FACULTY OF CHEMICAL SCIENCES

SYLLABUS

FOR

B.Sc. (Honours) CHEMISTRY

(SEMESTER: I-VI)

(Under Choice based Credit System)

Examinations: 2025 Onwards

Department of Chemistry

I K GUJRAL PUNJAB TECHNICAL UNIVERSITY

KAPURTHALA

Note:

(i) Subject to change in the syllabi at any time. Please visit the University website time to time.

IK Gujral Punjab Technical University

VISION

To be an institution of excellence in the domain of higher technical education that serves as the fountainhead for nurturing the future leaders of technology and techno- innovation responsible for the techno-economic, social, cultural and environmental prosperity of the people of the State of Punjab, the Nation and the World.

MISSION

To provide seamless education through the pioneering use of technology, in partnership with industry and society with a view to promote research, discovery and entrepreneurship and

To prepare its students to be responsible citizens of the world and the leaders of technology and techno-innovation of the 21st Century by developing in them the desirable knowledge, skill and attitudes base for the world of work and by instilling in them a culture for seamlessness in all facets of life.

OBJECTIVES

- To offer globally-relevant, industry-linked, research-focused, technology- enabled seamless education at the graduate, postgraduate and research levels in various areas of engineering & technology and applied sciences keeping in mind that the manpower so spawned is excellent in quality, is relevant to the global technological needs, is motivated to give its best and is committed to the growth of the Nation;
- To foster the creation of new and relevant technologies and to transfer them to industry for effective utilization;
- To participate in the planning and solving of engineering and managerial problems of relevance to global industry and to society at large by conducting basic and applied research in the areas of technologies**.** To develop and conduct continuing education programmes for practicing engineers and managers with a view to update their fundamental knowledge base and problem-solving capabilities in the various areas of core competence of the University;
- To develop strong collaborative and cooperative links with private and public sector industries and government user departments through various avenues such as undertaking

of consultancy projects, conducting of collaborative applied research projects, manpower development programmes in cutting**-**edge areas of technology, etc;

- To develop comprehensive linkages with premier academic and research institutions within the country and abroad for mutual benefit;
- To provide leadership in laboratory planning and in the development of instructional resource material in the conventional as well as in the audio**-** visual, the video and computer**-**based modes;
- To develop programmes for faculty growth and development both for its own faculty as well as for the faculty of other engineering and technology institutions;
- To anticipate the global technological needs and to plan and prepare to cater to them;
- To interact and participate with the community**/**society at large with a view to inculcate in them a feel for scientific and technological thought and endeavour; and
- To actively participate in the technological development of the State of Punjab through the undertaking of community development programmes including training and education programmes catering to the needs of the unorganized sector as well as that of the economically and socially weaker sections of society**.**

ACADEMIC PHILOSOPHY

The philosophy of the education to be imparted at the University is to awaken the **"deepest potential"** of its students as holistic human beings by nurturing qualities of self-confidence, courage, integrity, maturity, versatility of mind as well as a capacity to face the challenges of tomorrow so as to enable them to serve humanity and its highest values in the best possible way.

Department of Chemistry

VISION

The Chemical Sciences at IKGPTU campus will address the challenging and important questions in the physical and life sciences of current era using its multi-disciplinary vision, its culture of synergistic collaboration and translational science, and its excellence in the physical, medical and engineering sciences. Chemical Sciences Department continues to explore the new fields and frontiers and, with them, fundamentally new and innovative ways to address the increasingly complex scientific, health, energy and environmental problems of our time.

MISSION

- Inspiring and educating undergraduate students in chemistry and molecular-driven sciences in the core concepts of chemistry and the scientific methodology.
- To explore the new frontier area of organometallic catalysis in synthetic chemistry.
- Developing more-economic and greener strategies for chemical synthesis and production
- Understanding how molecules and materials behave, interact and transform at macroscopic, molecular, atomic and electronic levels, and exploring the contribution of geometric and electronic structure to function.
- Informing the public about the excitement of science, its impact on everyday life, and the crucial role it plays in human health, energy and environmental stewardship
- Building centralized, state-of-the-science facilities designed to promote collaborative synergies among faculty, staff and students and across disciplinary boundaries.
- Sharing the excitement of new chemical knowledge across IKGPTU and to other institutions, educators, and the global community through scientific communications and outreach.

TITLE OF THE PROGRAM: B.Sc. (Honours) CHEMISTRY

YEAR OF IMPLIMENTATION: New Syllabus will be implemented from June 2019 onwards.

DURATION: The course shall be three years, with semester system (6 semesters, with two semesters in a year). The Choice based credit system will be applicable to all the semesters.

ELGIBILITY FOR ADMISSION: Candidates with 50% marks (5% relaxation for SC/ST) in aggregate in 10+2 in any science subject or any other examination recognized equivalent thereto.

INTAKE CAPACITY: 45 (Forty five)

MEDIUM OF INSTRUCTION: English.

PROGRAM EDUCATIONAL OBJECTIVES:

The Program Educational Objectives (PEOs) of the B.Sc. (Honours) Chemistry Program indicate expectations from our graduates a few years after graduation

PEO1	Apply scientific knowledge of chemical sciences and its allied sciences and maturity of experience to lead in the solution of complex problems in chemical Sciences
PEO2	Become a technically qualified chemist to address complex problems and be able to apply learned skills in chemical world.
PEO3	Maintain and enhance professional competence by acquiring new knowledge and refining skills
PEO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PEO5	Apply reasoning using scientific knowledge to assess health, safety, legal and cultural issues of society.
PEO6	Fulfill the needs of society in solving technical problems using chemistry techniques, principles, tools and practices, in an ethical and responsible manner.

