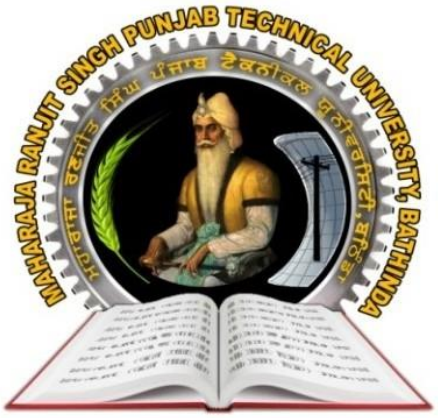
Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001



FACULTY OF SCIENCES

SYLLABUS

FOR

B.SC. (NON-MEDICAL)

2022 BATCH ONWARDS

STUDY SCHEME

1st Semester		Course Type	Contact Hrs.			Marks			Credits
Sub. Code	Subject		L	T	P	Int.	Ext.	Total	
BHSMC0-042	English	AECC-I	2	0	0	40	60	100	2
BSNMS1-102	Mechanics	CC-I	4	0	0	40	60	100	4
BSNMS1-103	Inorganic Chemistry-I	CC-II A	3	0	0	40	60	100	3
BSNMS1-104	Organic Chemistry-I	CC-II B	3	0	0	40	60	100	3
BSNMS1-105	Differential Calculus-I	CC-III A	3	0	0	40	60	100	3
BSNMS1-106	Differential Calculus-II	CC-III B	3	0	0	40	60	100	3
BSNMS1-107	Mechanics Lab	CC-I Lab	0	0	4	60	40	100	2
BSNMS1-108	Chemistry Lab- I	CC-I Lab	0	0	4	60	40	100	2
Total			**18**	**0**	**8**	**360**	**440**	**800**	**22**

Type of Courses: Ability Enhancement Compulsory Course (AECC), Core Course (CC), Skill Enhancement Course (SEC), Discipline Specific Elective (DSE)

2nd Semester		Course Type	Contact Hrs.			Marks			Credits
Sub. Code	Subject		L	T	P	Int.	Ext	Total	
BMNCC0-041	Drug abuse: problem, management and prevention	AECC-II	2	0	0	100	00	100	0
BSNMS1-202	Electricity, Magnetism and EMT	CC-IV	4	0	0	40	60	100	4
BSNMS1-203	Physical Chemistry-I	CC-V A	3	0	0	40	60	100	3
BSNMS1-204	Organic Chemistry-II	CC-V B	3	0	0	40	60	100	3
BSNMS1-205	Differential Equations-I	CC-VI A	3	0	0	40	60	100	3
BSNMS1-206	Differential Equations-II	CC-VI B	3	0	0	40	60	100	3
BSNMS1-207	Electricity, Magnetism and EMT Lab	CC-IV Lab	0	0	4	60	40	100	2
BSNMS1-208	Chemistry Lab-II	CC-V Lab	0	0	4	60	40	100	2
Total			**18**	**0**	**08**	**420**	**380**	**800**	**20**

3rd Semester		Course Type	Contact Hrs.			Marks			Credits
Sub. Code	Subject		L	T	P	Int.	Ext.	Total	
BSNMS1-301	Thermal Physics and Statistical Mechanics	CC-VII	4	0	0	40	60	100	4
BSNMS1-302	Thermal Physics and Statistical Mechanics Lab	CC-VII Lab	0	0	4	60	40	100	2
BSNMS1-303	Inorganic Chemistry-II	CC-VIII A	3	0	0	40	60	100	3
BSNMS1-304	Physical Chemistry-II	CC-VIII B	3	0	0	40	60	100	3
BSNMS1-305	Chemistry Lab III	CC-VIII Lab	0	0	4	60	40	100	2
BSNMS1-306	Real Analysis-I	CC-IX A	3	0	0	40	60	100	3
BSNMS1-307	Real Analysis-II	CC-IX B	3	0	0	40	60	100	3
BSNMS1-308	Computational Physics Skills	SEC-I	0	0	4	60	40	100	2
Total			**16**	**0**	**12**	**380**	**420**	**800**	**22**

4th Semester		Course Type	Contact Hrs.			Marks			Credits
Sub. Code	Subject		L	T	P	Int.	Ext	Total	
BHSMC0-041	Environmental Science	AECC-III	3	0	0	40	60	100	3
BSNMS1-401	Waves and Optics	CC-X	4	0	0	40	60	100	4
BSNMS1-402	Waves and Optics Lab	CC-X Lab	0	0	4	60	40	100	2
BSNMS1-403	Organic Chemistry-III	CC-XI A	3	0	0	40	60	100	3
BSNMS1-404	Physical Chemistry-III	CC-XI B	3	0	0	40	60	100	3
BSNMS1-405	Chemistry Lab-IV	CC-XI Lab	0	0	4	60	40	100	2
BSNMS1-406	Algebra-I	CC-XII A	3	0	0	40	60	100	3
BSNMS1-407	Algebra-II	CC-XII B	3	0	0	40	60	100	3
BSNMS1-408	Basic Analytical Chemistry	SEC-II	0	0	4	60	40	100	2
Total			**19**	**0**	**12**	**420**	**480**	**900**	**25**

5th Semester		Course Type	Contact Hrs.			Marks			Credits
Sub. Code	Subject		L	T	P	Int	Ext	Total	
BSNMD1-511	Digital Analog and Instrumentation	DSE-I	4	0	0	40	60	100	4
BSNMD1-521	Chemistry of Main group elements	DSE-II	4	0	0	40	60	100	4
BSNMD1-531	Matrices	DSE-III A	3	0	0	40	60	100	3
BSNMD1-532	Linear Algebra	DSE-III B	3	0	0	40	60	100	3
BSNMD1-512	Digital Analog and Instrumentation Lab	DSE-I Lab	0	0	4	60	40	100	2
BSNMD1-522	Chemistry of Main group elements Lab	DSE-II Lab	0	0	4	60	40	100	2
BSNMS1-533	Computer Programming Lab	SEC-III	0	0	4	60	40	100	2
Total			**14**	**0**	**12**	**340**	**360**	**700**	**20**

6th Semester		Course Type	Contact Hrs.			Marks			Credits
Subject Code	Subject		L	T	P	Int.	Ext	Total	
BSNMD1-611	Elements of Modern Physics	DSE-IV	4	0	0	40	60	100	4
BSNMD1-612	Elements of Modern Physics Lab	DSE-IV Lab	0	0	4	60	40	100	2
BSNMD1-621	Comprehensive Chemistry	DSE-V	4	0	0	40	60	100	4
BSNMD1-622	Comprehensive Chemistry Lab	DSE-V Lab	0	0	4	60	40	100	2
BSNMD1-631	Numerical Methods	DSE-VI A	3	0	0	40	60	100	3
BSNMD1-632	Complex Analysis	DSE-VI B	3	0	0	40	60	100	3
BSNMS1-633	Numerical Analysis Lab	SEC-IV	0	0	4	60	40	100	2
Total			**14**	**0**	**12**	**340**	**360**	**700**	**20**

