

# **Study Scheme & Syllabus of** **Bachelor of Science in Non-Medical** **(B.Sc. Non-Medical)**

## **Batch 2018 onwards**



**By**

**Department of Academics**  
**IK Gujral Punjab Technical University**

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. (Non-Medical) Batch 2018 onwards**

Semester 1<sup>st</sup>

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSNM101-18	Organic Chemistry	3	0	0	25	50	75	3
BSNM102-18	Inorganic Chemistry	3	0	0	25	50	75	3
BSNM103-18	Mathematical Physics	3	0	0	25	50	75	3
BSNM104-18	Mechanics-I	3	0	0	25	50	75	3
BSNM105-18	Differential Calculus	3	0	0	25	50	75	3
BSNM106-18	Solid Geometry	3	0	0	25	50	75	3
BSNM107-18	English	3	0	0	25	50	75	3
BSNM108-18 BSNM108A-18	Punjabi /OR Punjab History & Culture	3	0	0	25	50	75	3
BSNM109-18	Chemistry Lab-I	0	0	4	30	20	50	2
BSNM110-18	Physics Lab-I	0	0	4	30	20	50	2
	<b>Total</b>	<b>24</b>	<b>0</b>	<b>8</b>	<b>260</b>	<b>440</b>	<b>700</b>	<b>28</b>

## Semester-I

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>ORGANIC CHEMISTRY</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

### Details of the Course

Unit	Content
<b>I</b>	<p><b>Structure and Bonding</b>  Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.</p> <p><b>Mechanism of Organic Reactions</b>  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.  Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).</p>
<b>II</b>	<p><b>Stereochemistry of Organic Compounds</b>  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 stereogenic centers, diastereomers, threo and erythro, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D &amp; L and R &amp; S systems of nomenclature.  Geometric isomerism - determination of configuration of geometric isomers. E &amp; 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.</p>
<b>III</b>	<p><b>Alkanes and Cycloalkanes</b>  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 - 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.</p>
<b>IV</b>	<p><b>Alkenes, Cycloalkenes, Dienes and Alkynes</b>  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, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation,</p>

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	<p>ozonolysis, hydration, hydroxylation and oxidation with <math>\text{KMnO}_4</math>, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.</p> <p><i>Cycloalkenes</i> Methods of formation, conformation and Chemical reactions of cycloalkenes.</p> <p><i>Dienes</i> 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.</p> <p><i>Alkynes</i> 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.</p>
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"><li>1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.</li><li>2. Fundamentals of Organic Chemistry, Solomons, John Wiley.</li><li>3. Organic Chemistry. F.A. Carey, McGraw Hill, Inc.</li><li>4. Organic Chemistry, L.G. Wade Jr. Prentice Hall.</li><li>5. Organic Chemistry Vol. I, II &amp; III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd (New Age International).</li><li>6. Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmillan.</li></ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>INORGANIC CHEMISTRY</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p><b>Atomic Structure</b>  de Broglie equation, Heisenberg's Uncertainty Principle and its significance. Schrödinger's wave equation and its derivation, significance of <math>\psi</math> and <math>\psi^2</math>. Quantum numbers. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions and distribution curves. Shapes of s, p, d and f orbitals.  Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations.</p>
<b>II</b>	<p><b>Chemical Periodicity</b>  Effective nuclear charge, shielding or screening effect (Slater rules), variation of effective nuclear charge in periodic table.  Atomic and ionic radii, Ionization enthalpy, Electron gain enthalpy and their trend in groups and periods.  Electronegativity and various scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity.</p>
<b>III</b>	<p><b>Chemical Bonding I</b>  <i>Ionic bond:</i> General characteristics of ionic compounds, size effects, radius ratio rule and its limitations. 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.  Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.</p>
<b>IV</b>	<p><b>Chemical Bonding II</b>  <i>Covalent bond:</i> Lewis structure, Valence Bond theory, VSEPR theory (Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory), Hybridization, Molecular orbital theory (LCAO method). Molecular orbital diagrams of diatomic and simple polyatomic molecules (<math>\text{Be}_2</math>, <math>\text{N}_2</math>, <math>\text{O}_2</math>, <math>\text{F}_2</math>, <math>\text{LiH}</math>, <math>\text{NO}</math>, <math>\text{CO}</math>, <math>\text{HCl}</math>, <math>\text{NO}_2</math>, <math>\text{BeH}_2</math>, <math>\text{NO}_2^-</math>), Formal charge, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds (Bond moment, dipole moment, Percentage ionic character)  <i>Metallic Bond:</i> Valence bond and band theories. Semiconductors and insulators, defects in solids.  <i>Weak Interactions:</i> van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, Hydrogen bonding.</p>
	<p><b>Recommended Books:</b>  1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.  2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.  3. J.D. Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.</p>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title</b>	<b>MATHEMATICAL PHYSICS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p><b>First Order and Second Order Ordinary Differential equations:</b> First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problem.</p> <p><b>Calculus of functions of more than one variable:</b> Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.</p>
<b>II</b>	<p><b>Vector Calculus:</b> Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.</p>
<b>III</b>	<p><b>Vector Differentiation:</b> Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities.</p> <p><b>Vector Integration:</b> Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications.</p>
<b>IV</b>	<p><b>Orthogonal Curvilinear Coordinates:</b> Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.</p> <p><b>Dirac Delta function:</b> Dirac Delta function and its properties: Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function.</p>
	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7<sup>th</sup> Edn., Elsevier.</li> <li>2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning.</li> <li>3. Differential Equations, George F. Simmons, 2007, McGraw Hill.</li> <li>4. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.</li> <li>5. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book.</li> <li>6. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning.</li> <li>7. Mathematical Physics, Goswami, 1<sup>st</sup> edition, Cengage Learning.</li> <li>8. Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press.</li> <li>9. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.</li> <li>10. Essential Mathematical Methods, K.F.Riley &amp; M.P.Hobson, 2011, Cambridge Univ. Press.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>			
<b>Subject Title:</b>	<b>Mechanics-I</b>		
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0 Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Fundamentals of Dynamics:</b> Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable- mass system: motion of rocket. Motion of a projectile in Uniform gravitational field. Conservation of Energy, Conservative forces, Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Angular Momentum about the Centre of mass, Rotational invariance, Shape of Galaxy.
<b>II</b>	<b>Work and Energy:</b> Work and Kinetic Energy Theorem. Conservative and non- conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. <b>Elastic and Inelastic Scattering:</b> Types of scattering and conservation laws, Laboratory and centre of mass systems, collision of particles which stick together, General elastic collision of particles of different mass, Cross-section of elastic scattering, Rutherford scattering.
<b>III</b>	<b>Rotational Dynamics:</b> Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation. Cylinder on an accelerated rough plane, Behavior of angular momentum vector, Principal axes and Euler's equations, Elementary Gyroscope, Symmetrical Top.
<b>IV</b>	<b>Elasticity:</b> Hooke's law-Stress-strain diagram-Elastic moduli-Relation between elastic constants-Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire-Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - $q$ , $\eta$ , and $\sigma$ by Searles method
	<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.</li> <li>2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.</li> <li>3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.</li> <li>4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.</li> <li>5. Feynman Lectures, Vol. I, R.P. Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education</li> <li>6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.</li> <li>7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.</li> <li>8. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000</li> <li>9. University Physics. F.W Sears, M.W Zemansky, H. D Young 13/e, 1986, Addison Wesley.</li> <li>10. Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serwa, 2010, Cengage Learning.</li> <li>11. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>DIFFERENTIAL CALCULUS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>
<b>I</b>	Definition of a sequence. limit of a sequence, theorems on limits of sequences, bounded, monotonic sequences. Least upper bound and greatest lower bound of a sequence. Limit superior, limit inferior. Nested Intervals. Cauchy's convergence criterion, infinite series.
<b>II</b>	Limits of Functions, $\varepsilon - \delta$ definition, right- and left-hand limits. Theorems on limits. Infinity. Special Limits. Continuity, $\varepsilon - \delta$ definition, right- and left-hand Continuity, continuity in an interval, theorems on continuity, piecewise continuity, uniform Continuity.
<b>III</b>	The concept and definition of a derivative, right- and left-hand derivatives, differentiability in an interval, piecewise differentiability, differentials, differentiation of composite functions, implicit differentiation, mean value theorems, Taylor theorem, applications.
<b>IV</b>	Functions of two or more variables, neighborhoods, regions, limits, iterated limits, continuity, uniform continuity, partial derivatives, higher-order partial derivatives, differentials, theorems on differentials, differentiation of composite functions, Euler's theorem on homogeneous functions. Implicit functions, Jacobians, partial derivatives using Jacobians, theorems on Jacobians, applications.
	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Robert Wrede and Murray R. Spiegel, Advanced Calculus, 3<sup>rd</sup> Edition, Schaum's Outline Series (McGraw Hill), 2010.</li> <li>2. Maurice D Weir, Frank R. Giordano and Joel Hass, Thomas' Calculus, 11<sup>th</sup> Edition, Pearson, 2008.</li> <li>3. James Stewart, Calculus, 5<sup>th</sup> Edition, Brooks/Cole(Thomson), 2003.</li> <li>4. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>SOLID GEOMETRY</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>
<b>I</b>	The concept of co-ordinates, co-ordinate of a point in space, distance between two points. Plane: Definition of a plane, Normal form of the equation of a plane, Transformation from general form to normal form, Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.
<b>II</b>	Sphere: Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a plane; Conjugate points; Conjugate planes; Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres.
<b>III</b>	Cone: Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; Enveloping cone of a sphere; Equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone; Condition that a cone may have three mutually perpendicular generators; Intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex; Right circular cone; Equation of the right circular cone with a given vertex; axis and semi-vertical angle.
<b>IV</b>	Cylinder: Definition of a cylinder, Equation to the cylinder whose generators intersect a given conic and are parallel to a given line; Enveloping cylinder of a sphere; The right circular cylinder; Equation of the right circular cylinder with a given axis and radius.
	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Shanti Narayan and P. K. Mittal, Analytical Solid Geometry, 17<sup>th</sup> Edition, S. Chand &amp; Company, 2007.</li> <li>2. P. K. Jain, A Textbook of Analytical Geometry of Three Dimensions, New Age International, 2005.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>			
<b>Subject Title:</b>	<b>English</b>		
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0 Credits:3</b>

**Detail of Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p style="text-align: center;"><b><u>Literature</u></b></p> <p><b><i>The Poetic Palette (Orient BlackSwan, Second Edition, 2016)</i></b>  The following poems from this anthology are prescribed:</p> <ol style="list-style-type: none"> <li>1. Apparently With No Surprise: Emily Dickinson</li> <li>2. Fool and Flea: Jeet Thayil</li> <li>3. The Soul's Prayer: Sarojini Naidu</li> <li>4. I Sit and Look Out: Walt Whitman</li> <li>5. Women's Rights: Annie Louise Walker</li> <li>6. Pippa's Song: Robert Browning</li> </ol> <p style="text-align: center;"><b><u>Vocabulary</u></b></p> <p>Antonyms; Synonyms; One-word substitution; Homophones/Homonyms; Abbreviations</p>
<b>II</b>	<p style="text-align: center;"><b><u>Literature</u></b></p> <p><b>(b) <i>Prose Parables (Orient Black Swan, 2013)</i></b>  The following stories from the above volume are prescribed:</p> <ol style="list-style-type: none"> <li>a. The Eyes Are Not Here: Ruskin Bond</li> <li>b. Grief: Anton Chekov</li> <li>c. The Doctor's Word: R.K. Narayan</li> <li>d. The Doll's House: Katherine Mansfield</li> <li>e. Dusk: H.H. Munroe (Saki)</li> <li>f. The Kabuli wallah : Rabindranath Tagore</li> </ol> <p style="text-align: center;"><b><u>Grammar</u></b></p> <p>Parts of Speech; Articles, Determiners; Modals; Modifiers; Prepositions; Voice; Transformation of sentences</p>
<b>III</b>	Close Reading; Comprehension; Summarizing; Paraphrasing; Analysis and Interpretation; Translation (from Hindi/Punjabi to English and vice-versa)
<b>IV</b>	Essay Writing -Descriptive/Narrative/Argumentative; Business letters; Précis Writing
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"> <li>1. Oxford Practice Grammar by John Eastwood (Ed. 2014)</li> <li>2. Business English, Pearson, 2008.</li> <li>3. Language, Literature and Creativity, Orient Black swan, 2013.</li> <li>4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr. Brati Biswas</li> <li>5. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.</li> </ol>

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ਬੀ.ਐਸ.ਸੀ. ਨਾਨ-ਮੈਡੀਕਲ  
ਸਮੇਸਟਰ-ਪਹਿਲਾ  
ਸਲੇਬਸ-ਪੰਜਾਬੀ  
ਪੰਜਾਬੀ-3L-3 ਕਰੈਡਿਟ

ਪਾਠ-ਕ੍ਰਮ:

ਯੂਨਿਟ-1 (ਸਾਹਿਤ)

(ੳ) ਕਵਿਤਾ ਭਾਗ :

1. ਰਉਂ ਰੁੱਖ- ਭਾਈ ਵੀਰ ਸਿੰਘ
2. ਰਾਧਾ ਸੰਦੇਸ਼-ਧਨੀ ਰਾਮ ਚਾੜ੍ਹਕ
3. ਪੁਰਾਣੇ ਪੰਜਾਬ ਨੂੰ ਆਵਾਜ਼ਾਂ-ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ
4. ਆਉ ਨੱਚੀਏ-ਪ੍ਰੋ.ਮੋਹਨ ਸਿੰਘ
5. ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਰੀ ਦੀ ਦਾਸਤਾਨ-ਹਰਿਭਜਨ ਸਿੰਘ
6. ਚੌਂਕ ਸ਼ਹੀਦਾਂ ਵਿਚ ਉਸਦਾ ਆਖਰੀ ਭਾਸ਼ਣ- ਸੁਰਜੀਤ ਪਾਤਰ

(ਅ) ਕਹਾਣੀ ਭਾਗ :

1. ਭੂਆ-ਨਾਨਕ ਸਿੰਘ
2. ਪੇਮੀ ਦੇ ਨਿਆਣੇ-ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ
3. ਧਰਤੀ ਹੇਠਲਾ ਬੋਲਦ- ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ
4. ਦੂਜੀ ਵਾਰ ਜੇਬ ਕੱਟੀ ਗਈ-ਨਵਤੇਜ ਸਿੰਘ
5. ਬੁੱਤ ਸ਼ਿਕਨ-ਅਜੀਤ ਕੌਰ
6. ਬੱਸ ਕੰਡਕਟਰ-ਦਲੀਪ ਕੌਰ ਟਿਵਾਣਾ

ਯੂਨਿਟ-2 (ਭਾਸ਼ਾ ਤੇ ਲਿਪੀ)

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।

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**ਯੂਨਿਟ-3 (ਵਿਆਕਰਣ)**

ਮੂਲ ਵਿਆਕਰਣਕ ਇਕਾਈਆਂ :

ਭਾਵੰਸ਼

ਸ਼ਬਦ

ਵਾਕੰਸ਼

ਉਪ-ਵਾਕ

ਵਾਕ

**ਯੂਨਿਟ-4 (ਲੇਖਣੀ-ਕਲਾ)**

ਸੰਖੇਪ ਰਚਨਾ (ਪ੍ਰੈਸੀ)

ਪੈਰਾ ਰਚਨਾ

ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਪੈਰੇ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

ਦੋ ਰੰਗ , ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ (ਸੰਪ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ ਤੇ ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ),  
ਦੂਜਾ ਐਡੀਸ਼ਨ, 2014.