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

PO1	Describe and apply the basic principles of chemistry and to carry out practical techniques important in chemical analysis.
PO2	Create and evaluate hypotheses, theories, methods and evidence within their proper contexts. Solve complex problems by critical understanding, analysis and synthesis
PO3	Develop proficiency in the analysis of complex chemistry problems and the use of allied fields or other appropriate techniques to solve them.

PO4	Be familiarised with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.
PO5	Engage in lifelong learning and adapt to changing professional and societal needs.
PO6	Communicate effectively scientific information both in written and oral formats.

PROGRAM SPECIFIC OUTCOMES:

At the end of the program,

PSO1	Students will have an ability to identify, formulate, and solve complex chemical problems by applying principles of chemistry, science, and mathematics
PSO2	The students will acquire in-depth knowledge to understand the role of chemistry in society and critically interpret the chemical literature.
PSO3	Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to problems related to chemical sciences.
PSO4	Students will be able to address social, economic, and environmental issues.
PSO5	Students will be able to learn and analyze the various principles using various scientific experiments.
PSO6	Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
PSO7	Students will have an ability to communicate effectively with a range of audiences in writing and orally.

SCHEME OF THE PROGRAM:

Semester-I								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1.	BHCL101-19	Inorganic Chemistry-I	45	3-1-0	4	40	60	100
2.	BHCL102-19	Organic Chemistry-I	45	3-1-0	4	40	60	100
3.	UC-BSHP-112-19/ UGSEC2501	Electricity and Magnetism Or **Computer I (Problem Solving Techniques)**	45	3-1-0	4	40	60	100
4.	UC-BSHM-104-19	Calculus-I	45	3-1-0	4	40	60	100
5.	BHHL105-19	Communicative English-I	30	2-0-0	2	20	30	50
6.	BHHL106A-19 BHHL106B-19	Punjabi Compulsory-I OR Mudhli Punjabi-I	30	2-0-0	2	20	30	50
7.	BHCP107-19	Inorganic Chemistry Lab-I	40	0-0-4	2	30	20	50
8.	BHCP108-19	Organic Chemistry Lab-I	40	0-0-4	2	30	20	50
9	UC-BSHP-113-19	Physics Lab-I Or **Computer Lab I (Problem Solving Techniques Laboratory)**	40	0-0-4	2	30	20	50
		Total		**16-4-12**	**26**			**650**

Semester-II								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1.	BHCL111-19	Inorganic Chemistry-II	45	3-1-0	4	40	60	100
2.	BHCL112-19	Physical Chemistry-I	45	3-1-0	4	40	60	100
3.	UC-BSHP-124-19	Waves and Vibrations Or **Computer II**	45	3-1-0	4	40	60	100
4.	UC-BSHM-204-19	Vector Algebra & Vector Analysis	45	3-1-0	4	40	60	100
5.	BHHL115-19	Communicative English-II	30	2-0-0	2	20	30	50
6.	BHHL116A-19 BHHL116B-19	Punjabi Compulsory-II OR Mudhli Punjabi-II	30	2-0-0	2	20	30	50
7.	BHCP117-19	Inorganic Chemistry Lab-II	40	0-0-4	2	30	20	50
8.	BHCP118-19	Physical Chemistry Lab-I	40	0-0-4	2	30	20	50
9	UC-BSHP-125--19	Physics Lab-II Or **Computer Lab II**	40	0-0-4	2	30	20	50
		Total		**16-4-10**	**26**			**650**

Semester-III								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1.	BHCL201-19	Organic Chemistry-II (Chemistry of Functional Groups-II)	45	3-1-0	4	40	60	100
2.	BHCL202-19	Physical Chemistry-II (Chemical Thermodynamics)	45	3-1-0	4	40	60	100
3.	BHCL203-19	Spectroscopy	45	3-1-0	4	40	60	100
4.	UC-BSHP-214-19	Physics-III (Elements of Modern Physics**)** Or **Computer III**	45	3-1-0	4	40	60	100
5.	BHCL205-19	Environmental Science	30	2-0-0	2	20	30	50
6.	BHCP206-19	Organic Chemistry Lab-II (Functional group Transformations and their Identifications)	40	0-0-4	2	30	20	50
7.	BHCP207-19	Physical Chemistry Lab-II	40	0-0-4	2	30	20	50
8.	UC-BSHP-215-19	Physics Lab-III Or **Computer Lab III**	40	0-0-4	2	30	20	50
		Total		**14-4-12**	**24**			**600**

Semester-IV

Sr. No	Code	Theory Papers	Hours	L-T-P	Credits	Marks Distribution		Marks
						Internal	External	
1.	BHCL211-19	Inorganic Chemistry-III (Crystal field theory and transition elements)	45	3-1-0	4	40	60	100
2.	BHCL212-19	Physical Chemistry-III (Phase Equilibria and Chemical Kinetics)	45	3-1-0	4	40	60	100
3.	BHCL2XX-19	Discipline Specific Elective -I	45	3-1-0	4	40	60	100
4.	UC-BSHM-408-19	Maths-III	45	3-1-0	4	40	60	100
5.	BHCL216-19	Basic Analytical Chemistry	30	2-0-0	2	20	30	50
6.	BHCP217-19	Inorganic Chemistry Lab-III	40	0-0-4	2	30	20	50
7.	BHCP218-19	Physical Chemistry Lab-III	40	0-0-4	2	30	20	50
8.	BHCP219-19	Basic Analytical Chemistry Lab	40	0-0-2	2	30	20	50
		Total		**14-4-10**	**24**			**600**

