishal Publishing Co.
2. Waves and Vibrations, T.S. Bhatia, Vishal Publishing Co.
3. Field & wave Electromagnetics by David & Cheng, Addison Wesley Publishing co
4. Electricity & Magnetism- A.K. Sikri, Pradeep Publications

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand the magnetic effects of electric current.
CO2	Understand magnetic properties of matter.
CO3	Understand diamagnetism, paramagnetism and ferromagnetism.
CO4	Understand the concept and applications of electromagnetic induction.
CO5	Understand electromagnetic waves.

B.Sc. (HONS.) PHYSICS SEMESTER–II
BHP-122
WAVES & OSCILLATIONS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Max. Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **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

Simple and Damped Oscillations: Simple Harmonic Motion, energy of SHO, Compound pendulum, Torsional pendulum, Equation of SHM, Superposition of two perpendicular SHM, Lissajous figures–superposition of many SHM's, complex number notation and use of exponential series. Damped motion of mechanical and electrical oscillator, heavy damping, critical damping. Energy dissipation and energy of damped oscillator, amplitude decay, logarithmic decrement, relaxation time, Q value, comparison between Free and Damped oscillations

UNIT-II

Forced Oscillations: Differential equation of forced mechanical oscillator**,** Transient and steady state behaviour of a forced oscillator, Variation of displacement and velocity with frequency of driving force, frequency dependence of phase angle between force and (a) displacement, (b) velocity, Power supplied to oscillator by driving force and its variation with driving force frequency, Resonance absorption and Q-value as a measure of power absorption bandwidth, Q-value as amplification factor, Forced electrical oscillator, Variation of current with frequency, Variation of power supplied with frequency of applied voltage, Q factor as amplification factor.

UNIT-III

Coupled Oscillations: Stiffness coupled oscillators, In phase and Out phase modes, normal co-ordinates and normal modes of vibration, solutions for differential equations for normal modes and exchange of energy, inductance coupling of electrical oscillators, loose, intermediate and strong coupling, energy exchange between two electrically coupled

oscillators.

UNIT-IV

Wave Motion: Types of wave motion**,** The wave equation, transverse waves on a string, the string as a forced oscillator, characteristic impedance of a string, reflection and transmission of transverse waves on a string at a boundary, Energy of a progressive wave, impedance matching, standing waves on a string of fixed length, Energy of a vibrating string, normal modes and eigen frequencies. Energy in a normal mode of oscillation wave groups, group velocity, dispersive and non dispersive media, Longitudnal waves.

TUTORIAL : Relevant problem on the topics covered in the course.

Books Prescribed

1. Waves and Vibrations, T.S. Bhatia, Vishal Publishing Co.
2. The Physics of Vibrations and Waves- H.J. Pain, John Wiley, Chichester, 1999
3. Vibrations and Waves in Physics- I.G. Main-Cambridge University, Cambridge, 1993.

Course Outcomes:

Sr. No.	**On completing the course, the students will be able to:**
CO1	Understand the physical characteristics of SHM and obtaining solution of the oscillator using differential equations.
CO2	Calculate logarithmic decrement relaxation time and quality factor of a harmonic oscillator.
CO3	Understand the difference between simple harmonic vibrations of same frequencies and different frequencies.
CO4	Solve wave equation and to understand the significance of transverse waves and longitudinal waves.
CO5	Explain the concept of coupled mechanical as well as electrical oscillators.

B.Sc. (HONS.) PHYSICSSEMESTER–II
MAP-121
MATHEMATICS –II

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks:50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS

1.The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit) Section-B from Unit-I and Section-C from Unit-II.

2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & Section-C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from Section-B & Section-C. Each question carries six marks.
4. Teaching time for this paper would be six periods per week.

Course objectives:

- To become familiar with ordinary and partial differential equations.
- To acquire knowledge about concept of double and triple integration.

Course contents:

Unit I

Ordinary Differential Equation (ODEs): Definition & formation of linear ODEs, First order Linear, Linear homogenous and non- homogenous ODEs of second order, Complementary function and particular integral, Solutions of Linear differential equations with constant and variable coefficients, Solution by variation of parameters method.

Partial Differential Equations (PDEs): First order PDEs: Definition, origins of first order PDEs. Second order PDEs, Definition, origins of second order PDEs, Second order PDEs with application in Physics, Laplace, Wave and diffusion equation in one and two dimensions, Solutions of second order PDEs by separation of variables.

Unit II

Double Integral, Change of order of integration, Area and volume by double integral, Triple integral, change of variables, volume by triple integral, Volume as surface of revoluton, Centre of gravity and moment of intertia by double and triple integral.

Books prescribed:

1. I.N. Sneddon, Elements of Partial Differential Equations, Dover,2006.

2. Applied Mathematics for Engineers and Physicists: Pipes &Harvill, London, McGraw Hill, 1970

3. Mathematics of Physics and Modern Engineering : Sokolnikoff & Recheffer.

4. Mathematical Methods for Physicists: George Arfken, New York, Academic Press,1970.

Course outcomes:

Sr. No.	**On completing the course, the students will be able to:**
CO1	Solve problems based on ordinary differential equations.
CO2	Use partial differential equations in solving practical problems.
CO3	Deal with the problems related to area and volume using double and triple integrals.

B.Sc. (HONS.) PHYSICS SEMESTER–II
CHX 121
INORGANIC CHEMISTRY-II

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight short answer type questions carrying 1½ mark each. Students are required to attempt any six questions.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

Course Objectives: Students will learn naming of coordination complexes, Factors affecting co-ordination numbers and stereo-chemistry. The objective of the course is to teach the various theories dealing with the bonding in co-ordination compounds like VBT theory, CFT and MOT theory applied to homoneuclear diatomic molecules and heteronuclear Diatomic molecules. charge transfer transitions, π-Acid Ligands, and Alkali metal and alkaline earth metal chelators

Course contents:

UNIT-I

Co-ordination Chemistry: Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12 and their stereo-chemistries. Factors affecting co-ordination numbers and stereo-chemistry

(a) Configurational Isomers
(b) Conformational isomerism,

Bonding in metal complexes: Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, Electro-neutrality and back bonding, limitations of V.B. theory.

UNIT-II

Crystal field theory: Splitting of d-orbitals in octahedral, tetrahedral. Pairing Energy, Calculation of C.F.S.E. in high spin and low spin octahedral and High spin tetrahedral complexes, factors affecting the 10 Dq Value. Structural effects of crystal field splitting (Jahn-Teller distortion, variation of Ionic radii with increase in atomic number). Thermodynamics effects of C.F. splitting, variation in lattice energies and Hydration energies.

UNIT-III

Electronic spectra, Beer Lambert Law, Angular Momentum of electron spectra, Total

angular momentum, Microstates and spectroscopic terms, a calculation of spectroscopic terms ford, electronic configurations, L S coupling, Hund's rule for finding the ground state terms, Electronic spectral properties of Ist transition series, Orgel Diagrams for d^1 - d^{10} systems, for weak field octahedral and tetrahedral complexes, limitations of C.F.T

UNIT-IV

Alkali metal and alkaline earth metal chelators: Macrocyclic ligands, macrocyclic effect, crownethers and podands, coronands, cryptands, structure of 18 crown-6 complex with KNCS, ion cavity complex, effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions, sandwich formation.

Books Prescribed:

1. J.E. Huheey, Inorganic Chemistry, 3rd Ed.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry.
3. B.E. Douglas and D.H. McDaniel, Concepts and Models of Inorganic Chemistry.
4. R. Hilgenfeld and W. Saengar, Topics in current chemistry Vol-II.

Course Outcomes:

Sr. No.	On completing the course,
CO1	Learn about the coordination compounds, theory, their nature of bonding,
CO2	Gain knowledge to apply ligand field theory CFT on simple molecules.
CO3	Learn about Molecular orbital theory
CO4	Learn about VSEPR theory, VBT
CO5	Understand HSAB principle, Orgel Diagram, Macrocyclic ligands

B.Sc. (HONS.) PHYSICS SEMESTER–II
BCEN-1223
COMMUNICATIVE ENGLISH
For B.Sc. (Hons.) Physics, Chemistry, Botany, Maths and Computational Statistics and Data Analytics

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks:50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Suggested paper pattern:-

1. Practical Question on Essay Writing with internal choice as prescribed in *The Written Word.* **(8 marks)**
2. Short answer type questions from Unit 3 and 4 of *Making Connections : A Strategic Approach To Academic Reading* **(12 marks)**
3. Essay type question with internal choice from Unit 3 and 4 of *Making Connections: A strategic Approach to Academic Reading* **(8 marks)**
4. Practical Question on Report Writing from *The Written Word* **(5 marks)**
5. The question will carry 4 Prefixes and 4 Suffixes (from the list given above) from the book *The Written Word.* The students will attempt any four (4) out of eight (8) **(4 marks)**

Course Objectives:
I: To develop competence in oral and visual communication.
II: To inculcate innovative and critical thinking among the students.
III: To enable them to grasp the application of communication theories.
IV: To acquire the knowledge of latest technology related with communication skills.
V: To provide knowledge of multifarious opportunities in the field of this programme

Course Contents:

1. Reading and Comprehension Skills:

Students will be required to read and comprehend the essays in Unit 3 and 4 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Third Edition. They will be required to answer the questions given after each essay.

2. Developing Vocabulary and using it in the right context :

Students will be required to study 'prefix' and 'suffix' from the chapter "vocabulary" in the book *The Written Word.* The question will be set from the following words :
Prefixes :- a-, anti-, auto-, bi-, dia-, di-, dis-, homo-, Hyper-, hypo-, mis-, non-, semi-, un-, pre-

Suffixes :- -able, -al, -cy, -dom, -fy, -hood, -ious, -ist, -ment, -ness, -ship, -some, -y, -logy.

3. Writing Skills

Students will be required to learn Essay writing, Report Writing and Letter Writing as in the book *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

Course Outcomes:

Sr. No.	On Completing the Course, the Students will be able to:
CO1	Identify common errors in language and rectify them.
CO2	Develop and expand writing skills through controlled and guided activities.
CO3	Develop coherence, cohesion and competence in oral discourse through intelligible pronunciation.
CO4	Develop the ability to handle the interview process confidently and learn the subtle nuances of an effective group discourse.
CO5	Communicate contextually in specific and professional situations with courtesy.

B.Sc. (HONS.) PHYSICS SEMESTER–II

BHPB-1201

lwzmI pMjwbI

B.Sc. Hons. (Physics, Chemistry, Mathematics), B.Sc. Bio-Tech./IT/Fashion Designing/ Food Sc., BCA, B.A. JMC, B.Sc. in Computational Statistics and Data Analytics, B.Voc. (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology)

smW : 3 GMty

kRYift pRqI hPqw : 04
ku`l GMty : 60
ku`l AMk : 50
iQaUrI AMk : 37
ieMtrnl AsY~smYNt : 13

AMk-vMf Aqy pRIiKAk leI hdwieqW

- islybs dy cwr Bwg hn pr pRSn-p`qr dy pMj Bwg hoxgy[ pihly cwr BwgW ivc 02-02 pRSn pu`Cy jwxgy[hryk Bwg ivcoN 01-01 pRSn krnw lwzmI hovygw[hryk pRSn dy brwbr (08) AMk hoxgy[pRSn p`qr dy pMjvyN Bwg ivc swry islybs ivcoN 01-01 AMk dy Cy pRSn pu`Cy jwxgy, ijnHW ivcoN 05 pRSnW dy au~qr dyxw lwzmI hovygw[pypr sY~t krn vwlw jykr cwhy qW pRSnW dI vMf A`goN v`D qoN v`D cwr aup-pRSnW ivc kr skdw hY[
  not: ieMtrnl AsY~smYNt 13 AMkW dI hY, jo kwlj v`loN inrDwirq idSw inrdySW Anuswr iQaUrI AMkW qoN v`KrI hovygI[ies pypr dy ku`l AMk 37+13 = 50 hn[

kors dw audyS Course Objective

- ividAwrQIAW ivc swihqk rucIAW pYdw krnw[
- Awlocnwqmk rucIAW ƒ ivksq krnw[
- BwSweI igAwn ivc vwDw krnw[

pwT-kRm

Bwg-pihlw

swihq dy rMg, fw. mihl isMG (sMpw.), rvI swihq pRkwSn, AMimRqsr[
Bwg dUjw - vwrqk Aqy ryKw-ic`qr, fw. primMdr isMG, fw. BuipMdr isMG Aqy fw. kuldIp isMG iF`loN (sih sMpw.)
(vwrqk Bwg ivcoN swr/ivSw-vsqU[ryKw-ic`qr Bwg ivcoN swr/nwiek ibMb)

Bwg-dUjw

ieiqhwisk XwdW
s. s. Amol (sMpw.), pMjwbI swihq pRkwSn, AMimRqsr[
(inbMD 7 qoN 12 qk swr/ ivSw-vsqU/SYlI)

Bwg-qIjw

(a) d&qrI ic`TI p`qr
(A) muhwvry Aqy AKwx

Bwg-cOQw

(a) Sbd-bxqr Aqy Sbd-rcnw – pirBwSw Aqy mu`Fly sMklp
(A) Sbd-SRyxIAW

pwT-kRm nqIjy Course Outcomes (COs)