Distribution of Credits in various type of Courses:

Course Type	Type of Courses in the Programme				Total Credits in Semester
	AECC	CC	SEC	DSE	
Semester-I	2	20	0	0	**22**
Semester-II	0	20	0	0	**20**
Semester-III	0	20	2	0	**22**
Semester-IV	3	20	2	0	**25**
Semester-V	0	0	2	18	**20**
Semester-VI	0	0	2	18	**20**
Total Credits in Courses:	**5**	**80**	**8**	**36**	**129**

Type of Courses: Ability Enhancement Compulsory Course (AECC), Core Course (CC), Skill Enhancement Course (SEC), Discipline Specific Elective (DSE)

SEMESTER FIRST

ENGLISH

Subject Code: BHSMC0-042 **L T P C** **Duration:30 Hrs.**
2 0 0 2

UNIT-I (8 Hours)

Communication Skills: Introduction, Definition, the Importance of Communication,
The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

UNIT-II (7 Hours)

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.
Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

UNIT-III (7 Hours)

Communication Styles: Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.
Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

UNIT-IV (8 Hours)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview
Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

Recommended Books:

1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education, 2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press, 2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson, 2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life, 2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquette for Success', 5th Edition, Pearson, 2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,2010.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI, 2011.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press, 2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011.
10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw Hill Education, 2011.
10. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
11. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,1999

MECHANICS

Subject Code: BSNMS1-102 **L T P C** **Duration: 60Hrs.**
4 0 0 4

Course Outcome (CO): After the completion of the course, student will be able to:

CO1: Understand the concepts of vector calculus and basic laws of motion
CO2: Gain the knowledge about gravitational motion, and global positioning system
CO3: Understand the concepts of harmonic oscillations.
CO4: Learn the concept of theory of Relativity.

UNIT-I (15 Hrs)

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. Momentum and Energy: Conservation of momentum. Work and energy.

Conservation of energy. Motion of rockets. Rotational Motion: Angular velocity and angular momentum. Torque, Conservation of angular momentum.

UNIT-II (15Hrs)

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

UNIT-III (15Hrs)

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Elasticity: 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, η and σ by Searles method.

UNIT-IV (15 Hrs)

Special Theory of Relativity: Concept of Inertial and non-inertial frames, Concept of ether, Constancy of speed of light, Michelson-Morley Experiment, Galilean transformation, Postulates of Special Theory of Relativity, Lorentz transformation, Length contraction. Time dilation, Relativistic addition of velocities.

Recommended Books:

1.University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison Wesley
2.Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3.Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley.
4.Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.
5.University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

INORGANIC CHEMISTRY-I

Subject Code: BSNMS1-103 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Course Objectives

1. To familiarize with atomic structure, quantum numbers and shapes of orbitals
2. To understand periodic table and periodic properties of elements
3. To understand the concept of crystal structure of molecules
4. To understand the concept of various bonding theories

Course Outcomes: The completion of this course will make student to acquire the knowledge of:

CO1: Wave mechanics, atomic theories and shapes of orbitals
CO2: Periodic table and various periodic properties
CO3: Ionic bond and crystal structure of molecules
CO4: Covalent bond, metallic bond and various weak chemical forces

Unit-I (8 Hrs.)

Atomic Structure:

de-Broglie equation, Heisenberg's Uncertainty Principle and its significance. Schrödinger's wave equation and its derivation, significance of ψ and ψ^2. 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.

Unit-II (7 Hrs.)

Chemical Periodicity:

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 electro negativity.

Unit-III (15 Hrs.)

Chemical Bonding-I:

Ionic bond: 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.

Unit-IV (15 Hrs.)

Chemical Bonding-II:

Covalent bond: 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 (Be_2, N_2, O_2, F_2, LiH, NO, CO, HCl, NO_2, BeH_2, NO_2^-), 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)

Metallic Bond: Valence bond and band theories. Semiconductors and insulators, defects in solids. **Weak Interactions:** van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, Hydrogen bonding.

Recommended Books:

Latest edition of:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', ELBS Oxford.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, 'Inorganic Chemistry', Pearson Education, Singapore.
3. J.D. Lee, 'Concise Inorganic Chemistry', ELBS, Oxford.

ORGANIC CHEMISTRY-I

Subject Code: BSNMS1-104 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Course Objectives:

1. To familiarize with the concepts of basics of organic chemistry
2. To understand the concept of mechanisms of organic reactions
3. To familiarize with the chemistry of alkanes and cycloalkanes
4. To understand chemistry of alkenes and alkynes
5. To know the chemistry behind aromatic hydrocarbons

Course outcomes: After the completion of course students will acquire the knowledge of:

CO1: Concepts of basics of structure and bonding
CO2: Mechanisms of organic reactions
CO3: Chemistry of aliphatic hydrocarbons
CO4: Chemistry behind aromatic hydrocarbons

Unit-I (15 Hrs.)

Structure and Bonding:

Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions:

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrenes). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

Unit-II (10 Hrs.)

Alkanes and Cycloalkanes:

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.

Unit-III (14 Hrs.)

Alkenes, Cycloalkenes, Dienes and Alkynes:

Alkenes Nomenclature, methods of synthesis (mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination), physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Cycloalkenes Methods of formation, conformation and Chemical reactions of cycloalkenes.

Dienes Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2 and 1,4 additions, Diels-Alder reaction.

Alkynes Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal-ammonia reductions, oxidation and polymerization.

Unit-IV (6 Hrs.)

Aromatic hydrocarbons:

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Recommended Books:

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', JohnWiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

DIFFERENTIAL CALCULUS-I

Subject Code: BSNMS1-105 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the concept of Continuity and Differentiability.
CO2: Extend the knowledge to the different type of series, Roll's Theorem and Lagrange Mean Value Theorem
CO3: Develop the skill to sketch the curves in a plane using its mathematical properties in the different coordinate systems of reference.
CO4: Understand the concept of Partial Differential Equation.

Unit-I (12Hrs.)

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

Unit-II (11Hrs.)

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $sin\ x$, $cos\ x$, ex, $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit-III (14 Hrs.)

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

Unit-IV (8 Hrs.)

Partial differentiation - Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative,
Differentiation of implicit functions and composite functions, Jacobians and its properties.