Discipline Specific Elective-I

Sr. No	Code	Theory Papers	Hours	L-T-P	Credits	Marks Distribution		Marks
						Internal	External	
1	BHCL213-19	Green Chemistry	45	3-1-0	4	40	60	100
2	BHCL214-19	Polymer Chemistry	45	3-1-0	4	40	60	100
3		**Computer IV**	45	3-1-0	4	40	60	100

Semester-V								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1.	BHCL301-19	Inorganic Chemistry-IV (Organometallic Chemistry)	45	3-1-0	4	40	60	100
2.	BHCL302-19	Organic Chemistry-III (Heterocyclic Chemistry)	45	3-1-0	4	40	60	100
3.	BHCL303-19	Quantum Chemistry	45	3-1-0	4	40	60	100
4.	BHCL3XX-19	Discipline Specific Elective-II	45	3-1-0	4	40	60	100
5.	BHCL306-19	Ligand Field Theory	45	3-1-0	4	40	60	100
6.	BHCP307-19	Inorganic Chemistry Lab-IV	40	0-0-4	2	30	20	50
7.	BHCP308-19	Organic Chemistry Lab-III	40	0-0-4	2	30	20	50
		Total		**15-5-8**	**24**			**600**

Discipline Specific Elective-II								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1	BHCL304-19	Analytical Clinical Biochemistry	45	3-1-0	4	40	60	100
2	BHCL305-19	Industrial Chemicals and Environment	45	3-1-0	4	40	60	100
3		**Computer V**	45	3-1-0	4	40	60	100

Semester-VI								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1.	BHCL311-19	Organic Chemistry-IV (Natural Products and Biochemistry)	45	3-1-0	4	40	60	100
2.	BHCL312-19	Physical Chemistry-IV (Electrochemistry)	45	3-1-0	4	40	60	100
3.	BHCL3XX-19	Discipline Specific Elective-III	45	3-1-0	4	40	60	100
4.	BHCL3XX-19	Discipline Specific Elective-IV	45	3-1-0	4	40	60	100
5.	BHCP318-19	Organic Chemistry Lab-IV	40	0-0-4	2	30	20	50
6.	BHCP319-19	Physical Chemistry Lab-IV	40	0-0-4	2	30	20	50
		Total		**12-4-8**	**20**			**500**

Discipline Specific Elective-III & IV								
Sr. No	**Code**	**Theory Papers**	**Hours**	**L-T-P**	**Credits**	**Marks Distribution**		**Marks**
						Internal	External	
1	BHCL313-19	Catalysis	45	3-1-0	4	40	60	100
2	BHCL314-19	Analytical Methods in Chemistry	45	3-1-0	4	40	60	100
3	BHCL315-19	Nanochemistry	45	3-1-0	4	40	60	100
4	BHCL316-19	**Computer VI** (Molecular Modelling and Drug Design)	45	3-1-0	4	40	60	100

EXAMINATION AND EVALUATION

THEORY					
S.No.			Weightage in Marks		Remarks
1	Internal Evaluation	Mid-Semester Examination	30	10	MSTs, Quizzes, assignments, attendance, etc. Constitute internal evaluation. Best of two mid-semester exams will be considered for evaluation
2		Attendance	5	5	
3		Assignments	5	5	
4	External Evaluation	End-Semester Examination	60	30	Conduct and checking of the answer sheets will be at the university level.
	Total		**100**	**50**	
PRACTICAL					
1	Internal Evaluation	Daily evaluation of practical performance/ record/ viva voce	15		
2		Attendance	5		
3		Internal Practical Examination	10		
4	External Evaluation	Final Practical Examination	20		
		Total	**50**		

PATTERN OF END-SEMESTER EXAMINATION

I. **Part A** will be One Compulsory question consisting of short answer type questions [Q No. 1(a-h)] covering whole syllabus. There will be no choice in this question. It will be of 16 marks comprising of **8 questions of 2 marks each**.

II. **Part B** will be comprising of eight questions [2-9]. Student will have to attempt any six questions from this part. It will be of 24 marks with **6 questions of 4 marks each**.

III. **Part C** will be comprising of two compulsory questions with internal choice in both these questions [10-11]. It will be of 20 marks with **2 questions of 10 marks each**.

SYLLABUS OF THE PROGRAM

The syllabus has been upgraded as per provision of the UGC module and demand of the academic environment. The contents of the syllabus have been duly arranged unit wise and included in such a manner so that due importance is given to requisite intellectual and laboratory skills. The application part of the respective contents has been appropriately emphasized.

SEMESTER-I

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMISTY**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL101-19**			
Subject Title:	**INORGANIC CHEMISTRY-I**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	To teach the fundamental concepts of Inorganic Chemistry and their applications.			