- ividAwrQI dI soc-smJ ivksq hovygI[
- aus AMdr swihqk rucIAW pRPil~q hoxgIAW[
- aus AMdr swihq isrjxw dI sµBwvnw vDygI[
- auh sµbµiDq ivSy dw gihn AiDAYn krn dy suXog hovygw[
- auh BwSweI bxqr qoN jwxU hovygw[

B.Sc. (HONS.) PHYSICS SEMESTER–II

BPBI-1202

muFlI pMjwbI

(In Lieu of Compulsory Punjabi)

B. A., B. A. JMC, B. A. Social Science, B. Com. (Hons.), B. Com. (R), B. Sc. Computer Science, B. Sc. Economics, B. Sc. Medical, B. Sc. Non-Medical, B.Sc. Bio-Technology, B.Sc. Fashion Designing, B.Sc. Hons. Chemistry, B.Sc. Hons. Mathematics, B.Sc. Hons. Physics, B.Sc. in Computational Statistics and Data Analytics, B.Sc. IT, B.Sc. Food Science, BBA, BCA, B.Voc. (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology)

smW : 3 GMty

kRYift pRqI hPqw : 04
ku`l GMty : 60
ku`l AMk : 50
iQaUrI AMk : 37
ieMtrnl AsY~smYNt : 13

AMk-vMf Aqy pRIiKAk leI hdwieqW

- Bwg pihlw ivcoN cwr pRSn p~uCy jwxgy ijnHW ivcoN iqMn pRSnW dw au~qr dyxw lwjæmI hY[hr pRSn dy cwr-cwr AMk hn[Bwg dUsrw ivcoN do-do AMk dy pMj pRSn pu`Cy jwxgy[ swry pRSn lwjæmI hn[ Bwg qIsrw ivcoN cwr pRSn pu`Cy jwxgy ijnHW ivcoN do pRSn h`l krny lwzmI hn[ Bwg cOQw ivcoN do pRSn pu`Cy jwxgy ijnHW ivcoN iek pRSn h`l krnw hovygw[
not: ieMtrnl AsY~smYNt 13 AMkW dI hY, jo kwlj v~loN inrDwirq idSw inrdySW Anuswr iQaUrI AMkW qoN v`KrI hovygI[ies pypr dy kul AMk 37+13 = 50 hn[

kors dw audyS Course Objective

- ividAwrQI AMdr pMjwbI BwSw dI smJ ivksq krnw[
- pMjwbI BwSw dy ivAwkrnk pRbMD sMbMDI igAwn krwauxw[
- isKlweI qy AiBAws duAwrw pMjwbI BwSw 'qy pkV vDwauxw[

pwT-kRm

Bwg-pihlw

pMjwbI Sbd-bxqr :
DwqU, vDyqr (Agyqr, mDyqr, ipCyqr), pMjwbI koSgq Sbd Aqy ivAwkrnk Sbd

Bwg-dUjw

pMjwbI Sbd-pRkwr :
(a) sMXukq Sbd, smwsI Sbd, dojwqI Sbd, dohry/duhrukqI Sbd Aqy imSrq Sbd
(A) isKlweI qy AiBAws

Bwg-qIjw

pMjwbI Sbd-rcnw :
iek-vcn/bhu-vcn, ilMg-puilMg, bhuArQk Sbd, smwnArQk Sbd, bhuqy SbdW leI iek Sbd, Sbd ju`t, ivroDArQk Sbd, smnwmI Sbd

Bwg-cOQw

in`q vrqoN dI pMjwbI Sbdwvl I
Kwx-pIx, swkwdwrI, ru`qW, mhIinAW, igxqI, mOsm, bwjæwr, vpwr, DMidAW nwl sMbMiDq

pwT-kRm nqIjy Course Outcomes (COs)

- ividAwrQIAW dI in`q vrqoN dI pMjwbI Sbdwvl I bwry smJ hor ivkisq hovygI[
- auh pMjwbI Sbd-bxqr dI jwxkwrI hwisl krky BwSweI igAwn nUM ivkisq krngy[
- pMjwbI Sbd-rcnw sMbMDI jwxkwrI aunHW dy igAwn ivc vwDw krygI[

B.Sc. (HONS.) PHYSICS SEMESTER–II
BPHC-1204
PUNJAB HISTORY & CULTURE (C 321 TO 1000 A.D.)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

B. A.; B.A. (SS); B. A. (Hons. – English); B. Com. (Hons., R, Ac. & Finance); B. Sc. Bio-Tech./Comp. Sc./Eco./FD/Food Sc./IT/Med./N.Med.; B.Sc. (Hons. –Botany, Chemistry, Mathematics, Physics, Zoology); B. of Mult.; B. in Int. & Mob. Tech.; BBA; BCA;BJMC; B. Voc. (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology)

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks:50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Instructions for the Paper Setters:
The question paper consists of five units: I, II, III, IV and V. Units I, II, III and IV will have two questions each. Each question carries 8 marks. The students are to attempt one question from each unit approximately in 800 words. Unit-V consists of 7 short answer type questions to be set from the entire syllabus. Students are to attempt any 5 questions in about 20 words each. Each question carries 1 mark.
Note: **The examiner is to set the question paper in two languages: English & Hindi.**

Course Objectives: The main objective of this course is to educate the students who are not domicile of the Punjab about the history and culture of the Ancient Punjab. It is to provide them knowledge about the social, economic, religious, cultural and political life of the people of the Punjab during the rule of various dynasties such as The Mauryans, The Khushans, The Guptas, The Vardhanas and other ancient ruling dynasties of the period under study.

Course Contents:

Unit-I

1. Punjab under Chandragupta Maurya and Ashoka.
2. The Kushans and their Contribution to the Punjab.

Unit-II

3. The Punjab under the Gupta Emperors.
4. The Punjab under the Vardhana Emperors

Unit-III

5. Political Developments 7th Century to 1000 A.D.
6. Socio-cultural History of Punjab from 7th Century to 1000 A.D.

Unit-IV

7. Development of languages and Literature.
8. Development of art & Architecture.

Suggested Readings:-

1. L. Joshi (ed), History and Culture of the Punjab, Part-I, Patiala, 1989
(3rd edition)
2. L.M. Joshi and Fauja Singh (ed), History of Punjab, Vol.I, Patiala 1977.
3. Budha Parkash, Glimpses of Ancient Punjab, Patiala, 1983.
4. B.N. Sharma, Life in Northern India, Delhi. 1966.

Course Outcomes:

After completion of the course, the students will be able to learn:

CO-1 The history and culture of the Punjab in Ancient Period.

CO-2 Social, economic, religious, cultural and political life of Ancient Indian dynasties.

CO-3 Political developments from 7th century to1000AD.

CO-4 Socio-cultural history of the Punjab from 7th century to1000AD.

CO-5 Language, literature, art and architecture of Ancient Punjab.

B.Sc. (HONS.) PHYSICS SEM-II
BHP-123
PHYSICS LAB-II

Credit Hours (per week): 6

Time: 3 Hours **Maximum Marks:50**
(Practical Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

8 Periods/ Week

General Guidelines for Practical Examination

I. The distribution of marks is as follows:
i) One experiment **15 Marks**
ii) Brief Theory **5 Marks**
iii) Viva–Voce **10Marks**
iv) Record (Practical file) **7 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and 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 purpose of the course is to understand the concept of resonance in series and parallel LCR circuits, study of induced e.m.f. as a function of velocity of a magnet, acceleration due to gravity by compound pendulum and by Kater's reversible pendulum. It includes measurement of logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum, laws of vibrating string by using Melde's apparatus and to show that $\lambda/2$ is constant.

LIST OF EXPERIMENTS

1. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
2. To study the induced e.m.f. as a function of the velocity of the magnet.
3. To study the phase relationships using impedance triangle for LCR circuit and calculate impedance.
4. Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value.
5. To measure the charge sensitivity of a moving coil Ballistic galvanometer using a known capacitor.
6. To measure the self-inductance L of a given coil by Anderson Bridge method.
7. To find the value of B_H, the horizontal component of ear using a deflection & vibration magnetometer.
8. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.
9. To plot a graph between the distance of the knife edge from the centre of gravity and the time period of a compound pendulum from graph find (a) acceleration due to gravity, (b) the radius of gyration and moment of inertia about an axis passing through centre of gravity.
10. To determine the acceleration due to gravity by Kater's reversible pendulum.

11. To verify the laws of vibrating string by using Meldes apparatus and to show that λ/2 is constant.
12. To measure logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.

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	Understand the concept of resonance in series and parallel LCR circuits.
CO2	Study the induced e.m.f. as a function of velocity of a magnet.
CO3	Find out acceleration due to gravity by compound pendulum and by Kater's reversible pendulum.
CO4	Measure logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.
CO5	Verify the laws of vibrating string by using Melde's apparatus and to show that λ/2 is constant.

B.Sc. (HONS.) PHYSICS SEMESTER-II
CHP-122
INORGANIC CHEMISTRY LAB-II

Credit Hours (per week):6
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Practical Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will give one organic salt to the students.
II. Each student will get different salt and analyse it for elements, functional group and prepare
its derivatives.
III. The question paper will be 37 marks with split as under:
(Write up = 12, Performance = 12, Viva-voce = 8, Practical note book = 5)

Course Objective: Students learn to identify and separate different cations in the inorganic mixtures through different methods. Students will be able to perform special tests for anions.

Course Contents:

Section-A

Identification of cations and anions in a mixture which may contain combinations of acid ions.
a) Special Tests for Mixture of Anions
(i) Carbonate in the presence of sulphate.
(ii) Nitrate in the presence of nitrite
(iii) Nitrate in the presence of bromide and iodide.
(iv) Nitrate in the presence of chlorate.
(v) Chloride in the presence of bromide and iodide.
(vi) Chloride in the presence of iodide.
(vii) Bromide and iodide in the presence of each other and of chloride.
(viii) Phosphate, arsenate and arsenite in the presence of each other.
(ix) Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
(x) Borate in the presence of copper and barium salts.
(xi) Oxalate in the presence of fluoride.

Section-B

Identification of Cations in Mixtures
Identification of Group I, Group II (Group IIA and IIB), Group III,
Group IV, Group V and Group VI cations.

Books Prescribed:

Vogel's book on Inorganic Qualitative Analysis

Course Outcomes:

Sr. No.	**On completing the course, Students will be able to**

CO1	identify the anions present in the mixture.
CO2	identify the cations present in the mixture.
CO3	Gain hands-on practice of handling different Chemicals in the lab
CO4	Learn to prepare basic solution required to identify cations and anions in the mixture
CO5	Learn about determination of boiling points of various compounds.

B.Sc. (HONS.) PHYSICS SEMESTER–II
Course Code: ZDA121
Course Title-DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
DRUG ABUSE: MANAGEMENT AND PREVENTION
(Compulsory for all Under Graduate Classes)

Credit Hours (per week): 1.5 Hrs
Total Hours: 22.5
Time: 3 Hours **Maximum Marks:50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

.

Instructions for the Paper Setters:

Section–A: (15 Marks): It will consist of five short answer type questions. Candidates will be required to attempt three questions, each question carrying 05 marks. Answer to any of the questions should not exceed two pages.

Section–B: (20 Marks) It will consist of four essay type questions. Candidates will be required to attempt two questions, each question carrying 10 marks. Answer to any of the questions should not exceed four pages.

Section–C: (15 Marks) It will consist of two questions. Candidate will be required to attempt one question only. Answer to the question should not exceed 5 pages.

Course Objectives:

The course aim is to

CO-1.	Describe the role of family in the prevention of drug abuse.
CO-2.	Describe the role of school and teachers in the prevention of drug abuse.
CO-3.	Emphasize the role of media and educational and awareness program.
CO-4.	Provide knowhow about various legislation and Acts against drug abuse.

UNIT-I

- **Prevention of Drug abuse**

  Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active scrutiny.

UNIT-II

- **School:** Counseling, Teacher as role-model, Parent-Teacher-Health Professional Coordination, Random testing on students.

UNIT-III

- **Controlling Drug Abuse**

Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and Awareness Program

UNIT-IV

- **Legislation:** NDPS Act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

References:

1. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment,

Government of India, 2004.

2. Gandotra, R. and Randhawa, J.K. 2018. voZrI d[otos'A (BPky'oh) gqpzXB ns o'eEkw. Kasturi

Lal & Sons, Educational Publishers, Amritsar- Jalandhar.

3. Inciardi, J.A. 1981. The Drug Crime Connection. Beverly Hills: Sage Publications.

4. Modi, Ishwar and Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.

5.Randhawa, J.K. and Randhawa, Samreet 2018. Drug Abuse-Management and Prevention. Kasturi Lal & Sons, Educational Publishers, Amritsar- Jalandhar.

6. Sain, Bhim 1991, Drug Addiction Alcoholism, Smoking obscenity New Delhi: Mittal Publications.

7. Sandhu, Ranvinder Singh, 2009, Drug Addiction in Punjab: A Sociological Study. Amritsar:

Guru Nanak Dev University.

8. Singh, Chandra Paul 2000. Alcohol and Dependence among Industrial Workers: Delhi: Shipra. 9. World Drug Report 2011, United Nations office of Drug and Crime.

10. World Drug Report 2010, United Nations office of Drug and Crime

Course Outcomes:

Sr. No.	On completion of this course, the students will be able to:
CO-1.	Understand the importance of family and its role in drug abuse prevention.
CO-2.	Understand the role of support system especially in Schools and inter-relationships between students, parents & teachers.
CO-3.	Understand the impact of Media on substance abuse prevention.
CO-4.	Understand the role of awareness drives, campaigns etc. in Drug abuse management.
CO-5.	Learn about the Legislations and Acts governing Drug trafficking & Abuse in India.

