FACULTY OF CHEMICAL SCIENCES

SYLLABUS

FOR

B.Sc. (Honours) CHEMISTRY

(SEMESTER: I-II)

(Under Choice based Credit System)

Examinations: 2019 Onwards

Department of Chemical Sciences

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 Chemical Sciences

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.	BHCL103-19	Physics-I	45	3-1-0	4	40	60	100
4.	BHCL104-19	Mathematics-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	BHCP109-19	Physics Lab-I	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.	BHCL113-19	Physics-II	45	3-1-0	4	40	60	100
4.	BHCL114-19	Mathematics-II	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	BHCP119-19	Physics Lab-II	40	0-0-4	2	30	20	50
		Total		**16-4-10**	**26**			**650**

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 CHEMICAL SCIENCES**				
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.	11

	Sanderson's electron density ratio.	
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 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.	12
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 CHEMICAL SCIENCES**				
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 CHEMICAL SCIENCES				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL103-19**			
Subject Title:	**Physics -I**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The objective of this course in Physics is to equip students with the knowledge of Electromagnetic waves and Dielectrics, Magnetic and superconducting materials, Theory of Relativity and the concept of Crystallography.			

Details of the Course

Unit	Contents	Contact Hours
I	**EM waves & Dielectrics:** Physical significance of Gradient, Divergence & Curl, Relationship between Electric Field & Potential, Dielectric polarization, displacement Current, Types of polarization, Maxwell's Equations, Equation of EM waves in free space, velocity of EM waves, Poynting vector, Clausius-Mossotti equation.	12
II	**Magnetic Materials & Superconductivity:** Magnetisation, permeability and susceptibility, magnetic domains and hysteresis, classification of magnetic materials: Dia, Para, Ferro & Ferri, Ferrites, Magnetic Anisotropy, Magnetostriction its applications in production of Ultrasonic waves, Superconductivity, Superconductors as ideal diamagnetic materials, Signatures of Superconducting state, Meissner Effect, Type I & Type II superconductors, London Equations, Introduction to BCS theory.	11
III	**Elements of crystallography and X-rays**: Unit cell, Basis, Space lattice, Crystal Systems, Miller Indices of Planes & Directions in cubic system, Introduction, Production of X-rays, Continuous & Characteristic X-Rays, X-Ray Diffraction & Bragg's law in Crystals, Bragg's spectrometer, X-ray radiography.	12
IV	**Special Theory of Relativity:** Concept of Ether, Michelson Morley Experiment, Einstein's postulates, Lorentz transformation equations; length, time and simultaneity in relativity, addition of velocity, variation of mass with velocity, Mass-Energy and Energy-momentum relation.	11

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1.	Griffiths; DJ	Introduction to Electrodynamics	Prentice Hall
2.	Serway & Jewett	Physics for Scientists & Engineers (Vol. I & II)	6th Edition., Cengage Learning
3.	Malik; HK & Singh; AK	Engineering Physics	Tata McGraw Hill
4.	S. Sharma and J. Sharma	Engineering Physics,	Pearson, 2018
5.	Beiser; A., Mahajan; S. & Choudhary; SR	Concepts of Modern Physics	Tata McGraw Hill
6.	Raghvan V.	Materials Science & Engg.	Prentice Hall of India.
7.	Dan Wei	Solid State Physics,	Cengage Learning
8.	Azaroff LV	Introduction to Solids	Tata Mc Graw Hill
9.	S. Banerji and A. Banerji	The Special Theory of Relativity	PHI, 2012.

Course Outcomes and Mapping

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

CO1. Specify the constitutive relationships for fields and understand their important.

CO2. Acquire the knowledge of Maxwell equation and electromagnetic field theory and propagation and reception of electro-magnetic wave systems.

CO3. Explain the properties of magnetic material and superconductors in magnetic fields.

CO4. Explain the characteristics, properties, and applications of X-rays.