Details of the Course (Atomic Structure and Chemical Bonding)

Unit	Contents	Contact Hours
I	**Atomic Structure:** Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.	10
II	**Periodicity of Elements:** s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s & p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.	11
III	**Chemical Bonding I:** (a) Properties of ionic substances, Occurrence of ionic bonding, The radius ratio rules, Efficiency of packing, Hexagonal close packing, Cubic close packing, Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Pervoskite, Rhenium oxide, Calcium carbide, The calcite	12

	and aragonite structures. (b) Lattice energy, Born-Haber cycle, The calculations of the lattice energy on the basis of Born- Lande equation, The predictive power of thermochemical calculations on ionic compounds, Covalent character in predominantly ionic compounds, Imperfections of crystals, Conductivity in ionic solids, Band theory, Intrinsic and photoexcited semiconductors, Transistors, High temperature superconductors.	
IV	**Chemical Bonding II:** The Lewis theory, Valence bond theory - A mathematical approach, Resonance, Valence Shell Electron Pair Repulsion Model (VSEPR theory), Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory, Concept of hybridization, Rules for obtaining hybrid orbitals, Extent of d-orbital participation in molecular bonding (SO_2, PCl_5, SO_3), Molecular orbital theory (LCAO method), Symmetry of molecular orbitals, Applications of MOT to homo- and hetero-nuclear diatomic molecules, Molecular orbital energy level diagrams (Be_2, N_2, O_2, F_2, LiH, NO, CO, HCl, NO_2, BeH_2, NO_2^-).	12

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	Lee, J.D.	Concise Inorganic Chemistry	ELBS, 1991.
2	Douglas, B.E. and Mc Daniel, D.H.	Concepts & Models of Inorganic Chemistry	Oxford, 1970
3	Atkins, P.W. & Paula	J. Physical Chemistry	Oxford Press, 2006
4	Day, M.C. and Selbin, J.	Theoretical Inorganic Chemistry	ACS Publications 1962

Course Outcomes and Mapping

At the end of the course, the student will be able to

CO1. Understand the fundamental concepts and postulates of various theories regarding the structure of atom

CO2. Learn the periodicity of the s & p block elements

CO3. Understand the various types of bonding present in the different inorganic compounds.

CO4. Learn about the various theories pertaining to the different types of bonding

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	2	2	3	3	2	3
CO2	2	1	2	3	2	3	3
CO3	1	2	2	2	3	3	2
CO4	0	2	1	3	2	2	2

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMISTRY**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL102-19**			
Subject Title:	**ORGANIC CHEMISTRY-I**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	1. To teach the basic principles, reaction mechanisms and stereochemistry of organic compounds**.** 2. To impart knowledge regarding physical properties and chemical reactions of alkanes, alkenes, dienes, alkynes, arenes, alkyl and aryl halides etc**.** 3. To predict and account for the most commonly encountered reaction mechanisms **(**substitution, addition and elimination**)** in organic chemistry**.**			

Details of the Course

Unit	Contents	Contact Hours
I	**Structure and Bonding** Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding. **Mechanism of Organic Reactions** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking, Types of reagents-electrophiles and nucleophiles, Types of organic reactions, Energy considerations, Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrenes), Assigning formal charges on intermediates and other ionic species. **Stereochemistry of Organic Compounds I** Isomerism and its types, Optical isomerism-elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeric centers, diastereomers, threo and erythro, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.	12

II	**Stereochemistry of Organic Compounds II** Geometric isomerism-determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds, Conformational isomerism-conformational analysis of ethane and n-butane, conformational analysis of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivative, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation. **Alkanes** Introduction, IUPAC nomenclature, Isomerism and classification of carbon atoms of alkanes, Sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), Physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. **Cycloalkanes** Cycloalkanes-nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring; banana bonds	13
III	**Alkenes, Cycloalkenes, Dienes and Alkynes** *Alkenes* Nomenclature, methods of synthesis (mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination), physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikiff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene. *Cycloalkenes* Methods of formation, conformation and Chemical reactions of cycloalkenes. *Dienes* Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2 and 1,4 addition, Diels-Alder reaction. *Alkynes* Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal-ammonia reductions, oxidation and polymerization.	10
IV	**Alkyl and Aryl Halides** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions**.** Mechanisms of nuclephilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams**.**	10

	Polyhalogen compounds**:** chloroform, carbon tetrachloride**.** Methods of formation of aryl halides, nuclear and side chain reactions**.** The addition elimination and the elimination**-**addition mechanisms of nucleophilic aromatic substitution reactions**.** Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides**.** Synthesis and uses of DDT and BHC**.** **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**-**carbonbond lengths of benzene, resonance structure, MO picture**.** Aromaticity**:** The Huckel rule, aromatic ions, Aromatic electrophilic substitution **-**general pattern of mechanism, role of sigma and pi complexes**.** Machansim of nitration, halogenation, sulponation, mercuration and Friedel**-**Crafts reaction**.** Energy profie diagrams**.** Activating and deactivating substituents, orientation and ortho**/**para ratio**.** Side chain reactions of benzene derivations**.** Birch reduction**.** Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl**.**	

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	R. T. Morrison and P. S. Boyd	Organic Chemistry, 5th Edition	Allyn and Bacon Inc., Boston, 1992
2	S. M. Mukerji, S. P. Singh and R. P. Kapoor	Organic Chemistry Vol. I/II	Wiley Eastern Ltd., New Delhi, 1985
3	F. A. Carey	Organic Chemistry	McGraw-Hill, Inc, 2003
4	G. Solomons	Fundamentals of Organic Chemistry	John Wiley, 2002
5	Jerry March	Organic Reaction Mechanism	John Wiley Ed. 5, 2002
6	L. G. Jr. Wade	Organic Chemistry	Prentice-Hall,1990
7	T. L. Gilchrist and C.W. Rees	Carbenes, Nitrenes and Arynes	Thomas Nelson and Sons Ltd., London

Course Outcomes and Mapping

At the end of the course, the student will be able to

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

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	3	3	-	3	1	2
CO2	3	-	3	1	3	2	1
CO3	4	2	1	-	4	4	-
CO4	4	4	4	-	4	3	-
CO5	4	3	4	-	4	-	-

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF CHEMISTY				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**UC-BSHP-112-19**			
Subject Title:	**ELECTRICITY AND MAGNETISM**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The objective of the course is to expose the students to the formal structure of electricity and magnetism so that they can use these as per their requirement.			