B.Sc. (HONS.) PHYSICS SEMESTER–III
BHP-231
MECHANICS-II

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Total Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: Objectives of this course are to understand the velocity of light, relative motion. To understand the importance of special theory of relativity. To understand the geometrical representation of relativity. To understand the concepts of frames of references, relativistic dynamics, structure of space time, principle of equivalence, fictitious forces etc. To realize the various phenomenon in terms of relativity and mechanics.

Course Contents:

UNIT–I

Frames of References; Inertial frame of reference; Galilean transformations; **Application of Galilean transformation to mechanics and electromagnetism**; **The Ether**; Michelson Morley Experiment; Explanation of the Null Result; Postulates of Special Theory of Relativity; Lorentz transformations; Length contraction; Time dilation; **Proper time interval**; Experimental evidence in support of time dilation; Twin paradox; Relativity of simultaneity; **Co-locality**; Relativistic formula for the composition of velocities-The velocity addition theorem.

UNIT–II

Variation of mass with velocity (Relativity of mass); mass energy **relationship**/equivalence; **Conservation of mass-energy**; Relation between momentum and energy, Transformation of momentum, energy **and force**; Relativistic Doppler effect (longitudinal and transverse) and its confirmation.

UNIT–III

Space-time continuum; Concept of Minkowski space; geometrical interpretation of Lorentz transformations of space, time **and** simultaneity; **intervals between events**: Space-like, time like and light-like intervals; concept of world lines; four vectors; **some important four-vectors-position four vector, velocity four-vector, momentum four-vector and four-force (Minkowski force)**.

UNIT–IV

Electric field and force in different frame of reference and their transformations; Principle of Equivalence; Gravitational and inertial mass; Gravitational mass of photons; Gravitational red shift; Fictitious forces; Effect of rotation of earth on 'g'; Effects of centrifugal and Coriolis forces produced as a result of earth's rotation. Foucault Pendulum.

Books Prescribed:

1. 1. A Primer of Special Theory of Relativity by P. L. Sardesai; New Age International Publisher.
2. Relativity and Electromagnetism, T.S. Bhatia, Vishal Publishing Co.
3. Mechanics : Berkeley Physics Course Vol-I, C. Kittel, W.D. Knight, M.A. Ruderman, C.A. Helmholtz and B.J. Moyer- Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. The Special Theory of Relativity, S. Banerji & A. Banerji (Prentice Hall India).
5. Introduction of to Special Relativity: R. Resnick Wiley Eastern India Pvt. Ltd.
6. The Feymann Lectures Physics: R.P. Feymann, R.B. Leighton and M. Sands, Vol. I & II- Narosa Publishing House, New Delhi.
7. "Special Relativity" A.P. French, N.W. Norton and Company Inc. , New York.
8. Electricity & Magnetism-T.S. Bhatia and Gurpreet Singh, Vishal Publishing Co.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand the velocity of light, relative motion.
CO2	Understand the importance of general and special theory of relativity.
CO3	Understand the geometrical representation of relativity.
CO4	Understand the concepts of frames of references, relativistic dynamics, structure of space time, principle of equivalence, fictitious forces etc.
CO5	Realize the various phenomenon in terms of relativity and mechanics

B.Sc. (HONS.) PHYSICS–SEMESTER-III
BHP-232

STATISTICAL AND THERMAL PHYSICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The objective of this course is to employ fundamental physics concepts and theories to set up and formulate problems in thermodynamics and statistical mechanics, develop a working knowledge of the laws and methods of thermodynamics and elementary statistical mechanics and to use this knowledge to explore various applications. To know the existence and properties of the entropy, different thermodynamic potentials and their uses and treatment of ideal gases.

Course Contents:

UNIT–I

Basic ideas of Statistical Physics, Scope of Statistical Physics, Basic ideas about probability, **Examples of independent events, principle of equal a priori probability, Case of a box divided into equal sized compartments, Permutations and combinations,** Distribution of four distinguishable particles into compartments of equal size. Concept of macrostates and microstates, Thermodynamic Probability, Effects of constraints on the system. Distribution of n particles in two compartments. Deviation from the state of maximum probability. Equilibrium state of dynamic system. Distribution of distinguishable n particles in k compartments of unequal sizes. **Division into cells.**

UNIT–II

Phase space and division into elementary cells. Three kinds of statistics. The basic approach in three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. **Number of phase space cells, values of α and β, Maxwell Boltmann law of molecular energies.** Experimental verification of law of distribution of molecular speeds: **Zartmann**

and Ko Experiment, Graphical depiction of Maxwell Boltzmann speed distribution, most probable speed, average speed and root mean square speed of particles. Need for Quantum Statistics – B.E. **Application of BE statistics to a photon gas**. Statement of Planck's law of Radiation, Wien's Displacement and Stefan's law. Fermi Dirac (FD) statistics. Application of FD statistics to free electron gas inside conductor, Stability of white dwarfs, Comparison of M.B, B.E and F.D statistics.

UNIT- III

Statistical Basis of Entropy: Definition of entropy, change of entropy of a system, third law of thermodynamics. Additive nature of entropy, law of increase of entropy, reversible and irreversible processes and their examples, work done in a reversible process, Examples of increase of entropy in some natural processes: **Transfer of heat and second law of thermodynamics, Expansion of gas, diffusion of one gas into another**, entropy and disorder. Brief review of terms used in thermodynamics, Laws of Thermodynamics, Carnot's Heat Engine, Entropy changes in Carnot's cycle, Carnot's theorem, Thermodynamic temperature scale, Thermoelectric effect and its Applications, change of entropy along a reversible path in P-V diagram, entropy of a perfect gas, equation of state of an ideal gas, Heat death of Universe.

UNIT- IV

Maxwell's Thermodynamic Relations: Perfect differentials in Thermodynamics, Derivation of Maxwell Thermodynamic Relationships, **A device to remember Maxwell Thermodynamic Relationships,** Cooling produced by adiabatic expansion, adiabatic compression, adiabatic stretching of wires and thin films, change of internal energy with volume. Expression for Cp-Cv, variation of Cv with volume, **variation of Cp with pressure**, Clapeyron's equation. Joule-Thomson effect and its thermodynamic treatment, Joule-Thomson effect for a Vander Waal's gas, Production of very low temperatures by adiabatic demagnetization, Thermodynamic Potentials and Equilibrium of Thermodynamic Systems, Equation of state of an ideal gas, degrees of freedom, Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic, Mean free path (Zeroth Order).

TUTORIAL : Relevant problem on the topics covered in the course.

Books Prescribed:

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.

2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
4. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill
5. Statistical Physics and Thermodynamics, V.S. Bhatia and T.S. Bhatia(Vishal Publishing Co.)

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Explain the fundamental differences between classical and quantum statistics and learn about quantum statistical distribution laws.
CO2	Analyze important examples of ideal Bose systems and Fermi systems.
CO3	Apply the concepts and principles of black body radiations.
CO4	Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines etc.
CO5	Use the statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi Dirac and Bose-Einstein distributions to solve problems in some physical systems.

B.Sc. (HONS.) PHYSICS SEMESTER–III
MAP-231
MATHEMATICS-III

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks:50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS

1.The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit) Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & Section-C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from Section-B & Section-C. Each question carries six marks.
4. Teaching time for this paper would be six periods per week.

Course objectives:

- To acquire the knowledge of complex numbers and their properties.
- To have knowledge about the geometrical concepts.
- To study the convergence and divergence of infinite series.

Course contents:

UNIT-I

Complex numbers: Complex numbers and their geometrical representation, De-Moivre's theorem and its applications.

Co-ordinate Geometry: Polar and Cartesian co-ordinates, Distance formula, Section formula of a line in different forms, Angle between two lines, Intersection of two lines , Standard equation of ellipse, parabola and hyperbola.

UNIT-II

Infinite Series, Series of positive terms, Alternate series, Behaviour of infinite series, Cauchy's convergence criterion, D'Alembert's ration test, Cauchy's Root test, Raabe's test, Gauss test, Cauchy's integral test, Absolute and conditional convergence (Tests without proof).

Books prescribed:

1. Malik, S.C: Mathematical Analysis, Wiley Eastern Ltd. 1991.
2. Apostal, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics (1974).

3. Rajinder Pal Kaur, Geometry: Co-ordinate and Solid, Sharma Publication Jalandhar(2016).

Course outcomes:

Sr. No.	**On completing the course, the students will be able to:**
CO1	Understand the concept of complex numbers, De-Moivre's along with its application.
CO2	Understand the concepts of co-ordinate geometry which includes problems on straight line, ellipse, parabola, and hyperbola.
CO3	Acquire knowledge regarding convergence and divergence of series using different tests.

B.Sc. (HONS.) PHYSICS SEMESTER-III
CHX-231
Physical Chemistry-III

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight short answer type questions carrying 1½ mark each. Students are required to attempt any six questions.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

Course Objectives: The Physical Chemistr-III course enables the students to learn deeply about the states of matter and inculcate the theory for further practical approach. Students will learn about the gaseous, liquid states and the colloidal state. The mathematical derivations and formulas will provide knowledge of the various analytical properties of gases and liquids. The colligative properties and solutions topic is very crucial for exploring the day to day life phenomenon, and also from the perspective of research for solution preparations. Some important topics such as emulsions, gels and adsorption are very important for students in daily life.

Course Contents:

UNIT I

1. Solutions and Colligative Properties

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, Dilute solution, colligative properties, Raoult's law, relative lowering ofvapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, elevation of boiling point and depression of freezing point.

UNIT-II

2. **Electrochemistry**

Electrical transport-conduction in metals and in electrolyte solutions, specific conduction and equivalent conduction, variation of specific and equivalent conduction with dilution, Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte, dissociation, weak and strong electrolytes, Ostwald's dilution law.

UNIT-III

3. Chemical Kinetics

Rate of reaction, rate constant and rate laws, the order of reaction, first, second & third and zero order reactions, half-lives; determination of reaction order. Temperature dependence of

reaction rates, reaction mechanism, rate-determining step approximation, steady-state approximation. Catalysis, homogeneous catalysis, autocatalysis, oscillation reactions. Enzyme catalysis, heterogeneous catalysis.

UNIT-IV

4. Liquid State

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

5. Colloidal State

Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical, properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. General applications of colloids.

Books Prescribed:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)
4. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.
5. Physical Chemistry by R. J. Silbey, R. A. Albert &Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

Course Outcomes:

S. No.	On completing the course,
CO1	Learn about ideal and non–ideal solutions, methods of expressing concentrations of solutions, dilute solution, colligative properties and Raoult's law
CO2	Understand rate of reaction, rate constant and rate laws, the order of reaction, first, second & third and zero order reactions
CO3	Learn about homogeneous catalysis, autocatalysis, oscillation reactions.Enzyme catalysis and heterogeneous catalysis
CO4	Understand the structure of liquids Structural differences between solids, liquids and gases. Liquid crystals
CO5	Understand the classification of colloids. kinetic, optical and electrical, properties, stability of colloids,protective action, Hardy Schulze law, gold number, types of emulsions, Emulsifiers and applications of colloids.

B.Sc. (HONS.) PHYSICSSEMESTER–III
Course code: ESL–221

Course Title: ENVIRONMENTAL STUDIES–I (COMPULSORY)

B.A./B.Sc. (Biotech., Food Sci., Comp. Sci., Eco., FD., IT., Med., Non Med.)/B.Sc. (Hons.-Physics, Chemistry, Maths)/B.B.A./B.C.A./B.Com./B.Com. (Hons.)/BJMC/BA Social Sciences/BA (Hons.) Punjabi, BA (Hons.) English, B.Voc (Food Processing, Theatre and Stage Craft, Software Development, Textile Design & Apparel Tech)

Credit Hours (Per Week): 2
Total Hours : 30
Maximum Marks : 50 Marks

Instructions for Paper Setters: The question paper will consist of three sections. Candidate will be required to attempt all the sections. Each unit of the syllabus should be given equal weightage of marks. Paper to be set in English, Punjabi and Hindi.

Section–A: (16 Marks): It will consist of five short answer type questions. Candidates will be required to attempt four questions, each question carrying four marks. Answer to any of the questions should not exceed two pages.

Section–B: (24 Marks): It will consist of five questions. Candidates will be required to attempt four questions, each question carrying six marks. Answer to any of the questions should not exceed four pages.

Section–C: (10 Marks): It will consist of two questions. Candidate will be required to attempt one question (carrying ten marks) only. Answer to the question should not exceed 5 pages.

Course Objectives

1	The main goal of Environmental studies is to create the environmental awareness to create a safe, green and sustainable environment.
2	To make students aware about the importance of ecosystem, types of ecosystem, energy flow in an ecosystem, ecological succession, food chain and food web.
3	To make students aware of water conservation, global warming, consumerism and waste products. and, also about the environmental protection acts.
4	Role of National Service Scheme (NSS). Health and hygiene.

Unit-I

The Multidisciplinary Nature of Environmental Studies: Definition, components, scope and importance of environment/environmental studies, Need for public awareness.