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ (ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ), ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, 2006.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Punjab History &amp; Culture</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Detail of Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<ol style="list-style-type: none"> <li>1. Physical Features of the Punjab and impact on history.</li> <li>2. Sources of the ancient history of Punjab.</li> </ol>
<b>II</b>	<ol style="list-style-type: none"> <li>3. Harappan Civilization : Town planning ; Social, economic and religious life of the Indus valley people</li> <li>4. The indo-Aryans: original home and settlement in Punjab.</li> </ol>
<b>III</b>	<ol style="list-style-type: none"> <li>5. Social, Religious and Economic life during later Rig Vedic age.</li> <li>6. Social, Religious and Economic life during later Vedic Age.</li> </ol>
<b>IV</b>	<ol style="list-style-type: none"> <li>7. Teaching and impact of Buddhism</li> <li>8. Jainism in the Punjab.</li> </ol>
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"> <li>1. L. joshi (ed): History and Culture of the Punjab, Art-1, Patiala, 1989(3<sup>rd</sup> edition)</li> <li>2. L.M joshi and fauja singh (ed); History of Punjab, Vol.I, Patiala 1977.</li> <li>3. Budha Parkash: Glimpses of Ancient Punjab, Patiala, 1983.</li> <li>4. B.N Sharma: life in Northern India, Delhi. 1966.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>CHEMISTRY LAB I</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

**Inorganic Chemistry:** Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

**Organic Chemistry Laboratory Techniques:**

*Determination of Melting Point*

Naphthalene 80-82°C

Cinnamic acid 132.5-133 °C

Benzoic acid 121.5-122 °C

Salicylic acid 157.5-158 °C

Urea 132.5-133 °C

Acetanilide 113.5-114 °C

Succinic Acid 184.5-185 °C

*m*-dinitro benzene 90 °C

*p*-dichlorobenzene 52 °C

Aspirin 135 °C

*Determination of Boiling Point*

Ethanol 78 °C

Cyclohexane 81.4 °C

Benzene 80 °C

Toluene 110 °C

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Physics Lab-I</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

*At least 06 experiments from the following:*

1. Measurements of length (or diameter) using vernier caliper, screw gauge, and travelling microscope. Use of Plumb line and Spirit level.
2. Analysis of experimental data by:  
a) fitting the given data to a straight line b) to study probable error in observations.
3. To determine the height of an inaccessible object using a sextant.
4. To determine the horizontal distance of an object using a sextant.
5. To determine the vertical distance of an object using a sextant.
6. To verify the law of vibrating string by Melde's experiment.
7. To setup CRO for Sine and Square wave and to find their frequency and amplitude.
8. To study the Motion of Spring and calculate (a) Spring constant, (b)  $g$  and (c) Modulus of rigidity.
9. To establish a relation between angular acceleration  $\alpha$  and torque  $\tau$ , and hence to find out the moment of Inertia of flywheel.
10. Study the dependence of the moment of Inertia on distribution of mass (by noting the time periods of oscillations) using objects of various shape but of same mass.
11. To determine the Young's Modulus of a Wire by Optical Lever Method.
12. To determine the Young's Modulus of a Wire by Searle's method.
13. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.

**REFERENCE BOOKS:**

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. Practical Physics, G.L. Squires, 2015, 4<sup>th</sup> Edition, Cambridge University Press.
5. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 201, Kitab Mahal
6. B Sc Practical Physics by C. L. Arora, S. Chand & Co.

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Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSNM201-18	Inorganic Chemistry-II	3	0	0	25	50	75	3
BSNM202-18	Physical Chemistry-I	3	0	0	25	50	75	3
BSNM203-18	Mechanics-II	3	0	0	25	50	75	3
BSNM204-18	Electricity and Magnetism	3	0	0	25	50	75	3
BSNM205-18	Integral Calculus	3	0	0	25	50	75	3
BSNM206-18	Theory of equations	3	0	0	25	50	75	3
BSNM207-18	English-II	3	0	0	25	50	75	3
BSNM208-18 BSNM208A-18	Punjabi / <b>OR</b> Punjab History & Culture	3	0	0	25	50	75	3
BSNM209-18	Chemistry Lab-II	0	0	4	30	20	50	2
BSNM210-18	Physics Lab-II	0	0	4	30	20	50	2
BSNM211-18	Computer Algebra system: MATLAB	0	0	2	30	20	50	1
	<b>Total</b>	<b>24</b>	<b>0</b>	<b>10</b>	<b>290</b>	<b>460</b>	<b>750</b>	<b>29</b>

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**Semester-II**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM201-18			
<b>Subject Title:</b>	<b>INORGANIC CHEMISTRY-II</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p><b>Chemistry of s Block Elements</b>                      General characteristics (melting point, flame color, reducing nature, diagonal relationships and anomalous behavior of first member of each group).                      Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water. Ease of formation, thermal stability and solubility of the following alkali and alkaline earth metal compounds: hydrides, oxides, peroxides, superoxides, carbonates, nitrates, sulphates.                      Complex formation tendency of s-block elements; crown ethers, cryptands and podands of Group I; basic beryllium acetate, beryllium nitrate, EDTA complexes of calcium and magnesium.                      Solutions of alkali metals in liquid ammonia and their properties.</p>
<b>II</b>	<p><b>Chemistry of p Block Elements</b>                      Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, electronegativity, inert pair effect, diagonal relationship between B and Si and anomalous behaviour of first member of each group.  <b>Group III (Boron Group):</b> 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.  <b>Group IV (Carbon Group):</b> 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.  <b>Group V (Nitrogen Group):</b> Hydrides, properties and structure of ammonia, hydrazine, hydroxylamine, trihalides and Pentahalides of V groups elements, oxides of nitrogen, structure of N<sub>2</sub>O, NO, N<sub>2</sub>O<sub>3</sub>, N<sub>2</sub>O<sub>4</sub> and N<sub>2</sub>O<sub>5</sub>, oxo acids of nitrogen and phosphorous, phosphazenes and cyclophosphazenes.  <b>Group VI (Oxygen Group):</b> Structure and allotropy of the elements. Oxides of sulfur (structure of SO<sub>2</sub> and SO<sub>3</sub>) oxoacids of sulfur halides of sulfur, selenium and tellurium, compounds of Sulfur and nitrogen (S<sub>4</sub>N<sub>4</sub>).  <b>Group VII:</b> Oxides of halogens (OF<sub>2</sub>, O<sub>2</sub>F<sub>2</sub>, Cl<sub>2</sub>C, ClO<sub>2</sub>, Cl<sub>2</sub>O<sub>6</sub>, BrO<sub>2</sub>, I<sub>2</sub>O<sub>5</sub>) (structures), Preparation, reaction and structure of interhalogen compounds. (ClF<sub>3</sub>, BrF<sub>3</sub>, I<sub>2</sub>, Cl<sub>5</sub>, IF<sub>5</sub>, IF<sub>7</sub>), Polyhalides, basic properties of halogens.</p>
<b>III</b>	<p><b>Acids-bases</b>                      Various definitions of acids and bases, A generalized acid-base concept, Measurement of acid-base strength, Lewis interactions in non-polar solvents, Systematics of Lewis acid-base interactions, Bond energies, steric effects, solvation effects and acid-base anomalies, Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.</p>
<b>IV</b>	<p><b>Chemistry of Transition Elements</b>                      Characteristic properties of d-block elements. Properties of the elements of the first transition</p>

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	series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behavior.
	<b>Recommended Books:</b> 1. J.D. Lee, Concise Inorganic Chemistry, 4th Ed. 2. J.E. Huheey, Inorganic Chemistry, Harper & Row. 3. F.A.Cotton and G. Wilinon, Advanced Inorganic Chemistry, Interscience Publishers. 4. N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon Press.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>
<b>Subject Code:</b>	BSNM202-18
<b>Subject Title:</b>	<b>PHYSICAL CHEMISTRY-I</b>
<b>Contact Hours:</b>	<b>L:3   T:0   P:0   Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Gaseous state</b> Kinetic molecular theory of gases, derivation of kinetic gas equation, deduction of gas laws from kinetic gas equation, imperfection in real gases, the compressibility of real gases, isotherms of real gases, equations of state, Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.
<b>II</b>	<b>Liquids state</b> 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.
<b>III</b>	<b>Colloidal State</b> Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical, properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. General applications of colloids.
<b>IV</b>	<b>Solutions, Dilute Solutions and Colligative Properties</b> Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass degree of dissociation and association of solutes.
	<b>Recommended Books:</b> 1. Principles of physical chemistry, S.H. Maron & C.F. Prutton. 2. Physical Chemistry, K.J. Laidler. 3. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 13 (2006). 4. Ball, D. W. Physical Chemistry Thomson Press, India (2007). 5. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004). 6. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM203-18			
<b>Subject Title:</b>	<b>Mechanics-II</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>	<b>Contact Hours</b>
<b>I</b>	<b>Gravitation:</b> Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Force between a Point Mass and Spherical shell. Force between a Point Mass and Solid Sphere, Gravitational and Electrostatic self-energy. Gravitational energy of the Galaxy and of uniform sphere.	<b>8</b>
<b>II</b>	<b>Central Force Motion:</b> Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS).  Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of velocity and acceleration in cylindrical and spherical Coordinate systems.	<b>10</b>
<b>III</b>	<b>Oscillations:</b> Simple Harmonic Oscillations (SHM). Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.	<b>8</b>
<b>IV</b>	<b>Special Theory of Relativity:</b> Michelson-Morley Experiment. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Kinematics. Transformation of Energy and Momentum.	<b>8</b>
	<b>Reference Books:</b> 14. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill. 15. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill. 16. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley. 17. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.	

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|  | <ol style="list-style-type: none"><li>18. Feynman Lectures, Vol. I, R.P .Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education</li><li>19. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.</li><li>20. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.</li><li>21. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000</li><li>22. University Physics. F.W Sears, M.W Zemansky, H. D Young 13/e, 1986, Addison Wesley.</li><li>23. Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serwa, 2010, Cengage Learning</li><li>24. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.</li></ol> |
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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM204-18			
<b>Subject Title:</b>	<b>ELECTRICITY AND MAGNETISM</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>	<b>Contact Hours</b>
<b>I</b>	<b>Electrostatics and Dielectrics:</b> Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.	<b>12</b>
<b>II</b>	<b>Magnetism:</b> Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-,para- and ferro-magnetic materials.	<b>6</b>
<b>III</b>	<b>Electromagnetic Induction:</b> Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.	<b>6</b>
<b>IV</b>	<b>Maxwell's equations and Electromagnetic wave propagation:</b> Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.	<b>8</b>
	<b>Reference Books:</b> 12. Edward M. Purcell, Electricity and Magnetism, McGraw-Hill Education 1986. 13. J.H. Fewkes & J. Yarwood. Electricity and Magnetism, Oxford Univ. Press Vol. I, 1991. 14. D C Tayal, Electricity and Magnetism, Himalaya Publishing House 1988. 15. Ronald Lane Reese, University Physics, Thomson Brooks/Cole 2003. 16. D.J. Griffiths, Introduction to Electrodynamics, Benjamin Cummings 3rd Edn, 1998.	

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM205-18			
<b>Subject Title:</b>	<b>INTEGRAL CALCULUS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>
<b>I</b>	Integrals of functions of one variable, geometrical interpretation of integral as area, integration of standard functions, integration by substitution and parts, Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals.
<b>II</b>	Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations. Areas and lengths of curves in the plane, volumes and surfaces area of solids of revolution.
<b>III</b>	Integrals of functions of two variables, double integrals, Applications to evaluation of area, volumes and surfaces of solids of revolution, Change of order of Integration. Change of variables.
<b>IV</b>	Integrals of functions of three variables, Triple integral, Evaluation of volume, density etc., Change of order of Integration. Change of variables. Implicit and Explicit functions, Integration of hyperbolic and inverse hyperbolic functions.
	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>3. H. S. Hall and S. R. Knight, Higher Algebra, H. M. Publications, 1994.</li> <li>4. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., 2017.</li> <li>5. Richard L. Burden and J. Douglas Faires, Numerical Analysis, 9<sup>th</sup> Edition, Cengage Learning, 2012.</li> <li>6. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6<sup>th</sup> Edition, New Age International Publishers, 2012.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM206-18			
<b>Subject Title:</b>	<b>THEORY OF EQUATIONS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course:**

<b>Unit</b>	<b>Content</b>
<b>I</b>	Euclid's algorithm, synthetic division, roots and their multiplicity. Complex roots of real polynomials occur in conjugate pairs with same multiplicity. Relation between roots and coefficients. Transformation of equations. Descartes' Rule of Signs.
<b>II</b>	Solution of cubic and bi-quadratic equations, Cardano's method of solving a cubic, discriminant and nature of roots of real cubic, trigonometric solutions of a real cubic with real roots. Ferrari's method for a bi-quadratic equation.
<b>III</b>	Computer arithmetic and errors: Floating point representation of numbers, numbers and their accuracy, significant digits, source of errors, types of errors, errors in arithmetic operations. Numerical instability.
<b>IV</b>	Algorithms, convergence, solution of nonlinear equations: Bisection method, False position method, Fixed point iteration method, Newton-Raphson's method, Secant method.
	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. H. S. Hall and S. R. Knight, Higher Algebra, H. M. Publications, 1994.</li> <li>2. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., 2017.</li> <li>3. Richard L. Burden and J. Douglas Faires, Numerical Analysis, 9<sup>th</sup> Edition, Cengage Learning, 2012.</li> <li>4. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6<sup>th</sup> Edition, New Age International Publisher, 2012.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM207-18			
<b>Subject Title:</b>	<b>ENGLISH-II</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	The following <b>short novel</b> to be read for enhancing vocabulary and learning sentence/speech construction:  The Strange Case of Dr. Jekyll and Mr Hyde by Robert Louis Stevenson
<b>II</b>	<b>Grammar:</b>  Parts of Speech, Adjectives and its degrees, Simple, compound and complex structures, Active and passive voices, Subject-verb agreement, Punctuation, Spelling rules and formation of words.
<b>III</b>	<b>Writing Skills:</b> Report writing, Letter writing: Business and official letters, notices and memorandums, Precis writing
<b>IV</b>	<b>Language Skills:</b> Comprehension, Public speaking/Oral communication, Translation (Punjabi into English), Technical words/vocabulary
	<p><b>Recommended Books:</b></p> <p>Robert Louis Stevenson, <i>The Strange Case of Dr Jekyll and Mr Hyde</i>, Madhuban Publications, 2005</p> <p>Wren and Martin, <i>High School English Grammar and Composition</i>, S Chand (Indian edition), 2008.</p> <p>A J Thomson and A V Martinet, <i>A Practical English Grammar</i>, Oxford India, 2007</p> <p>R V Lesikar, M E Flatley, K Rentz and N Pande, <i>Business Communication (Making Connections in Digital World)</i>, Tata McGraw Hill, 2010</p> <p>M Frank, <i>Writing as Thinking: A Guided Process Approach</i>, Englewood Cliffs, Prentice Hall Regents.</p>