CO5. Derive and understand the need for relativity and their mathematical formalism.

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

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL104-19**			
Subject Title:	**MATHEMATICS-I**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	1. To apply basic concepts for clear understanding of mathematical principles. 2. To solve problems related to trigonometry, matrices and geometry. 3. Improve their ability to apply the knowledge of matrices and trigonometry to real life problems.			

Details of the Course

Unit	Contents	Contact Hours
I	**Trigonometry:** t-ratios, addition and subtraction formulae, multiple angles, sub-multiple angles, trigonometric equations, inverse trigonometry functions (proofs of articles are not required). Algebra: Fundamental principle of counting, Permutation and Combination with simple applications. Principle of mathematical induction, statement of Binomial Theorem and its applications.	12
II	**Determinants and Matrices:** Introduction to matrix, Different kinds of matrices, Addition, Multiplication, Symmetric and Skew symmetric matrix, Transpose of matrix. Determinant of matrix, properties of determinant, product of two matrices upto third order. Adjoint and Inverse of matrix, Rank of matrices, Condition of Consistency of system of linear equations, Eigen vectors and Eigen values using matrices, Cayley's Hamilton Theorem (without proof).	11
III	**Co-ordinate Geometry:** Polar & Cartesian co-ordinates in plane, different forms of straight lines, Angle between two straight lines, Conditions of parallelism and perpendicularity. Standard equations of circle, parabola, ellipse and hyperbola (without proof) and simple problems.	12
IV	**Solid Geometry:** Sphere, Cone, Cylinder	10

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year

1	Shanti Narayan	A Text book of Matrices	S Chand & Co. Ltd
2	B.S.Grewal	Elementary Engineering Mathematics	Khanna Publishers
3	B. L. Moncha and H.R. Choudhary	A text book of Engineering Mathematics	

Course Outcomes and Mapping

At the end of the course, the student will be

CO1. Acquainted with the basic concepts of t-ratios and their formulas.

CO2. Skilled to solve the problems related to matrices.

CO3. Capable to apply the concepts from determinants to solve linear system of equations.

CO4. Able to understand the concepts of Cartesian coordinates, lines, ellipse, parabola etc.

CO5. Familiar enough to use the essential tool of solid geometry in a comprehensive manner.

	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 CHEMICAL 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 LSRW skills- listening, speaking, reading, and writing

CO2. To develop their vocabulary so that they can understand spoken and written English language, particularly the language of their chosen technical field

CO3. To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas through study of literary texts.

CO4. They will be able to converse fluently and produce on their own clear and coherent texts.

CO5. To improve the employability of students and make them proficient in professional communication through understanding of career documents; job interviews; group discussions; internal communication in office environments etc.

	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 :	8

	ਤੂੜੀ ਦੀ ਪੰਡ ਗੁਰਦਿਆਲ ਸਿੰਘ : ਸਾਂਝ	
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 ਪ੍ਰਕਾਸ਼ਨ, 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	6

	ਇਕ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ	
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 CHEMICAL SCIENCES**				
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 KMnO4 solution. (ii) Estimation of oxalic acid and sodium oxalate in a given mixture. (iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator. **(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 CHEMICAL SCIENCES**				
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 CHEMICAL SCIENCES				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCP109-19**			
Subject Title:	**Physics Lab -I**			
Contact Hours:	**L:4**	**T:0**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The objective of this course is to enable the students to verify some of the concepts learnt in the theory courses. The course provides them training in carrying out precise measurements and handling sensitive equipment.			

Details of the Course:

Note: Students are expected to perform about 9-10 experiments from the following list, selecting minimum of 6-7 from the Section-A and 3-4 from the Section-B.