Details of the Course

Unit	Contents	Contact Hours
I	**Review of Vector Analysis:** Vector algebra, scalar and vector product; Concept of Fields; scalar and vector field; gradient, divergence and curl and their physical significance; Conservative field, Line, surface and volume integral of a vector field, Gauss-divergence theorem and Stoke's theorem.	10
II	**Electrostatics:** Electrostatic field; electric flux; Gauss's law in differential and integral form; Applications of Gauss law-Electric filed due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charge sheet; Electric potential as line integral of electric field, potential due to point charge and electric dipole; calculation of electric field from potential; Poisson's equation and Laplace's equation(Cartesian coordinate); Capacitance; capacitance of a spherical conductor and cylindrical capacitor, Energy per unit volume in electrostatic field, Dielectric medium, dielectric polarization and its types, Displacement vector, Boundary conditions.	13
III	**Magnetostatics:** Magnetic flux; magnetic flux density; Faraday's law; magnetomotive force; Biot-Savart's law and its applications-straight conductor, circular coil, divergence and curl of magnetic field; Ampere's Circuital law in differential and integral form; Magnetic vector potential; ampere's force law; magnetic vector potential; Energy stored in a magnetic field, boundary conditions on magnetic fields.	12
IV	**Maxwell's Equations and Electromagnetic Waves:** Equation of	11

	continuity for time varying fields; Inconsistency of ampere's law; concept of sinusoidal time variations (Phasor notation); Maxwell's equations in differential and integral form, physical significance; Maxwell equations in free space, static field and in Phasor notation; Difference between displacement current and conduction current; Wave equation in free space and in homogenous medium, Concept of Poynting vector; Poynting Theorem.	

Reference Books

1. David Griffiths, Introduction to Electrodynamics, Pearson Education India Learning Private Limited; 4th Edition.
2. E.C. Jordan and K.G. Balmain, Electromagnetic waves and radiating systems, Prentice Hall.
3. Kraus John D, Electromagnetics, McGraw-Hill Publisher
4. W. Saslow, Electricity, magnetism and light, Academic Press
5. A Textbook of Electricity and Magnetism, S K Sharma, Shalini Sharma, S Dinesh & Co.
6. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.

Course Outcomes and Mapping

At the end of the course, the student will be able to	
CO1	Understand and describe the different concepts of electromagnetism
CO2	To obtain the electric and magnetic fields for simple configurations under static conditions.
CO3	To analyse time varying electric and magnetic fields.
CO4	To understand Maxwell's equation in different forms and different media.
CO5	have a solid foundation in fundamentals required to solve problems and also to pursue higher studies.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	2	2	2	1	2
CO2	3	2	1	-	2	2	1
CO3	3	2	3	-	2	1	2
CO4	3	2	3	2	-	2	2
CO5	2	2	3	2	-	2	2

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMISTRY**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**UC-BSHM-104-19**			
Subject Title:	**CALCULUS-I**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	1. The fundamental concepts of differential and integral calculus**.** 2. The geometrical meaning of functions, limits, continuity, derivatives, mean value theorems**.** 3. Applications of derivatives and integrals**.** 4. Limit, Continuity, partial derivatives and their applications in finding extreme values**.** 5. The utility of double and triple integrals in finding area and volume bounded by surfaces**.**			

Details of the Course

Unit	Contents
I	Functions of single variable, Simple examples of limit, continuity, differentiability, Derivative of elementary functions **(**t**-**ratios, logarithmic functions, exponential functions**)**, Higher order derivatives, Statement of Mean value theorems and simple applications, Applications of derivative**:** increasing decreasing functions, extreme values of functions**. (Ref. 1)**
II	Integration as an inverse process of differentiation, Finding integrals by partial fractions, by parts, Statement of fundamental theorem of calculus, Finding definite integrals by method of substitution, Applications of definite integral in finding length of an arc, area under simple curves, area enclosed between two curves**. (Ref. 1)**
III	Introduction of Limit, continuity of functions of two variables with simple examples, partial derivatives, Total derivatives, Homogeneous functions, Statement of Euler**'**s theorem, Simple examples of maxima**-**minima of functions of several variables, Lagrange**'**s method of multipliers**.**
IV	Double integrals, Change of order of integration, Jacobian, Double integral in polar coordinates, Triple integrals, Simple applications in finding area and volumes**.**

Reference Books

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

Course Outcomes and Mapping

At the end of the course, the student will be

CO1. Understand the basic concepts of Differential and Integral Calculus.

CO2. Visualize all concepts geometrically.

CO3. Apply the knowledge of derivatives in finding extreme values of the function and definite integrals to find area under the curve.

CO4. Explain the concept of Limit, Continuity, partial derivatives of functions of severable variables and their applications.