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ਬੀ.ਐਸ.ਸੀ. ਨਾਨ-ਮੈਡੀਕਲ  
ਸਮੈਸਟਰ-ਦੂਜਾ  
ਸਲੇਬਸ-ਪੰਜਾਬੀ  
ਪੰਜਾਬੀ-3L-3 ਕਰੈਡਿਟ

ਪਾਠ-ਕ੍ਰਮ:

**ਯੂਨਿਟ-1 (ਸਾਹਿਤ)**

1. ਵਤਨ ਦਾ ਪਿਆਰ - ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ
2. ਸਾਕਾ ਸ੍ਰੀ ਨਨਕਾਣਾ ਸਾਹਿਬ- ਭਾਈ ਮੋਹਨ ਸਿੰਘ ਵੈਦ
3. ਘਰ ਦਾ ਪਿਆਰ - ਪ੍ਰਿੰ. ਤੇਜਾ ਸਿੰਘ
4. ਮੇਰੇ ਦਾਦੀ ਜੀ-ਗੁਰਬਖਸ਼ ਸਿੰਘ (ਪ੍ਰੀਤਲੜੀ)
5. ਮਨ ਦੀ ਮੌਜ - ਗਿ. ਲਾਲ ਸਿੰਘ ਕਮਲਾ ਅਕਾਲੀ
6. ਗੁਰ-ਸੰਗਤ ਬਾਣੀ - ਗਿ. ਹੀਰਾ ਸਿੰਘ ਦਰਦ
7. ਕਾਠ ਦੀ ਚੋਟੀ - ਪ੍ਰੋ. ਸਾਹਿਬ ਸਿੰਘ
8. ਗੁਰੂ ਅਰਜਨ ਦੇਵ ਜੀ ਦੀ ਸ਼ਹਾਦਤ - ਡਾ. ਗੰਡਾ ਸਿੰਘ
9. ਸ਼ਾਂਤੀ ਨਿਕੇਤਨ - ਸ.ਸ. ਅਮੋਲ
10. ਗਿੱਧਾ - ਦੇਵਿੰਦਰ ਸਤਿਆਰਥੀ
11. ਅੱਥਰੂ- ਬਲਰਾਜ ਸਾਹਨੀ
12. ਪੰਜਾਬ ਦਾ ਸਭਿਆਚਾਰ - ਸੂਬਾ ਸਿੰਘ
13. ਬੁਲ੍ਹੇ ਸ਼ਾਹ ਦੀ ਕਾਵਿ ਕਲਾ - ਪ੍ਰੋ. ਦੀਵਾਨ ਸਿੰਘ
14. ਸੜਕ ਪਾਰ ਕਰਦਾ ਬੁਢੇਪਾ -ਕੁਲਬੀਰ ਸਿੰਘ ਕਾਂਗ

**ਯੂਨਿਟ-੨ (ਭਾਸ਼ਾ )**

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ  
ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਉਪਰ ਪਏ ਪ੍ਰਭਾਵ

**ਯੂਨਿਟ-੩ (ਵਿਆਕਰਣ)**

ਪੰਜਾਬੀ ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਸਹਾਇਕ ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸਬੰਧਕ, ਯੋਜਕ, ਵਿਸਮਿਕ।

**ਯੂਨਿਟ-੪ (ਲੇਖਣੀ-ਕਲਾ)**

ਰਿਪੋਰਟਿੰਗ, ਸਮਾਚਾਰ ਲਿਖਣ ਦੀ ਵਿਧੀ ਤੇ ਤੱਤ  
ਪੰਜਾਬੀ ਪੈਰ੍ਹੇ ਦਾ ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ  
ਦਫਤਰੀ ਚਿੱਠੀ ਪੱਤਰ

**ਸਹਾਇਕ ਪੁਸਤਕਾਂ:**

*ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਵਾਰਤਕ* (ਸੰਪ. ਗੁਰਬਚਨ ਸਿੰਘ ਤਾਲਿਬ), ਪੰਜਾਬੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ ਅੰਮ੍ਰਿਤਸਰ।

*ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਣ* (ਭਾਗ-1) ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ, ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ, ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ, ਵੇਦ ਅਗਨੀਹੋਤਰੀ), ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, ਐਡੀਸ਼ਨ 2009.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM208A-18			
<b>Subject Title:</b>	<b>Punjab History &amp; Culture</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	Foundation of Sikh Panth: Guru Nanak Dev and his Teachings: Early life, Conception of God, Importance of the Guru, Insistance on right conduct and earnest profession; Institution of community kitchen (Langer) and Congregational worship (sangat), Succession to Guruship.
<b>II</b>	Development of the Sikh Panth: Guru Angad Dev to Guru Arjan Dev: Increasing number of sangats: Sikh ceremonies; the Manji and Masand system, The founding of the sacred places, The Harimandir. Compilation of the Adi Granth.
<b>III</b>	Transformation of the Sikh Panth: Guru Hargobind to Guru Tegh Bahadur: Martyrdom of Guru Arjan Dev and Guru Hargobind's response; Armed conflict with the state; Circumstances leading to the accession and martyrdom of Guru Tegh Bahadur.
<b>IV</b>	Creation of Khalsa: Meaning; Circumstances leading to the creation of the Khalsa (1699); New Social order; Conflict with the Hill chiefs and Mughal administrators; Legacy.
	<p><b>Recommended Book</b></p> <ol style="list-style-type: none"> <li>1. Grewal J.S., From Guru Nanak to Maharaja Ranjit Singh, G.N.D. University, Amritsar, 1982.</li> <li>2. The New Cambridge History of India: The Sikhs of the Punjab, CUP, New Delhi, 1990.</li> <li>3. Guru Nanak in History, Panjab University, Chandigarh, 1969.</li> <li>4. Khushwant Singh, A History of the Sikhs, Vol. I (1469-1839), OUP, Delhi, 1977.</li> <li>5. McLeod, W.H., Guru Nanak and the Sikh Religion, OUP, Delhi, 1968.</li> <li>6. Teja Singh and Ganda Singh, A Short History of the Sikhs Vol. (1469-1765), Patiala 1983</li> <li>7. Banerjee, I.B. Evolution of the Khalsa, 2 Vols., A. Mukherjee &amp; Co., Calcutta, 1979.</li> <li>8. Grewal, J.S. and S.S. Bal, Guru Gobind Singh, Panjab University, Chandigarh, 1987.</li> <li>9. Indu Banga, The Khalsa Over 300 Years, Manohar, New Delhi, 1999.</li> <li>10. Harbans Singh (ed), The Encyclopedia of Sikhism, 4 Vols., Punjabi University, Patiala 1992.</li> <li>11. McLeod, W.H. Evolution of the Sikh Community, OUP, Delhi, 1970.</li> <li>12. Historical Dictionary of Sikhism, OUP, New Delhi, 2002.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM209-18			
<b>Subject Title:</b>	<b>CHEMISTRY LAB II</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

**Crystallization:**

Concept of indication of crystallization. Phthalic acid from hot water (using fluted filter paper & stem less funnel)

Acetanilide from boiling water.

Naphthalene from Ethanol

Benzoic acid from water

**Physical Chemistry:**

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalysed by Hydrogen ions at room temperature.

2. To study the effect of acid strength on hydrolysis of an ester.

**Viscosity, Surface Tension (Pure Liquids)**

3. To study the viscosity and surface tension of CCI glycerine solution in water.

4. To determine the solubility of benzoic acid at different temperatures and to determine  $\Delta H$  of the dissolution process.

5. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.

6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

**Recommended Books:**

1. Practical Organic Chemistry by F.G. Mann and B.C. Saunders
2. Advanced Practical Physical Chemistry by J.B. Jadav.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM210-18			
<b>Subject Title:</b>	<b>Physics Lab</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

*At least 08 experiments from the following:*

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. To compare capacitances using De`Sauty's bridge.
3. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
4. To study the Characteristics of a Series RC Circuit.
5. To study the series and parallel LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor Q.
6. To determine a Low Resistance by Carey Foster's Bridge.
7. To verify the Thevenin and Norton theorem.
8. To verify the Superposition, and Maximum Power Transfer Theorem
9. To determine unknown capacitance by flashing and quenching method.
10. To study B-H curve for a ferromagnetic material using CRO.
11. To find out the frequency of AC mains using electric-vibrator.
12. To find out polarizability of a dielectric substance.
13. To determine the value of self-inductance by Maxwell Inductance/Capacitance Bridge.
14. To determine the mutual inductance of two coils.
15. To find out the horizontal component of earth's magnetic field (B<sub>h</sub>).
16. Ballistic Galvanometer: (i) Measurement of charge and current sensitivity (ii) Measurement of CDR (iii) Determine a high resistance by Leakage Method (iv) To determine Self Inductance of a Coil by Rayleigh's Method.

**REFERENCE BOOKS:**

11. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
12. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
13. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
14. Practical Physics, G.L. Squires, 2015, 4<sup>th</sup> Edition, Cambridge University Press.
15. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 201, Kitab Mahal.
16. B Sc. Practical Physics, C. L. Arora, S. Chand & Co.
17. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM211-18			
<b>Subject Title:</b>	<b>Computer Algebra system: MATLAB</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:2</b>	<b>Credits:1</b>

**Course Objectives** This course is designed to introduce a Computer Algebra System: MATLAB which is currently used in scientific computations. The main focus will be on introduction to basic concepts of MATLAB using simple examples.

**UNIT-I**

The MATLAB environment, scalars, variables, arrays, mathematical operations with arrays, built-in and user defined functions, graphics: two-dimensional and three-dimensional, m-files: script and function files, functions: input; disp and fprintf, relational and logical operators.

**UNIT-II**

Symbolic math: symbolic objects and expressions; collect; expand; factor; simplify; solve; diff and int commands, Programming: if-end structure; if-else-end structure; loops: for-end and while-end.

**Course Outcomes** After completion of the course, the students will be able to

- Visualize functions in 2-D and 3-D.
- Use symbolic tools of MATLAB for solving problems arising in various fields of applications.
- Make their own computer programs for solving problems of their interest.

**Reference Books.**

1. D. J. Higham and N. J. Higham, MATLAB Guide, 2<sup>nd</sup> Edition, Society for Industrial and Applied Mathematics (SIAM), 2005.
2. Amos Gilat, MATLAB: An Introduction with Applications, 5<sup>th</sup> Edition, John Wiley & Sons, 2014.+

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**Third Semester**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSNM-301-18	Organic Chemistry-II	3	0	0	25	50	75	3
BSNM-302-18	Physical Chemistry-II	3	0	0	25	50	75	3
BSNM-303-18	Optics	3	0	0	25	50	75	3
BSNM-304-18	Thermal Physics	3	0	0	25	50	75	3
BSNM-305-18	Analysis-I	3	0	0	25	50	75	3
BSNM-306-18	Differential Equations	3	0	0	25	50	75	3
BSNM-307-18	English-III	3	0	0	25	50	75	3
BSNM-308-18(A) / BSNM-308-18(B)	Punjabi-III/Punjab History & Culture-III	3	0	0	25	50	75	3
BSNM-309-18	Environment Science	2	0	0	25	50	75	1
BSNM-310-18	Chemistry Lab-III	0	0	4	30	20	50	2
BSNM-311 -18	Physics Lab-III	0	0	4	30	20	50	2
<b>Total</b>		<b>26</b>	<b>0</b>	<b>8</b>	<b>285</b>	<b>490</b>	<b>775</b>	<b>29</b>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM301-18</b>			
<b>Subject Title:</b>	<b>ORGANIC CHEMISTRY-II</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p><b>Alkyl and Aryl Halides</b>            Nomenclature and classes of alkyl halides, Chemical reactions. Mechanisms of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. 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.</p>
<b>II</b>	<p><b>Arenes and Aromaticity</b>            Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: Molecular formula and Kekule structure. Stability and carbon carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity : the Huckel's rule, aromatic ions. Aromatic electrophilic substitution—general pattern of the mechanism, role of <math>\sigma</math> and <math>\pi</math> complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes.</p>
<b>III</b>	<p><b>Alcohols</b>            Classification and nomenclature. Monohydric alcohols-nomenclature. Acidic nature. Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage <math>[\text{Pb}(\text{OAc})_4]</math> and <math>[\text{HIO}_4]</math> and pinacol-pinacolone rearrangement.</p> <p><b>Phenols</b>            Nomenclature, structure and bonding, Preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Reimer Tiemann reaction.</p>
<b>IV</b>	<p><b>Aldehydes and Ketones</b>            Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, <math>\text{LiAlH}_4</math> and <math>\text{NaBH}_4</math> reductions. Halogenation of enolizable ketones. Halogenation of enolizable ketones.</p>
	<p><b>Recommended Books:</b>            1. Organic Chemistry, Morrison and Boyd, Prentice- Hall.            2. Fundamentals of Organic Chemistry, Solomons, John Wiley.</p>

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	<ol style="list-style-type: none"><li>3. Organic Chemistry. F.A. Carey, McGraw Hill, Inc.</li><li>4. Organic Chemistry, L.G. Wade Jr. Prentice Hall.</li><li>5. Organic Chemistry Vol. I, II &amp; III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd (New Age International).</li><li>6. Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmilan.</li></ol>
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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM302-18</b>			
<b>Subject Title:</b>	<b>PHYSICAL CHEMISTRY-II</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p><b>Thermodynamics-I</b>            Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.            First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature, Calculation of <math>w</math>, <math>q</math>, <math>dU</math> &amp; <math>dH</math> for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.</p>
<b>II</b>	<p><b>Thermodynamics-I</b>            Thermochemistry: Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.  <b>Thermodynamics-II</b>            Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.            Concept of Entropy : Entropy as a state function, entropy as a function of <math>V</math> &amp; <math>T</math>, entropy as a function of <math>P</math> &amp; <math>T</math>, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.</p>
<b>III</b>	<p><b>Thermodynamics-III</b>            Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (<math>G</math>) and Helmholtz function (<math>A</math>) as thermodynamic quantities, <math>A</math> &amp; <math>G</math> as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of <math>G</math> and <math>A</math> with <math>P</math>, <math>V</math> and <math>T</math>.  <b>Equilibrium</b>            Chemical Equilibrium            Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of <math>K_p</math>, <math>K_c</math>, <math>K_a</math> and their relationship, Clausius-Clapeyron equation, applications.</p>
<b>IV</b>	<p><b>Introduction to Phase Equilibrium</b>            Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, <math>CO_2</math> and <math>S</math> systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (<math>NaCl-H_2O</math>), (<math>FaCl_3-H_2O</math>) and (<math>CuSO_4-H_2O</math>) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-<math>H_2O</math> and ethanol water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-</p>