Section-A: Physical lab

1. Multimeter for measuring (a)Resistances (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the magnetic field of a circular coil carrying current.
3. To find out polarizability of a dielectric substance.
4. To find out the frequency of AC mains using electric-vibrator/sonometer.
5. To study B-H curve using CRO.
6. To find the velocity of ultrasound in liquid.
7. To determine the value of horizontal component of Earth's magnetic field Bh.
8. To determine unknown capacitance by flashing and quenching method.
9. To study laser interference using Michelson's Interferometer.

Section-B: Virtual Lab

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.

3.	To find out the frequency of AC mains using electric-vibrator/sonometer.
4.	To study V-I characteristic of a Ge-Si junction.
5.	Analyze the suitability of a given Zener diode as a power regulator.

Reference Books

S.No.	Author(s)	Title of the Book	Publisher
1	B.L. Flint and H.T. Worksop	Advanced Practical Physics for students	1971, Asia Publishing House
2	Michael Nelson and Jon M. Ogborn	Advanced level Physics Practical	4th Edition, reprinted 1985, Heinemann Educational Publishers
3	I. Prakash & Ramakrishna	A Text Book of Practical Physics	11th Edn. 2011, Kitab Mahal
4	S. Panigrahi & B. Mallick	Engineering Practical Physics	2015, Cengage Learning India Pvt. Ltd
5	C.L. Arora	Practical Physics	S. Chand & Company Ltd
6	http://www.vlab.co.in		

Course Outcomes and Mapping

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

CO1. verify some of the theoretical concepts learnt in the theory courses.

CO2. trained in carrying out precise measurements and handling sensitive equipment.

CO3. Introduced to 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. Write a technical report which communicates scientific information in a clear and concise manner

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

SEMESTER-II

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL111-19**			
Subject Title:	**INORGANIC CHEMISTRY-II**			
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

Unit	Contents	Contact Hours
I	**Chemistry of s & p block elements:** **IA-VII A and Zero Groups:** General remarks about each group, trends in electronic configuration, structure of elements, atomic and ionic, Radii, ionization potential, electron affinity, electronegativity, oxidation states, Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements, Important classes of Compounds of s and p block elements. **Alkali Metals:** Oxides, hydroxides, peroxides and super oxides, halides, halides, hydrides, solutions of metals in liquid ammonia, complexes crowns and cryptands and podands. **Alkaline Earth Metals:** Solutions of the metals in liquid ammonia, hydroxides, oxides, sulfates, hydrides, halides, carbides, structures of calcium carbide, structures of basic beryllium acetate $Be_4O(CH_3COO)_6$, beryllium oxalate complexes $Be(Oxalate)_2$. Structure of chlorophyll `a'.	11
II	**Chemistry of s & p block elements:**	13

	Group III (Boron Group): Oxides, halides and hydrides of group III elements, boron sesquioxide and borates structure of borates, trihalides and lower halides of boron, preparation of boron hydrides reactions and structures of boranes. **Group IV (Carbon Group):** Structure and allotropy of the elements, types and structure of carbides, oxides of carbon and silicon, types and structures of silicates, Organo-silicon compounds and the silicones, halides of IV group elements. **Group V (Nitrogen Group):** Hydrides, properties and structure of ammonia, hydrazine, hydroxylamine, trihalides and Pentahalides of V groups elements, oxides of nitrogen, structure of N_2O, NO, N_2O_3, N_2O_4 and N_2O_5, oxo acids of nitrogen and phosphorous, phosphazenes and cyclophosphazenes.	
III	**Chemistry of s & p block elements:** **Group VI (Oxygen Group):** Structure and allotropy of the elements. Oxides of sulfur (structure of SO_2 and SO_3) oxoacids of sulfur halides of sulfur, selenium and tellurium, compounds of Sulfur and nitrogen (S_4N_4). **Group VII:** Oxides of halogens (OF_2, O_2F_2, Cl_2O, ClO_2, Cl_2O_6, BrO_2, I_2O_5) (structures), Preparation, reaction and structure interhalogen compounds. (ClF_3, BrF_3, I_2, Cl_5, IF_5, IF_7) Polyhalides, basic properties of halogens. **Zero Group (Chemistry of noble gases):** Clatharate compounds, preparation, structure and bonding of noble gas compounds (XeF2, XeF4, XeF6, XeO3, XeO2F2, XeO4).	11
IV	**Coordination Chemsitry I:** Werner's theory, nomenclature of coordination complexes, isomerism in coordination complexes, chelating agents, metal chelates and chelate effects, names and abbreviations of important ligands, polydenate ligands, polypyarzolyborates, macrocylic ligands, macrocylic effect, ketoenolates, troplonates, tripod ligands, conformation of chelate rings, stereochemistry of coordination numbers 2-12, factors determining kinetic and thermodynamic stability.	10