Recommended Books:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

DIFFERENTIAL CALCULUS-II

Subject Code: BSNMS1-106 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Apply the knowledge of advanced concepts of calculus in order to study theoretical development of different mathematical techniques and their applications.
CO2: Develop the knowledge of computing arc length, area and volume by using integration.
CO3: Understand the concept of integration and different kind of functions.
CO4: Expand the knowledge of multiple integrals and vector surface integrals.

Unit-I (12Hrs.)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function $z = f(x, y)$, Lagrange's method of undetermined multipliers.

Unit-II (10Hrs.)

Arc formula for the Cartesian equation $y = f(x)$, other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves.

Unit-III (12Hrs.)

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations.

Unit-IV(11Hrs.)

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity, Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds.

Recommended Books:

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, Prentice Hall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

MECHANICS LAB

Subject Code: BSNMS1-107 **L T P C** **Duration: 60Hrs.**
0 0 4 2

Course Outcomes (COs): After the completion of the course, Student will be able to

CO1: Use basic measurements tools like Vernier caliper, screw gauge etc.
CO2: Find the Moment of Inertia of a Flywheel.
CO3: Determine the Modulus of elasticity
CO4: Learn about motion of Bar Pendulum and Kater's Pendulum.

List of Experiments:

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique.
10. To study the Motion of a spring and calculate (a) Spring Constant (b) Value of g

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, 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. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

CHEMISTRY LAB- I

Subject Code: BSNMS1-108 **L T P C** **Duration:60Hrs.**
0 0 4 2

Course Objectives:

1. To develop basic understanding of various lab practices including safety measures.
2. To understand qualitative semi micro analysis of mixtures.
3. To analyze unknown functional group in organic molecules.
4. To understand various chromatographic techniques used for separation of dyes.

Course Outcomes: The students will acquire knowledge of

CO1: Different safety measures in lab
CO2: Analysis of mixture for cations and anions
CO3: Analysis of unknown functional group in organic molecules
CO4: chromatographic techniques used for separation of dyes

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:
Detection of various functional groups in organic compounds (containing upto two extra elements)

Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
Identify and separate the components of a given mixture of two dyes (red and blue ink, fluorescent and methylene blue) by paper chromatography

Recommended Books:
Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis',Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

SEMESTER SECOND

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BMNCC0-041 **L T P C** **Duration: 30Hrs.**
2 0 0 0

UNIT-I (6 Hours)

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II (8 Hours)

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

UNIT-III (8 Hours)

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV (8 Hours)

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications,Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 &2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,2013.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, 2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, 2000.
12. S.Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press, 2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, 2017. 1
14. 'World Drug Report', United Nations Office of Drug and Crime, 2016.
15. 'World Drug Report', United Nations Office of Drug and Crime,2017

ELECTRICITY, MAGNETISM AND EMT

Subject Code: BSNMS1-202 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Understand the concepts of vector Algebra.
CO2: Understand the basic concepts of electrostatics
CO3: Gain the knowledge about the basic concepts of magneto-statics
CO4: Learn the concept of Maxwell equation and electromagnetic waves.

UNIT-I (13Hrs)

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss- divergence theorem and Stoke's theorem of vectors (statement only).

UNIT-II (16Hrs)

Electrostatics: 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.

UNIT-III (16Hrs)

Magnetism: 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. Electromagnetic Induction: 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.

UNIT-IV (15 Hrs)

Maxwell`s equations and Electromagnetic wave propagation: 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.

Recommended Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

PHYSICAL CHEMISTRY-I

Subject Code: BSNMS1-203 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To develop basic understanding of different states of matter.
2. To understand concept of chemical kinetics.
3. To understand underlying processes associated with various states of matter.
4. To familiarize with relevance of matter properties for realistic applications.

Course Outcomes: Students will be able to acquire the knowledge of

CO1: Basic understanding of different states of matter
CO2: Rate of chemical reactions and related theories.
CO3: Underlying processes associated with various states of matter
CO4: Relevance of matter properties for realistic applications

Unit-I (15 Hrs.)

Gaseous State:

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases (based on Joule-Thomson effect).

Unit-II (8 Hrs.)

Liquid State:

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

Unit-III (12Hrs.)

Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals.

Unit-IV (10 Hrs.)

Basics of Chemical Kinetics:

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of

activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Recommended Books:

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company.

ORGANIC CHEMISTRY-II

Subject Code: BSNMS1-204 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand the concepts of stereochemistry of organic compounds
2. To understand concepts behind aromaticity
3. To understand the concept of mechanisms of organic reactions
4. To familiarize with the aromatic electrophilic substitution reactions
5. To familiarize with the chemistry of alkyl and aryl halides

Course Outcomes: After the completion of course students will acquire the knowledge of

CO1: Concepts of stereochemistry of organic compounds
CO2: Concepts behind aromaticity
CO3: Mechanisms of organic reactions
CO4: Aromatic electrophilic substitution reactions
CO5: Chemistry of alkyl and aryl halides

Unit-I (15Hrs.)

Stereochemistry of Organic Compounds:

Concept of isomerism. Types of isomerism Optical isomerisin-elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & Land R & S systems of nomenclature. Geometric isomerism- determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

Unit-II (7 Hrs.)

Arenes and Aromaticity:

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram, the Huckel rule, aromatic ions.

Unit-III (11Hrs.)

Aromatic Electrophilic Substitution:

Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes. Mechanism or 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 reaction of alkylbenzenes alkynylbenzenes.

Unit-IV (12 Hrs.)

Alkyl and aryl halides:

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

Recommended Books:

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', John Wiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

DIFFERENTIAL EQUATIONS-I

Subject Code: BSNMS1-205 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the concept of ordinary differential equation, its formation, order and degree.
CO2: Apply various methods to solve first order non-linear differential equation.
CO3: Solve linear differential equations of higher order by using various methods.
CO4: Apply differential equations to significant applied and theoretical problems.

Unit-I (12Hrs.)

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian and its properties, Solving a differential equation by reducing its order.

Unit-II (11Hrs.)

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-III(12Hrs.)

General solution of homogeneous equation of second order, principle of superposition for a homogeneous equation, Wronskian, its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

Unit-IV (10Hrs.)

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Recommended Books:

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover, 1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

DIFFERENTIAL EQUATIONS-II

Subject Code: BSNMS1-206 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the concept of first order and linear partial differential equation.
CO2: Apply various power series methods to find series solution of differential equation.
CO3: Recognize the major classification of PDEs and the qualitative differences between the classes of equations.
CO4: Understand the formation and solution of some significant PDEs like wave and heat equation.

Unit-I (10Hrs.)

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Unit-II (13Hrs.)

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Bessel equation and Legendre equation, its properties and their recurrence relations, Hyper geometric equation, Bessel function and their recurrence relations, Strum liouville boundary values.