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	thermodynamic derivation and applications.
	<b>Recommended Books:</b> 1. Thermodynamics for Chemists, S. Glasstone. 2. Chemical thermodynamics, P.A. Rock. 3. Principles of Physical Chemistry, S.H. Maron & C.F. Prutton. 4. Physical Chemistry, P.W. Atkins. 5. Physical Chemistry, Vol.2, K.L. Kapoor. 6. Physical Chemistry, K.J. Laidler.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM303-18</b>			
<b>Subject Title:</b>	<b>OPTICS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Interference:</b> Definition and properties of wave front, Temporal and Spatial Coherence, Young's double slit experiment, Lloyd's single mirror and Fresnel's Biprism. Phase change on reflection, Interference in Thin Films: parallel and wedge-shaped films, Newton's Rings: Measurement of wavelength and refractive index, Interferometer: Michelson Interferometer. (10 Lectures)
<b>II</b>	<b>Diffraction:</b> Huygens Principle, Fraunhofer diffraction: Single slit. Circular aperture, Rayleigh criterion of resolution, Resolving Power of a telescope, Double slit, Multiple slits, Diffraction grating, Resolving power of grating, Fresnel diffraction pattern of a straight edge and circular aperture. (10 Lectures)
<b>III</b>	<b>Polarization:</b> Plane polarized light, Representation of Unpolarized and Polarized light, Polarization by Reflection, Brewster's law, Malus Law, Polarization by Selective absorption by Crystals, Polarization by Scattering, Polarization by Double Refraction, Nicol Prism. (10 Lectures)
<b>IV</b>	<b>Laser and Application:</b> Lasers, Spontaneous emission, Stimulated absorption, Stimulated emission, Einstein coefficients, Einstein relations, Conditions for Laser actions, Population inversion, Different types of Laser Pumping mechanism: Optical Pumping, Electric Discharge and Electrical pumping, Resonators, Two, Three and Four level laser systems, Ruby laser, He-Ne gas Laser, CO2 laser, applications of laser: Holography. (10 Lectures)
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"> <li>1. Optics: A.K. Ghatak (Tata-McGraw Hill), 1992.</li> <li>2. Fundamentals of Optics: F.A. Jenkins and H.E. White (McGraw Hill), 1981.</li> <li>3. Introduction to Modern Optics (2nd ed.), G.R. Fowles, Dover, ISBN 0-486-65957-7, 2012.</li> <li>4. Fundamentals of Optics, F.A. Jenkins &amp; H.E. White, McGraw-Hill, 2011.</li> <li>5. Schaum's Outline of Theory and Problems of Optics, E. Hecht, McGraw-Hill, ISBN 0-07-027730-3, 1998.</li> </ol>

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**B.Sc. (Non-Medical) Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM304-18</b>			
<b>Subject Title:</b>	<b>THERMAL PHYSICS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Thermodynamics:</b> Laws of Thermodynamics: The zeroth law; indicator diagrams, work done, first law, internal energy, Carnot cycle, Carnot's theorem, the second law. Entropy as a thermodynamic variable; reversible and irreversible processes. Principle of increase of entropy. Thermodynamic scale of temperature; its identity with perfect gas scale, impossibility of attaining absolute zero. (10 Lectures)
<b>II</b>	<b>Maxwell's equations</b> , application to Clausius-Clapeyron equation and Joule-Thomson effect. Thermodynamic potentials, relation to thermodynamic variables; equilibrium in thermo dynamic systems, simple applications, Thomson and adiabatic cooling, Joule-Thomson expansion; Constancy of $U+PV$ , cooling, liquefaction of gases. Low temperatures: Production and measurement of very low temperatures, adiabatic demagnetization. (10 Lectures)
<b>III</b>	<b>Statistical Physics:</b> The statistical basis of thermodynamics: Probability and thermodynamic probability; principle of equal a priori probabilities, probability distribution, its narrowing with increasing $n$ , average properties, fluctuations, micro and macrostates, accessible and inaccessible states. Phase space, division of phase space into cells.
<b>IV</b>	Thermal equilibrium between two systems, beta parameter and its identification with $(kT)^{-1}$ , probability and entropy, Boltzmann's entropy relation, statistical interpretation of second law of thermodynamics. Maxwell-Boltzmann statistics, application of M-B statistics to monoatomic gas, principle of equipartition of energy, Bose-Einstein statistics, deduction of Planck's radiation law, derivation of Wiens's displacement law and Stefan's law. Fermi-Dirac statistics, comparison of three types of statistics. (10 Lectures)
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"> <li>1. Statistical Physics and Thermodynamics-V.S. Bhatia, Punjab University, Chandigarh, 1977</li> <li>2. Thermodynamics and Statistical Physics-Khandelwal and Loknathan, Shivrul Agnawala, Agna, 1979</li> <li>3. Heat and Thermodynamics-Zemansky and Dittman, Mc Graw HillScience/Engineering/Math-7<sup>th</sup> edition (Nov,1, 1996)</li> </ol>

**BSNM305-18 ANALYSIS-I**

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>0</b>	<b>0</b>

**UNIT-I**

Series of non-negative terms, P-test, comparison tests, Cauchy's integral test, Cauchy's root test, D'Alembert ratio test, Raabe's test, De Morgan and Bertrand's test, Gauss' test, logarithmic test, Alternating series, absolute and conditional convergence, rearrangement of absolutely convergent series.

**UNIT-II**

Riemann integral, integrability of continuous and monotonic functions, properties of integrable functions, the fundamental theorem of integral calculus, mean value theorems of integral calculus.

**UNIT-III**

Improper integral and their convergence, comparison tests, absolute and conditional convergence, Abel's and Dirichlet's test.

**UNIT-IV**

Beta and Gamma functions, properties of Gamma function, transformation of Gamma function, symmetrical property of Beta function, transformation of Beta function, relation between Beta and Gamma functions.

**Reference Books.**

- Shanti Narayan and M. D. Raisinghania, Elements of Real Analysis, S. Chand, 2018
- 7. Robert Wrede and Murray R. Spiegel, Advanced Calculus, 3<sup>rd</sup> Edition, Schaum's Outline Series (McGraw Hill), 2010.
- 8. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
- 9. S C Malik and Savita Arora, Mathematical Analysis, New Age International Publishers, 2017

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>0</b>	<b>0</b>

### **UNIT-I**

Exact differential equations, first order and higher degree equations solvable for  $x$ ,  $y$  and  $p=dy/dx$ . Clairaut's form, singular solution as an envelope of general solutions. Geometric meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant coefficients.

### **UNIT-II**

Linear differential equations with variable coefficients: Cauchy and Legendre equations. Linear differential equations of second order- transformation of the equation by changing the dependent variable/ the independent variable, methods of variation of parameters and reduction of order, Simultaneously differential equations.

### **UNIT-III**

Partial differential equation: Formation of first and second order equations, linear equation of first order, integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces.

### **UNIT-IV**

Nonlinear first order partial differential equations: Charpit's method, Higher order linear partial differential equations with constant coefficients: complementary function, particular integral.

#### **Reference Books.**

1. W E Boyce and R C DiPrima, Elementary Differential Equations and Boundary Value Problems, 9<sup>th</sup> Edition, Wiley, 2009.
2. R K Jain and S R K Iyengar, Advanced Engineering Mathematics, 4<sup>th</sup> Edition, Narosa Publishing House Pvt Ltd, New Delhi, 2012
3. I N Sneddon, Elements of Partial Differential Equations, McGraw-Hill, 1957
4. S L Ross, Differential Equations, John Wiley & Sons, 2004
5. M D Raisinghania, Advanced Differential Equations, 19<sup>th</sup> Edition, S. Chand, 2018

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**B.Sc. (Non-Medical) Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>	<b>BSNM307-18</b>		
<b>Subject Title:</b>	<b>ENGLISH-III</b>		
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0 Credits:3</b>

**Details of the course:**

<b>Unit</b>	<b>Contents</b>
<b>I</b>	<p><b>Textbook entitled ‘Prism: Spoken and Written Communication, Prose &amp; Poetry’ published by Orient Longman</b></p> <p><u>For enhancing vocabulary and learning sentence/speech construction:</u></p> <p><b>Prose:</b></p> <ol style="list-style-type: none"> <li>1) The Bet – Anton Chekov</li> <li>2) An Astrologer’s Day – R. K. Narayan</li> <li>3) The Gift of the Magi – O’ Henry</li> </ol> <p><b>Poetry:</b></p> <ol style="list-style-type: none"> <li>1) The Felling of the Banyan Tree – Dilip Chitre</li> <li>2) Stay Calm – Grenville Kleiser</li> </ol>
<b>II</b>	<p><b>Grammar and Vocabulary</b>            Modal auxiliaries, Gerunds Infinitives; Participles; Usage of Conjunctions; Scientific &amp; Technical Vocabulary;</p>
<b>III</b>	<p><b>Reading &amp; Writing Skills:</b> Note Making and Note Taking; Writing abstracts &amp; summaries</p>
<b>IV</b>	<p><b>Spoken Skills</b></p> <ol style="list-style-type: none"> <li>1) Meeting People, Exchanging Greetings and Taking Leave</li> <li>2) Introducing Yourself</li> <li>3) Introducing People to Others</li> <li>4) Answering the Telephone and Asking for Someone</li> <li>5) Dealing with a Wrong Number</li> <li>6) Taking and Leaving Messages</li> <li>7) Making Inquiries on the Phone</li> <li>8) Calling for Help in an Emergency</li> </ol>
	<p><b>Recommended Books:</b>            William Zinsser. <i>On Writing Well</i>. Harper Resource Book. 2001</p> <p>Robert Louis Stevenson, <i>The Strange Case of Dr Jekyll and Mr Hyde</i>, Madhuban Publications, 2005</p> <p>Wren and Martin, <i>High School English Grammar and Composition</i>, S Chand (Indian edition), 2008.</p> <p>A J Thomson and A V Martinet, <i>A Practical English Grammar</i>, Oxford India, 2007</p>

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	<p>R V Lesikar, M E Flatley, K Rentz and N Pande, <i>Business Communication (Making Connections in Digital World)</i>, Tata McGraw Hill, 2010</p> <p>M Frank, <i>Writing as Thinking: A Guided Process Approach</i>, Englewood Cliffs, Prentice Hall Regents.</p>
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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM308-18 (A)</b>			
<b>Subject Title:</b>	<b>PUNJABI-III</b>			
<b>Contact Hours:</b>	<b>L:</b>	<b>T:</b>	<b>P:</b>	<b>Credits:</b>

**Details of the Course**

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
I	<p><b>ਕਵਿਤਾ ਭਾਗ:</b></p> <p>ਭਾਈ ਵੀਰ ਸਿੰਘ:</p> <p style="padding-left: 40px;">ਸਮਾਂ, ਚਸ਼ਮਾ</p> <p>ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ :</p> <p style="padding-left: 40px;">ਪੰਜਾਬ ਨੂੰ ਕੂਕਾਂ ਸੈਂ, ਹੱਲ ਵਾਹੁਣ ਵਾਲੇ</p> <p>ਪ੍ਰੋ. ਮੋਹਨ ਸਿੰਘ :</p> <p style="padding-left: 40px;">ਮਾਂ, ਕੋਈ ਆਇਆ ਸਾਡੇ ਵਿਹੜੇ, ਪਿਆਰ ਪੰਧ</p> <p><b>ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ:</b></p> <p style="padding-left: 40px;">ਆਖਾਂ ਵਾਰਿਸ ਸ਼ਾਹ ਨੂੰ, ਅੰਨਦਾਤਾ</p>	12
II	<p><b>ਕਹਾਣੀ ਭਾਗ:</b></p> <p>ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ :</p> <p style="padding-left: 40px;">ਪੇਸ਼ੀ ਦੇ ਨਿਆਣੇ</p> <p>ਸੁਜਾਨ ਸਿੰਘ :</p> <p style="padding-left: 40px;">ਕੁਲਫੀ</p> <p>ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ :</p> <p style="padding-left: 40px;">ਤੂੜੀ ਦੀ ਪੰਡ</p> <p>ਗੁਰਦਿਆਲ ਸਿੰਘ :</p> <p style="padding-left: 40px;">ਸਾਂਝ</p>	11
III	<p>ਸਵਰ ਤੇ ਵਿਅੰਜਨ ਧੁਨੀਆਂ ਦਾ ਨਿਖੇੜਾ ਤੇ ਵਰਗੀਕਰਨ</p> <p>ਦੁੱਤ ਵਿਅੰਜਨ ਤੇ ਸੰਯੁਕਤ ਵਿਅੰਜਨ</p> <p>ਅਗੇਤਰ, ਪਿਛੇਤਰ</p>	12

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IV	ਪੰਜਾਬੀ ਦੀਆਂ ਧੁਨੀਆਂ ਦੇ ਪਰਿਵਰਤਨ ਦੀਆਂ ਦਿਸ਼ਾਵਾਂ : ਲੋਪ, ਆਗਮ, ਵਿਕਾਰ, ਵਿਸ਼ਮੀਕਰਨ, ਵਿਪਰਜ। ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ ਦਾ ਵਿਸਤਾਰ ਪੂਰਵਕ ਅਧਿਐਨ	10
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**Reference Books**

S.No.	Author(s)	Title of the Book	Publisher/Year
1	ਡਾ. ਮਹਿਲ ਸਿੰਘ (ਸੰਪ.)	ਸਾਹਿਤ ਦੇ ਰੰਗ	ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2	ਡਾ. ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM301-18 (B)</b>			
<b>Subject Title:</b>	<b>Punjab History &amp; Culture-III</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	The Indo-Aryans: Original home and settlement in Punjab, Social, Religious and Economic life during the Rig Vedic Age, Social, Religious and Economic life during later Vedic Age
<b>II</b>	Alexandra's invasion and its impact. Punjab under Chandragupta Maurya and Ashoka.
<b>III</b>	The Kushans and their contribution to the Punjab. The Panjab under the Gupta Emperor. The Punjab under the Vardhana Emperors.
<b>IV</b>	The Punjab from 7th Century to 1000 A.D. (A Survey of Political and Socio-cultural History of Punjab). Development of Art and Architecture of Punjab.
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"> <li>1. L.M. Joshi (ed): History and Culture of the Punjab, Art-I, Patiala, 1989 (3rd edition)</li> <li>2. L.M. Joshi and Fauja Singh (ed); History of Punjab, Vol. I, Patiala, 1977.</li> <li>3. Budha Prakash: Glimpses of Ancient Punjab, Patiala, 1983.</li> <li>4. B.N. Sharma: Life in Northern India, Delhi, 1966.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM309-18</b>			
<b>Subject Title:</b>	<b>ENVIRONMENT SCIENCE</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness. Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.
<b>II</b>	Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: Floods, earthquake, cyclone and landslides.
<b>III</b>	Social Issues and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness (5)
<b>IV</b>	Human Population and the Environment, Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies (4) Field Work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban/Rural/Industrial/Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lectures)
	Recommended Books: 1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner. 2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R) 3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p 4. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB) 5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p 6. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 7. Down to Earth, Centre for Science and Environment (R) 8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment &

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- Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p
23. Rao M. N. & Datta A.K. 1987. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
24. Principle of Environment Science by Cunningham, W.P. (TB)
25. Essentials of Environment Science by Joseph. (TB)
26. Environment Pollution Control Engineering by Rao, C.S. (TB)

(M) Magazine (R) Reference (TB) Textbook

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM310-18</b>			
<b>Subject Title:</b>	<b>CHEMISTRY LAB III</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

### **Quantitative Analysis**

#### **Volumetric Analysis**

1. Determination of acetic acid in commercial vinegar using NaOH.
2. Determination of alkali content-antacid tablet using HCl.
3. Estimation of calcium content in chalk as calcium oxalate by permanganometry.
4. Estimation of hardness of water by EDTA.
5. Estimation of ferrous and ferric by dichromate method.
6. Estimation of copper using sodiumthiosulphate.

#### **Gravimetric Analysis**

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

### **Organic Chemistry Laboratory Techniques**

#### **Thin Layer Chromatography**

Determination of  $R_f$  values and identification of organic compounds.