Natural Resources: Definition, types, use, overexploitation, benefits, case studies (if any) and associated problems of following natural resources: Forest Resources, Water Resources, Mineral Resources, Food Resources, Energy Resources, Land Recourses *etc.*

Roleof an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit-II

Ecosystem:

General introduction, types (Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems *viz.* ponds, streams, lakes, rivers, oceans, estuaries),Structure and functions of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Unit-III

Social Issues and Environment: Sustainable development,Urban problems related to energy, Water conservation, rain water harvesting.Resettlement and rehabilitation of people; its problems and concerns. Case studies.Environmental ethics: Issues and possible solutions.Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents andholocause. Case studies.Wasteland reclamation.

Environmental Protection Act: Air (prevention and Control of Pollution) Act.Water (prevention and Control of Pollution) Act.Wildlife Protection Act.Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit-IV

National Service Scheme

Introduction and Basic Concepts of NSS: History, philosophy, aims & objectives ofNSS; Emblem, flag, motto, song, badge *etc.;* Organizational structure, roles and responsibilities of various NSS functionaries.

Health, Hygiene & Sanitation: Definition, needs and scope of health education; Food and Nutrition; Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan); National Health Programme; Reproductive health.

Suggested Books:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2013 . Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Basu, M., Xavier, S. 2016. Fundamentals of Environmental Studies, Cambridge University Press, India
3. Down to Earth, Centre for Science and Environment, New Delhi.
4. Jadhav, H. and Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
5. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
6. Kaushik, A. and Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
7. Mahapatra, R., Jeevan, S.S. and Das, S. 2017. Environment Reader for Universities, Centre for Science and Environment, New Delhi.
8. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
9. Raven, P.H., Hassenzahl, D.M. and Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
10. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
11. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar
12. Kanta, S., 2012. Essentials of Environmental Studies, ABS Publications, Jalandhar.
13. Saroj A., Kaur R., Walia H., Kaur T, 2021. Environmental Studies - A Holistic Approach, KLS Publishers.

Suggested Websites:

1. https://nss.gov.in
2. https://moef.gov.in
3. http://punenvis.nic.in

4. https://www.unep.org

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO-1	learn about the sustainable environment.
CO-2	gain the knowledge ecosystem and its functioning.
CO-3	know about the water conservation programs like rain water harvesting and water shedding and to gain knowledge of environmental (air, water and pollution) protections acts.
CO-4	know about the role and importance of NSS– a volunteer organization, in making up a better environment and to maintain better health and hygiene.

B.Sc. (HONS.) PHYSICS SEMESTER–III

Psychology

IDPSY-2331

INTERDISCIPLINARY COURSE ID-I

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks:50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS:

Section A: - Seven Questions will be set in Section A. Students are required to attempt all the questions in about 50 words. Each question carries 1 mark. **7x1=7 Marks**
Section B: - Eight questions will be set. Students are required to attempt any five out of the eight questions in about 100 words. Each question carries 6 marks. **5x6=30 Marks**
The medium of this paper will be English only.

Course Objectives:

1. To provide basic knowledge of different psychological and cognitive processes.
2. To bring awareness in students regarding their mental processes, behaviors and emotional reactions.
3. To teach various coping strategies to deal with stress effectively.
4. To enhance communication skills of students.

UNIT-I

Personality

a. Brief introduction of theories of Personality (Eysenck, Freud, Erikson and Big Five).
b. Description of Personality tests: EPQ, NEO-PIR, W.A.T.

Stress

a. Definition and Techniques of Stress management.
b. Role of Hardiness in Stress.

Attitudes

a. Definition and components of Attitude.
b. Formation of Attitude and ways to change Attitude.

UNIT-II

Motivation

a. Theories of Motivation (Maslow and Herzberg)
b. Types of Motivation and ways to enhance Motivation

Goal Setting

a. Understanding Goal Setting (Locke's theory)
b. Goal-Setting Principles

Problem Solving

a. Concept and Stages of Problem Solving.
b. Role of Analytical intelligence in Problem Solving.

UNIT- III

Confidence

a. Defining Confidence (Vealey)
b. Defining and developing optimistic mind-set
c. Role of self-efficacy in Confidence (Bandura).

Concentration

a. Understanding Concentration
b. Components, Strategies of Concentration

Communication

a. Definition and Types of Communication.
b. Developing effective Communication skills.

Books Prescribed:

1. Crano, W.D., &Prislin, W. (2008). *Attitudes and Attitude Change.* Psychology Press.
2. Feist, J., Feist, G.J., & Ann. T. (2017). Theories of Personality. New Delhi: McGraw Hill.
3. Jain, S. (2001). *Introduction to Psychology*. New Delhi: Kalyani Publishers.
4. McClelland, D.C. (1988). *Human motivation*. Cambridge University Press.
5. Morgan, G.T., King, P.A., Weisz, T.R., &Schopler, J. (1999). *Introduction to Psychology.* New York: Mcgraw Hill Book Co.
6. Waitley, D. (1993). *Psychology of Motivation.* Nightingale-Conant.

Course Outcomes:
This course will enable students to:

CO1: Understand their thoughts, feelings and behaviors appropriately.

CO2: Cope with stressful situations in an effective manner.

CO3: Verbally and non- verbally expressing themselves productively in interviews.

B.Sc. (HONS.) PHYSICS SEMESTER–III
BHP-233
PHYSICS LAB-III

General Guidelines for Practical Examination

Credit Hours (per week): 6

Time: 3 Hours **Maximum Marks: 50**
(Practical Marks: 37 + Internal Assessments: 13)
Pass Marks: 35%

Periods 8 Periods/week
I. The distribution of marks is as follows:

i) One experiment: **15 Marks**

ii) Brief Theory: **Marks**

iii) Viva–Voce:**10 Marks**

iv) Record (Practical file):**7 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and 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: Objectives of this course are to understand the applications of sextant in different situations. To understand the basics of adiabatic expansion and probability. To understand the concept of thermal conductivity. To study stefan's law. To study concept of the heating efficiency of electric kettle.

Course Content:
LIST OF EXPERIMENTS

1. To measure an accessible (Horizontal and vertical) height using sextant.
2. To measure inaccessible height by using sextant.
3. Verify laws of probability distribution by throwing of similar coins.
4. To study adiabatic expansion of gas and hence to calculate value of γ.
5. To determine the heating efficiency of an electric kettle with varying voltage.
6. To determine Stefan's constant using Boltzmann's Law.
7. To find the coefficient of Thermal Conductivity of a bad conductor by Lee's method.
8. To plot a calibration curve of a given thermocouple (copper constantan) using a potentiometer.
9. To measure thermal expansion of crystal using interference fringes.
10. To measure the thermo e.m.f. as a function of temperature of the hot junction.
11. To determine the value of Boltzmann constant.

Books Prescribed:

1. Practical Physics Vol.II, 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	Understand the applications of sextant in different situations.
CO2	Understand the basics of adiabatic expansion and probability.
CO3	Understand thermal conductivity.
CO4	Study Stefan's law.
CO5	Study how to find the heating efficiency of electric kettle

B.Sc. (HONS.) PHYSICS SEMESTER-III
CHX-232
Physical Chemistry Lab-III

Credit Hours (per week):6
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Practical Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:
I. Examiner will set two questions selecting one from Section-A and one from Section-B.
II. Students will be asked to complete write up of both practical within first 20 minutes on the first sheet provided.
III. On the second sheet provided after 20 minutes, students will perform and note the record on second sheet during the conduct of practical exam
IV. The split of marks will be as under:
(Write up = 12, Performance = 12, Viva-voce = 8, Practical note book = 5)

Course Objectives: This practical course enables the students to understand the physical properties of liquids such as surface tension, density and viscosity. Students are able to understand the measurement techniques of some of the physical properties. Students will learn to handle apparatus like stalagmometer, Ostwald's viscometer and calorimeter. Students will be able to understand the acid-base titrations in the laboratory.

Course Contents:

Section-A Crystalisation:

Concept of indication of crystalisation. Phthalic acid from hot water (using fluted filter paper & stem less funnel)
Acetanilide from boiling water.
Naphthalene from Ethanol
Benzoic acid from water

Section-B Physical Chemistry

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalyzed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)

3. To study the viscosity and surface tension of glycerine solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine H of the dissolution process.
5. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Books Prescribed:

1. Findlay's Practical Physical Chemistry, 9th Edition, Revised by B.P. Levitt

2. Experimental Physical Chemistry by RC DAS and B. Behera 9th Edition,
3. Advance Practical Chemistry, J. B. Yadav

Course Outcomes:

Sr. No.	On completing the course,
CO1	Measure important physical properties like surface tension, viscosity, density, enthalpy, heat of neutralization etc.
CO2	Learn to examine various physical parameters by different methods.
CO3	Learn to handle important apparatus like stalagmometer, Ostwalds viscometer and calorimeter.
CO4	Learn to examine the rate of reactions (hydrolysis of ester)
CO5	Learn to perform acid-base titrations.

B.Sc. (HONS.) PHYSICS SEMESTER–IV
BHP-241
OPTICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: Objectives of this course are to understand the concept of polarization, interference and diffraction. To understand the light propagation through lenses, mirrors, prisms, and other optical systems. To understand different branches of optics with associated experiments. To differentiate Fraunhofer and Fresnel diffraction. To understand the science and applications of laser technology. To understand the applications and importance of optics in daily life.

UNIT–I

Superposition of light waves and interference; Young's double slit experiment; Distribution of intensity in young's double slit experiment; Conditions for sustained interference pattern; Coherent sources of light; Temporal and spatial coherence; Interference pattern by division of wave front; Fresnel Biprism; Displacement of fringes; Fresnel double mirror; Llyod's single mirror.

UNIT–II

Interference by Division of Amplitude; Change of phase on reflection; Interference in thin films (reflected and transmitted regions); Need for extended source and Fringes of equal inclination & equal thickness; Non-reflecting films/Anti reflection coatings; Newton's Rings and their application; Fabry Perot interferometer and etalon; Huygen's Principle, Diffraction of Light, Huygen's-fresnel Diffraction theory; Fresnel's half-period zones; Zone plate; Diffraction at a straight edge; Diffraction by a circular **and rectangular apertures**; Distinction between fresnel and fraunhoffer diffraction; Fraunhoffer diffraction at a single slit, at double slit, and for N slits/transmission grating; Rayleigh Criterion for resolution; Resolving power of telescope and grating.

UNIT–III

Polarization: Transverse nature of light; Polarization by reflection and refraction; Brewster's Law; Malus Law; Double refraction; Nicol Prism; Elliptically and circularly polarized light; Quarter wave and half-wave plates; Production and detection of polarized light; Optical activity; Specific rotation; Half shade polarimeter.

UNIT–IV

Derivation of Einstein relations; Concept of stimulated emission and population inversion; Broadening of spectral lines (Qualitative); Three level and four level laser schemes; Elementary theory of optical cavity; Longitudinal and transverse modes; Components of laser devices; Condition for laser action; Types of lasers, Ruby, Nd:YAG lasers, He-Ne and CO_2 lasers; Mode of creating population inversion and output characteristics; Application of lasers.

TUTORIAL: Relevant problem on the topics covered in the course.

Books Prescribed:

1. Text book of Optics: N. Subramanayam, B. Lal and M. N. Avadhamulu

2. Fundamentals of Optics: Jenkins and White

3. Optics: Ajoy Ghatak

4. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi, 1996

5. Laser and Non-Liner Optics, B.B. Laud (New Age Pub.) 2002

6. Optics, Born and Wolf, (Pergamon Press) 3rd edition, 1965

7. Laser, Svelto, (Plenum Pres) 3rd edition, New York

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand polarization, interference and diffraction.
CO2	Understand the light propagation through lenses, mirrors, prisms, and other optical systems.
CO3	Understand different branches of optics with associated experiments.
CO4	Differentiate between Fraunhofer and Fresnel diffraction.
CO5	Understand the applications and importance of optics in daily life.

B.Sc. (HONS.) PHYSICS SEMESTER–IV
BHP-242
MODERN PHYSICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The Objective of this course is to make the students gain knowledge about cathode rays, positive rays and their properties, atomic models of Thomson, Rutherford and Bohr, quantum methods in the solution of problems involving atomic spectra, blackbody radiation, the photoelectric effect and the structure of the atom, wave nature of matter and uncertainty principle.

Unit – I

Cathode Rays and Positive Rays

Electrical conduction through gases, ionization of gas, ionization current, phenomena of discharge through gases at low pressure, properties of cathode rays, determination of specific charge (e/m) of electron, Millikan's oil drop method, balanced drop method, **Importance of knowledge of Electric Charge, Energy of moving electron in electron-volt,** Positive rays and particles, **Properties of positive rays,** Thomson's experiment, positive ray parabolas, isotopes of hydrogen. **Atomic weight and atomic number.**

Unit – II

Atomic Structure of the Matter

Thomson's atom model, Rutherford's nuclear atom model**, Impact parameter, Distance of closest approach, drawbacks of Rutherford model,** Bohr's theory of hydrogen atom, spectral series of hydrogen atom, atomic energy levels, Bohr's correspondence principle, successes and failures of Bohr's theory, **Ritz Combination Rule, Correction in Bohr's Theory for finite mass of the nucleus, Evidences in favour of Bohr's Theory.**

Unit – III

Foundation of Quantum Mechanics

Black body radiations, Wien's theory, Rayleigh Jeans law, Planck's law of radiation, Failure of classical theory to explain black body radiations, Photoelectric effect, **Laws of photoelectric emission, Classical explanation of photoelectric effect. Work function,** Einstein's photoelectric equation, Compton scattering, Theory of Compton effect and its limitations, **Kinetic energy of recoil electron.**

Unit – IV

Wave Nature of Matter and Uncertainty Principle

The wave particle duality, de Broglie concept of matter waves, phase and group velocities, de Broglie relation for a photon and wavelength of material particles, characteristics of de Broglie waves, Davisson and Germer's experiment, The uncertainty principle for position and momentum (x and p_x), Energy and time (E and t) and angular position-angular momentum, illustrations of uncertainty principle, Gamma ray microscope. Diffraction by a single slit, applications of uncertainty principle- nonexistence of free electrons and existence of n, p and α particles in nucleus, zero point energy and size of hydrogen atom.