Unit-III (12Hrs.)

Separation of variables in a PDE, Laplace equation: mean value property, Weak and strong maximum principle, Green's function, Poisson's formula, Dirichlet's principle, Existence of solution using Perron's method (without proof).

Unit-IV (10Hrs.)

Heat equation: Initial value problem, Fundamental solution, Weak and strong maximum principle and uniqueness results, Wave equation: uniqueness, D'Alembert's method, method of spherical means and Duhamel's principle.

Recommended Books:

1. W.E.Boyce and P.C.Diprima: Elementary Differential Equations and Boundary value problems, John Wiley, 1986.
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, 2003.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover, 1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

ELECTRICITY, MAGNETISM AND EMT LAB

Subject Code: BSNMS1-207 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Take measurements by using Multimeter.
CO2: Learn the measurement of charge, current and resistance using Method.
CO3: Determine resonance in LCR circuit.
CO4: Verify the Thevenin, Norton theorem and Maximum Power Transfer Theorem

List of Experiments:

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. 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.
3. To compare capacitances using De' Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determined B/dx).
5. To study the Characteristics of a Series RC circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer theorem.

Recommended Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

CHEMISTRY LAB-II

Subject Code: BSNMS1-208 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand the concepts behind crystallization
2. To understand the determination of melting points and effect of impurities on m.p.
3. To understand various purification techniques used for purification.
4. To make students familiar with the determination of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

Course Outcomes: After completion of course students will acquire the knowledge and practical hands on training of

CO1: Purification of organic compound using various solvent combinations
CO2: Determination of melting and boiling points of various organic compound
CO3: Chromatographic techniques
CO4: Calculation of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

Laboratory Techniques:

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
    a. Water
    b. Alcohol
    c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)

Physical Chemistry: Experimental Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To determine the viscosity and surface tension of C_2H_5OH and glycerine solution in water
4. Calculation of the enthalpy of ionization of ethanoic acid.

Recommended Books:

Latest edition of:

1. H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.
3. G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.

SEMESTER THIRD

THERMAL PHYSICS AND STATISTICAL MECHANICS

Subject Code: BSNMS1- 301 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Understand the concepts of laws of thermodynamics, entropy.
CO2: Learn about the concepts of Maxwell's thermodynamic relations.
CO3: Gain knowledge of Laws associated with thermal radiations and kinetic theory of gases.
CO4: Understand the concepts of thermodynamic probability, phase space

UNIT-I (16 Hrs)

Laws of Thermodynamics: Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT-II (16 Hrs)

Thermodynamic Potential and Theory of Radiation: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

UNIT-III (14 Hrs)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT-IV (14 Hrs)

Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.

Recommended Books:

1. Statistical Physics, thermodynamics and kinetic theory by V.S.Bhatia
2. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
3. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
4. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
5. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 14
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

THERMAL PHYSICS AND STATISTICAL MECHANICS LAB

Subject Code: BSNMS1- 302 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Perform Mechanical Equivalent of Heat and thermal conductivity of related experiments.
CO2: Learn about the variation of thermo emf across two junctions of a thermocouple with temperature.
CO3: Record and analyze the cooling temperature using a thermocouple and suitable data acquisition system.
CO4: Calibrate Resistance Temperature Device (RTD

List of Experiments:

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

Recommended Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

INORGANIC CHEMISTRY-II

Subject Code: BSNMS1-303 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand chemistry of s block element
2. To familiarize with the concepts of acids and bases
3. To understand the concepts behind chemistry of s & p block elements
4. To understand the chemistry of various transition elements.

Course Outcomes: After the completion of course students will acquire the knowledge of:

CO1: Concepts behind acids and bases
CO2: Chemistry of s and p block elements
CO3: Concepts of chemistry of various transition elements

Unit-I (6 Hrs.)

s-Block Elements: Comparative studies, diagonal relationship, salient features of hydrides, solvation and complexation tendencies.

Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

Unit-II (12 Hrs.)

p–Block Elements–I: Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–17, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes. VBT, VSPER theory, MOT.

Unit-III (12 Hrs.)

p–Block Elements-II: Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide ,Silicones and phosphazenes as examples of inorganicpolymers, nature of bonding in triphosphazenes.

Unit-IV (15 Hrs.)

Chemistry of Transition Elements:

Characteristic properties of d–block elements. Properties of the elements of the first transition 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 behaviour. CFT and CFSE for Octahedral/Tetrahedral complexes.

Recommended Books:
Latest edition of:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; Pubs: John Wiley and Sons.
2. Lee, J.D., Concise Inorganic Chemistry;Pubs: Chapman & Hall Ltd.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; Pubs: Oxford University Press.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; Pubs: John Wiley and Sons Inc.
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; Pubs: Pearson Education Inc.
7. Jolly, W.L., Modern Inorganic Chemistry; Pubs: Tata McGraw-Hill Publishing Company Limited.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; Pubs: Milestones Publisher.

PHYSICAL CHEMISTRY-II

Subject Code: BSNMS1-304 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand energy exchange processes
2. To familiarize with the system of variable compositions.
3. To understand the concepts of thermodynamics.
4. To understand the concept of chemical equilibrium.

Course Outcomes: On completion of this course, students will be able to:

CO1: Identify and describe energy exchange processes.
CO2: Manipulate physical parameters to favour a particular process.
CO3: Compare the system properties with variation in composition.
CO4: Identify and analyze uni/multicomponent system.

Unit-I (14 Hrs.)

Thermodynamics-I:

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 w,q,dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

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.

Unit-II (15 Hrs.)

Thermodynamics-II & III:

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 V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

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 (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T.

Unit-III (6 Hrs.)

Chemical Equilibrium:

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of Kp, Kc, Ka and their relationship, Clausius-Clapeyron equation, applications.

Unit-IV (10 Hrs.)

Introduction to Phase Equilibrium:

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S 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, (NaCl-H_2O), $FeCl_3$-H_2O) and $CuSO_4$-H_2O) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-H_2O and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

Recommended Books:

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book company.

CHEMISTRY LAB III

Subject Code: BSNMS1-305 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand the concepts behind Estimation of metals.
2. To synthesis and separation if various inorganic compounds

Course Outcomes: After completion of course students will gain the knowledge of:

CO1: Obtaining precise results of estimation by titrations
CO2: Preparation separations of organic compounds.

Quantitative Analysis:

i. Volumetric Analysis

a) Determination of acetic acid in commercial vinegar using NaOH.
b) Determination of alkali content-antacid tablet using HCI.
c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
d) Estimation of hardness of water by EDTA.
e) Estimation of ferrous and ferric by dichromate method.
f) Estimation of copper using sodiumthiosulphate.

ii. Gravimetric Analysis

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

Organic Chemistry Laboratory Techniques

Thin Layer Chromatography

a) Determination of R_f values and identification of organic compounds.
b) Separation of green leaf pigments (spinach leaves may be used).
c) 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).
d) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

Recommended Books:

Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis, Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education6.
6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,Textbook of Practical Organic Chemistry, Prentice-Hall.