1. Separation of green leaf pigments (spinach leaves may be used).
2. Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
3. Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

#### **Recommended Books:**

3. Practical Organic Chemistry by F.G. Mann and B.C. Saunders
4. Practical Inorganic Chemistry by J.R. Barrante G. Marr and B.W. Rockett
5. Vogel's Inorganic Quantitative Analysis

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>BSNM311-18</b>			
<b>Subject Title:</b>	<b>PHYSICS LAB-III</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

*At least 08 experiments from the following:*

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 study laser interference using Michelson's Interferometer.
4. To study wavelength of sodium light using Newton Rings.
5. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
6. To find the refractive index of a material/glass using spectrometer.
7. To find the refractive index of a liquid using spectrometer
8. To find the velocity of ultrasound in liquid.
9. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.
10. To determine the coefficient of thermal conductivity of a bad conductor using Lee's disc apparatus.
11. To compare heat transfer between different material surface and the black body surface by radiation.
12. To find the emissivity of different material surface.

**REFERENCE BOOKS:**

18. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
19. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
20. Engineering Practical Physics, S.Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
21. Practical Physics, G.L. Squires, 2015, 4<sup>th</sup> Edition, Cambridge University Press.
22. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 201, Kitab Mahal.
23. B Sc. Practical Physics, C. L. Arora, S. Chand & Co.
24. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

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**Fourth Semester**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSNM401-18	Inorganic Chemistry-III	3	0	0	25	50	75	3
BSNM402-18	Organic Chemistry-III	3	0	0	25	50	75	3
BSNM403-18	Wave Vibrations	3	0	0	25	50	75	3
BSNM404-18	Electronics	3	0	0	25	50	75	3
BSNM405-18	Analysis-II	3	0	0	25	50	75	3
BSNM406-18	Linear Algebra	3	0	0	25	50	75	3
BSNM407-18	English-IV	3	0	0	25	50	75	3
BSNM408-18 (A) / BSNM408-18 (B)	Punjabi-IV/Punjab History & Culture-IV	3	0	0	25	50	75	3
BSNM409-18	Chemistry Lab-IV	0	0	4	30	20	50	2
BSNM410-18	Physics Lab-IV	0	0	4	30	20	50	2
BSNM411-18	MATHEMATICA Software	0	0	2	30	20	50	1
<b>Total</b>		<b>24</b>	<b>0</b>	<b>10</b>	<b>290</b>	<b>460</b>	<b>750</b>	<b>29</b>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM401-18			
<b>Subject Title:</b>	<b>INORGANIC CHEMISTRY-III</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Coordination Compounds</b> Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.
<b>II</b>	<b>Non-aqueous Solvents</b> Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH <sub>3</sub> and liquid SO <sub>2</sub> . <b>Oxidation and Reduction</b> Use of redox potential data-analysis of redox cycle, redox stability in water-Frost, Latimer and Pourbaix diagrams.
<b>III</b>	<b>Chemistry of Lanthanide Elements</b> Electronic structure, oxidation states and ionic radii and lanthanide contraction. Electronic absorption and magnetic properties of lanthanides. <b>Chemistry of Actinides</b> General features and chemistry of actinides, similarities between the later actinides and the later lanthanides. Electronic and magnetic properties of actinides and their general comparison with the lanthanide elements.
<b>IV</b>	<b>Bioinorganic Chemistry</b> Essential and trace elements in biological processes, metalloporphyrins and special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca <sup>2+</sup>
	<b>Recommended Books:</b> 1. J.D. Lee, Concise Inorganic Chemistry, 4th Ed. 2. J.E. Huheey, Inorganic Chemistry, Harper & Row. 3. F.A.Cotton and G. Wilinon, Advanced Inorganic Chemistry, Interscience Publishers. 4. N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon Press. 5. D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991s

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**B.Sc. (Non-Medical) Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM402-18			
<b>Subject Title:</b>	<b>ORGANIC CHEMISTRY-III</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<p><b>Carboxylic Acids</b>            Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.</p> <p><b>Carboxylic Acids Derivatives</b>            Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability &amp; reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).</p>
<b>II</b>	<p><b>Ethers and Epoxides</b>            Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.</p> <p><b>Organometallic Compounds</b>            Organomagnesium Compounds: The Grignard reagents-formation, structure and chemical reactions. Organolithium Compounds: Formation and chemical reactions.            Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.</p>
<b>III</b>	<p><b>Organic Compounds of Nitrogen</b>            Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.</p>
<b>IV</b>	<p><b>Heterocyclic Compounds</b>            Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.</p>
	<p><b>Recommended Books:</b></p> <ol style="list-style-type: none"> <li>1. Organic Chemistry. F.A. Carey, McGraw Hill, Inc. 8th edition.</li> <li>2. Organic Chemistry, Morrison and Boyd, Prentice Hall</li> <li>3. Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, 3<sup>rd</sup> edition, Indian reprint, 2004. Chennai Microprint Pvt. Ltd.</li> <li>4. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical</li> <li>5. Organic Chemistry Vol. I, II &amp; III, S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley Eastern Ltd (New Age International).</li> <li>6. Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmillan.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM403-18			
<b>Subject Title:</b>	<b>Waves Vibrations</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Simple and Damped Harmonic Motion:</b> Simple harmonic motion, energy of a SHO, Compound pendulum, Torsional pendulum, Electrical Oscillations, Lattice Vibrations, Transverse Vibrations of a mass on a string, Anharmonic Oscillations. Damped simple harmonic motion, Decay of free Vibrations due to damping, types of damping, Determination of damping coefficients – Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping. (10 Lectures)
<b>II</b>	<b>Forced Vibrations and Resonance:</b> Forced mechanical and electrical oscillator, Transient and Steady State Oscillations, Displacement and velocity variation with driving force frequency, Variation of phase with frequency resonance, Power supplied to forced oscillator by the driving force. Q-factor and band width of a forced oscillator, Electrical and nuclear magnetic resonances. (8 Lectures)
<b>III</b>	<b>Coupled Oscillations:</b> Stiffness coupled oscillators, Normal coordinates and modes of vibrations. Inductance coupling of electrical oscillators, Normal frequencies, Forced vibrations and resonance for coupled oscillators, Masses on string-coupled oscillators. (8 Lectures)
<b>IV</b>	<b>Waves in Physical Media:</b> Types of waves, wave equation (transverse) and its solution characteristics impedance of a string, Impedance matching, Reflection and Transmission of waves at boundary, Energy of vibrating string, wave and group velocity. (10 Lectures)
	<b>Recommended Books:</b> <ol style="list-style-type: none"> <li>1. Text Book of Vibrations and Waves: S.P. Puri (Macmillan India), 2004.</li> <li>2. The Physics of Vibrations and Waves: H.J. Pain (Wiley and ELBS), 1976.</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM404-18			
<b>Subject Title:</b>	<b>ELECTRONICS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>P.N. Junction:</b> Intrinsic/Extrinsic semiconductor, Fermi level, Charge carries in semiconductors, PN junctions, depletion region, current components in pn junction, Characteristic of pn junction diode, pn junction as rectifier, characteristics and applications of Zener diode, Photodiode, LED and photocells. (10 Lectures)
<b>II</b>	<b>Electronic Devices:</b> Bipolar junction transistor, current components in transistors, CB, CE, CC configuration, h-parameters, transistor biasing, transistor as an amplifier, Emitter follower, characteristics and applications of FET, MOSFET. (10 Lectures)
<b>III</b>	<b>Transistor Circuits:</b> Feedback amplifiers; classification of amplifiers, feed-back concept, Sinusoidal oscillations; phase shift oscillators, Wien Bridge Oscillator, Crystal oscillator, Basic idea about AM modulation and demodulations, Oscilloscope. (10 Lectures)
<b>IV</b>	<b>Digital Principles:</b> Number system, Decimal, binary, Octal, hexadecimal, logic gates, AND, OR, NOT, NAND, NOR, XOR, XNOR, Karnaugh map techniques. (10 Lectures)
	<b>Recommended Books:</b> <ol style="list-style-type: none"> <li>1. Integrated Electronics: J.Millman and C.C.Halkias (Tata McGraw Hill,2001).</li> <li>2. Electronic Devices &amp; Circuits–J.Millman and C.C.Halkias (Tata McGraw Hill, 2009).</li> <li>3. Digital Principles &amp; Applications–P.Malvine &amp; Leach (Tata McGraw Hill,1993)</li> </ol>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM407-18			
<b>Subject Title:</b>	<b>ENGLISH-IV</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the course:**

<b>Unit</b>	<b>Contents</b>
<b>I</b>	<p><b>Textbook entitled ‘Prism: Spoken and Written Communication, Prose &amp; Poetry’ published by Orient Longman</b></p> <p><b><u>For enhancing vocabulary and learning sentence/speech construction:</u></b></p> <p><b>I. Prose:</b></p> <p>1) Socrates and the Schoolmaster – F. L. Brayne            2) With the Photographer – Stephen Leacock</p> <p><b>II. Poetry:</b></p> <p>1) On Television – Roald Dahl            2) Say Not the Struggle Naught Availeth – Arthur Hugh Clough            3) Abou Ben Adhem – James Leigh Hunt</p>
<b>II</b>	<p><b>Grammar and Vocabulary:</b>            Transformation of sentences; Tenses; Active/Passive Voice; Narration</p>
<b>III</b>	<p><b>Reading &amp; Writing Skills:</b> Analytical reports; Drafting of career documents: Job Applications/ Resume/CV</p>
<b>IV</b>	<p><b>Spoken Skills</b></p> <ol style="list-style-type: none"> <li>1. Getting People’s Attention and Interrupting</li> <li>2. Giving Instructions and Seeking Clarifications</li> <li>3. Making Requests and Responding to Requests</li> <li>4. Asking for Directions and Giving Directions</li> <li>5. Thanking Someone and Responding to Thanks</li> <li>6. Inviting and Accepting and Refusing an Invitation</li> <li>7. Apologizing and Responding to an Apology</li> <li>8. Asking for, Giving and Refusing Permission</li> </ol>
	<p><b>Recommended Books:</b>            William Zinsser. <i>On Writing Well</i>. Harper Resource Book. 2001</p> <p>Robert Louis Stevenson, <i>The Strange Case of Dr Jekyll and Mr Hyde</i>, Madhuban Publications, 2005</p> <p>Wren and Martin, <i>High School English Grammar and Composition</i>, S Chand (Indian edition),</p>

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	<p>2008.</p> <p>A J Thomson and A V Martinet, <i>A Practical English Grammar</i>, Oxford India, 2007</p> <p>R V Lesikar, M E Flatley, K Rentz and N Pande, <i>Business Communication (Making Connections in Digital World)</i>, Tata McGraw Hill, 2010</p> <p>M Frank, <i>Writing as Thinking: A Guided Process Approach</i>, Englewood Cliffs, Prentice Hall Regents.</p>
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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>	BSNM408-18 (A)		
<b>Subject Title:</b>	<b>Punjabi-IV</b>		
<b>Contact Hours:</b>	<b>L:</b>	<b>T:</b>	<b>P: Credits:</b>

**Details of the Course**

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
I	<p>ਡਾ.ਹਰਿਭਜਨ ਸਿੰਘ:</p> <p>ਅਪ੍ਰਮਾਣਿਕ, ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਰੀ ਦੀ ਦਾਸਤਾਨ</p> <p>ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ:</p> <p>ਕੀਡਿਆਲੀ ਬੋਰੂ, ਧਰਮੀ ਬਾਬਲ ਪਾਪ ਕਮਾਇਆ, ਰੁੱਖ</p> <p>ਪਾਸ਼:</p> <p>ਇਨਕਾਰ,ਸਭ ਤੋਂ ਖਤਰਨਾਕ,ਦਹਿਕਦੇ ਅੰਗਿਆਰਾਂ ‘ਤੇ</p> <p>ਸੁਰਜੀਤ ਪਾਤਰ:</p> <p>ਹੁਣ ਘਰਾਂ ਨੂੰ ਪਰਤਣਾ, ਕੁਝ ਕਿਹਾ ਤਾਂ..., ਪੁਲ</p>	12
II	<p>ਕਹਾਣੀ ਭਾਗ:</p> <p>ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ:</p> <p>ਕੋਈ ਇਕ ਸਵਾਰ</p> <p>ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼:</p> <p>ਲੱਛਮੀ</p> <p>ਮੋਹਨ ਭੰਡਾਰੀ :</p> <p>ਘੋਟਣਾ</p> <p>ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ :</p> <p>ਆਪਣਾ ਆਪਣਾ ਹਿੱਸਾ</p>	11
III	<p>ਕੰਪਿਊਟਰ ਦੀ ਪਰਿਭਾਸ਼ਾ, ਡਾਟਾ ਸਟੋਰੇਜ਼ ਡਿਵਾਈਸਜ਼, ਟਾਈਪਿੰਗ ਦੀ ਮਹੱਤਤਾ,</p> <p>ਫਾਈਡ ਐਂਡ ਰੀਪਲੇਸ : ਫਾਈਡ ਐਂਡ ਚੇਜ਼ ਦ ਟੈਕਸਟ, ਸਪੈਲ ਚੈੱਕਰ</p>	12

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	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਤੇ ਇੰਟਰਨੈੱਟ : ਈ.ਨਿਊਜਪੋਪਰ, ਵਿਕੀਪੀਡੀਆ	
IV	ਸਾਹਿਤ ਦੇ ਰੂਪ : ਕਵਿਤਾ, ਵਾਰਤਕ, ਕਹਾਣੀ, ਨਾਵਲ	10

**Reference Books**

S.No.	Author(s)	Title of the Book	Publisher/Year
1	ਡਾ. ਮਹਿਲ ਸਿੰਘ (ਸੰਪ.)	ਸਾਹਿਤ ਦੇ ਰੰਗ	ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2	ਡਾ. ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ
3	ਰਤਨ ਸਿੰਘ ਜੱਗੀ	ਸਾਹਿਤ ਦੇ ਰੂਪ	ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ

## Semester-IV

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>	BSNM408-18 (B)		
<b>Subject Title:</b>	<b>Punjab History &amp; Culture IV</b>		
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0 Credits:3</b>

### Details of the Course

Unit	Content
<b>I</b>	Guru Gobind Singh and the Khalsa Banda Singh Bahadur: Conquests and Execution
<b>II</b>	Sikh Struggle for Sovereignty Sikh Misls Ranjit Singh: Conquests, Administration and the Anglo-Sikh Relations Anglo-Sikh Wars and the Annexation
<b>III</b>	The Punjab under the British: New Administration, Education and Social Change
<b>IV</b>	Socio-Religious Reform Movements Role of Punjab in the Freedom Struggle
	<p><b>Recommended Books:</b></p> <p>1. Kirpal Singh (ed.): History and Culture of the Punjab, Part-II, Punjabi University, Patiala, 1990.</p> <p>2. Fauja Singh (ed.): History of Punjab, Vol. III, Punjabi University, Patiala, 1987.</p> <p>3. J.S. Grewal: The Sikhs of the Punjab, CUP, Cambridge, 1991.</p> <p>4. Sukhwant Singh. Agricultural Growth under Colonial Constraints: The Punjab 1849-1947, Manpreet Publication, Delhi, 2000.</p> <p>5. Khushwant Singh, A History of the Sikhs, Vol. I, OUP, New Delhi, 1990.</p> <p>6. Khushwant Singh, A History of the Sikhs, Vol. I, OUP, New Delhi, 1990.</p>

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM409-18			
<b>Subject Title:</b>	<b>CHEMISTRY LAB IV</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

### Qualitative Analysis

Detection of elements

1. Nitrogen,
2. Sulphur
3. Halogens

Detection of functional groups

1. Phenolic
  2. carboxylic,
  3. carbonyl,
  4. esters,
  5. carbohydrates,
  6. amines, amides, nitro and anilide
- in simple organic compounds and preparing their derivatives

### Recommended Books:

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

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	BSNM410-18			
<b>Subject Title:</b>	<b>Physics Lab-IV</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

*At least 08 experiments from the following:*

1. To determine the value of horizontal component of Earth's magnetic field  $B_h$ .
2. To determine unknown capacitance by flashing and quenching method.
3. To study the magnetic field of a circular coil carrying current.
4. To find out polarizability of a dielectric substance.
5. To determine the frequency of an electrically maintained tuning fork by i) Transverse mode of vibration ii) Longitudinal mode of vibration
6. To find out the frequency of AC mains using electric-vibrator/sonometer.
7. Experiment to study Doppler effect
8. To study V-I characteristic of a Ge-Si junction.
9. Analyze the suitability of a given Zener diode as a power regulator.
10. To study the band gap of a Ge semiconductor.
11. To study the the band gap of a Si semiconductor.