CO5. Utilize the concept of multiple integrals in finding areas and volumes of different geometrical shapes.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	-	3	2	3	2	-
CO2	3	1	3	2	-	-	-
CO3	1	1	3	1	2	1	-
CO4	3	3	3	1	2	1	-
CO5	3	3	3	1	2	1	-

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMISTRY SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHHL105-19**			
Subject Title:	**COMMUNICATIVE ENGLISH-I**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**2**			
Objective(s):	1. To help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills. 2. To help the students become the independent users of English language. 3. To develop in them vital communication skills, integral to their personal, social and professional interactions. 4. To teach them the appropriate language of professional communication.			

Details of the Course

Unit	Contents	Contact Hours
I	**(A)** ***The Poetic Palette*** **(Orient Black Swan, Second Edition, 2016)** The following poems from this anthology are prescribed: 1. Pippa's Song: Robert Browning 2. Apparently With No Surprise: Emily Dickinson **3.** Fool and Flea: Jeet Thayil **(B)** ***Prose Parables*** **(Orient Black Swan, 2013)** The following stories from the above volume are prescribed: a. The Kabuliwallah : Rabindranath Tagore b. The Eyes Are Not Here: Ruskin Bond c. Grief: Anton Chekov	10
II	**Vocabulary: Word Formation Processes;** Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms **Grammar:** Subject-verb agreement; Noun-pronoun agreement; Misplaced modifiers; Articles; Determiners; Modals; Prepositions	06
III	**Reading and Understanding** Close Reading; Comprehension	04
IV	**Mechanics of Writing & Speaking Skills** Essay Writing (Descriptive/Narrative/Argumentative); Business letters; Précis Writing; Self Introductions; Group Discussion	10

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	John Eastwood	Oxford Practice Grammar	Oxford University Press,

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

Course Outcomes and Mapping

At the end of the course,

CO1. Students will acquire basic proficiency in reading &listening, writing and speaking skills.

CO2. Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.

CO3. They will be able to converse fluently and produce on their own clear and coherent texts.

CO4. Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	3	2	2	2
CO2	3	3	2	3	2	3	3
CO3	2	3	3	2	2	3	3
CO4	2	2	3	3	3	2	3
CO5	2	1	1	3	1	1	3

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF CHEMICAL SCIENCES				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHHL106A-19**			
Subject Title:	**PUNJABI COMPULSORY-I (ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-I)**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**2**			
Objective(s):	1. To enhance the language ability of students. 2. To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.			

Details of the Course

Unit	Contents	Contact Hours
I	**ਕਵਿਤਾ ਭਾਗ:** ਭਾਈ ਵੀਰ ਸਿੰਘ: ਸਮਾਂ, ਚਸ਼ਮਾ ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ : ਪੰਜਾਬ ਨੂੰ ਕੂਕਾਂ ਮੈਂ, ਹੱਲ ਵਾਹੁਣ ਵਾਲੇ ਪ੍ਰੋ.ਮੋਹਨ ਸਿੰਘ : ਮਾਂ, ਕੋਈ ਆਇਆ ਸਾਡੇ ਵਿਹੜੇ, ਪਿਆਰ ਪੰਧ ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ: ਆਖਾਂ ਵਾਰਿਸ ਸ਼ਾਹ ਨੂੰ, ਅੰਨਦਾਤਾ	8
II	**ਕਹਾਣੀ ਭਾਗ:** ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ : ਪੇਮੀ ਦੇ ਨਿਆਣੇ ਸੁਜਾਨ ਸਿੰਘ : ਕੁਲਫੀ ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ : ਤੂੜੀ ਦੀ ਪੰਡ ਗੁਰਦਿਆਲ ਸਿੰਘ : ਸਾਂਝ	8
III	ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਤੇ ਉਪ-ਭਾਸ਼ਾ ਵਿਚ ਅੰਤਰ, ਪੰਜਾਬੀ ਦੀਆਂ ਉਪ-ਭਾਸ਼ਾਵਾਂ,ਪੰਜਾਬੀ ਭਾਸ਼ਾ:ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ। ਭਾਸ਼ਾ ਤੇ ਲਿਪੀ, ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਗੁਰਮੁਖੀ ਲਿਪੀ: ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ।	8
IV	ਸੰਖੇਪ ਰਚਨਾ (ਪ੍ਰੈਸੀ) ਪੈਰ੍ਹਾ ਰਚਨਾ ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਪੈਰ੍ਹੇ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ	6

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ	ਸਾਹਿਤ ਦੇ ਰੰਗ	ਰਵੀ ਸਾਹਿਤ ਪਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ,2016.

Course Outcomes and Mapping

At the end of the course, the student will be able to

CO1. Translate and transfer/broadcast the western scientific knowledge in the local language.

CO2. Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.

CO3. Understand the society through Punjabi language, literature and culture.

CO4. Learning science and in developing science literacy.

CO5. Improve the internal communication**.**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	2	1	1	2	2	2
CO2	2	2	2	2	1	2	3
CO3	2	1	2	3	1	1	3
CO4	1	2	1	2	2	2	1
CO5	2	1	1	2	2	2	3

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHHL106B-19**			
Subject Title:	**MUDHLI PUNJABI-I (ਮੁਢਲੀ ਪੰਜਾਬੀ)**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**2**			
Objective(s):	1. To enhance the language ability of students. 2. To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.			