REAL ANALYSIS-I

Subject Code: BSNMS1-306 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the various properties of the real line $\mathbb{R}$.
CO2: Understand the concept of different kinds of sequences, their convergence, squeeze theorem and Cauchy's theorem on limit.
CO3: Apply the various tests for convergence and absolute convergence of an infinite series of real numbers
CO4: Understand the concept of sequence in series function, M-test and power series methods.

Unit-I (12Hrs.)

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano Weierstrass theorem.

Unit-II (11Hrs.)

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Unit-III (12Hrs.)

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof), Definition and examples of absolute and conditional convergence.

Unit-IV (10Hrs.)

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Recommended Books:

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5) ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
7) S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.

REAL ANALYSIS-II

Subject Code: BSNMS1-307 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand properties of Riemann integral and related theorems.
CO2: Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.
CO3: Examine the point wise and uniform convergence using various tests
CO4: To understand basic topology of metric spaces.

Unit-I (11Hrs.)

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem.

Unit-II (12Hrs.)

Pointwise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic and trigonometric functions.

Unit-III (10Hrs.)

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weirstrass M-test.

Unit-IV (12Hrs.)

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

Recommended Books:

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. ROBERT G. Bartle and Donald R. Sherbert,
5) Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.

COMPUTATIONAL PHYSICS SKILLS

Subject Code: BSNMS1-308 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Learn the Importance of computers in Physics
CO2: Enhance skill in Linux and FORTRAN,
CO3: Understand the concepts of statements
CO4: Gain knowledge about the Computer programing

Introduction:

Importance of computers in Physics, paradigm for solving physics problems for solution. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

Scientific Programming:

Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic.

Control Statements:

Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DOWHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines.

Visualization:

Introduction to graphical analysis and its limitations. Introduction to Gnuplot. Importance of visualization of computational and computational data.

Programming:

1. To print out all natural even/ odd numbers between given limits.
2. To find maximum, minimum and range of a given set of numbers.
3. Calculating Euler number using exp(x) series evaluated at x=1.
4. To compile a frequency distribution and evaluate mean, standard deviation etc.
5. To evaluate sum of finite series and the area under a curve.
6. To find the product of two matrices

7. To find a set of prime numbers and Fibonacci series.
8. To write program to open a file and generate data for plotting using Gnuplot.
9. Plotting trajectory of a projectile projected horizontally.
10. Plotting trajectory of a projectile projected making an angle with the horizontally.
11. To find the roots of a quadratic equation.
12. Motion of a projectile using simulation and plot the output for visualization.
13. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
14. Motion of particle in a central force field and plot the output for visualization

Recommended Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
4. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
5. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi (1999)
6. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning

SEMESTER FOURTH

ENVIRONMENTAL SCIENCE

Subject Code: BHSMC0-041 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To familiarize the student with the basic concept of Environmental and Environmental Chemistry.
2. To elaborate the ecosystem and their properties.
3. To understand the concept of Environmental Pollution and its diverse effect of pollution.
4. To understand the concept of sustainable and unsustainable development and its importance.

Course Outcomes: On completion of this course, students will be able to:

CO1: Understand the basics of Environment chemistry
CO2: Analyze the general concept of ecosystem and their components.
CO3: Comprehend the applicability of social issues and Environment.
CO4: Recognize the Environment Pollution and control measures of urban and industrial wastes.

Unit-I (08 Hours)

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

Unit-II (15 Hours)

Natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit-III (12 Hours)

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- IV (10 Hours)

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books:

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clark R.S., Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

WAVES AND OPTICS

Subject Code: BSNMS1-401 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Outcome (CO): After the completion of the course, Student will be able to
CO1: Understand the concepts of harmonic oscillations and wave motion.
CO2: Gain knowledge of simple harmonic motion and its applications.
CO3: Learn about the concepts of Interference.
CO4: Understand the concepts polarization and diffraction.

UNIT-I (15 Hrs)

Harmonic oscillators and Wave Motion:
Superposition of two collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity

UNIT-II (15 Hrs)

Simple Harmonic motion and applications:
Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria

UNIT-II (16 Hrs)

Wave optics and Interference:
Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes.

UNIT-IV (14 Hrs)

Diffraction and Polarization:
Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

Recommended Books:
1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young1986. Addison-Wesley.

WAVES AND OPTICS LAB

Subject Code: BSNMS1- 402 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Learn about the motion of coupled oscillators and Lissajous Figures
CO2: Understand various diffraction phenomenon using prism and biprism
CO3: Determine the Refractive Index, dispersive Power of the Material, and Resolving Power of prism using various methods
CO4: Understand Schuster`s focusing and photo sensor

List of Experiments:

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ2 – T Law.
3. To study Lissajous Figures.
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
8. To determine the value of Cauchy Constants of a material of a prism.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

ORGANIC CHEMISTRY-III

Subject Code: BSNMS1-403 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand the chemistry of carboxylic acids and their derivatives
2. To understand the mechanisms of organic reactions
3. To understand ethers epoxides and nitrogen based organic compounds
4. To familiarize with the chemistry of organometallic compounds
5. To understand the chemistry behind heterocyclic compounds

Course Outcomes: After the completion of course students will acquire the knowledge of:

CO1: Chemistry behind carboxylic acids and their derivatives
CO2: Mechanisms of organic reactions
CO3: Chemistry of heteroatom based organic molecules.
CO4: Chemistry of organometallic compounds

Unit-I (12 Hrs.)

Carboxylic Acids: 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.

Carboxylic Acids Derivatives: Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & 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).

Unit-II (20 Hrs.)

Ethers and Epoxides:

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.

Organic Compounds of Nitrogen: preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilc 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.

Unit-III (5 Hrs.)

Organometallic Compounds:

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.

Unit-IV (8 Hrs.)

Heterocyclic Compounds

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.

Recommended Books:

Latest edition of:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry;Pubs: Prentice-Hall.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; Pubs: Pearson Education.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; Pubs: Wiley India.
5. Carey, F.A., Organic Chemistry; Pubs: McGraw-Hill.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; Pubs: Macmillan Publishing Company.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

PHYSICAL CHEMISTRY-III

Subject Code: BSNMS1-404 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course objectives:

1. To understand the redox perspective of various processes.
2. To familiarize with various nuclear and electronic phenomenon.
3. To understand concepts of electrochemistry.
4. To familiarize with basic concept of spectroscopy.

