1st Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BSNMS1-101	English (Ability Enhancement Compulsory Course –I)*	2	0	0	40	60	100	2
BSNMS1-102	Mechanics (Core Course-I)*	4	0	0	40	60	100	4
BSNMS1-103	Inorganic Chemistry-I (Core Course-II A)*	3	0	0	40	60	100	3
BSNMS1-104	Organic Chemistry-I (Core Course-II B)*	3	0	0	40	60	100	3
BSNMS1-105	Differential Calculus-I (Core Course-III A)*	3	0	0	40	60	100	3
BSNMS1-106	Differential Calculus-II (Core Course-III B)*	3	0	0	40	60	100	3
BSNMS1-107	Mechanics Lab (Core Course-I Practical)*	0	0	4	60	40	100	2
BSNMS1-108	Chemistry Lab- I (Core Course-II Practical)*	0	0	4	60	40	100	2
Total		**18**	**0**	**8**	**360**	**440**	**800**	**22**

2nd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
BSNMS1-201	Environmental Science (Ability Enhancement Compulsory Course –II)*	2	0	0	40	60	100	2
BSNMS1-202	Electricity, Magnetism and EMT (Core Course-IV)*	4	0	0	40	60	100	4
BSNMS1-203	Physical Chemistry-I (Core Course-V A)*	3	0	0	40	60	100	3
BSNMS1-204	Organic Chemistry-II (Core Course-V B)*	3	0	0	40	60	100	3
BSNMS1-205	Differential Equations-I (Core Course-VI A)*	3	0	0	40	60	100	3
BSNMS1-206	Differential Equations-II (Core Course-VI B)*	3	0	0	40	60	100	3
BSNMS1-207	Electricity, Magnetism and EMT Lab (Core Course-IV Practical)*	0	0	4	60	40	100	2
BSNMS1-208	Chemistry Lab-II (Core Course-V Practical)*	0	0	4	60	40	100	2
Total		**18**	**0**	**08**	**360**	**440**	**800**	**22**

3rd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BSNMS1-301	Thermal Physics and Statistical Mechanics (Core Course-VII)*	4	0	0	40	60	100	4
BSNMS1-302	Thermal Physics and Statistical Mechanics Lab (Core Course-VII Practical)*	0	0	4	60	40	100	2
BSNMS1-303	Inorganic Chemistry-II (Core Course-VIII A)*	3	0	0	40	60	100	3
BSNMS1-304	Physical Chemistry-II (Core Course-VIII B)*	3	0	0	40	60	100	3
BSNMS1-305	Chemistry Lab III (Core Course-VIII Practical)*	0	0	4	60	40	100	2
BSNMS1-306	Real Analysis-I (Core Course IX A)*	3	0	0	40	60	100	3
BSNMS1-307	Real Analysis-II (Core Course IX B)*	3	0	0	40	60	100	3
BSNMS1-308	Computational Physics Skills (Skill Enhancement Course-1)*	0	0	4	60	40	100	2
Total		**16**	**0**	**12**	**380**	**420**	**800**	**22**

4Th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
BSNMS1-401	Waves and Optics (Core Course-X)*	4	0	0	40	60	100	4
BSNMS1-402	Waves and Optics Lab (Course-X Practical)*	0	0	4	60	40	100	2
BSNMS1-403	Organic Chemistry-III (Core Course-XI A)*	3	0	0	40	60	100	3
BSNMS1-404	Physical Chemistry-III (Core Course-XI B)*	3	0	0	40	60	100	3
BSNMS1-405	Chemistry Lab-IV (Core Course-XI Practical)*	0	0	4	60	40	100	2
BSNMS1-406	Algebra-I (Core Course-XII A)*	3	0	0	40	60	100	3
BSNMS1-407	Algebra-II (Core Course-XII B)*	3	0	0	40	60	100	3
BSNMS1-408	Basic Analytical Chemistry (Skill Enhancement Course-II)*	0	0	4	60	40	100	2
Total		**16**	**0**	**12**	**380**	**420**	**800**	**22**

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

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

ENGLISH

Subject Code: BSNMS1-101 **L T P C** **Duration:30 Hrs.**
2 0 0 2

UNIT-I

Introduction:
Theory of Communication, Types and modes of Communication
Language of Communication:
Verbal and Non-verbal, (Spoken and Written), Personal, Social and Business, Barriers and StrategiesIntra-personal, Inter-personal and Group communication

UNIT-II

Speaking Skills:
Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech

UNIT-III

Reading and Understanding
Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation(from Indian language to English and vice-versa), Literary/Knowledge Texts.