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	J.D. Lee	Concise Inorganic Chemistry, 4th Ed.	ELBS, 1991
2	J.E. Huheey	Inorganic Chemistry	Harper & Row
3	F.A.Cotton and G. Wilinson	Advanced Inorganic Chemistry	Wiley, VCH, 1999
4	N.N. Greenwood and A. Earnshaw	Chemistry of Elements	Butterworth Heinemann 1997
5	G. L. Miessler & A. Tarr. Donald	Inorganic Chemistry 4th Ed.,	Pearson, 2010
6	B.E. Douglas, D.H. Mc Daniel, & J.J. Alexander	Concepts & Models of Inorganic Chemistry 3rd Ed.	John Wiley Sons, N.Y. 1994.

Course Outcomes and Mapping

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

CO5. Understand the fundamental concepts and theories of s & p block elements

CO6. Learn about the different compounds of s & p block elements, their structure, synthesis and stability of the coordination complexes.

CO7. Understand the structure, formation and properties of various compounds of s & p block elements.

CO8. Learn about various ligands and their effect on the formation of coordination compounds.

CO9. Learn about the terms and theories of the coordination compounds.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	2	3	2	2	3	2
CO2	2	1	2	3	3	2	2
CO3	1	2	2	3	2	2	1
CO4	1	2	2	3	2	2	1
CO5	0	1	2	2	1	2	1

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL112-19**			
Subject Title:	**PHYSICAL CHEMISTRY-I**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of physical chemistry viz. different states of matter and ionic equilibrium. The problem solving skills of students are expected to be enhanced through due weightage given to numerical problems in each unit.			

Details of the Course

Unit	Contents	Contact Hours
I	**Gaseous stat**e Kinetic molecular theory of gases: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy. Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behavior. van der Waals equation of state, its derivation and application in explaining real gas behaviour, continuity of states, critical state, relation between critical constants	12

	and van der Waals constants, law of corresponding states, Numericals.	
II	**Liquid state:** Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.	10
III	**Solid State** Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals.	11
IV	**Ionic equilibria** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.	12

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	P.W. Atkins & J. de Paula	Atkin's Physical Chemistry	Oxford University Press (2006)
2	S.H. Maron & C.F. Prutton	Principles of Physical Chemistry, 1st edition	Oxford and IBH (1958)
3	G.W. Castellan	Physical Chemistry, 4th edition	Narosa (2004)
4	D. W. Ball	Physical Chemistry	Thomson Press, India (2007)

Course Outcomes and Mapping

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

CO1.	Understand the basic principles and theories pertaining to various states of matter
CO2.	Solve various problems related to real gases and pH concept.
CO3.	Define the various types of crystal systems and defects in solids.
CO4.	Familiarise with the concept of acids and bases and differentiate between them
CO5.	Rationalise bulk properties and processes governing gaseous, liquid and solid states.

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

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY
DEPARTMENT OF CHEMICAL SCIENCES

Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL113-19**			
Subject Title:	**Physics -II**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The objective of this course in Physics is to equip students with the knowledge of Wave optics, Fibre optics and Lasers and to introduce them with the field of Nanophysics.			