Course outcomes: On completion of this course, students will be able to:

CO1: Understand the redox perspective of various processes.
CO2: Understand various nuclear and electronic phenomenon.
CO3: Apply electrochemical concepts and analyse outcomes of different conditions.
CO4: Assign the reasoning for various physical phenomenon.

Unit-I (12 Hrs.)

Electrochemistry-I:

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 Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit-II (12 Hrs.)

Electrochemistry – II:

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 irreverisible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions (ΔG ΔH and K), 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-Hazel equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

Unit III (10 Hrs.)

Nuclear Chemistry:

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 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.

Unit-IV (11 Hrs.)

Spectroscopy: Introduction, Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Electronic Spectrum: 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

Recommended Books:

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Companies Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry, Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
9. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book Company.
10. Friedlander, Kennedy, Miller and Macias Nuclear and Radio Chemistry: John Wiley & Sons Inc.
11. Choppin, Lijenzin, Rydberg and Ekberg Radio Chemistry and Nuclear Chemistry Pubs Elsevier.

CHEMISTRY LAB-IV

Subject Code: BSNMS1-405 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course objectives:

1. To understand the principle and application of conductometric titrations.
2. To understand various physical processes and their principle.
3. To understand synthesis and analysis of inorganic complexes

Course outcomes: On completion of this course, students will be able to:

CO1: Understand the principle and application of conductometric titrations.
CO2: Understand various physical phenomenon and their principle.
CO3: Synthesis and analysis of inorganic complexes.

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) Weight Determination

i. Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent (Rast's methods).
ii. To determine the molecular weight of a polymer by viscosity measurements.

c) Adsorption

i. 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_4 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.

f) Determining the half-life of radio isotope using GEIGER-MULLER COUNTER.

Recommended Books:
Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry, University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry, Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

ALGEBRA-I

Subject Code: BSNMS1-406 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the concept of groups and its properties.
CO2: Understand the concept of permutation group and groups of symmetries.
CO3: Analyze & demonstrate different types of algebraic structures such as subgroups, cosets and their properties.
CO4: Understand the concept of normal subgroup and Lagrange's theorem.

Unit-I (11Hrs.)

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

Unit-II (10Hrs.)

circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

Unit-III (12Hrs.)

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets.

Unit-IV (12Hrs.)

Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Recommended Books:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
5. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi, 1993.
6. Herstein, I.N., 'Topics in Algebra. '2nd Ed, Vikas Publishing House, 1976.

ALGEBRA-II

Subject Code: BSNMS1-407 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the concept of Ring and their properties.
CO2: Apply the concepts of isomorphism, homomorphism, ideal and integral domain for rings to solve different types of problems.
CO3: Access the idea of inner product space and determine its orthogonality on vector space.
CO4: Understand the basic concepts of linear transformations, algebra of transformations, eigenvalues and corresponding eigenvectors.

Unit-I(12Hrs.)

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

Unit-II (11Hrs.)

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem.

Unit-III (12Hrs.)

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

Unit-IV (10Hrs.)

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

Recommended Books:

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, 2004.
2. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,1993.
3. Herstein, I.N., 'Topics in Algebra' 2nd Ed., Vikas Publishing House, 1976.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

BASIC ANALYTICAL CHEMISTRY

Subject Code: BSNMS1-408 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives

1. To develop ability of analytical thinking.
2. To understand scientific data analyses.
3. To understand various analytical techniques.
4. To develop ability to analyze different types of samples.

Course Outcomes: On completion of this course, students will be able to:

CO1: Develop analytical thinking.
CO2: Analyse data in scientific manner.
CO3: Develop understanding of various analytical techniques.
CO4: Analyse different types of samples.

Introduction:

Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil:

Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators. Determination of pH of soil samples. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water:

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity and alkalinity of a water sample. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products:

Nutritional value of foods, idea about food processing and food preservations and adulteration. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
Analysis of preservatives and colouring matter.

Chromatography:

Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.
Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
To compare paint samples by TLC method.

Ion-exchange:

Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion

/ cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics:
Major and minor constituents and their function
Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Suggested Applications (Any one):

a) To study the use of phenolphthalein in trap cases.
b) To analyze arson accelerants.
c) To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

a) Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
b) Spectro photometric determination of Iron in Vitamin / Dietary Tablets.
c) Spectro photometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

Recommended Books:
Latest edition of:

1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. Wadsworth Publishing Co. Ltd., Belmont, California, USA.
2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
3. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry, Saunders College Publishing, Fort Worth.
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
6. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
7. Freifelder, D. Physical Biochemistry, W.H. Freeman and Co., N.Y.USA.
8. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16.
9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall.
10. Vogel, A. I. Vogel's Quantitative Chemical Analysis, Prentice Hall.
11. Robinson, J.W. Undergraduate Instrumental Analysis, Marcel Dekker, Inc. New York.

SEMESTER FIFTH

DIGITAL ANALOG AND INSTRUMENTATION

Subject Code: BSNMD1-511 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Learn the Analog and Digital Circuits
CO2: Basic concepts of Semiconductor Devices
CO3: Learn about the concepts of Amplifiers
CO4: Gain knowledge about the basic physics instruments

UNIT-I (15 Hrs)

Digital Circuits:

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method. Binary Addition. Binary Subtraction using 2's Complement Method).

UNIT-II (15 Hrs)

Semiconductor Devices:

Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

UNIT-III (15 Hrs)

Amplifiers:

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff, and Saturation Regions. Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Q point. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers.

UNIT-IV (15 Hrs)

Instrumentation:

Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers. Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation Timer IC: IC 555 Pin diagram and its application as Astable & Monostable Multivibrator

Recommended Books:

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
3. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
4. Digital Principles & Applications, A.P. Malvino, D.P. Leach & Saha, 7th Ed.,2011,
5. Tata McGraw Hill
6. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
7. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
8. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning.

CHEMISTRY OF MAIN GROUP ELEMENTS

Subject Code: BSNMD1- 521 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

This course is intended

1. To provide the students an in-depth understanding of the groups of elements in Inorganic Chemistry.
2. To know the periodic properties of s, p and d block elements and their metallurgical purification.
3. To understand the physical and chemical properties of elements and their compounds.

Course Outcomes:

CO1: Acquire knowledge and understanding of essential facts, concepts, principles, theories and metallurgical purification techniques related to the elements of periodic table.
CO2: Develop comprehension abilities of structure, bonding and properties of the compound /polymers of the elements.
CO3: Application of the principles of metallurgical process
CO4: To develop skills to evaluate, analyze and solve problems competently.

Unit-I (15 Hrs.)

Acids and Bases: Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

Unit-II (18 Hrs.)

s-and p-Block Elements: Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale). General characteristics of s-block metals like density, melting and boiling points, flame colour and reducing nature. Oxidation states of s and p block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of s block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of s-block metals.