Books Prescribed:

1. Quantum Physics of Atoms Molecules Solids, Nuclei & Particles: R. Eisberg and R. Resnick,
2. Elementary Modern Physics: Atam P. Arya.
3. Concepts of modern physics: A. Beiser.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand the properties of cathode rays and positive rays.
CO2	Explain the Photoelectric effect, Compton effect, the quantum theory of light, X
CO3	Understand the wave properties of particles and be knowledgeable about particle diffraction (Davisson Germer Experiment)
CO4	Know the uncertainty principle, the Atomic structure and its development, Thomson and Rutherford atomic model.
CO5	Have information about the Bohr atom model

B.Sc. (HONS.) PHYSICS SEMESTER–IV
MAP-241
MATHEMATICS-IV

Credit Hours per week: 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Max. Marks: 37 + Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit) Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & Section-C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from Section-B & Section-C. Each question carries six marks.
4. Teaching time for this paper would be six periods per week.

Course objectives:

- To become familiar with matrices and determinants along with their properties.
- To acquire knowledge about concept of probability and probability distributions.

Course contents:

UNIT-I

Determinants & Matrices: Properties of matrices and determinants, Algebra of matrices, Eigen Values and Eigen vectors, canonical forms, Unitary, Hermitian, and Orthogonal matrices and their properties, Cayley-Hamilton theorem, Rank of a matrix, Condition of Consistency of linear systems, Introduction to vector spaces, linear maps, basis and dimension(Excluding Theorems).

UNIT-II

Probability theory and distributions: Axiomatic theory of probability, probability density function, conditional probability, mathematical expectation, moments, moment generating function, Conditional and marginal distribution, special frequency distributions, Binomial, Possion, Normal, Uniform, Gamma, Beta and Exponential distribution.

Books prescribed:

1. Mathematics Hand book: M.Vygodsky, Mir, Moscow,1975.
2. Applied Mathematics for Engineers and Physicists: Pipes &Harvill, London, McGraw Hill, 1970
3. Mathematics of Physics and Modern Engineering :Sokolnikoff&Recheffer.

4. Fundamentals of Mathematica Statistics: S.C. Gupta, V.K.Kapoor.
5. Algebra: Rajinder Pal Kaur, First World Publication Ludhiana.

Course outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Solve problems on matrices and determinants, Eigen values and Eigen vectors.
CO2	Solve the system of equations by checking the consistency.
CO3	Understand the concept of probability functions and use Bayes theorem for future events.
CO4	Have knowledge on discrete, continuous distributions and their properties.

B.SC. (HONS.) PHYSICS SEMESTER-IV
CHX-241
MOLECULAR SPECTROSCOPY-IV

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 50**
(Theory Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight short answer type questions carrying 1½ mark each. Students are required to attempt any six questions.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 7 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

Course Objectives: Students will acquire the knowledge of energy and electromagnetic spectrum, ultraviolet and visible spectroscopy, Infrared spectroscopy. They will know about the applications of Wood-Fischer rule and IR Spectroscopy selection rules, factor affecting wave number. This course will help the students to know the instrumentation and basic concepts of NMR and Mass spectroscopy. They will be able to solve problems related to UV, IR, NMR and mass spectroscopy.

COURSE CONTENTS:

UNIT – I

Energy and Electromagnetic Spectrum

Introduction, the Electromagnetic Spectrum, Characteristics of Electromagnetic Radiations, Regions of the spectrum, Units of Frequency, Wavelength and Wave number, Interaction of radiation with matter, Absorption and emission spectroscopy, spectroscopic transition between two
stationary states, energy levels, Transition probability and Selection Rules, spin-orbit coupling, singlet and triplet states, Fluorescence and Phosphorescence, Statement of Born-Oppenheimer approximation, Degree of freedom, Frank Condon Principle, Basic features of different spectrometers.

UNIT – II

Ultraviolet and Visible Spectroscopy

Introduction, Theory (Origin) of UV-Visible Spectroscopy, the energy of electronic excitation, instrumentation, Sample handling, Measurement techniques, Sample and reference cells, Solvents and solutions, Laws of light absorption-Beer's and Lambert's laws, Molar extinction coefficient, Electronic Transitions, Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Transition Probability: Allowed and Forbidden Transitions, Formation of Absorption Bands, Designation of Absorption Bands, Conjugated Systems and Transition Energies Chromophore, Auxochromes, Absorption and intensity shifts, Factors affecting λmax , Stereochemical Factors in Electronic Spectroscopy, Biphenyls and binaphthyls, Solvent effects, Applications

of Electronic Spectroscopy-Conjugated Dienes and a,ß-Unsaturated Carbonyl Compounds.

Applications of UV-visible spectroscopy

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α,ß -unsaturated carbonyl compounds..

UNIT – III

Infrared Spectroscopy

Molecular Vibrations, Vibrational energy levels, Selection rules, Modes of vibration, Calculation of vibrational frequencies- degree of freedom, Force constant, Fundamental vibration frequencies, existence of overtones, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups. Instrumentation, sampling techniques-solids, liquids.

Applications IR Spectroscopy

Applications of IR spectroscopy, Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print regions. Simple numerical problems based on UV and IR spectroscopy.

UNIT – IV

Nuclear Magnetic Resonance

The Nuclear spin, Larmor frequency, the NMR isotopes, Population of nuclear spin level, Spin and Spin lattice relaxation. Measurement techniques (CW & FT method), Solvent used. Chemical shift, Reference compounds, Shielding constant, Range of typical chemical Shifts, Simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

Applications of NMR spectroscopy

NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p- nitrophenols, acetophenone. Simple numerical of structure elucidation of NMR spectroscopic data.

BOOKS PRESCRIBED:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York
2. D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster; Publisher: John Willey and Sons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing Company Inc.
5. Introduction to Spectroscopy – D. L. Pavia, G. M .Lampman, and G. S. Kriz Publisher: Brooks / Cole, a part of cengage learning

COURSE OUTCOMES:

Sr. No.	On completing the course, the student will be able to
CO1	Understand the spectrums, their types and characteristics.
CO2	Understand the various aspects of UV-Visible spectroscopy and behaviour of UV-peaks and its shifting under different conditions.
CO3	Ssolve the absorption wavelength of conjugated polyenes and α,ß -unsaturated carbonyl compounds.
CO4	Interpret the IR spectrum and relate the spectral peaks with the various types of bonds present in the molecules.
CO5	Interpret the actual NMR spectrum and calculate the chemical shift, coupling constant and correlate the NMR peaks with structure and proton counting.

B.Sc. (HONS.) PHYSICS SEMESTER–IV
Course Code: ESL–222

Course Title: ENVIRONMENTAL STUDIES–II (COMPULSORY)

B.A./B.Sc. (Biotech., Food Sci., Comp. Sci., Eco., FD., IT., Med., Non Med.)/B.Sc. (Hons.-Physics, Chemistry, Maths)/B.B.A./B.C.A./B.Com./B.Com. (Hons.)/BJMC/BA Social Sciences/BA (Hons.) Punjabi, BA (Hons.) English, B.Voc (Food Processing, Theatre and Stage Craft, Software Development, Textile Design & Apparel Tech)

Credit Hours (Per Week): 2
Total Hours : 30
Maximum Marks : 50 Marks

Instructions for Paper Setters: The question paper will consist of three sections. Candidate will be required to attempt all the sections. Each unit of the syllabus should be given equal weightage of marks. Paper to be set in English, Punjabi and Hindi.

Section–A: (16 Marks): It will consist of five short answer type questions. Candidates will be required to attempt four questions, each question carrying four marks. Answer to any of the questions should not exceed two pages.

Section–B: (24 Marks): It will consist of five questions. Candidates will be required to attempt four questions, each question carrying six marks. Answer to any of the questions should not exceed four pages.

Section–C: (10 Marks): It will consist of two questions. Candidate will be required to attempt one question (carrying ten marks) only. Answer to the question should not exceed 5 pages.

Course Objectives:

1	To study the concept of Biodiversity – role, importance, values and its conservation. Hot spots and threats to biodiversity.
2	To create awareness regarding environmental pollution, its causes and effects and preventive measure to control the different types of pollution.
3	To make students aware of growing human population – causes and concern. Family welfare programs. Road safety (Traffic) rules.
4	To know about entrepreneurship development and civil/self defense.

Unit-I

Biodiversity and its Conservation:

- Definition: Genetic, species and ecosystem diversity.
- Biogeographical classification of India.

- Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and optionvalues.
- Biodiversity of global, National and local levels.
- India as mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts. Threatened and endemic species of India.
- Endangered species, vulnerable species, and rare species.
- Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity. National Parks, Wild life sanctuaries, Biosphere reserve, Project Tiger, Project Elephant.

Unit-II

Environmental Pollution:

Environmental Pollution: Concepts and Types

- Definition, causes, effects and control measures of:
  a) Air Pollution

  b) Water Pollution

  c) Soil Pollution

  d) Marine Pollution

  e) Noise Pollution

  f) Thermal Pollution

  g) Nuclear Hazards

  h) Electronic Waste

- Concepts of hazards waste & human health risks.
- Solid Waste Management: Causes, effects and control measures of municipal, biomedical and e-waste
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Unit-III

Human Population and the Environment

- Human population growth: impacts on environment.
- Population explosion-Family welfare programme.
- Environment and human health: Concept of health and disease, common communicable and non communicable diseases, public awareness
- Human rights.
- Value education.
- Women and child welfare.
- Role of information technology in environment and human health.
- Environment movments in India: Chipko movement, Silent valley movement and other case studies.

- Road Safety Rules & Regulations**:** Use of Safety Devices while Driving, Do's and Don'tswhile Driving, Role of Citizens or Public Participation, Responsibilities of Public underMotor Vehicle Act, 1988, General Traffic Signs.
- Accident & First Aid**:** First Aid to Road Accident Victims, Calling Patrolling Police &Ambulance.

Unit-IV

National Service Scheme:

- **Entrepreneurship Development:** Definition & Meaning; Qualities of good entrepreneur; Steps/ ways in opening an enterprise; Role of financial and support service Institutions.
- **Civil/Self Defense:** Civil defense services, aims and objectives of civil defense; Needs for self-defense training.

Field Visits:

- Visit to a local area to document environmental assets–river/forest/ grassland/hill/mountain.
- Visit to a local polluted site–Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems–pond, river, hill slopes etc.
- Contribution of the student to NSS/any other social cause for service of society.
- Visit to Museum/Science City
- Municipal solid waste management and handling.

Note: In this section the students will be required to visit and write on the environment of an area/ ecosystem/vi1lage industry/disaster/mine/dam/agriculture field/waste management/hospital etc. with its salient features, limitations, their implications and suggestion for improvement.

References/Books:

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2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Down to Earth, Centre for Science and Environment, New Delhi.
4. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
5. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, PearsonEducation (Singapore) Pte. Ltd., Delhi.
6. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies,New Age International (P) Ltd, New Delhi.
7. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
8. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
9. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex,Amritsar
10. Asthana, D.K. 2006. Text Book of Environmental Studies, S. Chand Publishing.
11. Kanta, S., 2012. Essentials of Environmental Studies, ABS Publications, Jalandhar.
12. Basu, M., Xavier, S. 2016. Fundamentals of Environmental Studies, Cambridge University Press, India.
13. Mahapatra, R., Jeevan, SS, Das S. 2017. Environment Reader for Universities, Centre for Science and Environment, New Delhi.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO-1	Know about the meaning of Biodiversity and its role in environment.
CO-2	Learn about the causes of different forms of pollution and their control measures.
CO-3	Understand the causes and challenges of growing human population, women and child welfare programs.
CO-4	Know the development of entrepreneurship and techniques of civil/self-defense.

B.Sc. (HONS.) PHYSICS SEMESTER–IV
Geography
BGEO-2432
INTERDICIPLINARY COURSE ID-II
Syllabus for B.Sc. Hons. (Mathematics, Physics, Chemistry)

Time: 3 Hours **Credit Hours (per week): 4**
Total Hours: 60
Maximum Marks: 50
Theory: 30+7 Marks
Internal Assessment: 13 Marks

Instructions for the Paper Setter:
The Medium of Instruction is English.
Section A: -It will consist of 10 questions from the entire syllabus. All questions are compulsory. Each question will carry one mark; the total weightage being 10 marks.
(10×1=10 marks)
Section B: - It will consist of 8 short answer questions upto100 words in length. The students will be required to attempt any 5 questions. Each question will carry 4 marks the total weightage being 20 marks.
(5x4=20 Marks)

Course Objectives: To develop in them an understanding of basic concepts, principals and theories relating to geographical phenomena. Students will gain factual knowledge about atmospheric phenomena, global climate system and global oceans.