**REFERENCE BOOKS:**

25. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
26. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
27. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
28. Practical Physics, G.L. Squires, 2015, 4<sup>th</sup> Edition, Cambridge University Press.
29. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 201, Kitab Mahal.
30. B Sc. Practical Physics, C. L. Arora, S. Chand & Co.
31. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

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**B.Sc. (Non-Medical) Batch 2018 onwards**

**Course Title: ANALYSIS-II**

**Course Code: BSNM405-18**

**UNIT-I**

Sequence of functions: pointwise and uniform convergence, Cauchy's criterion for uniform convergence, Test ( $M_n$ -test) for uniform convergence, uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation.

**UNIT-II**

Series of functions: pointwise and uniform convergence, Cauchy's criterion for uniform convergence, Weierstrass's M-test test, Abel's test, Dirichlet's test, uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation. Weierstrass approximation theorem (Statement only).

**UNIT-III**

Vector differentiation, Gradient, Divergence and Curl with their properties and applications. Vector Integration: Line, Surface and Volume integration. Gauss divergence theorem, Stokes' theorem, Green's theorem.

**UNIT-IV**

Fourier series: Fourier expansion of piecewise monotonic functions, Fourier series for odd and even functions, half range series. Fourier series in the interval  $[0, 2\pi]$ ,  $[-1, 1]$  and  $[a, b]$ .

**Reference Books.**

1. Tom Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. Shanti Narayan, M. D. Raisinghania, Elements of Real Analysis, S. Chand & Company, 2018.
3. S. C. Malik, Savita Arora, Mathematical Analysis, New Age International Publishers, 2017.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc, New York, 1999.

**Course Title: LINEAR ALGEBRA**

**Course Code: BSNM406-18**

**UNIT-I**

Linear independence of row and column vectors, row rank, column rank and rank of a matrix and their equivalence. Applications of matrices to a system of linear equations (both homogeneous and non-homogeneous). Theorems on consistency of a system of linear equations (both homogeneous and non-homogeneous).

**UNIT-II**

Eigenvalues, eigenvectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix. Diagonalization.

**UNIT-III**

Vector Space: Definition and Examples of Vector Spaces, Subspaces, Algebra of subspaces, Linear span, Linear dependence and independence of vectors, Basis and dimension of a vector space, Basis and dimension of subspace, Direct sums and complements.

**UNIT-IV**

Linear transformations, Rank and Nullity of a linear transformation, Vector space of linear transformations. Linear transformations and matrices, Change of basis.

**Reference Books.**

1. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, First Course in Linear Algebra, New Age International Publishers, 2015.
2. Bernard Kolman, David R. Hill, Elementary Linear Algebra with Applications, Pearson, 2007.
3. Vivek Sahai, Vikas Bist, Linear Algebra, Narosa, 2017.

**Course Title: MATHEMATICA Software**

**Course Code: BSNM411-18**

### **UNIT-I**

The structure of MATHEMATICA, notebook interfaces, constants, variables, algebraic calculations, four kinds of brackets, lists, tables, expressions, functions, built-in functions, functional operations, graphics, patterns, manipulating lists, transformation rules, evaluation of expressions, modularity, manipulating notebooks, relational and logical operators.

### **UNIT-II**

Symbolic math commands: D; Integrate; Sum; Product; Solve; Eliminate; Reduce; Series; Limit; Minimize; Programming: conditionals; loops: Do; For and While.

### **Reference Books.**

1. Wolfram, S., The MATHEMATICA Book, 5<sup>th</sup> revised edition. Wolfram Media Inc, 2004.
2. Abell, M. and Braselton, J., Mathematica by Example, 5<sup>th</sup> Edition. Academic Press, 2017.

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. Non-Medical Batch 2018 onwards**

**Bachelors of Science in Non-Medical (B.Sc. Non-Medical):**

**Courses & Examination Scheme:**

**Fifth Semester**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSNM501-18	Inorganic Chemistry-IV	3	0	0	25	50	75	3
BSNM502-18	Physical Chemistry-III	3	0	0	25	50	75	3
BSNM503-18	Elements of Modern Physics	3	0	0	25	50	75	3
BSNM504-18	Quantum Mechanics	3	0	0	25	50	75	3
BSNM505-18	Theory of probability	3	0	0	25	50	75	3
BSNM506-18	Numerical Analysis	3	0	0	25	50	75	3
BSNM507-18	English-V	3	0	0	25	50	75	3
BSNM508-18(A)/ BSNM508-18(B)	Punjabi-V/Punjab History & Culture-V	3	0	0	25	50	75	3
BSNM509-18	Drug Abuse-I (Problem, and Management)	2	0	0	25	50	75	-
BSNM510-18	Chemistry Lab-V	0	0	4	30	20	50	2
BSNM511-18	Physics Lab-V	0	0	4	30	20	50	2
	<b>Total</b>							<b>28</b>

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>INORGANIC CHEMISTRY-IV</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>	<b>Contact Hours</b>
<b>I</b>	<b>Metal-ligand Bonding in Transition Metal Complexes</b> valence bond theory, Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.	10
<b>II</b>	<b>Magnetic Properties of Transition Metal Complexes</b> Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of $\mu_s$ and $\mu_{\text{eff}}$ values, orbital contribution to magnetic moments, application of magnetic moment data for characterization of 3d-metal complexes.	11
<b>III</b>	<b>Thermodynamic and Kinetic Aspects of Metal Complexes</b> A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes. <b>Electronic Spectra of Transition Metal Complexes</b> Term Symbols for $p^2$ & $d^2$ systems, spectroscopic ground states for $d^1$ - $d^{10}$ electronic configurations. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, Orgel diagram for $d^1$ - $d^5$ .	12
<b>IV</b>	<b>Organometallic Compounds</b> Definition, nomenclature and classification of organometallic compounds. EAN rule, Preparation, properties, and applications of alkyls aryls of lithium and aluminium, Bonding in metal-ethylenic complexes, Mechanism of homogeneous hydrogenation reactions.	12

**Reference Books:**

1. B.N. Figgis, Introduction to Ligand Field, Wiley Eastern.
2. A.B.P. Lever, Inorganic Electronic Spectroscopy, Elsevier.
3. A. Earnshaw, Introduction to Magnetochemistry, Academic Press.
4. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity, Harper Inter-Science.
5. R.S. Drago, Physical Method in Chemistry, W.B. Saunders Company.
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Inter-science.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>PHYSICAL CHEMISTRY-III</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>	<b>Contact Hours</b>
<b>I</b>	<p><b>Electrochemistry-I</b>                      Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of <math>K_a</math> of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.</p>	<b>11</b>
<b>II</b>	<p><b>Electrochemistry – II</b>                      Types of reversible electrodes-gas metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and Single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.                      EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions (<math>\Delta G</math>, <math>\Delta H</math> and <math>K</math>), polarization, over potential and hydrogen overvoltage.                      Concentration cells with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.                      Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hasselbalch equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.</p>	<b>12</b>
<b>III</b>	<p><b>Nuclear Chemistry</b>                      Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear</p>	<b>10</b>

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	Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.	
<b>IV</b>	<p><b>Spectroscopy</b>            Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.</p> <p><b>Rotational Spectrum</b>            Diatomic molecules. Energy levels of a rigid rotor (semiclassical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.</p> <p><b>Vibrational Spectrum</b>            Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.            Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.</p> <p><b>Electronic Spectrum</b>            Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of s, p, and n M.O., their energy levels and the respective transitions.</p>	<b>12</b>

**Reference Books:**

1. Thermodynamics for Chemists, S. Glasstone.
2. R.S.Drago, "Physical Methods in Chemistry".
3. Principles of Physical Chemistry, S.H. Maron & C.F. Prutton.
4. Physical Chemistry, P.W. Atkins.
5. G.M. Barrow "Introduction to Molecular Spectroscopy".
6. C.N. Banwell "Fundamentals of Molecular Spectroscopy"
7. Concise Inorganic Chemistry by J.D. Lee, Oxford; Fifth edition

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Elements of Modern Physics</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Dual Nature of Waves and Particles:</b> Black body radiation, Planck's quantum, Planck's constant and light as a collection of photons; Photo Electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment, Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. <span style="float: right;">Lecture (10)</span>
<b>II</b>	<b>Quantum Mechanics:</b> Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension. One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example <span style="float: right;">Lecture (10)</span>
<b>III</b>	<b>Atomic structure:</b> The nuclear atom, Electron orbits, Atomic spectra, The Bohr Model, Energy level and spectra, Correspondence principle, Nuclear motion, Atomic excitation, Many electron atoms, Exclusion Principle, electron spin, spin orbit coupling, X-ray spectra. Zeeman effect, Stern-Gerlach experiment. <span style="float: right;">Lecture (10)</span>
<b>IV</b>	<b>Special Theory of Relativity:</b> Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy-Momentum Four Vector. <span style="float: right;">Lecture (10)</span>

**Recommended Books:**

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2009, PHI Learning
3. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill
4. Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
5. Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Cengage Learning

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Quantum Mechanics</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Time dependent and independent Schrodinger equation:</b> Time dependent Schrodinger equation, dynamical evolution of a quantum state; Interpretation of Wave Function, Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Position, momentum & Energy operators; Expectation value, Commutator of position and momentum operators; Wave Function of a Free Particle. Time independent Schrodinger equation, Hamiltonian, stationary states and energy eigenvalues; General solution of the time dependent Schrodinger equation, wave packets, Fourier transforms and momentum space wave function; Position-momentum uncertainty principle. (12 Lectures)
<b>II</b>	<b>Applications of Schrodinger Equation:</b> General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method. (12 Lectures)
<b>III</b>	<b>Quantum theory of hydrogen-like atoms:</b> time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions from Frobenius method; Orbital angular momentum quantum numbers $l$ and $m$ ; s, p, d,.. shells (idea only) (12 Lectures)
<b>IV</b>	<b>Atoms in Electric and Magnetic Fields:-</b> Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment & Magnetic Energy, Gyromagnetic Ratio & Bohr Magneton. Atoms in External Magnetic Fields: Normal and Anomalous Zeeman Effect. (10 Lectures)

**Recommended Books:**

1. A Text book of Quantum Mechanics, P.M.Mathews & K.Venkatesan, 2nd Ed., 2010, McGraw Hill
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
4. Quantum Mechanics, G. Aruldas, 2nd Edn. 2002, PHI Learning of India.
5. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
6. Quantum Mechanics for Scientists and Engineers, D.A.B. Miller, 2008, Cambridge University Press
7. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
8. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education
9. Quantum Mechanics, Walter Greiner, 2<sup>nd</sup> Edn., 2001, Springer

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>THEORY OF PROBABILITY</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Course Objectives** This course is designed to introduce theory of probability. The main focus of the course will be on the notions and uses of probability, random variables and probability distributions.

**UNIT-I**

Random experiment, sample space, event, algebra of events, Probability definition, addition law of probability, multiplication law of probability, conditional probability and independence, Bayes' Theorem

**UNIT-II**

Random variables, distribution function, properties of distribution function, discrete random variable, probability mass function, discrete distribution function, continuous random variable, probability density function. Continuous distribution function.

**UNIT-III**

Mathematical expectation, expectation of a random variable, Discrete probability distributions: binomial, Poisson, negative binomial distribution.

**UNIT-IV**

Continuous probability distributions: uniform distribution, normal distribution, normal distribution as a limiting case of binomial distribution, Gamma distribution, Beta distribution.

**Course Outcomes** After completion of the course, the students will be able to

- Understand and demonstrate the notion of randomness.
- Apply the concepts of probability in modeling processes and decision making.

**Reference Books**

- S. Ross, A First Course in Probability, Pearson, 2008.
- S.C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi, 2014.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>NUMERICAL ANALYSIS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Course Objectives** This course is designed to introduce basic concepts of numerical analysis. The main objective of the course is to introduce the methods for solving problems numerically which are difficult to deal with analytically.

**UNIT-I**

**Linear System of Equations:** Gauss elimination method, Gauss Jordan method, LU decomposition method. **Iterative Methods:** Jacobi, Gauss-Seidel, Relaxation Methods; **Eigenvalue Problem:** Power Method.

**UNIT-II**

**Interpolation:** Interpolation with Unevenly Spaced Points: Lagrange Interpolation, Newton's Divided Difference Interpolation; Interpolation with Evenly Spaced Points: Newton's Forward Difference Interpolation Formula, Newton's Backward Difference Interpolation Formula, Spline interpolation.

**UNIT-III**

**Numerical Differentiation and Integration:** Numerical differentiation: Newton's Forward Difference Formula, Newton's Backward Difference Formula, Newton's Divided Difference Formula; Numerical Integration: Trapezoidal rule, Simpson's 1/3-rule and Simpson's 3/8 rule.

**UNIT-IV**

**Numerical solution of ordinary differential equations (ODEs):** Initial Value Problems of ODEs: Taylor series method, Euler's methods, Runge-Kutta methods and linear multi-step methods (Adams-Bashforth & Adams-Moulton).

**Course Outcomes** After completion of the course, the students will be able to

- Analyze and solve different types of problems numerically arising in various fields of applications.
- Use different numerical methods for solving problems with the understating of their limitations.