Unit-III (10 Hrs.)

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental

chemistry wherever applicable:
Diborane and concept of multicentre bonding, hydrides of Groups 13 (BH_3), 14, 15, 16 and 17. Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S (PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2) Interhalogen compounds. A brief idea of pseudohalides.

Unit-IV (17 Hrs.)

Noble gases: Rationalization of inertness of noble gases, clathrates, preparation and properties of XeF_2, XeF_4 and XeF_6 ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.

Inorganic Polymers: Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$.

Recommended Books:
Latest edition of:

1. Lee, J.D. Concise Inorganic Chemistry ELBS
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India.
6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry, Pearson.
7. Atkin, P. Shriver & Atkins' Inorganic Chemistry, Oxford University Press.

MATRICES

Subject Code: BSNMD1-531 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the concept of vector space.
CO2: Understand the concept of rotation and reflection in a point and numerical approach to eigen values and eigen vectors.
CO3: Develop the knowledge of matrices and its properties.
CO4: Develop the advanced knowledge of matrix and examples of matrix from various fields of sciences.

Unit-I (12Hrs.)

R, R^2, R^3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R^2, R^3.

Unit-II (12Hrs.)

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

Unit-III (9Hrs.)

Types of matrices Rank of a matrix, Invariance of rank under elementary transformations, Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns up-to four.

Unit-IV (12 Hrs.)

Matrices in diagonal form, Reduction to diagonal form up-to matrices of order 3, Computation of matrix inverses using elementary row operations, Rank of matrix. Solutions of a system of linear equations using matrices, Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Recommended Books:

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

LINEAR ALGEBRA

Subject Code: BSNMD1-532 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Apply the knowledge of algebra which enable to build mathematical thinking and skills.
CO2: Analyze and solve the problems related to rank and nullity of linear transformation.
CO3: Compute the eigenvalues and corresponding eigenvectors for a square matrix.
CO4: Apply the concepts of isomorphism to solve different types of problems.

Unit-I(10Hrs.)

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit-II(12Hrs.)

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

Unit-III(12Hrs.)

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

Unit-IV (11Hrs.)

Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Recommended Books:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

DIGITAL ANALOG AND INSTRUMENTATION LAB

Subject Code: BSNMD1- 512 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Verify and design different gates
CO2: Understand Half adder, Full adder and Adder-subtrector
CO3: Design monostable, astable multivibrator using 555 timer
CO4: Understand and design various circuits using Op-amp 741

List of Experiments:

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder
5. Adder-Subtractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its frequency Response.
13. To study a precision Differential Amplifier of given I/O specification using Opamp.
14. 14. To investigate the use of an op-amp as a Differentiator
15. To design a Wien Bridge Oscillator using an op-amp.

Recommended Books:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994,Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

CHEMISTRY OF MAIN GROUP ELEMENTS LAB

Subject Code: BSNMD1-522 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand the concepts behind Iodo/Iodimetric titrations
2. To develop basic understanding of gravimetric analysis and estimation of different metals using the concept
3. To make the students understand principles involved in estimation of dissolved impurities of water
4. To familiarize the students with inorganic preparation

Course Outcomes: After completion of course students will gain the knowledge and practical hands on training of

CO1: Obtaining precise results of Iodo/Iodimetric titrations
CO2: Gravimetric analysis and estimation of different metalions
CO3: Estimation of dissolved impurities of water
CO4: Preparation of transition metal based inorganic compounds

List of Experiments:

1) Iodometric estimation of potassium dichromate and copper sulphate.
2) Iodimetric estimation of antimony in tartaremetic.
3) Estimation of amount of available chlorine in bleaching powder and household bleaches.
4) Estimation of iodine in iodized salts.
5) Iodimetric estimation of ascorbic acid in fruit juices.
6) Estimation of dissolved oxygen in water samples.
7) Gravimetric estimation of sulphate as barium sulphate.
8) Gravimetric estimation of aluminium as oximato complex.
9) Preparation of the following: potash alum, chrome alum, tetraammine copper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

Recommended Books:
Latest edition of:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson.

COMPUTER PROGRAMMING LAB

Subject Code: BSNMS1-533 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcomes: After the completion of the course, Student will be able to:

CO1: Learn the Importance of computers in Physics
CO2: Enhance skill in Linux and FORTRAN
CO3: Understand the concepts of statements
CO4: Gain knowledge about the graphical analysis and importance of visualization of computational and computational data

List of following programs are as follows:

1. Operators: Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. Decision Making: switch, if-else, nested if, else-if ladder, break, continue, go to
3. Loops: while, do-while, for
4. Functions: Definition, Declaration, call by value, Call by reference, Recursive Function
5. Arrays: Arrays declarations, Single and multi-dimensional, Strings and string functions
6. Pointers: Pointer declarations, Pointer to function, Pointer to array.

Recommended Books:

1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3rd Edn., PHI.
4. P.K. Sinha, 'Computer Fundamentals', 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, 'Application Programming in C', 2nd Edn., Khanna Book Publishing.

SEMESTER SIXTH

ELEMENTS OF MODERN PHYSICS

Subject Code: BSNMD1-611 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Gain knowledge about crystal structure
CO2: Understand the concepts of quantum mechanics.
CO3: Understand the concepts nuclear Physics.
CO4: Learn about Particle interactions and Conservation Laws.

UNIT-I (12 Hrs)

Crystal structure and lattice vibrations:

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell, Types of Lattices. Miller Indices. Reciprocal Lattice. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Lattice Vibrations in Linear Monoatomic and Diatomic Chains. Concept of phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

UNIT-II (18 Hrs)

Introduction to Quantum Mechanics:

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- German experiment. Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. 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. One dimensional infinitely rigid box- energy eigenvalues and eigen functions, normalization; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

UNIT-III (15 Hrs)

Nuclear Physics:

Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. Radioactive decay: alpha, beta and gamma decay, internal conversion, positron emission, electron capture, neutrino hypothesis. Interaction of Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter.

UNIT-IV (15 Hrs)

Particle Physics:

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. Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

Recommended Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson, 2009.
3. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw Hill Co.
4. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning.
5. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer.

ELEMENTS OF MODERN PHYSICS LAB

Subject Code: BSNMD1-612 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Gain practical knowledge about photoelectric effect
CO2: Understand the practically ionization potential, e/m ratio, Boltzmann constant
CO3: Gain knowledge about the absorption and emission spectra.
CO4: Study the diffraction patterns of single and double slits

List of Experiments:

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
8. To determine the value of e/m by magnetic focusing.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source-Na light.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

COMPREHENSIVE CHEMISTRY

Subject Code: BSNMD1-621 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To understand the concepts behind basics of inorganic chemistry
2. To understand the concept of stereochemistry
3. To familiarize with the Bioinorganic Chemistry.
4. To understand concepts of spectroscopy.