UNIT-IV

Writing Skills
Documenting, Report Writing, Making notes, Letter writing

Recommended Books:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul,Dr Brati Biswas

MECHANICS

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

UNIT-I

Vector Calculus and Laws of Motion **(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

Gravitation **(15 Hrs)**

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

Oscillations **(15 Hrs)**

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

Special Theory of Relativity **(15 Hrs)**

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. AddisonWesley
2. Mechanics Berkeley Physics course,volume.1: Charles Kittel, et. Al. 2007, Tata McGrawHill.
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.

MECHANICS LAB

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

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 Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

INORGANIC CHEMISTRY-I

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

Unit-I

Atomic Structure: **(8 Hrs.)**

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

Chemical Periodicity: **(7 Hrs.)**

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

Chemical Bonding-I: **(15 Hrs.)**

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

Chemical Bonding-II: **(15 Hrs.)**

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:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', ELBS Oxford, **1991**.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, 'Inorganic Chemistry', 4th Edn., Pearson Education, Singapore, **1999**.
3. J.D. Lee, 'Concise Inorganic Chemistry', ELBS, Oxford, **1994**.

ORGANIC CHEMISTRY-I

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

Unit-I

Structure and Bonding: **(5 Hrs.)**

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: **(10 Hrs.)**

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

Alkanes and Cycloalkanes: **(10 Hrs.)**

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

Alkenes, Cycloalkenes, Dienes and Alkynes: **(14 Hrs.)**

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

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

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

Aromatic hydrocarbons **(6 Hrs.)**

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:

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).

CHEMISTRY LAB-I

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

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 R_f 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:

1.H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH,1996.
2.G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books,1999.
3.G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', 2ndEdn., Chapman and Hall, London, 1974.
4.J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education,2006.
5.G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education, 2006.

DIFFERENTIAL CALCULUS-I

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

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(l+x), $(l+x)^m$, 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.

RecommendedBooks:

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

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, 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.

ENVIRONMENTAL SCIENCES

Subject Code: BSNMS1-201 **L T P C** **Duration: 30 Hrs.**
2 0 0 2

UNIT-I

Natural Resources

Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefitsand problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

UNIT-II

Ecosystems

(a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids.

Biodiversity and its Conservation: (a) Introduction – Definition: genetic, species and ecosystem diversity. (b) Biogeographically classification of India. (c) Value of biodiversity: consumptive use, productive use, social, ethical aesthetic.

UNIT-III

Environmental Pollution

Definition (a) Causes, effects and control measures of: i) Air pollution ii) Water pollution iii) Soil pollution iv) Marine pollution v) Noise pollution vi) Thermal pollution vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

UNIT-IV

Social Issues and the Environment

(a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. Case studies. (e) Environmental ethics: Issues and possible solutions (f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Recommended Books:

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004**.
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004**.
3. ErachBharucha, 'Textbook for Environmental Studies', UGC, New Delhi.

ELECTRICITY, MEGNETISM AND EMT

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

UNIT-I

Vector Analysis **(13 Hrs)**

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

Electrostatics **(16 Hrs)**

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

Magnetism **(16 Hrs)**

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

Maxwell`s equations and Electromagnetic wave propagation **(15 Hrs)**

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 McGrawHill.
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.

ELECTRICITY, MEGNETISM AND EMT LAB

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

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 (Determine dB/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.

PHYSICAL CHEMISTRY-I

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

Unit-I

Evaluation of Analytical Data **(10 Hrs.)**

Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation, confidence limits, rejection of measurements (F-test and Q-test) numerical problems related to evaluation of analytical data.

Unit-II

Liquid State **(8 Hrs.)**

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 eholestric phases. Thermography and seven segment cell.

Unit-III

Gaseous State **(15 Hrs.)**

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, Liquifacation of gases (based on Joule-Thomson effect).