**Reference Books.**

1. Richard L. Burden and J. Douglas Faires, Numerical Analysis, 9<sup>th</sup> Edition, Cengage Learning, 2012.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6<sup>th</sup> Edition, New Age International Publisher, 2012.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>			
<b>Subject Title:</b>	<b>ENGLISH-V</b>		
<b>Contact Hours</b>	<b>L: 3</b>	<b>T: 0</b>	<b>P: 0</b>
	<b>Credits: 3</b>		

**Details of the Course:**

Unit	Content
<b>I</b>	<p><b>(A) Literature</b></p> <p><b><i>The Poetic Palette (Orient Black Swan, Second Edition, 2016)</i></b></p> <p>The following poems from this anthology are prescribed:</p> <ol style="list-style-type: none"> <li>a. The Charge of the Light Brigade: Alfred Tennyson</li> <li>b. He Wishes for the Cloths of Heaven: W. B. Yeats</li> <li>c. True ease in writing comes from art, not chance: Alexander Pope</li> <li>d. Goodbye party for Miss Pushpa T. S.: Nissim Ezekiel</li> </ol> <p><b>(B) Vocabulary:</b></p> <p>Various processes of Word formation; Standard Abbreviations &amp; Acronyms; Internet Texting Abbreviations &amp; Acronyms</p>
<b>II</b>	<p><b>(A) Literature</b></p> <p><b><i>Prose Parables (Orient Black Swan, 2013)</i></b></p> <p>The following stories from the above volume are prescribed:</p> <ol style="list-style-type: none"> <li>a. The Voice of God: Prem Chand</li> <li>b. The Face on the Wall: E.V. Lucas</li> <li>c. The Gold Frame: R. K. Laxman</li> <li>d. My Brother, My Brother: Norah Burke</li> </ol> <p><b>(B) Grammar:</b></p> <p>Use of Idioms/Phrases in sentences; Understanding Sentences Structures &amp; practice on Transformation of sentences</p>
<b>III</b>	<p><b>Reading &amp; Writing Skills:</b></p> <p>Close Reading; Comprehension; Translation (from Hindi/Punjabi to English and vice-versa)</p> <p>Business Correspondence- Business letters; Letter to the Editor; Business Emails; Drafting Notices &amp; Memos</p>
<b>IV</b>	<p><b>Interactive practice sessions on Oral Communication</b></p> <ul style="list-style-type: none"> <li>• Self-Introduction,</li> <li>• Group Discussion and Role Play</li> <li>• Common Everyday Situations: Conversations and Dialogues</li> </ul>

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**Recommended Books:**

1. *Oxford Practice Grammar* by John Eastwood (Ed. 2014)
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Black swan, 2013.
4. *Remedial English Grammar*. F.T. Wood. Macmillan.2007.
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
7. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Punjabi-V</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

ਪਾਠ-ਕ੍ਰਮ:

**ਯੂਨਿਟ-1 (ਸਾਹਿਤ)**

1. ਡਾ. ਗੰਡਾ ਸਿੰਘ - ਪ੍ਰੋ. ਪ੍ਰੀਤਮ ਸਿੰਘ
2. ਨਾਨਕ ਸਿੰਘ - ਬਲਵੰਤ ਗਾਰਗੀ
3. ਬਾਬਾ, ਬੋਹੜ ਨਹੀਂ - ਭਗਵੰਤ ਸਿੰਘ
4. ਨਿੱਕੀ ਕਹਾਣੀ ਦਾ ਬਾਦਸ਼ਾਹ-ਅਜੀਤ ਕੌਰ
5. ਬਾਤਾਂ ਮੋਹਨ ਸਿੰਘ ਕੀਆਂ- ਕੁਲਬੀਰ ਸਿੰਘ ਕਾਂਗ
6. ਗੁਲਾਬੀ ਕਾਗਜ਼ ਉੱਤੇ ਲਿਖੀ ਕਵਿਤਾ:ਸੰਤੋਖ ਧੀਰ-ਗੁਰਬਚਨ ਸਿੰਘ ਭੁੱਲਰ
7. ਸੁਤਿੰਦਰ ਸਿੰਘ ਨੂਰ: ਸਾਹਿਤ ਦਾ ਜਥੇਦਾਰ-ਗੁਰਬਚਨ
8. ਮਿਲਖਾ ਸਿੰਘ-ਸਰਵਣ ਸਿੰਘ

**ਯੂਨਿਟ-2 (ਭਾਸ਼ਾ )**

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਚ ਆਏ ਪਰਵਿਰਤਨ  
 ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਵਿਗਿਆਨ ਦੀ ਸਿਖਿਆ ਵਿਚ ਭੂਮਿਕਾ

**ਯੂਨਿਟ-3 (ਵਿਆਕਰਣ)**

ਪੰਜਾਬੀ ਵਿਆਕਰਣਕ ਇਕਾਈਆਂ: ਸਵਾਧੀਨ ਉਪਵਾਕ ਤੇ ਪਰਾਧੀਨ ਉਪਵਾਕ।

**ਯੂਨਿਟ-4 (ਲੇਖਣੀ-ਕਲਾ)**

ਸਨੇਹੀਆਂ ਨੂੰ ਚਿੱਠੀ-ਪੱਤਰ  
 ਪੋਸਟ ਕਾਰਡ ਲਿਖਣ ਦੀ ਵਿਧੀ ਤੇ ਨਮੂਨਾ

**ਸਹਾਇਕ ਪੁਸਤਕਾਂ:**

ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪ. ਡਾ.ਮਹਿਲ ਸਿੰਘ),ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ ਅੰਮ੍ਰਿਤਸਰ।

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਣ ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ, ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ, ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ, ਵੇਦ ਅਗਨੀਹੋਤਰੀ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, ਐਡੀਸ਼ਨ 2009.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	Punjab History & Culture-V			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**SECTION-A**

Economy: Development of Resources: Transport and Communication,

Agriculture: Industry, Trade and Commerce, Education

**SECTION-B**

Society and Culture: Aristocracy, Middle classes, Artisans, Agricultural

Labourers: Social Religious Reformers.

**SECTION-C**

National Movement: Early Nationalist Activities, Agrarian Agitation  
Of 1907, Ghadar Movement; Gandhian Movements

**SECTION-D**

Naujwan Bharat Sabha ;Hindustan Socialist Republican Association.  
The Akali Movement (1920-25)

**Suggested Readings:-**

1. Badan-Powell, B.H., The Land System of British India, II, Oriental Publishers, 1974(reprint).
2. Bal, S.S., A Brief History of the Modern Punjab, Lyall Book Depot, Ludhiana, 1974.
3. Banga Indu, Five Punjabi Centuries: Essays for Dr J.S. Grewal, Manohar, New Delhi 1997.
4. Banerjee, Himadri, Agrarian Society of the Punjab, 1849-1901, Manohar Book Service, New Delhi 1982.
5. Barrier, N.G, The Sikhs and their Literature, Manohar Books Service, Delhi 1970.

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>			
<b>Subject Title:</b>	<b>Drug Abuse-I (Problem and Management)</b>		
<b>Contact Hours:</b>	<b>L:2</b>	<b>T:0</b>	<b>P:0</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Meaning of Drug Abuse:</b> Concept and Overview, Historical Perspective of Drug Abuse, Drug Dependence, Drug Addiction, Physical and Psychological Dependence: Drug Tolerance and withdrawal symptoms.
<b>II</b>	<b>Types of Abused Drugs and their Effects.</b> 1) Stimulants: Amphetamines – Benzedrine, Dexedrine, Cocaine. 2) Depressants: Alcohol Barbiturates: Nembutal, Seconal, Phenobarbital and Rohypnol. 3) Narcotics: Heroin, Morphine, Oxycodone. 4) Hallucinogens: Cannabis, Marijuana, Hashish, Hash Oil, MDMA, LSD. 5) Steroids.
<b>III</b>	<b>Nature and Extent of the Problem:</b> Magnitude or prevalence of the menace of Drug Abuse in India and Punjab, Vulnerable groups by age, gender and economic status, Signs and Symptoms of Drug Abuse: Physical, Academic, Behavioural and Psychological Indicators.
<b>IV</b>	<b>Management of Drug Abuse:</b> Medical Management: Medication for treatment and to reduce withdrawal effects. Psychiatric Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental Intervention.

**References:**

8. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
9. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
10. Inciardi, J.A. 1981. The Drug Crime Connection. Beverly Hills: Sage Publications.
11. Kapoor. T. (1985) Drug epidemic among Indian Youth, New Delhi: Mittal Pub. 15
12. Modi, Ishwar and Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.
13. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
14. Sain, Bhim 1991, Drug Addiction Alcoholism, Smoking obscenity New Delhi: Mittal Publications.
15. Singh, Chandra Paul 2000. Alcohol and Dependence among Industrial Workers: Delhi: Shipra.
16. Sussman, S and Ames, S.L. (2008). Drug Abuse: Concepts, Prevention and Cessation, Cambridge University Press.

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>CHEMISTRY LAB V</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

**(I) Synthesis and Analysis**

- (a) Preparation of Sodium trioxalatoferrate(III)
- (b) Preparation of Ni-DMG Complex
- (c) Preparation of Copper tetrammine complex
- (d) Preparation of *cis*-bisoxalatodiaquachromate(III)ion

**(II) Physical Chemistry**

**(a) Conductometric Titrations**

- (i) Determine the end point of the following titrations by the conductometric methods.

Strong acid-Strong base

Strong acid-Weak base

Weak acid-Strong base

Weak acid-Weak base

- (ii) Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.

**(b) (i) Molecular Weight Determination** of acetanilide, naphthalene, using camphor as solvent (Rast's methods).

- (ii) To determine the molecular weight of a polymer by viscosity measurements.

**(c) Adsorption:** To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.

**(d) Phase Equilibria:** To determine the distribution coefficient of iodine between CCl<sub>4</sub> and water.

**(e) Refractometry:** (i) Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.

- (ii) To determine the composition of unknown mixture of two liquids by refractive index measurements.

**Reference books**

1. Practical Inorganic Chemistry by J.R. Barrante G. Marr and B.W. Rockett
2. Vogel's Inorganic Quantitative Analysis
3. Advanced Practical Physical Chemistry by J.B. Jadav

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Physics Lab- V</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

**List of Experiments:**

1. Measurement of Planck's constant using black body radiation and photo-detector.
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
3. To determine work function of material of filament of directly heated vacuum diode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of  $e/m$  by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunneling effect in tunnel diode using I-V characteristics.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating.
14. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency.
15. Study of Zeeman effect: with external magnetic field; Hyperfine splitting.
16. To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode.

**Reference Books:**

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Engineering Practical Physics, S.Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. Practical Physics, G.L. Squires, 2015, 4<sup>th</sup> Edition, Cambridge University Press.
5. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 201, Kitab Mahal.
6. B Sc. Practical Physics, C. L. Arora, S. Chand & Co.
7. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

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**Sixth Semester**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSNM601-18	Organic Chemistry-IV	3	0	0	25	50	75	3
BSNM602-18	Physical Chemistry-IV	3	0	0	25	50	75	3
BSNM603-18	Solid State Physics	3	0	0	25	50	75	3
BSNM604-18	Nuclear and Particle Physics	3	0	0	25	50	75	3
BSNM605-18	Modern algebra	3	0	0	25	50	75	3
BSNM606-18	Statics and dynamics	3	0	0	25	50	75	3
BSNM607-18	English-VI	3	0	0	25	50	75	3
BSNM608-18(A)/ BSNM608-18(B)	Punjabi- VI / Punjab History & Culture- VI	3	0	0	25	50	75	3
BSNM609-18	Drug Abuse-II (Management and Prevention)	2	0	0	25	50	75	-
BSNM610-18	Chemistry Lab- VI	0	0	4	30	20	50	2
BSNM611-18	Physics Lab- VI	0	0	4	30	20	50	2
	<b>Total</b>							<b>28</b>

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>ORGANIC CHEMISTRY-IV</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>	<b>Contact Hours</b>
<b>I</b>	<p><b>Spectroscopy</b></p> <p><b>Nuclear Magnetic Resonance (NMR) spectroscopy.</b></p> <p>Proton Magnetic Resonance (<sup>1</sup>H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.</p> <p><b>Electromagnetic Spectrum: Absorption Spectroscopy</b></p> <p>Ultraviolet (U.V.) absorption spectroscopy introduction- (Beer-Lambert law), molar absorptivity, analysis of UV spectra, types of electronic transitions effect of conjugation. Concept of chromophores and auxochrome, Bathochrome, hypsochrome, hyperchrome, hypochromic shifts-UV spectra of conjugated compounds, Infrared (IR) Absorption spectroscopy-introduction, Hooke's law, Selection rules, intensity and IR bands, measurement of IR spectrum time characteristic absorption of various fundamental band interpretation of IR spectra of simple organic compounds.</p>	<b>11</b>
<b>II</b>	<p><b>Problems based on spectroscopy</b></p> <p>Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.</p> <p><b>Synthetic Polymers</b></p> <p>Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers</p>	<b>12</b>
<b>III</b>	<p><b>Organosulphur Compounds</b></p> <p>Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.</p>	<b>10</b>

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	<p><b>Organic Synthesis via Enolates</b></p> <p>Acidity of <math>\alpha</math>-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.</p>	
<b>IV</b>	<p><b>Carbohydrates</b></p> <p>Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides.</p> <p>Cyclic structure of D(+)-glucose. Mechanism of mutarotation.</p> <p><i>Structures of ribose and deoxyribose</i></p> <p>An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.</p> <p><b>Amino Acids, Peptides, Proteins and Nucleic Acids</b></p> <p>Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of <math>\alpha</math>-amino acids.</p> <p>Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.</p> <p>Nucleic acids: Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.</p>	<b>12</b>

**Recommended Books:**

1. Organic Chemistry. F.A. Carey, McGraw Hill, Inc. 8th edition.
2. Organic Chemistry, Morrison and Boyd, Prentice Hall
3. R.M. Silverstein, G.C. Bassler, T.C. Morrill, "Spectrometric Identification of Organic Compounds.
4. W. Kemp, "Organic Spectroscopy".
5. D.H. Williams, I. Fleming, "Spectroscopic Methods in Organic Chemistry".
6. J.R.Dyer, "Application of Absorption Spectroscopy of Organic Compounds".
7. D. H. Williams, I. Fleming, "Spectroscopic Problems in Organic Chemistry" 1967.
8. R.C. Banks, E.R. Matjeka, G. Mercer, "Introductory Problems in Spectroscopy" 1980.

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>PHYSICAL CHEMISTRY-IV</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>	<b>Contact Hours</b>
<b>I</b>	<b>Quantum Mechanics-I</b> Black-body radiation, Planck's radiation law, Photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. de Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box, quantization of energy levels, extension to two and three dimensional boxes, degeneracy.	<b>12</b>
<b>II</b>	<b>Quantum Mechanics-II</b> Simple harmonic oscillator model of vibrational motion, setting up Schrodinger equation and discussion of solution and wave functions. Rigid rotator model of rotation of diatomic molecules transformation to spherical polar coordinates spherical harmonics and their discussion. Qualitative investigation H-atom, setting up Schrodinger equation, radial and angular part, radial distribution functions of 1s, 2s, 2p, 3s, 3p and 3d.	<b>12</b>
<b>III</b>	<b>Solid State</b> Definition of space lattice and unit cell, Law of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's Law in Reciprocal space. Determination of crystal structure of NaCl, KCl by use of Powder method; Laue's method.	<b>10</b>
<b>IV</b>	<b>Photochemistry</b> Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus–Drapper law, Stark–Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non–radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions–energy transfer processes (simple examples).	<b>11</b>

**Recommended Books:**

1. Physical Chemistry, A Molecular Approach by D.A. Mcguarrie and J.D. Simon.
2. Quantum Chemistry, Ira N. Levine.
3. Quantum Chemistry, H. Eyring J. Walter and G.E. Kimball.
4. Molecular Quantum Mechanics, P.W. Atkins.
5. R.S.Drago, "Physical Methods in Chemistry".

