Jagannath University

Bahadurgarh - NCR

BACHELOR OF SCIENCE (B.Sc.)

(Non- Medical)

Detailed Scheme and Syllabus

(w.e.f 2019)

First Semester

Theory / Prictical		Course Type	No. of Teaching Hours			Marks Allocations			Credits
Code	Subject/Paper		L	T	P	IA	EA	Total	
BSN 101	English & Comm. Skills	**AECC-1**	3	-	-	30	70	100	3
BSN 102	Algebra	CORE	3	-	-	30	70	100	3
BSN 103	Calculus	CORE	2	-	-	30	70	100	2
BSN 104	Solid Geometry	CORE	3	-	-	30	70	100	3
BSN 105	Mechanics	CORE	2	-	-	30	70	100	2
BSN 106	Inorganic Chemistry	CORE	2	-	-	30	70	100	2
BSN 107	Organic Chemistry	CORE	2	-	-	30	70	100	2
BSN 108	Physical Chemistry	CORE	3	-	-	30	70	100	3
BSN 109	Electricity and Magnetism	CORE	3	-	-	30	70	100	3
BSN 110	Chemistry Practical	CORE	-	-	1				-
BSN 111	Physics Practical	CORE	-	-	1				-
Total			**23**		**2**	**270**	**630**	**900**	**23**

Second Semester

Theory Papers		Course Type	No. of Teaching Hours			Marks Allocations			Credits
Code	Subject/Paper		L	T	P	IA	EA	Total	
BSN 201	Environmental Studies	**AECC-2**	3	-	-	30	70	100	3
BSN 202	Number Theory and Trignometry	CORE	3	-	-	30	70	100	3
BSN 203	Ordinary Differential Equations	CORE	2	-	-	30	70	100	2
BSN 204	Inorganic Chemistry	CORE	2			30	70	100	2
BSN 205	Organic Chemistry	CORE	2	-	-	30	70	100	2
BSN 206	Properties of Matter, Kinetic Theory and Relativity	CORE	2	-	-	30	70	100	2
BSN 207	Electromagnetic Induction and Electronic Devices	CORE	3	-	-	30	70	100	3
BSN 208	Physical Chemistry	CORE	3	-	-	30	70	100	3
BSN 209	Vector Calculus	CORE	3	-	-	30	70	100	3
BSN 110	Chemistry Practical	CORE	-	-	1	30	20	50	1
BSN 111	Physics Practical	CORE	-	-	1	30	20	50	1
Total			**23**		**2**	**330**	**670**	**1000**	**25**

Third Semester

Theory Papers		Course Type	No. of Teaching Hours			Marks Allocations			Credits
Code	**Subject/Paper**		L	T	P	IA	EA	Total	
BSN 301	Advanced Calculus	CORE	3	-	-	30	70	100	3
BSN 302	Partial Differential Equations	CORE	2	-	-	30	70	100	2
BSN 303	Statics	CORE	3	-	-	30	70	100	3
BSN 304	Computer Programming and Thermodynamics	CORE	2	-	-	30	70	100	2
BSN 305	Inorganic Chemistry	CORE	2	-	-	30	70	100	2
BSN 306	Organic Chemistry	CORE	2	-	-	30	70	100	2
BSN 307	Physical Chemistry	CORE	3	-	-	30	70	100	3
BSN 308	Computer Fundamental	**SEC-1**	3	-	-	30	70	100	3
BSN 309	Optics – I	CORE	3	-	-	30	70	100	3
BSN 310	Chemistry Practical	**SEC-2**	-	-	1				-
BSN 311	Physics Practical	**SEC-3**	-	-	1				-
Total			**23**		**2**	**270**	**630**	**900**	**23**

Fourth Semester

Theory Papers		Course Type	No. of Teaching Hours			Marks Allocations			Credits
Code	**Subject/Paper**		L	T	P	IA	EA	Total	
BSN 401	Statistical Mechanics	CORE	2	-	-	30	70	100	2
BSN 402	Optics - II	CORE	3	-	-	30	70	100	3
BSN 403	Sequences and Series	CORE	3	-	-	30	70	100	3
BSN 404	Special Functions and Integral Transforms	CORE	3	-	-	30	70	100	3
BSN 405	Inorganic Chemistry	CORE	2	-	-	30	70	100	2
BSN 406	Organic Chemistry	CORE	2	-	-	30	70	100	2
BSN 407	Physical Chemistry	CORE	3	-	-	30	70	100	3
BSN 408	Programming in C and Numerical Methods	CORE	2	-	-	30	70	100	2
BSN 310	Chemistry Practical	**SEC-2**	-	-	1	30	20	50	1
BSN 311	Physics Practical	**SEC-3**	-	-	1	30	20	50	1
Total			**20**		**2**	**300**	**600**	**900**	**22**