Unit-IV

Solid state: **(12 Hrs.)**

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.

Recommended Books:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

ORGANIC CHEMISTRY-II

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

Unit-I

Stereochemistry of Organic Compounds **(15 Hrs.)**

Concept of isomerism. Types of isomerism Optical isomerisin-elements of symmetry, molecular chirality, enantiomers, stereogenic centrec, 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

Arenes and Aromaticity **(7 Hrs.)**

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

Aromatic Electrophilic Substitution: **(11 Hrs.)**

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 alkynyl benzenes.

Unit-IV

Alkyl and aryl halides **(12 Hrs.)**

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, $S_N2$and S_N1 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:

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).

CHEMISTRY LAB-II

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

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 Experiment
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:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH, 1996.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education, 2006.
3. G. Svehla, 'Vohel's Textbook of Quantitative Analysis', Pearson Education, 2006.

DIFFERENTIAL EQUATIONS-I

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

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

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.

THERMAL PHYSICS AND STATISTICAL MECHANICS

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

UNIT-I

Laws of Thermodynamics **(16 Hrs)**

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

Thermodynamic Potential and Theory of Radiation **(16 Hrs)**

Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, ClausiusClapeyron 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, RayleighJeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

UNIT-III

Kinetic Theory of Gases **(14 Hrs)**

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

Statistical Mechanics **(14 Hrs)**

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

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

Unit-I

s-Block Elements **(3 Hrs.)**

Comparative studies, diagonal relationship, salient features of hydrides, solvation and complexation tendencies.

Acids and Bases **(3 Hrs.)**

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

Unit-II

p–Block Elements–I **(12 Hrs.)**

Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–16, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes. VBT, VSPER theory, MOT.

Unit-III

p–Block Elements-II **(12 Hrs.)**

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

Chemistry of Transition Elements **(15 Hrs.)**

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 *3*d analogues in respect of ionic radii, oxidation states, magnetic behaviour. CFT and CFSE for Octahedral/Tetrahedral complexes.

Recommended Books:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004,
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.

PHYSICAL CHEMISTRY-II

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

Unit-I

Thermodynamics-I **(4 Hrs.)**

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: **(6 Hrs.)**

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: **(4 Hrs.)**

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

Thermodynamics-II & III **(15 Hrs.)**

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

Chemical Equilibrium **(6 Hrs.)**

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of K_p, K_c, K_a and their relationship, Clausius-Clapeyron equation, applications.

Unit-IV

Introduction to Phase Equilibrium **(10 Hrs.)**

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:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.

6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

CHEMISTRY LAB-III

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

Quantitative Analysis

Volumetric Analysis

a. Determination of acetic acid in commercial vinegar using NaOH.
b. Determination of alkali content-antacid tablet using HCl.
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.

Gravimetric Analysis

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

Organic Chemistry Laboratory Techniques

Thin Layer Chromatography

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

Recommended Books:

1.H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH,1996.
2.G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books,1999.
3.G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', 2ndEdn., Chapman and Hall, London, 1974.
4.J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education,2006.
5.G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education, 2006.
6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,

7. Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

REAL ANALYSIS-I

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

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 BolzanoWeierstrass 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, Mtest, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

RecommendedBooks:

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

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.

RecommendedBooks:

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

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

WAVES AND OPTICS

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

UNIT-I

Harmonic oscillators and Wave Motion **(15 Hrs)**

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

Simple Harmonic motion and applications **(15 Hrs)**

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--III

Wave optics and Interference **(16 Hrs)**

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

Diffraction and Polarization **(14 Hrs)**

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

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

Unit-I

Carboxylic Acids (7 Hrs.)

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 (5 Hrs.)

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

Ethers and Epoxides (5 Hrs.)

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 epoxiedes.

Organic Compounds of Nitrogen (15 Hrs.)