Part A: Physical Geography

1. **Exploring the Earth:** The shape of the Earth, The Earth's movements, Day and Night, The Earth's Revolution, Dawn and Twilight, Latitude and Longitude, Longitude and Time, Standard Time and Time Zones, The International Date line.
2. **The Earth's Crust:** The Structure of the Earth, Classification of Rocks, (Igneous, Sedimentary and Metamorphic), Types of Mountains, Types of Plateau, Types of Plains.
3. **The Oceans:** Ocean currents of Indian, Pacific Atlantic Ocean.

Part B: Weather, Climate and Vegetation

1. **Weather:** The Difference between Climate and Weather, The Elements of Weather and Climate: Rainfall, Pressure, Temperature and Humidity, Winds, Sunshine.
2. **Climate:** Composition and Structure of Atmosphere, Factors affecting Insulation, Factors affecting temperature, Precipitation, Rainfall, Monsoon
3. **Vegetation:** Climatic types and natural vagetation, World climatic types

Part-C: Practical work

Maps: Physical (India and World), Types of soil (India), Monsoon
Maps: Vegetation (India),Rainfall (India and World), Natural calamities (last six months) earthquake, flood, cyclone, tsunami and landslides

Prescribed Text:

1. Certificate Physical & Human Geography by G.C. Leong
2. Oxford India Atlas (Latest Edition)
3. Spectrum- Geography & India

Course Outcomes:-

CO-1 It enables the students to acquire basic knowledge of geography as a spatial science and to secure employment in the sectors of geospatial analysis development and planning mapping.

CO-2 Understand effects of rotation, revolution and interior structure of the earth.

CO-3 Analyze the interaction between Earth's atmosphere and Earth's surface and how atmospheric moisture works.

CO-4 Learn the behavior and characteristics of global oceans.

B.Sc. (HONS.) PHYSICS SEMESTER–IV
BHP-243
PHYSICS LAB-IV

General Guidelines for Practical Examination

Credit Hours (per week): 6

Time: 3 Hours **Maximum Marks:50**
(Practical Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Periods 8 Periods/week
I. The distribution of marks is as follows:

i) One experiment:**15 Marks**

ii) Brief Theory:**5 Marks**

iii) Viva–Voce:**10Marks**

iv) Record (Practical file):**7 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and 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: Objectives of this course are to understand spectrometer, telescope, microscope, plane diffraction grating, least count etc. To understand different sources of light and associated experiments. To understand how light propagates through lenses, mirrors, prisms, and other optical systems. To understand, design and conduct experiments, analyse and interpret data using optical systems. To understand the concept of polarization through experiment.

LIST OF EXPERIMENTS

1. To determine refractive index of glass and liquid using spectrometer.
2. To determine the Cauchy's constants.
3. To study the refractive index of a doubly refracting prism.
4. To set up Newton's rings to determine wavelength of sodium light.
5. To determine the wavelength by using plane diffraction grating (Use Hg source)
6. To determine dispersive power of plane diffraction grating.
7. To determine resolving power of a telescope.
8. To determine resolving power of a grating.
9. To study the absorption spectra of iodine vapours.
10. To study the rotation of plane of polarization by using polarimeter.
11. To determine the specific rotation of sugar using Laurent's half shade polarimeter

Books Prescribed:

1 Practical Physics Volume-II, 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	Understand spectrometer, telescope, microscope, plane diffraction grating, least count etc.
CO2	Understand different sources of light and associated experiments.
CO3	Understand the light propagation through lenses, mirrors, prisms, and other optical systems.
CO4	Understand design , conduct experiments, analyse and interpret data using optical systems.
CO5	Understand polarization with experiment.

B.SC. (HONS) PHYSICS (SEMESTER–IV)
CHX-242
PHYSICAL CHEMISTRY LAB-IV

Credit Hours: 6 Hrs/week
Total Hours: 60
Maximum Marks: 50
Theory: 37
Internal Assessment: 13

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:
I. Examiner will set two questions involving two different techniques.
II. Students will be asked to complete write up of both practical within first 20 minutes on the first sheet provided.
III. On the second sheet provided after 20 minutes, students will perform and note the record on second sheet during the conduct of practical exam
IV. The split of marks will be as under:
(Write up = 12, Performance = 12, Viva-voce = 8, Practical note book = 5)

COURSE OBJECTIVE: Students will be able to find strength, normality of unknown solution through conductometric titration, adsorption isotherms, polarimetry, refractometric, use of calorimeter to find enthalpy of neutralization of strong acid and base.

COURSE CONTENTS:
Note. The question paper will be set by the examiner based on the syllabus.

1. **Refractometry**: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).

2. **Polarimetry**: Determine the %age composition of an optically active solution.

3. Calorimetry:
a) Determination of Heat of neutralization
(i) Strong acid-strong base
(ii) Weak acid-strong base.
b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3

4. Conductometry:
a) Determination of cell constant.
b) Determination of specific and equivalent conductance of electrolyte (NaClandHCl).
c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.
d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid on charcoal.

Books Prescribed:

1. Advance Practical Chemistry, J. B. Yadav

Course Outcomes:

S. No.	On completing the course,
CO1	Students will learn to measure refractive index of various solvents using refractometer.
CO2	Students will learn to measure angle of rotation with the help of polarimeter and then calculate the optical activity of various solutions.
CO3	Students will learn to calculate the heat of neutrilization, heat of solution of acids, bases and salts with the help of a calorimeter..
CO4	By doing the experiments on conductometer, students will learn measure the cell constant, equivalent conductance, specific conductations and will also perform conductometric titrations.
CO5	By performing the experiment of adsorption ,they will learn about the adsorption isotherm.

B.Sc. (HONS.) PHYSICS SEMESTER–V
BHP-351
CONDENSED MATTER PHYSICS– I

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: To understand the different crystal structures through detailed studies on the concepts of crystalline and amorphous solids, the idea of lattice, unit cell, different types of lattices and crystal systems. To attain an ability to analyze the structure of different crystals by learning and understanding the basics of X-ray diffraction and crystallography through concepts of Reciprocal lattice and Brillion zones. To be able to differentiate between metals, semiconductors and Insulators by understanding the formation of energy bands through studies on Band theory of solids.

Course Contents:

Unit – I

Crystal structure, Symmetry operations for a two dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells, Crystal planes and Miller indices, **Distance between lattice planes in a cubic crystal, Characteristics of cubic crystals , Hexagonal close packed,** Diamond and NaCl structure.

Unit – II

Crystal Diffraction : Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Brag's law in reciprocal lattice, Brillouin zones and its derivation in two dimensions, Structure factor and atomic from factor.

Unit – III

Free Electron Theory: Drude-Lorentz theory, Sommerfeld model, three dimensional potential well, the Fermi-Dirac distribution, density of electronic states, Fermi energy, average kinetic energy.

Unit – IV

Band Theory: Formation of energy bands, Kronig Penney model of an infinite one dimensional crystal, band structures classification of insulators, semiconductors and metals.

Semiconductors: Intrinsic and extrinsic semiconductors, Energy band description, carrier concentration, fermi level and conductivity

Books Prescribed:

1. Concepts of Condensed Matter Physics, Vol. I, T.S. Bhatia and Rajesh Khatri, Vishal Publishing House
2. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
3. Elements of Modern Physics by S.H. Patil (TMGH, 1985).
4. Solid State Physics by Puri and Babbar.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Gain knowledge on classification of various crystal systems and crystal structures.
CO2	Understand the basics of X-ray diffraction and crystallography.
CO3	Comprehend the concept of Reciprocal lattice and Brillouin zones.
CO4	Gain a comprehensive view of Fermi energy through classical and quantum free electron theory.
CO5	Understand and Analyze the difference between metals, semiconductors and Insulators on the basis of formation of energy bands.

B.Sc. (HONS.) PHYSICS SEMESTER–V
BHP-352
NUCLEAR PHYSICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The purpose of this course is to impart knowledge about nucleus and its properties, nuclear deformations and nuclear models for understanding of related dynamics. Besides this, students will learn about nuclear interactions, reactions and radioactive decays carbon dating.

Course Contents:

UNIT–I

I. Nuclear Properties: Constituents of nucleus and their intrinsic properties, Quantitative facts about nuclear mass, density, binding energy and its variation with mass number, Wave mechanical properties of nucleus ,angular momentum, parity, magnetic dipole moment and electric quadruple moment of the nucleus, properties of nuclear forces, meson theory of nuclear forces.

UNIT–Il

Il. Nuclear Models: Liquid drop model, semi-empirical mass formula, conditions of stability, experimental evidence for nuclear magic numbers, development of Shell Model, energy level scheme, predictions of the Shell model: angular momenta of nuclear ground states, parity , magnetic moment of nuclear ground states, electric quadrupole moments and nuclear isomerism.

UNIT–Ill

Ill. Radioactive Decays: Modes of radioactive decay and decay laws, units of radioactivity radioactive decay series, successive disintegration, radioactive equilibrium , radioactive dating, modes of radioactive decay, Alpha decay: Gamow's theory of alpha decay, barrier penetration as applied to alpha decay, Geiger Nuttal law, Beta decays: β-, β+ and electron capture decays, Auger electron, conditions for spontaneous emission, nature of Beta particle spectrum Neutrino hypothesis and experimental evidence for its detection, Gamma decay: Gamma emission, internal conversion, internal pair conversion.

UNIT–IV

IV. Nuclear Reactions: Types of nuclear reactions, reaction cross section, microscopic and macroscopic cross-section, conservation laws, energetics of nuclear reactions, examples of nuclear

reactions, Q-value and its physical significance, threshold energy for exoergic and endoergic reactions. **Nuclear fission reactions, Nuclear fusion reactions, Nuclear Reactors (Basics), Types and Uses of Reactors.**

Books Prescribed:

1. Basic Ideas and Concepts in Nuclear Physics by K. Hyde
2. Introduction to Nuclear Physics : H.A. Enge
3. Nuclear Physics : I. Kaplan (Addison Wesley)
4. Nuclei and Particles by E. Segre5. Nuclear and Particle Physics: Kulwant S. Thind, Manmohan Singh,Vijay Kumar, Leif Gerward

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Explain the ground state properties of nucleus for the study of nuclear structure behavior.
CO2	Express the radioactive decays and find some quantities characterizing the decay such as half-life and decay constant.
CO3	Explain of the liquid drop model, shell model and collective model descriptions.
CO4	Apply various aspects of nuclear reactions in view of compound nuclear dynamics.
CO5	Find operating voltage and half life experiments in the lab.

B.Sc. (HONS.) PHYSICS SEMESTER–V
BHP-353
ATOMIC SPECTROSCOPY

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The objective of this course is to study the atomic spectra of Hydrogen atom and alkali atoms, explanation of Spectral series, different series in Alkali Spectra, doublet structure in alkali Spectra, the vector model of one electron system in weak magnetic field, production of X-rays and their spectra, Reflection and refraction of X-rays and comparison of optical and X-ray Spectra.

Course Contents:

Unit-I

Introduction to Atomic Spectra: Observation of spectra, Types of spectra, Light sources, Spectral analysis, Units in spectroscopy, Bohr's Theory and Hydrogen spectrum, Explanation of Spectral series, Representation of spectral lines by terms, Energy level Diagram, Continuum at series limit, Evidences in favour of Bohr's Theory, Experimental confirmation of Bohr's theory, Franck-Hertz Experiment.

Unit-II

Spectra of Alkali Atoms: **Bohr Magneton, Larmor Precession, Space quantization, Electron Spin, Coupling of Orbital and Spin Angular Momenta, Stern Gerlach Experiment,** Different series in Alkali Spectra, Ritz combination Rule, Electron Spin orbit interaction, **Explanation of Broad Features of Alkali Spectra,** Doublet structure in alkali Spectra (Fine Structure), Energy level diagram of Sodium Atom, Selection rules for doublets, Intensity rules for fine structure doublets. **Penetrating &Non-penetrating orbits**

Unit-III

Zeeman Effect and the Paschen-Back effect: Experimental Study of Zeeman Effect, Classical Interpretation of Normal Zeeman Effect, Quantum Theory of Normal Zeeman

Effect, Zeeman Shift, Vector Atom Model and Anomalous Zeeman Effect, Selection rules, Intensity rules, Paschen-Back effect, Selection rules for the Paschen-Back effect, **spin orbit correction, Lande's Factor for two valence Electron System: Lande's g Factor in L-S and JJ-coupling.**

Unit-IV

X-rays Spectra: Production of X-rays, intensity & Quality, Properties of X-ray, Origin of X-rays from electromagnetic theory, X-ray diffraction, Bragg's law, Laue Spots, Bragg's spectrometer, Reflection and refraction of X-rays, X-ray scattering, Continuous X-ray spectrum, Characteristics absorption and emission Spectra, comparison of optical and X-ray Spectra, Moseley's law, Applications of Moseley's law, **Auger Effect.**

TUTORIAL: Relevant problem on the topics covered in the course.