Fifth Semester

Theory Papers		Course Type	No. of Teaching Hours			Marks Allocations			Credits
Code	Subject/Paper		L	T	P	IA	EA	Total	
BSN 501	Real Analysis	DSE-1	3	-	-	30	70	100	3
BSN 502	Groups and Rings	DSE-2	3	-	-	30	70	100	3
BSN 503	Numerical Analysis	DSE-3	2	-	-	30	70	100	2
BSN 504	Solid State Physics	DSE-4	3	-	-	30	70	100	3
BSN 505	Inorganic Chemistry	DSE-5	2	-	-	30	70	100	2
BSN 506	Organic Chemistry	DSE-6	2	-	-	30	70	100	2
BSN 507	Physical Chemistry	DSE-7	3	-	-	30	70	100	3
BSN 508	Quantum Mechanics	DSE-8	3	-	-	30	70	100	3
BSN 509	Chemistry Practical	**SEC-4**	-	-	1				-
BSN 510	Physics Practical	**SEC-5**	-	-	1				-
Total			**21**		**2**	**240**	**560**	**800**	**21**

Sixth Semester

Theory Papers		Course Type	No. of Teaching Hours			Marks Allocations			Credits
Code	Subject/Paper		L	T	P	IA	EA	Total	
BSN 601	Real and Complex Analysis	DSE-9	2	-	-	30	70	100	2
BSN 602	Linear Algebra	DSE-10	3	-	-	30	70	100	3
BSN 603	Dynamics	DSE-11	3	-	-	30	70	100	3
BSN 604	Atomic Molecular and Laser Physics	DSE-12	3	-	-	30	70	100	3
BSN 605	Inorganic Chemistry	DSE-13	2	-	-	30	70	100	2
BSN 606	Organic Chemistry	DSE-14	2	-	-	30	70	100	2
BSN 607	Physical Chemistry	DSE-15	3	-	-	30	70	100	3
BSN 608	Nuclear Physics	DSE-16	3	-	-	30	70	100	3
BSN 509	Chemistry Practical	**SEC-4**	-	-	1	30	20	50	1
BSN 510	Physics Practical	**SEC-5**	-	-	1	30	20	50	1
Total			**21**		**2**	**300**	**600**	**900**	**23**

PROGRAMME SUMMARY

S.No.	Type of Course / Subject	Number of Courses/ Subjects	Credits
1.	Core Courses (CORE)	34	84
2.	Ability Enhancement Compulsory Courses (AECCs)	02	06
3.	Skill Enhancement Courses (SECs)	05	11
4.	Discipline Specific Electives (DSEs)	16	42
TOTAL		**57**	**143**

BSN 101: English & Communication Skills

Max. Marks: 70
Time: 3 hours

UNIT I   **[Lectures-5]**

An insight into Subject –Verb Agreement:

Subject –Verb Agreement:

- When Subject is placed after the Verb
- When there are intervening words or expressions between the Subject and the Verb
- When the Subject gives the appearance of being plural
- When there are problems in the agreement of Numbers
- When a pronoun is used in the wrong number
- Is used in the wrong case
- Verb classification Main verb Transitive and Intransitive verb, Auxiliary verb,

UNIT II   **[Lectures-6]**
Grammar And Usage

- punctuation
- Articles
- Framing question
- Simple, compound & Phrase preposition

UNIT III   **[Lectures-6]**
Sentence synthesis:

- Phrases and Clauses (Noun,Adjective and Adverb phrases anduses and where and when to use them.)
- Simple, Complex and Compound sentences (how to construct and when to use)
- Usage and purpose of Infinitives, Participles and Gerunds (where and when to use)
- Sequence of Tenses , Moods and Voice (where and when to use)
- Problems with Auxiliaries and Modals (what does each one of them denote)
- Reported Speech (Rewriting conversations in Reported Speech)

UNIT IV   **[Lectures-5]**
Playing with words

- Understanding the role Prefixation and Suffixation in word formation; transformation from one part of the speech to another)
- Vocabulary building activities(Learning words through Roots, Mnemonics and Associations, Analogies)
- Words with similar spellings or sounds and their meanings
- Revisiting the rules of Punctutation and Capitalisation

UNIT V   **[Lectures-8]**
Magic of language

- Idioms
- Phrasal Verbs
- Composition, Reading Skills, Public speaking and Discussions
- Precise writing(How to extract important information and express it in a way that it gives appropriate gist of the given passage))
- Essay writing (Principles of Coherence ,Cohesion ,Continuity)
- Reading Comprehensions Exercises (with focus on skimming and scanning)
- Extempore (Will be conducted throughout the semester)
- Notice writing, Memo & Circular

BSN 102: Algebra

Max. Marks: 70

Time: 3 hours

SECTION -I

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix.