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

Organometallic Compounds **(5 Hrs.)**

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

Heterocyclic Compounds **(8 Hrs.)**

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:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
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; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
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

Unit-I

Electrochemistry-I **(12 Hrs.)**

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

Electrochemistry – II **(12 Hrs.)**

Types of reversible electrodes-gas metal ion, metal ion, metal insolblue 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 electrochemi 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

Nuclear Chemistry **(10 Hrs.)**

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

Spectroscopy **(6 Hrs.)**

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

Electronic Spectrum **(5 Hrs.)**

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:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Companies Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd, 2002.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
9. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book Company, 1989.
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

(I) Synthesis and Analysis

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

(II)Physical Chemistry

(a) Conductometric Titrations

(i) Determine the end point of the following titrations by the conductometric methods.
Strong acid-Strong base
Strong acid-Weak base
Weak acid-Strong base
Weak acid-Weak base

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

(b) (i) Molecular Weight Determination of acetanilide, 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 CCI_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:

1.H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH,1996.
2.G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books,1999.
3.G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', 2ndEdn., Chapman and Hall, London, 1974.
4.J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', 5thEdn., Pearson Education,2006.
5.G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education, 2006.

ALGEBRA-I

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

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.

RecommendedBooks:

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

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

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
a. Determination of pH of soil samples.
b. 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.
a. Determination of pH, acidity and alkalinity of a water sample.
b. 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.
a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
b. Analysis of preservatives and colouring matter.

Chromatography

Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.
a. Paper chromatographic separation of mixture of metal ion (Fe3+ and Al3+).
b. 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
a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
b. 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:

1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods ofAnalysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA,1988.
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 AnalyticalChemistry 6th Ed., Saunders College Publishing, Fort Worth (1992).
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 2nd Ed., W.H. Freeman and Co., N.Y.USA (1982).
8. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16(1977).
9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
10. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
11. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc.,New York (1995).

DIGITAL ANALOG AND INSTRUMENTATION

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

UNIT-I

Digital Circuits **(15 Hrs)**

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

Semiconductor Devices **(15 Hrs)**

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

Amplifiers **(15 Hrs)**

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

Instrumentation **(15 Hrs)**

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, Tata McGraw Hill
5. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
6. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
7. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning.

DIGITAL ANALOG INSTRUMENTATION LAB

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

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
16. 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

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

Unit-I

Acids and Bases **(7 Hrs.)**

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 **(8 Hrs.)**

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

***s*- and *p*-Block Elements** **(18 Hrs.)**

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

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: (10 Hrs.)

Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH3), 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

Noble gases (7 Hrs.)

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 (10 Hrs.)

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:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed.,Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models inInorganic Chemistry, John Wiley & Sons.
4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann. 1997.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning IndiaEdition, 2002.
6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson,2010.
7. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford UniversityPress (2010).

CHEMISTRY OF MAIN GROUP ELEMENTS LAB

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

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, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

Recommended Books:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.

MATRICES

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

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.

RecommendedBooks:

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

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.

RecommendedBooks:

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.

COMPUTER PROGRAMMING LAB

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

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.

ELEMENTS OF MODERN PHYSICS

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

UNIT-I

Crystal structure and lattice vibrations: **(12 Hrs)**

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

Introduction to Quantum Mechanics: **(18 Hrs)**

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 eigenfunctions, normalization; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

UNIT-III

Nuclear Physics : **(15 Hrs)**

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

Particle Physics : **(15 Hrs)**

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, 4thEdn., 2001, Springer.

ELEMENTS OF MODERN PHYSICS LAB

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

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

Unit-I

Chemistry of 3d (6 Hrs.)

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 (8 Hrs.)

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

Bio-Inorganic Chemistry (12 Hrs.)

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

Polynuclear and heteronuclear aromatic compounds: (10 Hrs.)

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

Active methylene compounds: **(8 Hrs.)**

Preparation: Claisen ester condensation. Keto-enol tautomerism. *Reactions:* Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

Unit-IV

Application of Spectroscopy to Simple Organic Molecules **(16 Hrs.)**

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λmax & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β – unsaturated compounds.
Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Recommended Books:

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 OrganicCompounds, Prentice Hall.
7. R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification ofOrganic 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, S. Chand.

COMPREHENSIVE CHEMISTRY LAB

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

Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given) Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic 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, MgCl2 and LiCl3.

Organic Chemistry

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

Recommended Books:

1. A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
2. A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,
4. Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
5. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman,1960.

NUMERICAL METHODS

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

Unit-I(12Hrs.)

Rate of Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, GaussJacobi, 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

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.

RecommendedBooks:

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

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, NewDelhi/ 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.