Details of the Course

Unit	Contents	Contact Hours
I	ਪੈਂਤੀ ਅੱਖਰੀ (ਵਰਣਮਾਲਾ), ਅੱਖਰ ਕ੍ਰਮ ਮਾਤਰਾਵਾਂ : ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ ਲਗਾਖਰ :ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ	8
II	ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ: ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ ਮੂਲ ਸ਼ਬਦ , ਅਗੇਤਰ, ਪਿਛੇਤਰ ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ, ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ ਸ਼ੁੱਧ- ਅਸ਼ੁੱਧ: ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿੱਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ	8
III	ਹਫਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ ਰੁੱਤਾਂ ਦੇ ਨਾਂ ਇਕ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ	6
IV	ਸਧਾਰਣ ਸ਼ਬਦਾਂ ਦਾ ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਸਧਾਰਣ ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਤੋਂ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ	8

Course Outcomes and Mapping

At the end of the course, the student will be able to

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

CO5. Improve the internal communication**.**							
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	2	1	1	2	2	2
CO2	2	2	2	2	1	2	3
CO3	2	1	2	3	1	1	3
CO4	1	2	1	2	2	2	1
CO5	2	1	1	2	2	2	3

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMISTRY**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCP107-19**			
Subject Title:	**INORGANIC CHEMISTRY LAB-I**			
Contact Hours:	**L:0**	**T:0**	**P:4**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The objective of this course is to provide practical knowledge and illustrative experiments about various types of inorganic titrations and preparation of simple inorganic compounds.			

Details of the Course

Unit	Contents
I	**(A) Titrimetric Analysis** (i) Calibration and use of apparatus (ii) Preparation of solutions of different Molarity/Normality of titrants **(B) Acid-Base Titrations** (i) Estimation of carbonate and hydroxide present together in mixture. (ii) Estimation of carbonate and bicarbonate present together in a mixture. (iii) Estimation of free alkali present in different soaps/detergents **(C) Oxidation-Reduction Titrimetry** (i) Estimation of Fe (II) and oxalic acid using standardized $KMnO_4$ solution. (ii) Estimation of oxalic acid and sodium oxalate in a given mixture. (iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator. **(D) Iodo / Iodimetric Titrations** (i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically). (ii) Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically (iii) Estimation of available chlorine in bleaching powder iodometrically. **(E) Inorganic preparations** (i) Cuprous Chloride, Cu_2Cl_2 (ii) Preparation of Manganese (III) phosphate, $MnPO_4.H_2O$ (iii) Preparation of Aluminium potassium sulphate $KAl(SO_4)_2.12H_2O$ (Potash alum) or Chrome alum.

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	Vogel, A.I.	A Textbook of Quantitative Inorganic Analysis	ELBS

Course Outcomes and Mapping

At the end of the course, the student will be able to

CO1. Understand to calibrate and run the instruments for analysis.

CO2. Learn to the quantitative analysis of various metal ions/cations and anions.

CO3. Understand the various principles of different techniques involved in the quantitative analysis.

CO4. Learn to prepare various inorganic compounds.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	2	2	3	3	2	2
CO2	2	1	2	2	1	2	3
CO3	1	2	2	2	2	3	2
CO4	2	2	1	2	3	2	1
CO5	1	1	2	2	1	1	3

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMISTRY**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCP108-19**			
Subject Title:	**ORGANIC CHEMISTRY LAB-I**			
Contact Hours:	**L:0**	**T:0**	**P:4**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The objective of this course is to provide practical knowledge and illustrative experiments regarding qualitative analysis, isolation, and purification of organic compounds.			

Details of the Course

Unit	Contents
I	**Determination of melting point** Napthalene 80**-**82^{o}, Benzoic acid 121**.**5**-**122^{o}, Urea 132**.**5**-**133^{o}, Succinic acid 184**.**5**-**185^{o}, Cinnamic acid 132**.**5**-**133^{o}, Salicylic acid 157**.**5**-**158^{o}, Acetanilide 113**.**5**-**114^{o}, m**-**Dinitrobenzene 90^{o}, p**-**Dichlorobenzene 52^{o}, Aspirin 135^{o} **Determination of boiling point** Ethanol 78^{o}, Cyclohexane 81**.**4^{o}, Toluene 110**.**6^{o}, Benzene 80^{o}
II	**Distillation** Simple distillation of ethanol**-**water mixture using water condenser Distillation of nitrobenzene and aniline using air condenser **Crystallization** Concept of induction of crystallization Phthalic acid from hot water **(**using fluted filter paper and stemless funnel**)** Acetanilide from boiling water Napthalene from ethanol Benzoic acid from water
III	**Qualitative Analysis** ***Elemental analysis*** nitrogen, sulphur, chlorine, bromine, iodine ***Functional groups*** -phenols, carboxylic acids -carbonyl compounds - ketones, aldehydes -carbohydrates -aromatic amines -amides, ureas and anilides -aromatic hydrocarbons and their halo- derivatives

Reference Books

S.No.	Author(s)	Title of the Book	Publisher
1	Brian S. Furniss, Antony J. Hannaford, Peter W.G. Smith and Austin R. Tatchell	Vogel's Textbook of Practical Organic Chemistry, 5th Edition	Longman, London
2	F.G. Mann and B. C. Saunders	Practical Organic Chemistry	Longman, New York
3	J.T. Sharp	Practical Organic Chemistry: A student handbook of techniques	Springer
4	Philippa B. Cranwell, Laurence M. Harwood and Cristopher J. Moody	Experimental Organic Chemistry, 3rd Edition	Wiley

Course Outcomes and Mapping

At the end of the course, the students will be able

CO1. To check the purity of organic compounds by determining the melting or boiling points

CO2. To develop preparative skills for purification of organic compounds by crystallization method.