Books Prescribed:

1. Introduction to Atomic Spectra by H. E. White
2. Atomic Spectra and Atomic structure by Gerhard Herzberg
3. Concepts of Modern Physics by Arthur Beiser
4. Elements of Spectroscopy by Gupta, Kumar and Sharma

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Describe the atomic spectra of one valance electron atoms.
CO2	Explain the change in behavior of atoms in external applied magnetic field.
CO3	Understand the basic concept of atomic physics and learn about quantum states of one electron atoms
CO4	Understand the spectra of alkali elements, fine structure in alkali spectra, penetrating and non penetrating orbits.
CO5	Understand effect of external fields to spectra like, Normal and anomalous Zeeman effect, Paschen back effect

B.Sc. (HONS.) PHYSICS SEMESTER–V
BHP-354
QUANTUM MECHANICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The main objective of this course is to make students aware about the basic formulations in quantum mechanics. To acquire mathematical skills require to develop theory of quantum mechanics. To develop understanding of postulates of quantum mechanics and to learn to apply them to solve some quantum mechanical systems. To offer systematic methodology for the application of Schrodinger equation to solve quantum mechanical systems. There are many different types of representations of state and operators that are very useful in studying the subject deeply. It teaches about various commutation and uncertainty relations. Students will be given insight to solve Schrodinger wave equation in three dimensions.

Course Content:

UNIT–I

The Schrodinger Wave equation: Need of quantum mechanics, the wave function, matter waves, **phase and group velocity**, **de-broglie wave velocity**, one dimensional time dependent Schrodinger equation for free particle, particle under a potential V(x), time independent one dimensional Schrodinger wave equation, time dependent and time independent 3D Schrodinger wave equation, physical interpretation of wave function, **normalized and Orthogonal wave function**, **Expansion theorem**, stationary state, conservation of probability, probability current density, conditions of admissibility of the wave function. **The uncertainty principal and its applications, gamma ray microscope, diffraction of a beam of electrons.**

UNIT–II

Operator formalism in Quantum mechanics: Operators, operator algebra, linear operators, vector operators, Laplacian operator, Null operator, inverse operator, singular and non singular operator, Hermitian operator, Adjoint conjugate of an operator, Parity operator, operators corresponding to different dynamical variables, angular momentum operator, operator for total energy, eigen functions and eigen values, **Superposition of eigen states,**

Theorem of Commutativity and simultaneity, commutator algebra, commutator for position and momentum, commutator for energy and time, **angular momentum operator and their commutation rules, eigen values and eigen function of L^2 and L_z**, scalar product of states, properties of scalar product, norm of a state, Expectation value of dynamical quantities, Gaussian wave packet, Ehrenfest Theorem, Schwarz inequality, exact statement and proof of uncertainty principle for wave packets, Fundamental postulates of quantum mechanics.

UNIT–III

Application of Schrodinger wave equation to 1D problems: Separation of variables in time dependent schrodinger equation, Particle in a rigid one dimensional infinite potential well, density of states, A single step potential, one dimensional rectangular potential barrier, Application to barrier penetration or α decay, One dimensional square well potential. **Free and Bound states**, **potential well of finite depth**, **discrete energy levels, particle in one dimensional infinitely deep potential well,** linear harmonic oscillator, energy of oscillator, **eigen values and eigen function of harmonic oscillator**, significance of zero point energy, application of linear harmonic oscillator.

UNIT–IV

Application of Schrodinger equation to three dimensional problems: Free particle in three dimensional rectangular box, wave function and degeneracy, three dimensional harmonic oscillator (Cartesian coordinates), particle in spherical symmetric potential, solution of θ, φ, R equations, spherical harmonics, Hydrogen atom, **wave function of H atom, complete solution of hydrogen atom**, **degeneracy, electron spin hypothesis, Stern Gerlach experiment, Spin matrices for electron, Commutation relations of σ^2 with σ_x, σ_y and σ_z, pauli wave functions, coupling of orbital and spin angular momenta, spin orbit interaction energy, Total angular momentum operators, Eigen values of J^2 and J_z.**

Books Prescribed:

1. Quantum mechanics by Powell and Crasemann (Narosa Addison Wesley)

2. Quantum Mechanics by E. Merzbacher (Wiley)

3. Quantum mechanics by Mathews and Venketsan (Tata Mc Graw Hill)

4. **Quantum mechanics by Satya Prakash (Pragati Prakashan)**

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand and explain the differences between classical and quantum mechanics.
CO2	Understand the idea of wave function, probability density and uncertainty relations.
CO3	Understand time independent and time dependent Schrodinger wave equation.
CO4	Understand the idea of operators, eigen function, eigen value, quantization and degeneracy.
CO5	Solve Time independent Schrodinger wave equation for one, three dimensional dynamical systems, spherical harmonics and hydrogen atom.

B.Sc. (HONS.) PHYSICS SEMESTER–V
BHP-355
PHYSICS LAB-V

Credit Hours (per week): 6

Time: 3 Hours **Maximum Marks: 50**
(Practical. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Periods 8 Periods/week
General Guidelines for Practical Examination
I. The distribution of marks is as follows:
i) One experiment 15 Marks
ii) Brief Theory 5 Marks
iii) Viva–Voce 10Marks
iv) Record (Practical file) 7 Marks
II. There will be one session of 3 hours duration and the paper will consist of 10 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. No experiment is to be allotted to more than three examinee in any group.

Course Objectives: Acquire the appropriate data accurately from experiments of laser diffraction, solar cell, Plancks constant determination, ionization potential of Hg, working with GM counter etc. and keep systematic record of laboratory activities. Interpret findings using the correct physical scientific framework and tools.Prepare professional quality textual and graphical presentations of laboratory data and spectral results.Evaluate possible causes of discrepancy in practical experimental observations, results in comparison to theory.

LIST OF EXPERIMENTS:

Computer Oriented Data Analysis

1. **Basic understanding of the Microsoft Excel for data analysis and graph plotting**
2. **To measure the illuminating power of two light sources using photocell.**
3. To determine the wave-length of laser light using a plane diffraction grating.
4. **Study of areal characteristics of photovoltaic module.**
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. Measurement of Planck’s constant using photocell.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the Planck’s constant using LEDs of at least 4 different colour LED.
10. To determine the ionization potential of mercury.
11. To determine (i) wavelength and (ii) angular spread of semiconductor diode laser using plane diffraction grating.
12. Study the working of GM counter and draw the plateau curve.
13. Study the GM counter dead time.
14. Study the absorption of beta particles in aluminium sheet using GM counter absorption coefficients.
15. Study of C.R.O. as display and measuring device.
16. To measure (a) AC Voltage, and (b) Frequency of a some periodic waveforms using CRO

17. Study the variable DC power supply using CRO and obtain the graph between DC voltmeter and CRO measurements.

Books Prescribed

1. Practical Physics by CL Arora S. Chand Publications
2. Practical Physics Volume II & Volume III Vishal Publications
3. Prcatical Physics by S P Singh Pragati Parkashan Meerut.

Course Outcomes:

Sr. No.	**On completing the course, the students will be able to:**
CO1	Know the concept of Microsoft excel for data analysis and graph plotting.
CO2	Understand the concept of diffraction using diffraction grating and semiconductor laser.
CO3	Understand the concept of thermo e.m.f. using copper constantan thermocouple.
CO4	Understand Geiger Muller Counter, operating voltage, dead time and absorption coefficient.
CO5	Understand the determination of photoelectric effect and inverse square law.

B.Sc. (HONS.) PHYSICS SEMESTER–V
BHP-356
SEMINAR AND ASSIGNMENT

Credit Hours (per week): 6

Time: 3 Hours **Maximum Marks:50**
(Max. Marks: 37+Internal Assessment: 13)
Pass Marks: 35%

Course Objectives	The objective of this course is to provide an opportunity for the student to read research articles in physics in order to develop skills in technical reading, writing, and scientific presentation. In this course the student will learn to search research articles in physics, to write a scientific report on a topic on physics and to give technical presentations.
Course outcomes:	
Sr. No.	**On completing the course, the students will be able to:**
CO1	Develop rigorous quantitative understanding of core physical theories.
CO2	Get organized knowledge of the major branches of physics.
CO3	Give formal and informal scientific presentations to various audiences, including peers.
CO4	Communicate clearly and concisely in writing.
CO5	Apply scientific reasoning skills

B.Sc. (HONS.) PHYSICS SEMESTER–VI
BHP-361
PARTICLE PHYSICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The course is important for the students to learn about the most fundamental constituents of matter and radiation, interaction among elementary particles and hence to understand their behaviour. Particle detectors and particle accelerators can be understood in detail. This course is primarily an introduction to the experimental study of particle physics, but it also gives an understanding of the theoretical description of particle physics The course provides a platform for the students seeking research opportunities in high energy Physics.

Course Contents:

UNIT-I

Elementary Particles and their Properties - Historical introduction, classification of **elementary** particles, **fundamental interactions, conservation laws, space inversion invariance**, fermions and bosons, particles and antiparticles, **neutrino and anti-neutrino**, Properties of different baryons, Hyperons, Leptons and Mesons, **Muons, Tauons, Pions** like life time, mass, spin parity and conservation law. **Hypernuclei, Resonance states, SU(2) and SU(3) symmetry**. Introduction to quarks and their types, Quark contents of baryons and mesons

UINT-II

Interaction of Radiation and Charged Particles With Matter: Types of interactions, **Absorption of heavy and light charged particles**, Energy loss of electrons and positrons, Positrons annihilation in condensed media, Stopping power and range of heavier charged particle, derivation of Bethe-Bloch formula, interaction of gamma rays with matter, **absorption of gamma rays by matter, attenuation co-efficient, Bohr's classical cut-off formula, pair production.**

UNIT-III

Accelerators - Accelerators, **ion sources, Heavy ion sources**, linear accelerators, **Drift Tube accelerator, Wave guide accelerator, electron linear accelerator,** Cockcroft-Walton accelerator, Van de Graff accelerator, cyclic accelerators, Cyclotron, Betatron, Synchro-cyclotron, **Phase stability**, electron synchrotron, **microtrons, Gradient proton synchrotrons**, colliding beam machines, particle beams for fixed target experiment, CERN Super Proton Synchrotron (SPS), Larger Hadron collider (LHC), Fermilab Tevatron, **Indian accelerators.**

UNIT-IV

Nuclear Radiation Detection –Classification of detectors, Ionization chamber, Regions of multiplicative operation, Proportional and Geiger-Muller counters, Scintillation detectors, Semiconductor detectors, **Cerenkov counters, Wilson cloud chamber**, Electromagnetic and hadronic calorimeter, specialized detectors, solid state nuclear track detectors, bubble chambers, spark counter, nuclear emulsions, **Differentiating and integrating circuits, Nuclear instrument modules.**

Books Prescribed:

1. Introduction to Elementary Particles by D. Griffth (Wiley-VCH)

2. Introduction to High Energy Physics by D.H. Perkins (Cambridge University Press)

3. Elementary Particles by I.S. Hughes (Cambridge University Press)

4. **Nuclear Physics by D.C. Tayal (Himalaya Publishing House)**

Course Outcomes:

.**Sr. No.**	**On completing the course, the students will be able to:**
CO1	Learn about elementary particles and cosmos.
CO2	Have detailed knowledge on quarks and their models.
CO3	Learn about four fundamental forces of nature and their mutual interaction.
CO4	Learn about various accelerators used to accelerate the charged particles to be carried out in various nuclear physics reactions for various research purposes.
CO5	Learn about particle detectors like G.M. counter and scintillation detectors etc. to detect the charged particles to be carried out in various research activities

B.Sc. (HONS.) PHYSICS SEMESTER–VI
BHP-362
CONDENSED MATTER PHYSICS – II

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: Understand the concept of lattice vibrations and specific heat of solids through in-depth study of different classical and quantum models. Gain an understanding of the idea of superconductivity, superconducting materials and properties of superconducting state. understand dielectrics and their properties. Acquire detailed knowledge of the current status of nanotechnology, different Nanoscale materials and their synthesis and characterization techniques.

Course Contents:

UNIT – I

Lattice vibrations, One Dimensional Monoatomic Lattice, phonons, phonon momentum during elastic and inelastic scattering, Inelastic scattering of photons by phonons, Specific heat of solids, Classical Model of specific heat of solids (Dulong and Petit's Law), Einstein and Debye Models of Specific Heat of Solids

UNIT – II

Superconductivity, Persistent Currents, Effect of magnetic field on super conductor, Meisner effect, Types of Super Conductors, London's equation and penetration depth, Thermodynamics of Superconductors, BCS theory (formation of cooper pairs), ground state and energy gap.

UNIT – III

Polar and Non Polar Molecules, Dielectric Polarization, Electric displacement vector and dielectric constant, Local Electric Field, Clausius Mosotti equation, Types of polarizabilities and frequency dependence

UNIT – IV

Basic ideas of materials at nanoscale, Difference from bulk material properties, Nanoparticles, Preparation of Nano Materials,**Top down and Bottom up approach, Ball milling. Physical vapor deposition (PVD): Thermal evaporation and E-beam**

evaporation, Chemical vapor deposition (CVD): Spray pyrolysis. Characterization techniques- X-RAY diffraction, Scanning electron microscopy, Transmission electron microscopy, UV-visible spectroscopy, Applications of nanotechnology in various fields.

Books Prescribed:

1. Concepts of Condensed Matter Physics, Vol. II, T.S. Bhatia and Rajesh Khatri, Vishal Publishing House
2. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
3. Elements of Modern Physics by S.H. Patil (TMGH, 1985).
4. Solid State Physics by Puri and Babbar.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand the concept of lattice vibrations and gain an insight into the origin of Different properties of solids.
CO2	Understand well the concept of specific heat of solids and its temperature variation through in-depth study of different classical and quantum models.
CO3	Gain an understanding on superconductivity, superconducting materials and properties of superconducting state.
CO4	Attain detailed knowledge about dielectrics and their properties.
CO5	Acquire detailed knowledge on the current status of nanotechnology, different Nanoscale materials and their synthesis and characterization techniques.