Details of the Course

Unit	Contents	Contact Hours
I	**Wave Optics:** Interference: Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Michelson interferometer. Diffraction: Farunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power; Polarization: Introduction to polarization, polarisation by reflection, polarisation by double refraction.	12
II	**Lasers:** Spontaneous & Stimulated emissions, Einstein's theory of matter radiation interaction and A and B coefficients, Population Inversion, Pumping Mechanisms, Properties of laser beams, Components of a laser System, Three & four level laser systems; Ruby, He-Ne, CO_2 and semiconductor Lasers, and its applications, Introduction to Holography.	11
III	**Fibre Optics:** Introduction, optical fibre as a dielectric wave guide:	12

	total internal reflection, Acceptance Angle, Numerical Aperture and various fibre parameters, Normalized frequency, Modes of propagation, losses associated with optical fibres, step and graded index fibres, material dispersion & pulse broadening, fibre connectors, splices and couplers, applications of optical fibres.	
IV	**Nanophysics:** Introduction to Nanoscale, surface to volume ratio, electron confinement, nanoparticles (1D,2D,3D), Nanomaterials, Unusual properties of nanomaterials, top down and bottom approach, synthesis of nanomaterials-ball milling and sol-gel techniques, Carbon nanotubes, applications of nanomaterials, Basic idea of electron confinement in Quantum Dots.	11

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1.	Ghatak	**Optics**	McGraw Hill Education, 2012
2.	O. Svelto	Principles of Lasers	Springer Science & Business Media, 2010
3.	D. J. Griffiths	Quantum mechanics	Pearson Education, 2014
4.	R. Robinett	Quantum Mechanics	OUP Oxford, 2006
5.	P. Dass	Lasers & Optical engineering	Narosa Publishers
6.	K. Thygrajan, A.K. Ghatak	Laser Theory & Applications	Mc Millan India Ltd
7.	C.K. Kao	Optical Fibre system, Technology, Design & Applications	McGraw Hill
8.	Serway & Jewett	Physics for Scientists & Engineers (Vol. I & II)	6th Edition., Cengage Learning
9.	Malik; HK, Singh; AK	Engineering Physics	Tata McGraw Hill
10.	S. Sharma and J. Sharma	Engineering Physics	Pearson, 2018
11.	A. Beiser, S. Mahajan, S. R. Choudhary	Concepts of Modern Physics	Tata McGraw Hill

Course Outcomes and Mapping

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

CO6. Understand optical phenomenon, such as, polarization, interference, and diffraction in terms of the wave model.

CO7. Identify and illustrate the physical concepts and terminology used in Lasers, fibre optics, and nano physics

CO8. Describe the different types of lasers, its principle, properties of laser beam.

CO9. Describe the various types, working principle, properties and propagation of laser beam.

CO10. Acquire knowledge of basic properties and synthesis of nanoparticles.

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

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCL114-19**			
Subject Title:	**MATHEMATICS-II**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	4. To apply basic concepts for clear understanding of mathematical principles. 5. To solve problems related to Differential Calculus and integral calculus.			

Details of the Course

Unit	Contents	Contact Hours
I	**Function, Limit and Continuity** Functions and graphs, Domain and Co-Domain, range, Inverse Functions, Exponential and Logarithmic Functions, limit of Functions, Algebraic Computations of limits, Continuity of Functions at a point, Continuity of Functions in interval.	10
II	**Differential Calculus I** An Introduction to the Derivative, Differentiation of standard Functions, Formulae on derivative of sum, difference, product and quotient of functions, chain rule, derivative of Trigonometric functions, Inverse Trigonometric functions, Exponential and Logarithmic Functions. **Differential Calculus II** Differentiation of implicit functions, Derivative of functions expressed in parametric form, derivative of higher order, Increasing and decreasing functions, Sign of derivative, Maxima and Minima of a	14

	single variable. Introduction to Partial differentiation.	
III	**Differential Calculus III** Rolle's, Lagrange and Cauchy mean values theorems and their applications, Taylor theorem and Maclaurian's theorem with Lagrange's form of remainder and applications of formal expansions of functions.	10
IV	I**ntegral Calculus** Integration as inverse of differentiation, Indefinite Integral of standard forms, Methods of substitution, Methods of fractions, Integration by parts, Definite Integral.	10