CO3. To determine the element or functional groups present in organic compound by organic qualitative analysis.

CO4. To present their work with practical skills and the awareness of health and safety procedures.

CO5. To apply related experiments for their research work

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	-	2	-	3	1	-
CO2	2	-	3	-	3	3	-
CO3	3	3	4	-	3	3	-
CO4	3	4	3	4	4	5	4
CO5	2	3	4	2	4	4	4

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF CHEMISTRY				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**UC-BSHP-113-19**			
Subject Title:	**PHYSICS LAB -I**			
Contact Hours:	**L:0**	**T:0**	**P:4**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of the lab course is to introduce the students to the formal structure of electromagnetism and phenomenon of wave optics so that they can use these as per their requirement.			

Details of the Course:

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

List of experiments:

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

Reference Books

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

Course Outcomes and Mapping

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

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	2	1	2
CO2	3	3	1	-	2	2	1
CO3	3	3	2	-	2	1	2
CO4	3	2	2	2	-	2	2
CO5	2	2	2	2	-	2	2

Computer I (Problem Solving Techniques)

UGSEC2501	**Computer I (Problem Solving Techniques)**	**3L:1T:0P**	**4 Credits**

Course Objectives

CO1: Express the logical flow used in Programming.
CO2: Design algorithms for solving various real life problems
CO3: Implement programs using C.
CO4: Choose the right data type and statements for programs.
CO5: Explain various concepts of C programming language.

Prerequisite: This is an introductory programming course and hence no prerequisites

Course Content:

UNIT I: (CO-1, CO-2)

Logic Development: Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants. [CO1]

Operations and Expressions: Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions. [CO2]

UNIT II: (CO-2, CO-3, CO-4)

Data Input and Output: formatted & unformatted input output.
Control Statements: While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements.

UNIT III: (CO-2, CO-3, CO-4)

Functions: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. [CO4]
Arrays: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays.

Strings: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables. [CO3]

UNIT IV: (CO-2, CO-3, CO-4, CO-5)

Structures & Unions: Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions.

Pointers: Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays

File Handling: File Operations, Processing a Data File [CO5]

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill.
2. Programming in C, Third Edition, Stephen G Kochan, Pearson.
3. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication.

Reference Books:

1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

Computer Lab I (Problem Solving Techniques Laboratory)

UGSEC2502	**Problem Solving Techniques Laboratory**	**0L:0T:4P**	**2 Credits**

Course Outcomes: After studying this course, students will be able to:
CO1: Select the right statement for the program.
CO2: Experiment with different input values.
CO3: Test the output with boundary conditions.
CO4: Distinguish between various control statements and data types. CO5: Implement programs for various problems.

Instructions: Instructor can increase/decrease the experiments as per the requirement.
Assignments:
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1. WRITE A PROGRAM to display your name. Write another program to print message with inputted name.
2. WRITE A PROGRAM to add two numbers.
3. WRITE A PROGRAM to find the square of a given number.
4. WRITE A PROGRAM to calculate the average of three real numbers.
5. Write a program to Find ASCII Value of a Character
6. WRITE A PROGRAM to Find the Size of int, float, double and char
7. WRITE A PROGRAM to Compute Quotient and Remainder
8. WRITE A PROGRAM to accept the values of two variables.
9. WRITE A PROGRAM to find the simple interest, inputs are amount, period in years and rate of interest.
10. Basic salary of an employee is input through the keyboard. The DA is 25% of the basic salary while the HRA is 15% of the basic salary. Provident Fund is deducted at the rate of 10% of the gross salary(BS+DA+HRA). WRITE A PROGRAM to calculate the net salary
11. WRITE A PROGRAM to find area of a circle using PI as constant
12. WRITE A PROGRAM to find volume of a cube using side as input from user
13. WRITE A PROGRAM using various unformatted Input Functions
14. WRITE A PROGRAM to find area of rectangle and print the result using unformatted output Functions
15. WRITE A PROGRAM to find the larger of two numbers.
16. WRITE A PROGRAM to find greater of three numbers using Nested If.
17. WRITE A PROGRAM to find whether the given number is even or odd.
18. WRITE A PROGRAM to Generate Multiplication Table Using for loop
19. WRITE A PROGRAM to Generate Multiplication Table Using while loop
20. WRITE A PROGRAM to Make a Simple Calculator Using switch...case
21. WRITE A PROGRAM to find whether the given number is a prime number.
22. WRITE A PROGRAM using function to find the largest of three numbers
23. WRITE A PROGRAM using function to print first 20 numbers and its squares.

24. WRITE A PROGRAM to find the factorial of a given number.
25. WRITE A PROGRAM to print the sum of two matrices
26. WRITE A PROGRAM to Find the Length of a String
27. WRITE A PROGRAM to Copy String using strcpy()
28. WRITE A PROGRAM to compare a string
29. WRITE A PROGRAM to reverse a string
30. WRITE A PROGRAM to reverse a string
31. WRITE A PROGRAM to multiply two numbers using pointers.
32. WRITE A PROGRAM to display address of variable using pointers
33. WRITE A PROGRAM to show the memory occupied by Structure and Union
34. WRITE A PROGRAM to create Student I-Card using a Structure
35. WRITE A PROGRAM to read data from a file from a file
36. WRITE A PROGRAM to save Employee details in a file using File Handling