Course Outcomes: Students will acquire the knowledge of

CO1: Synthesis and applications of heterocyclic compounds
CO2: Applications of spectroscopy for the structure determination of organic compounds
CO3: Co-ordination Chemistry.
CO4: Role of Bioinorganic Chemistry.

Unit-I (14 Hrs.)

Chemistry of 3d Block Elements: Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

Organometallic Compounds: Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

Unit-II (12 Hrs.)

Bio-Inorganic Chemistry: A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones).

Unit-III (18 Hrs.)

Polynuclear and heteronuclear aromatic compounds:
Properties of the following compounds with reference to electrophilic and nucleophilic substitution reaction Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.

Active methylene compounds: Claisen condensation. Keto-enol tautomerism. Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

Unit-IV (16 Hrs.)

Application of Spectroscopy to Simple Organic Molecules:

Electromagnetic radiations, electronic transitions, λ_{max} & ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λ_{max} of conjugated dienes and α,β – unsaturated carbonyl compounds

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intra molecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions). Application of ultraviolet - visible and infrared spectroscopy in structure elucidation of organic molecules.

Recommended Books:

Latest edition of:

1. James E. Huheey, Ellen Keiter & Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
2. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
3. J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
4. F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
5. I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
6. John R. Dyer: Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall
7. R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification of Organic Compounds, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
9. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
10. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, Pub: S. Chand.

COMPREHENSIVE CHEMISTRY LAB

Subject Code: BSNMD1-622 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand the concepts behind synthesis of various inorganic compounds.
2. To determine the melting points of Inorganic compounds.
3. To understand chemistry involved in Organic functional group determination.

Course Outcomes: After completion of course students will acquire the knowledge of:

CO1: Synthesis of Inorganic compounds
CO2: Determination of melting and boiling points of synthesized Inorganic compound
CO3: Organic Functional group tests.

Inorganic Chemistry

1) Separation of mixtures by chromatography: Measure the Rf value (Combination of two ions to be given)

   Paper chromatography:

   (a) separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+}

   (b) separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}.

2) Preparation of any two of the following complexes and measurement of their conductivity:

   i. tetraamminecarbonatocobalt (III) nitrate
   ii. tetraamminecopper (II) sulphate
   iii. potassium trioxalatoferrate (III) trihydrate

   Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$.

Organic Chemistry

Systematic Qualitative Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of their one derivative.

Recommended Books:

Latest edition of:

1) A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall.
2) A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall.
3) Vogel's Textbook of Practical Organic Chemistry, Prentice-Hall.
4) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman.

NUMERICAL METHODS

Subject Code: BSNMD1-631 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Learn various types of numerical methods to find the roots of nonlinear equations and solution of a system of linear equations.
CO2: Find values for a tabulated function using interpolation techniques.
CO3: Apply different kind of numerical methods to solve integration.
CO4: Apply various numerical methods to solve ordinary differential equation.

Unit-I (12Hrs.)

Rate of Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

Unit-II (12Hrs.)

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

Unit-III (13 Hrs.)

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae- Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

Unit-IV (8 Hrs.)

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books:

1) B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2) M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3) S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, 1980.
4) J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., 2001.

COMPLEX ANALYSIS

Subject Code: BSNMD1-632 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Outcomes:

CO1: Understand the calculus of complex functions, concept and consequences of analyticity.
CO2: Formulation of analytic function and their application.
CO3: Evaluation of contour integrals directly by use of Cauchy theorem and Cauchy's integral formula.
CO4: Represent complex function as Taylor, Power and Laurent series.

Unit-I (11Hrs.)

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit-II (12Hrs.)

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

Unit-III (10Hrs.)

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula.

Unit-IV (12Hrs.)

Liouville's theorem and the fundamental theorem of algebra, Convergence of sequences and series, Taylor series and its examples, Laurent series and its examples, absolute and uniform convergence of power series.

Recommended Books:

1) James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
2) 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
3) E.T. Capson,, An Introduction to the Theory of functions of a complex Variable, Oxford university press, 1995.
4) R. Churchill, J.W. Brown, 'Complex Variables and Applications', 6th Edn., New York, McGraw-Hill, 1996.
5) A.R. Shastri, 'An Introduction to Complex Analysis', Macmillan India Ltd., 2003.
6) S. Ponnusamy, Foundation of Complex Analysis, Narosa Book Distributors, 2011.

NUMERICAL ANALYSIS LAB

Subject Code: BSNMS1-633 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Outcomes:

CO1: Apply computer programming to solve algebraic equations, linear systems of equations, ordinary differential equation, eigenvalue problems & Carry out numerical differentiation, integration and interpolation.
CO2: Utilize the symbolic tools of C++ language for solving given problem.
CO3: Understand different modes of a numerical method in order to solve a given problem efficiently.
CO4: Develop understanding of numerical error and applicability of a particular method.

The following programs of following methods are to be practiced:

1. To find a real root of an algebraic/ transcendental equation by using Bisection method.
2. To find a real root of an algebraic/ transcendental equation by using Regula-Falsi method.
3. To find a real root of an algebraic/ transcendental equation by using Newton-Raphson method.
4. To find a real root of an algebraic/ transcendental equation by using Iteration method.
5. Implementation of Gauss- Elimination method to solve a system of linear algebraic equations.
6. Implementation of Jacobi's method to solve a system of linear algebraic equations.
7. Implementation of Jacobi's method to solve a system of linear algebraic equations.
8. Implementation of Gauss-Seidel method to solve a system of linear algebraic equations.
9. To find differential coefficients of 1st and 2nd orders using interpolation formulae.
10. To evaluate definite integrals by using Newton - Cotes integral formulae.
11. To evaluate definite integrals by using Gaussian Quadrature.
12. To evaluate double integrals by using Trapezoidal and Simpson method.
13. To compute the solution of ordinary differential equations with Taylor's series method.
14. To compute the solution of ordinary differential equations by using Euler's method.
15. To compute the solution of ordinary differential equations by using Runge -Kutta methods.
16. To compute the solution of ordinary differential equations by using Milne-Simpson method.

Recommended Books:

1. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill, New Delhi, 1999.
2. J N Sharma, Numerical Methods for engineers and Scientists (2nd Edn) Narosa Publishing House, New Delhi/ Alpha Science International Ltd. Oxford UK, 2007.
3. Conte and de Boor, Numerical Analysis, McGraw Hill, New York, 1990
4. John H. Mathews, Numerical Methods for Mathematics, Science and Engineering (2nd Edn.), Prentice Hall, New Delhi, 2000.