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Reference Books

S.No.	**Author(s)**		**Publisher/Year**
1	Shanti Narayan	Differential Calculus	S Chand & Co Ltd
2	Shanti Narayan	Integral Calculus	S Chand & Co Ltd
3	B. S. Grewal	Elementary Engineering Mathematics	Khanna Publishers
4	B. L. Moncha and H.R. Choudhary	A text book of Engineering Mathematics	-

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHHL115-19**			
Subject Title:	**Communicative English-II**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**2**			
Objective(s):	5. To help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills 6. To develop in them vital communication skills, integral to their personal, social and professional interactions 7. To teach them the appropriate language of professional communication. 8. To help the students become the independent users of English language.			

Details of the Course

Unit	Contents	Contact Hours
I	**(Literature)** **(C) *The Poetic Palette* (Orient BlackSwan, Second Edition, 2016)** The following poems from this anthology are prescribed: 4. The Soul's Prayer: Sarojini Naidu 5. I Sit and Look Out: Walt Whitman 6. Women's Rights: Annie Louise Walker **(D) *Prose Parables* (Orient Black Swan, 2013)** The following stories from the above volume are	10

	prescribed: a. The Doctor's Word: R.K. Narayan b. The Doll's House: Katherine Mansfield c. Dusk: H.H. Munroe (Saki)	
II	**Vocabulary:** Standard abbreviations; One word substitution; Word Pairs (Homophones/Homonyms) **Grammar:** Sentence Structures; Use of phrases and clauses in sentences; Transformation of Sentences; Importance of proper punctuation	06
III	**Reading and Understanding:** Summary Paraphrasing; Analysis and Interpretation; Translation (from Hindi/Punjabi to English and vice-versa) Close Reading; Comprehension;	04
IV	**Mechanics of Writing & Speaking Skills:** Report writing; Career Documents- Job applications, Resume/CV writing, Common Everyday Situations: Conversations & Dialogues, Formal Presentations	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,

CO6. Students will acquire basic proficiency in LSRW skills- listening, speaking, reading, and writing.

CO7. To develop their vocabulary so that they can understand spoken and written English language, particularly the language of their chosen technical field

CO8. To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas through study of literary texts.

CO9. They will be able to converse fluently and produce on their own clear and coherent texts.

CO10. To improve the employability of students and make them proficient in professional communication through understanding of career documents; job interviews; group discussions; internal communication in office environments etc.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	3	2	2	2
CO2	3	2	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:	**BHHL116A-19**			
Subject Title:	**PUNJABI COMPULSORY-II (ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II)**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**2**			
Objective(s):	3. To enhance the language ability of students. 4. 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	ਡਾ.ਹਰਿਭਜਨ ਸਿੰਘ: ਅਪ੍ਰਮਾਣਿਕ, ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਰੀ ਦੀ ਦਾਸਤਾਨ	8

	ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ: ਕੰਡਿਆਲੀ ਥੋਰ੍ਹ, ਧਰਮੀ ਬਾਬਲ ਪਾਪ ਕਮਾਇਆ, ਰੁੱਖ ਪਾਸ਼: ਇਨਕਾਰ,ਸਭ ਤੋਂ ਖਤਰਨਾਕ,ਦਹਿਕਦੇ ਅੰਗਿਆਰਾਂ ‘ਤੇ ਸੁਰਜੀਤ ਪਾਤਰ: ਹੁਣ ਘਰਾਂ ਨੂੰ ਪਰਤਣਾ, ਕੁਝ ਕਿਹਾ ਤਾਂ..., ਪੁਲ	
II	**ਕਹਾਣੀ ਭਾਗ:** ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ: ਕੋਈ ਇਕ ਸਵਾਰ ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼: ਲੱਛਮੀ ਮੋਹਨ ਭੰਡਾਰੀ : ਘੋਟਣਾ ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ : ਆਪਣਾ ਆਪਣਾ ਹਿੱਸਾ	8
III	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਉਪਰ ਪਏ ਪ੍ਰਭਾਵ	6
IV	ਰਿਪੋਰਟਿੰਗ, ਸਮਾਚਾਰ ਲਿਖਣ ਦੀ ਵਿਧੀ ਤੇ ਤੱਤ ਪੰਜਾਬੀ ਪੈਰ੍ਹੇ ਦਾ ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ ਦਫਤਰੀ ਚਿੱਠੀ ਪੱਤਰ	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	**ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ**	**ਸਾਹਿਤ ਦੇ ਰੰਗ**	**ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, 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:	**BHHL116B-19**			
Subject Title:	**MUDHLI PUNJABI-II (ਮੁਢਲੀ ਪੰਜਾਬੀ-II)**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**2**			
Objective(s):	3. To enhance the language ability of students. 4. 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	ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਤੇ ਵਰਤੋਂ- ਨਾਂਵ ਪੜਨਾਂਵ ਵਿਸ਼ੇਸ਼ਣ ਕਿਰਿਆ ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ	8
II	ਰੋਜ਼ਾਨਾ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ: ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ ਤੇ ਕਿੱਤਿਆਂ ਸਬੰਧੀ।	6
III	ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ : ਸਧਾਰਣ ਵਾਕ ਸੰਯੁਕਤ ਵਾਕ ਮਿਸ਼ਰਤ ਵਾਕ	8
IV	ਸਧਾਰਣ ਵਾਕਾਂ ਦਾ ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਸਧਾਰਣ ਵਾਕਾਂ 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 CHEMICAL SCIENCES**	
Course Name	**B.Sc. (Honours) Chemistry**
Subject Code:	**BHCP117-19**
Subject Title:	**INORGANIC CHEMISTRY LAB-II**

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 regarding salt analysis.			

Details of the Course

Unit	Contents
I	Identification of cations and anions in a mixture which may contain combinations of acid ions. These must contain interferring acid anions and one, the insoluble. **(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 bromide. (vii) Chloride in the presence of iodide. (viii) Bromide and iodide in the presence of each other and of chloride. (ix) Iodate and iodide in the presence of each other. (x) Phosphate, arsenate and arsenite in the presence of each other. (xi) Sulphide, sulphite, thiosulphate and sulphate in the presence of each other. (xii) Borate in the presence of copper and barium salts. (xiii) Oxalate in the presence of fluoride. (xiv) Oxalate, tartrate, acetate, citrate in the presence of each other. **(b) Separation and Identification of Cations in Mixtures** (i) Separation of cations in groups. (ii) Separation and identification of Group I, Group II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations. **(c) Identification of Cations Including Less Familiar Elements by Spot Tests Assisted by Group Analysis (3 cations).**

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	Vogel, A.I.	Vogel's book on Inorganic Qualitative Analysis	ELBS

Course Outcomes and Mapping

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

CO1. Understand the concept of qualitative analysis.

CO2. Learn to identify present cations and anions through qualitative analysis of various metal ions/cations and anions.

CO3.	Understand the various techniques/principles involved in the qualitative analysis of mixtures in presence or absence of interfering ions.
CO4.	Learn to separate and identify less familiar ions through qualitative analysis.