B.Sc. (HONS.) PHYSICS SEMESTER–VI
BHP-363
ELECTRONICS

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The purpose of the course is to analyze PN junctions in semiconductor devices under various conditions and to design and analyze simple rectifiers and voltage regulators using diodes. It includes the behavior of special purpose diodes like Zener diode, LED, Tunnel diode and photodiodes, BJT, FET and MOSFET circuits. It also helps to understand the applications of digital electronics, oscillators, amplifiers, transistors and h-parameters.

Course Contents:

UNIT–I

Concepts of current and voltage sources, **Introduction to CRO**, Intrinsic and Extrinsic semiconductors, Fermi level, Charge carriers in semiconductors, p-n junction, p-n junction fabrication techniques, Depletion region, Biasing of diode, V-I characteristics, Voltage-current equation for p-n junction, Ideal diode, Static and Dynamic resistance of a Junction Diode, Transition and diffusion capacitance, Avalanche breakdown and Zener breakdown, **Kirchoff's current law, Kirchoff's voltage law,** Introduction to Zener diode and voltage regulation, Rectification: half wave rectifier, full wave rectifiers (Centre tapped and bridge rectifiers), Efficiency, Ripple factor, Qualitative ideas of filter circuits (L-filter, Shunt capacitor filter, LC and π filters)

UNIT–II

Junction transistor : Transistor fabrication techniques, Structure and working, relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics, Accurate expressions for collector current, Transistor load line analysis, Thermal runaway and heat

sink, Transistor biasing and stabilization of operating point, Fixed bias, Base bias with emitter feedback, Collector to base bias, **Thevenin Theorem** Voltage divider biasing circuit. Structure and characteristics of JFET, FET biasing: self-bias and voltage divider bias, Comparison of BJT and FET, MOSFET: Enhancement and depletion type.

UNIT–III

Working of CB and CE amplifier, Concept of hybrid parameters, Amplifier analysis using h-parameters, Equivalent circuits, Determination of current gain, voltage gain, Power gain, Input resistance, output resistance, overall voltage gain, FET amplifier (common source configuration and common drain configuration) and its voltage gain, Feed back in amplifiers, Different types, Voltage gain, Advantage of negative feed back, Emitter follower as negative feed back circuit. Barkausen criterion of sustained oscillations, LC oscillator (tuned collector, tuned base Hartley), RC oscillators, phase shift and Wein bridge.

UNIT–IV

Analog and digital signals, Digital circuit, Binary number system, Decimal to binary conversion, Binary to decimal conversion, Octal number system, Hexadecimal number system, Binary coded decimal code (BCD code), Basic logic gates (AND, OR, NOT) and their truth tables, Different combinations of basic logic gates and truth tables, NAND and NOR as universal logic gates, Boolean algebra.

Books Prescribed:

1. Electronc Devices and Circuits-J. Milkman and C. C. Halkias(Tata Mcgraw Hill)
2. Basic Electronics and Linear Circuits by N.N. Bhargave, D.C. Kulshreshtha and S.C. Gupta.
3. Foundations of Electronics by D. Chatophadhyay, P.C. Rakshit, B. Saha and N.N. Purkit.
4. Basic Electronics by D.C. Tayal (Himalaya Pub.)
5. Principles of Electronics by V.K. Mehta & Rohit Mehta (S. Chand Publishers)

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Analyze PN junctions in semiconductor devices under various conditions.
CO2	Design and analyze simple rectifiers and voltage regulators using diodes.
CO3	Easily understand the behavior of special purpose diodes like Zener diode, LED, Tunnel diode and photodiodes.
CO4	Design and analyze simple BJT, FET and MOSFET circuits.
CO5	Understand the concept of basic electronics and applications of digital electronics.
CO6	Obtain the knowledge on oscillators, amplifiers, transistors and h-parameters

B.Sc. (HONS.) PHYSICS SEMESTER–VI
BHP-364
MOLECULAR SPECTROSCOPY AND LASER

Credit Hours (per week): 4
Total Hours: 60
Time: 3 Hours **Maximum Marks: 75**
(Theory Marks: 56+Internal Assessment: 19)
Pass Marks: 35%

Note for paper setter and students:

1. **There will be five sections.**
2. **Section A carries 12 marks and is compulsory consisting of eight short answer type questions of 2 marks each covering the whole syllabus. The candidate will have to attempt six questions in section A.**
3. **Sections B, C, D and E will be set from units I, II, III & IV respectively and will consist of two questions of 11 marks each from the respective unit. The candidates are required to attempt one question from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The purpose of the course is to introduce students with Microwave, Infra-Red, Raman and Electronic Spectroscopy. This course also provides the students a thorough understanding of the fundamentals of lasers: their unique properties, operations and their applications. It will equip the students with the knowledge of how a coherent light is generated and amplified and how lasers are used in communications, industries and medical sciences.

Course Contents:

UNIT–I

Microwave and Infra-Red Spectroscopy

Types of molecules, Theory of microwave spectroscopy: rotation of molecules, rotational spectra of diatomic molecules as a rigid rotator, Intensity of spectral lines, Effect of isotopic substitution, diatomic molecule as non rigid rotator technique and instrumentation of microwave spectroscopy The vibrating diatomic molecule: Energy of a diatomic molecule, simple harmonic oscillator, anharmonic oscillator, vibration frequency and force constant for anharmonic oscillator, Outline of technique and instrumentation, Applications of Infrared spectroscopy.

UNIT–II

Raman and Electronic Spectroscopy:

Nature of the Raman spectra, characteristic properties of Raman lines, Experimental arrangement for Raman spectra, Quantum and classical theories of Raman Effect, Pure rotational Raman spectra for linear molecule, Structure determination from Raman and infra-red spectroscopy, Outline of technique and instrumentation of Raman spectroscopy, Applications of Raman spectroscopy

Electronic spectra: Salient features of molecular electronic spectra, Formation of electronic spectra, **Frank Condon Principle, Vibrational Coarse Structure, Rotational Fine Structure of Electronic Vibration Transition, Fortrat Diagram, and Explanation of Intensity Distribution in Absorption Bands from Frank Condon.**

UNIT–III

Laser Fundamentals:

Interaction of light radiations with matter: Absorption and spontaneous emission, Einstein coefficients and their relations, light amplification, Concept of stimulated emission and population inversion, **Laser Beam Characteristics Directionality, Intensity, Coherence, Temporal Coherence, Spatial Coherence, Optical Resonator, Action of Optical Resonator, Resonator Cavity Configuration: Fabry-Perot Resonator, Concentric Resonator, Confocal Resonator,** Principal pumping schemes, **Laser Rate Equation for three level and Four Level systems**, Fauchber Ledenberg formula, Threshold and Schawlow Tonnes condition,

UNIT–IV

Laser Systems: Types of lasers, Ruby and Nd:YAG lasers, He-Ne and CO_2, **Semiconductor lasers**, construction and their working, Applications of lasers: Holography: The underlying principle, applications of Holography

Books Prescribed:

1. Introduction to Atomic Spectra: H.E. White-Auckland McGraw Hill, 1934.
2. Fundamentals of Molecular Spectroscopy: C.B. Banwell-Tata McGraw Hill, 1986.
3. Spectroscopy Vol. I, II & III: Walker &Straughen
4. Introduction to Molecular Spectroscopy: G.M. Barrow-Tokyo McGraw Hill, 1962.
5. Spectra of Diatomic Molecules: Herzberg-New York, 1944.
6. Molecular Spectroscopy: Jeanne L McHale.
7.Optics and lasers, T S Bhatia, V K Sharma, Publishers PV's

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand basic principles, technique and instrumentation of Microwave, Infra red and Raman spectroscopy.
CO2	Explain rotational, vibrational, electronic and Raman spectra of molecules.
CO3	Understand the applications of Infrared and Raman spectroscopy.
CO4	Grasp the basic principle behind the Laser action and also be able to differentiate between the three and four level lasers.
CO5	Explain the difference between Stokes and anti-Stokes lines in a Raman spectrum

B.Sc. (HONS.) PHYSICS SEMESTER–VI
BHP-365
PHYSICS LAB-VI

Credit Hours per week: 6
Time : 3 Hours **Maximum Marks : 50**
(Practical Marks: 37 + Internal Assessment: 13)
Pass Marks : 35%

Periods 8 Periods/week
General Guidelines for Practical Examination
I. The distribution of marks is as follows:
i) One experiment 15 Marks
ii) Brief Theory 5 Marks
iii) Viva–Voce 10Marks
iv) Record (Practical file) 7 Marks
II. There will be one session of 3 hours duration and the paper will consist of 10 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. No experiment is to be allotted to more than three examinee in any group.

Course Objectives: The objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to achieve perfectness in experimental skills. The study of practical applications will bring more confidence and ability to deal with technical equipments.

LIST OF EXPERIMENTS

1. Measure the phase shift between current and voltage for RC and LR circuit using CRO.
2. To study the formation of Lissajous Figures and compare the frequency of oscillations produced by two oscillator.
3. Determination of frequency of A.C. mains by using electrical vibrator.
4. To measure the reverse saturation current in a pn junction diode at various temperatures and to find the approximate value of energy band gap.
5. To determine energy band gap of a given semiconductor using Four probe method.
6. To study the phase shift analysis of the LCR circuit using CRO.
7. Study the working of the thermistor.
8. To study the working of RC Circuit as integrating and differentiating circuit.
9. Study of B-H curves of various materials using C.R.O, and determination of various magnetic parameters.
10. To study the response of RC circuit at different frequencies.
11. Study the characteristics of the Light dependent resistor LDR.
12. Study the characteristics of the Photodiode.
13. Determine k/e ratio using transistor in CE mode.
14. To determine the value of e/m for the electron by long solenoid method.
15. To study the magnetic susceptibility of $FeCl_3/Mn(SO_4)_2$ by Quinke's method.

Books Prescribed
1. Practical Physics by CL Arora S. Chand Publications
2. Practical Physics Volume III Vishal Publications

3. Prcatical Physics by S P Singh Pragati Parkashan Meerut.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
CO2	Study the characteristics of the Light dependent resistor LDR, photodiode and thermistor.
CO3	Measure the energy band gap of a semiconductor using pn junction diode and four probe method.
CO4	Measure the phase shift between current and voltage for RC and LR circuit, study the phase shift analysis of the LCR circuit, working of RC Circuit as integrating and differentiating circuit and B
CO5	Study the magnetic susceptibility of $FeCl_3/Mn(SO_4)_2$ by Quinke's method.

B.Sc. (HONS.) PHYSICS SEMESTER–VI
BHP-366
PHYSICS LAB-VII

Credit Hours per week: 6

Time : 3 Hours **Maximum Marks : 50**

(Practical Marks: 37 + Internal Assessment: 13)

Pass Marks: 35%

Periods 8 Periods/week

General Guidelines for Practical Examination

I. The distribution of marks is as follows:
i) One experiment 15 Marks
ii) Brief Theory 5 Marks
iii) Viva–Voce 10Marks
iv) Record (Practical file) 7 Marks
II. There will be one sessions of 3 hours duration and the paper will consist of 10 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 objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to achieve perfectness in experimental skills. The study of practical applications will bring more confidence and ability to deal with technical equipments.

Electronics Lab

LIST OF EXPERIMENTS

1. Testing of resistance, pn junction, transistor, FET.
2. To study IV characteristics of PN diode, Zener and Light emitting diode.
3. Study the working of Zener diode as voltage stabilizer. Study the output as function of the input voltage and variable load resistance.
4. To study the diode as clipping and clamping element.
5. To study the half-wave and a full-wave rectifier (central tapped and Bridge rectifier) using CRO. Calculate the ripple factor and voltage regulation.
6. To study the half-wave and a full-wave rectifier (Bridge rectifier) using L section and π section filters.
7. To study common emitter (CE) characteristics of a given transistor pnp/npn and to determine various parameters.
8. To study the characteristics of a Transistor in common base (CB) npn/pnp configuration.
9. To study the output and mutual characteristics of the N-channel/P-channel Field effect transistor (FET).
10. To study the frequency response of voltage gain of a RC-coupled transistor amplifier in CE mode.
11. To design a Wien bridge oscillator for given frequency using an op-amp.
12. To design a phase shift oscillator of given specifications using BJT.
13. To study the Colpitt`s oscillator.
14. To study the Hartley oscillator.
15. Calculate the h-parameters from the common base (CB)/ common emitter (CE) transistor.

16. To verify and design AND, OR, NOT and NAND gates.

Books Prescribed:

1. Practical Physics by CL Arora S. Chand Publications
2. Practical Physics Volume III Vishal Publications
3. Practical Physics by S P Singh Pragati Parkashan Meerut.

Course Outcomes:

Sr. No.	On completing the course, the students will be able to:
CO1	Understand and verify the characteristics of PN junction, Zener and Light emitting diodes , the role of PN diode in full and half wave rectification and the working of Zener diode as a voltage regulator.
CO2	Study to test the resistance of PN junction diode and transistor.
CO3	Verify the diode as clipping and clamping element and its role in half and full wave rectification using CRO.
CO4	Understand and verify the characteristics of transistor in common base (CB) and common emitter (CE) configuration and also learn the working of a transistor as an amplifier, its role in the construction of different oscillators such as phase-shift, Hartley and Colpit.
CO5	Verify and design the AND, OR, NOT and NAND gates.