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Solid State Physics</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Crystal Structure:</b> Lattice translation, vectors and lattices, symmetry operations, basis and crystal structure, Miller indices, unit cell, two dimensional lattice, three dimensional lattices, hexagonal close packed structure. FCC and BCC structure, simple crystal structure, diffraction of x-rays according to law of Bragg and diffraction conditions. Reciprocal lattice, Brillouin zone, Reciprocal lattice to SC, BCC and FCC lattice, Atomic form factor, geometrical structure factor, experiment methods of x-rays diffraction. (10 Lectures)
<b>II</b>	<b>Crystal Binding and lattice Vibrations:</b> Various types of binding, crystals of inert gases, Vander-Waals-London interactions. Lenard-Jones potential, Ionic crystals, Madelung constant, Bulk Modulus, calculation of repulsive exponent. Born-Haber cycle, quantization of Lattice vibrations, phonon momentum, inelastic scattering by phonons. Wave motion on a lattice, one dimensional line of atoms, linear diatomic lattice, optical and acoustical branch. (10 Lectures)
<b>III</b>	<b>Free Electron Theory:</b> Drude-Lorentz theory, Sommerfeld model, the Fermi-Dirac distribution, Effect of temperature on f-d distribution, electronic specific heat, the electrical conductivity and Ohm's Law, the thermal conductivity of metals. Wiedemann-Frenz law, Hall effect. (12 Lectures)
<b>IV</b>	<b>Band Theory:</b> Nearly free electron model, origin and magnitude of energy gap, Density of states, K space, Bloch theorem, Kronig-Penney model of an infinite one dimensional crystal, classification of insulators, semiconductors and metals. The tight-binding approximation in evaluating the energy levels for an electron in a solid. The Weigner-Seitg approximation and the cohesive energy of metals. (12 Lectures)

**Recommended Books:**

1. Introduction to Solid State Physics, Charles Kittel, 8<sup>th</sup> Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2<sup>nd</sup> Ed., 2006, Prentice-Hall of India
3. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
4. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
5. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
6. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
7. Solid State Physics, M.A. Wahab, 2011, Narosa Publications

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Nuclear and Particle Physics</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Structure and Properties of the Nucleus:</b> Structure of the nucleus: Discovery of the nucleus, composition, basic properties; charge, mass, size, spin, magnetic moment, electric quadrupole moment, binding energy, binding energy per nucleon and its observed variation with mass number of the nucleus, coulomb energy, volume energy, surface energy, other corrections, explanation of the binding energy curve, liquid drop model of the nucleus, evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, nuclear force. (10 Lectures)
<b>II</b>	<b>Radioactive decays:</b> Alpha decay: basics of $\alpha$ -decay processes, theory of alpha emission, Gamow factor, Geiger Nuttall law, $\alpha$ -decay spectroscopy. (b) $\beta$ -decay: energy kinematics for $\beta$ -decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. <b>Reactions:</b> Types of Reactions, Conservation Laws, kinematics of reactions, Nuclear Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering). (10 Lectures)
<b>III</b>	<b>Interaction of Radiation with Matter:</b> Energy loss of particles in passage through matter, stopping power of matter for charged particles, energy range relationship and straggling. Interaction of gamma radiation with matter: photoelectric effect, Compton effect and pair production. Thomson scattering and Rayleigh scattering. Detectors and Accelerators: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector, Need for accelerators. (10 Lectures)
<b>IV</b>	<b>Cosmic Rays and Elementary Particles:</b> Discovery of cosmic rays: hard and soft components, discovery of elementary particle, muon, pion, heavy mesons and hyperons, mass and life time determination for muon and pion. Primary Cosmic Rays: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Modern algebra</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**Course Objectives** This course is designed to introduce the basic concepts of modern algebra. The main focus of the course will be on the notions of algebraic structures, groups and rings.

**UNIT-I**

Groups, properties of group elements, subgroups, cyclic groups, cosets of a subgroup, Lagrange's theorem, normal subgroups and Quotient groups.

**UNIT-II**

Homomorphism, Isomorphism theorems, conjugate elements, class equation, permutation groups, alternating groups, simplicity of  $A_n, n \geq 5$  (without proof).

**UNIT-III**

Rings, subring, characterization of a subring, integral domains, ideals, characteristic of a ring, Quotient rings.

**UNIT-IV**

Prime and maximal Ideals, homomorphism, Isomorphism theorems, Polynomial rings.

**Course MODERN ALGEBRA Outcomes** After completion of the course, the students will be able to

- Deal with algebraic structures and their use in proving theorems/results
- Demonstrate the abstract concepts of groups and rings.

**Reference Books**

- L. Gilbert, J. Gilbert, Elements of Modern Algebra, Cengage, 2015.
- M. Artin, Algebra, Pearson, 2010.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>STATICS AND DYNAMICS</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**UNIT-I**

Basic notions. Composition and resolution of concurrent forces-parallelgram law of forces, Components of a force in given directions, resolved parts of a force, resultant of any number of coplanar concurrent forces.

**UNIT-II**

Equilibrium conditions for coplanar concurrent forces, equilibrium of a body resting on a smooth inclined plane, equilibrium of three forces acting at a point, triangle law of forces,  $\lambda - \mu$  theorem, Lami's theorem, parallel forces.

**UNIT-III**

Motion of a particle with constant acceleration, acceleration of falling bodies, motion under gravity, motion of a body projected vertically upwards: Newton's Laws of Motion, Motion of two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane. Variable acceleration: Simple harmonic motion, elastic string.

**UNIT-IV**

Curvilinear motion of a particle in a plane: Definition of velocity and acceleration, projectiles, motion in a circle. Work, power, conservative fields and the potential energy, work done against gravity, potential energy of a gravitational field.

**Reference Books**

- S. L. Loney, Statics, Macmillan and Company London.
- R. S. Verma, A Textbook on Statics, Pothishala Pvt. Ltd. Allahabad.
- S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid bodies, Cambridge University Press, 1956.
- M. Ray, A Textbook on Dynamics, S. Chand & Company, 1989.

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**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>			
<b>Subject Title:</b>	<b>ENGLISH-VI</b>		
<b>Contact Hours</b>	<b>L: 3</b>	<b>T: 0</b>	<b>P: 0</b>
	<b>Credits: 3</b>		

**Details of the Course:**

Unit	Content
<b>I</b>	<p><b>Literature:</b></p> <p>The study of the whole text of the play, <i>All My Sons</i> by Arthur Miller for vocabulary enrichment, learning sentence/speech construction and understanding dialogues/conversations.</p>
<b>II</b>	<p><b>Grammar and Vocabulary:</b></p> <p>Scientific/Technical Vocabulary; One word Substitution; Tenses; Active/Passive Voice; Narration; Common Errors</p>
<b>III</b>	<p><b>Reading &amp; Writing Skills:</b></p> <p>Summary &amp; Paraphrasing, Analysis and Interpretation; Formal Report writing; Formal Presentations-Practice on preparing Formal Presentations; Power Point Presentations</p>
<b>IV</b>	<p><b>Interactive practice sessions on Oral Communication</b></p> <ul style="list-style-type: none"> <li>• Communication at Workplace</li> <li>• Preparation for Interviews; Mock interviews</li> <li>• Delivering Formal Presentations/Power Point Presentations/Oral Presentations</li> </ul>

**Recommended Books:**

1. *Oxford Practice Grammar* by John Eastwood (Ed. 2014)
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Black swan, 2013.
4. *Remedial English Grammar*. F.T. Wood. Macmillan. 2007.
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006
7. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

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<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Punjabi-VI</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

ਪਾਠ-ਕ੍ਰਮ:

**ਯੂਨਿਟ-1 (ਸਾਹਿਤ)**

1. ਕਿਰਤ - ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ
2. ਗੰਗਾ ਦੀਨ- ਪ੍ਰਿੰ. ਤੇਜਾ ਸਿੰਘ
3. ਮਾਂ-ਗੁਰਬਖਸ਼ ਸਿੰਘ ਪ੍ਰੀਤਲੜੀ
4. ਲਾਲ ਬਾਦਸ਼ਾਹ- ਹਰਿੰਦਰ ਸਿੰਘ ਰੂਪ
5. ਜਿਹੜੇ ਬੂਰੀਆਂ ਮੱਝੀਆਂ ਚੁੰਘਦੇ ਸੀ- ਸੂਬਾ ਸਿੰਘ
6. ਹਾਰ ਸਿੰਗਾਰ- ਗੁਲਜ਼ਾਰ ਸਿੰਘ ਸੰਧੂ
7. ਡੂੰਘੀਆਂ ਸਿਖਰਾਂ-ਨਰਿੰਦਰ ਸਿੰਘ ਕਪੂਰ
8. ਭਾਈ ਮਰਦਾਨਾ ਜੀ- ਹਰਪਾਲ ਸਿੰਘ ਪੰਨੂ

**ਯੂਨਿਟ-2 (ਭਾਸ਼ਾ )**

ਬਾਜ਼ਾਰ ਵਿਚ ਵਰਤੀ ਜਾਣ ਵਾਲੀ ਸ਼ਬਦਾਵਲੀ  
 ਵਪਾਰ ਵਿਚ ਵਰਤੀ ਜਾਣ ਵਾਲੀ ਸ਼ਬਦਾਵਲੀ

**ਯੂਨਿਟ-3 (ਵਿਆਕਰਣ)**

ਪੰਜਾਬੀ ਵਿਆਕਰਣਕ ਇਕਾਈਆਂ: ਨਾਂਵ ਵਾਕੰਸ਼ ਤੇ ਕਿਰਿਆ ਵਾਕੰਸ਼।

**ਯੂਨਿਟ-4 (ਲੇਖਣੀ-ਕਲਾ)**

ਅਖਬਾਰੀ ਲੇਖ  
 ਈ-ਮੇਲ ਲਿਖਣ ਦੀ ਵਿਧੀ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

*ਸਾਹਿਤ ਦੇ ਰੰਗ* (ਸੰਪ. ਡਾ. ਮਹਿਲ ਸਿੰਘ), ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ ਅੰਮ੍ਰਿਤਸਰ।

*ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਣ* ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ, ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ, ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ, ਵੇਦ ਅਗਨੀਹੋਤਰੀ), ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, ਐਡੀਸ਼ਨ 2009.

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>Punjab History &amp; Culture-VI</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:0</b>	<b>P:0</b>	<b>Credits:3</b>

**SECTION-A**

1. Partition and Rehabilitation
2. Punjabi Suba and Territorial Reorganization
3. Green Revolution

**SECTION-B**

1. Agrarian Crisis
2. Punjab Politics
3. Demographic Changes and Urbanization

**SECTION-C**

1. Centre – State Relations and the Punjab Crisis
2. Militancy/Terrorism: Emergence and Impact

**SECTION-D**

1. Punjabi Diaspora
2. Future Perspectives of Punjab: Economy, Politics, Culture and society

**Suggested Readings: -**

1. Grewal, J.S., The Sikhs of the Punjab, CUP, Cambridge, 1990.
2. Grewal, J.S., and Indu Banga (eds.), Punjab in Prosperity and Violence: Administration, Politics and Social Change (1947-97), K.K. Publishers, Chandigarh 1998.
3. Banga, Indu (ed.), Five Punjabi Centuries: Polity, Economy, Society and Culture c. 1500-1990: Essays for J.S.Grewal, Manohar, New Delhi, 1997.
4. Puri, Harish K. Paramjit Singh Judge and Jagroop Singh Sekhon, "Terrorism in Punjab : Understanding Reality at the Grassroots Level", Guru Nanak Journal of Sociology, Vol. XVIII No.I, G.N. D. University, Amritsar, 1997, pp. 37-99.
5. Khushwant Singh, A History of the Sikhs (1839-1988), Vol. II, OUP, Delhi, 1991.
6. Kirpal Singh, Partition of Punjab, Punjabi University, Patiala, 1972.
7. Pritam Singh & Shinder Singh Thandi (eds.), Punjabi Identity in Global Context, OUP, Oxford, 1999.
8. Pritam Singh, Punjab Economy: The Emerging Pattern, Enkay Publishers, New Delhi, 1995.

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>		
<b>Subject Code:</b>			
<b>Subject Title:</b>	<b>Drug Abuse-II (Management and Prevention)</b>		
<b>Contact Hours:</b>	<b>L:2</b>	<b>T:0</b>	<b>P:0</b>

**Details of the Course**

<b>Unit</b>	<b>Content</b>
<b>I</b>	<b>Prevention of Drug abuse I:</b> Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.
<b>II</b>	<b>Prevention of Drug abuse II:</b> School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination Random testing on students.
<b>III</b>	<b>Controlling Drug Abuse:</b> Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program
<b>IV</b>	<b>Legislation:</b> NDPs act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

**References:**

9. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
10. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
11. Inciardi, J.A. 1981. The Drug Crime Connection. Beverly Hills: Sage Publications.
12. Kapoor. T. (1985) Drug epidemic among Indian Youth, New Delhi: Mittal Pub. 15
13. Modi, Ishwar and Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.
14. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
15. Sain, Bhim 1991, Drug Addiction Alcoholism, Smoking obscenity New Delhi: Mittal Publications.
16. Singh, Chandra Paul 2000. Alcohol and Dependence among Industrial Workers: Delhi: Shipra.
17. Sussman, S and Ames, S.L. (2008). Drug Abuse: Concepts, Prevention and Cessation, Cambridge University Press.
18. Verma, P.S. 2017, "Punjab's Drug Problem: Contours and Characteristics", Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
19. World Drug Report 2016, United Nations office of Drug and Crime.
20. World Drug Report 2017, United Nations office of Drug and Crime.

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>				
<b>Subject Title:</b>	<b>CHEMISTRY LAB VI</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

**(I) Organic Chemistry Laboratory Techniques**

**(a) Column Chromatography**

Separation of *o* & *p*-nitrophenol  
Separation of Leaf pigments from Spinnach leaves  
Separation of *o* & *p*-nitro aniline  
Separation of dyes

**(b) Synthesis of Organic Compounds**

Preparation of *p*-nitroacetanilide  
Preparation of *p*-bromoacetanilide  
Green Chemistry Experiment: Preparation of benzoic acid from Benzyl-using green approach.  
Preparation of Methyl Orange, Methyl Red  
Preparation of benzoic acid from benzyl-using green approach

**Reference books**

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Practical Organic Chemistry by F.G. Mann and B.C. Saunders

**IK Gujral Punjab Technical University Jalandhar**  
**B.Sc. Non-Medical Batch 2018 onwards**

<b>Course Name</b>	<b>B.Sc. (Non-Medical)</b>			
<b>Subject Code:</b>	<b>Physics Lab VI</b>			
<b>Subject Title:</b>				
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>

**Details of the Course**

**List of Experiments:**

1. Characteristics of pn junction diode
2. Characteristics of Zener diode.
3. To determine the resistivity of semiconductors.
4. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
5. To measure the Magnetic susceptibility of Solids.
6. To determine the Coupling Coefficient of a Piezoelectric crystal.
7. To measure the Dielectric Constant of a dielectric Materials with frequency.
8. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR).
9. To determine the refractive index of a dielectric layer using SPR.
10. To study the PE Hysteresis loop of a Ferroelectric Crystal.
11. To study the BH curve of iron using a Solenoid and determine the energy loss.
12. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (room temperature to 150°C and to determine its band gap.
13. To determine the Hall coefficient of a semiconductor sample.

**REFERENCE BOOKS:**

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Engineering Practical Physics, S.Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. Practical Physics, G.L. Squires, 2015, 4<sup>th</sup> Edition, Cambridge University Press.
5. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 201, Kitab Mahal.
6. B Sc. Practical Physics, C. L. Arora, S. Chand & Co.
7. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.