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

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY **DEPARTMENT OF CHEMICAL SCIENCES**				
Course Name	**B.Sc.(Honours) Chemistry**			
Subject Code:	**BHCP118-19**			
Subject Title:	**PHYSICAL CHEMISTRY LAB-I**			
Contact Hours:	**L:0**	**T:0**	**P:4**	**Credits:2**

Examination Duration (hours)	**3**
Objective(s):	To provide students practical knowledge and skills about various topics taught in theory class of physical chemistry, which in turn will enhance their problem solving and analytical skills.

Details of the Course

Unit	Contents
I	**Surface tension measurements.** a) Determine the surface tension by (i) drop number (ii) drop weight method. b) Study the variation of surface tension of detergent solutions with concentration.
II	**Viscosity measurement using Ostwald's viscometer.** **a)** Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. **b)** Study the variation of viscosity of sucrose solution with the concentration of solute.
III	Indexing of a given powder diffraction pattern of a cubic crystalline system.
IV	**pH metry** a) Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures. b) Preparation of buffer solutions of different pH; (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide c) pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. d) Determination of dissociation constant of a weak acid.

Reference Books

S.No.	Author(s)	Title of the Book	Publisher
1	J.B. Yadav	Practical Physical Chemistry	Krishna
2	Findlay	Practical Physical Chemistry	Longman, New York

Course Outcomes and Mapping

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

CO1. Understand the basic procedures for carrying out a physical chemistry practical like preparation and standardisation of solutions, handling the equipments and measuring with precision.

CO2. Correlate the theoretical and practical aspects and know about the limits of the experimental error.

CO3. Determine the various physical parameters for the various problems under study.

CO4. Verify various laws studied in the theory part.

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

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF CHEMICAL SCIENCES				
Course Name	**B.Sc. (Honours) Chemistry**			
Subject Code:	**BHCP119-19**			
Subject Title:	**Physics Lab -II**			
Contact Hours:	**L:4**	**T:0**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			

Objective(s):	The objective of this course is to enable the students to verify some of the concepts learnt in the theory courses. The course provides them training in carrying out precise measurements and handling sensitive equipment.

Details of the Course:

Note: Students are expected to perform about 9-10 experiments from the following list, selecting minimum of 6-7 from the Section-A and 3-4 from the Section-B.

Section-A: Physical lab

1. Measurements of length (or diameter) using Vernier Caliper, screw gauge, and travelling microscope. Use of Plumb line and Spirit level.
2. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
3. Study of diffraction using laser beam and thus to determine the grating element.
4. To determine numerical aperture of an optical fibre.
5. To determine attenuation & propagation losses in optical fibres.
6. To find the resolving power of the prism.
7. To determine the angle of a given prism.
8. To find the refractive index of a material using spectrometer.
9. To find the refractive index of a liquid using spectrometer.

Section-B: Virtual Lab

1. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
2. Study of diffraction using laser beam and thus to determine the grating element.
3. To determine numerical aperture of an optical fibre.
4. To find the angle and resolving power e prism.
5. To find the refractive index of a material using spectrometer.

Reference Books

S.No.	Author(s)	Title of the Book	Publisher
1	B.L. Flint and H.T. Worksop	Advanced Practical Physics for students	1971, Asia Publishing House
2	Michael Nelson and Jon M. Ogborn	Advanced level Physics Practical	4th Edition, reprinted 1985, Heinemann Educational Publishers
3	I. Prakash & Ramakrishna	A Text Book of Practical Physics	11th Edn. 2011, Kitab Mahal
4	S. Panigrahi & B. Mallick	Engineering Practical Physics	2015, Cengage Learning India Pvt. Ltd
5	C.L. Arora	Practical Physics	S. Chand & Company Ltd
6	http://www.vlab.co.in		

Course Outcomes and Mapping

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

CO6. verify some of the theoretical concepts learnt in the theory courses.

CO7. trained in carrying out precise measurements and handling sensitive equipment.

CO8. Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic errors.

CO9. Learn to draw conclusions from data and develop skills in experimental design.

CO10. Write a technical report which communicates scientific information in a clear and concise manner

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