SECTION –II

Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix

SECTION –III

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

SECTION -IV

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

SECTION -V

Nature of the roots of an equation Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Books Recommended:

1. H.S. Hall and S.R. Knight : Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan : A Text Books of Matrices.
3. Chandrika Prasad : Text Book on Algebra and Theory of Equations.

    Pothishala   Private   Ltd.,   Allahabad.

BSN 103: Calculus

Max. Marks: 70

Time: 2 hours

Section – I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Section – II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes inpolar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations.

Section – III

Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Section – IV

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Section – V

Quardrature (area)Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Books Recommended :

Differential and Integral Calculus : Shanti Narayan.

Murray R. Spiegel : Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
N. Piskunov : Differential and integral Calculus. Peace Publishers, Moscow.
Gorakh Prasad : Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
Gorakh Prasad : Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

BSN 104: Solid Geometry

Credit - 03

Max. Marks : 70

Section – I :

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

Section – II :

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres.

Section – III:

Co-oxal system of spheres Cones. Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder.

Section – IV :

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

Section – IV :

Paraboloids: Circular section, Plane sections of conicoids. Generating lines. Confocal conicoid. Reduction of second degree equations.

BSN 105 : MECHANICS

Credit - 02

Max. Marks : 70

Unit I

Mechanics of single and system of particles, conservation of laws of linear momentum, angular momentum and mechanical energy,

Unit II

Centre of mass and equation of motion, constrained motion, degrees of freedom. Acceleration of a body rolling down on an inclined plane.

Unit III

Generalised coordinates, displacement, velocity, acceleration, momentum, force and potential. Hamilton's variational principle , Lagrange's equation of motion from Hamilton's Principle

Unit IV

Rotation of Rigid body, noment of inertia, torque, angular momentum, kinetic energy of rotation. Theorems of perpendicular and parallel axes with proof

Unit V

Moment of inertia of solid sphere, hollow sphere, spherical shell, solid cylinder, hollow cylinder and solid bar of rectangular cross-section.

References

1.   Classical Mechanics by V.K.Jain (Ane 2009)
2.   Classical Mechanics by H. Goldstein (2nd Edition)
3.   Berkeley Physics Course, Vol. I, Mechanics by E.M. Purchell

BSN106: Inorganic Chemistry

Max. Marks: 70
Time: 2 Hrs.

UNIT 1

Atomic Structure
Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals.

UNIT 2

Periodic Properties
General principles of periodic table: Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge, Slater's rules. Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, methods of determination or evaluation, trends in periodic table (in s &p block elements).

UNIT 3

Covalent Bond
Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7 SO_4^{2-}, ClO_4^-)

UNIT 4

Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O_+, SF_4, CIF_3, ICI_2^- and H_2O. MO theory of heteronuclear (CO and NO) diatomic molecules, , bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

UNIT 5

Ionic Solids
Ionic structures (NaCl, CsCl, ZnS (Zinc Blende), CaF_2) radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy (mathamtical derivation excluded) and Born-Haber cycle, solvation energy and its relation with solubility of ionic solids, polarizing power and
polarisability of ions, Fajan's rule.

BSN 107: Organic Chemistry

UNIT 1

Structure and Bonding
Localized and delocalized chemical bond, vander Waals interactions, resonance: conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

UNIT 2

Stereochemistry of Organic Compounds-I
Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and eryth ro diastereomers, meso compounds, resolution of enantiomers,inversion,retention and racemization.

UNIT 3

Stereochemistry of Organic Compounds-II
Relative and absolute configuration, sequence rules, R & S systems of nomenclature.
Geometric isomerism determination of configuration of geometric isomers. E & Z system of nomenclature, Conformational isomerism conformational analysis of ethane and n-butane,conformations of cyclohexane, axial and equatorial bonds, Newman projection and Sawhorse formulae, Difference between configuration and conformation.

UNIT 4

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

UNIT 5

Alkanes and Cycloalkanes
IUPAC nomenclature of branched and unbranched alkanes the alkyl group classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties. Cycloalkanes nomenclature, synthesis of cycloalkanes and their derivatives –photochemical (2+2) cycloaddition reactions, dehalogenation of dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations, theory of strainless rings

BSN 108: Physical Chemistry

Max. Marks: 70
Time: 3 Hrs.

UNIT 1

Gaseous States
Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path. Deviation of Real gases from ideal behaviour.

UNIT 2

Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature(compression factor) Explanation of behaviour of real gases using Vander Waal's equation.

UNIT3

Critical Phenomenon:
Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal"s constants. Critical compressibility factor. The Law of corresponding states. Lequifaction of gases.
7

UNIT 4

Liquid States
Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

UNIT 5

Solid State
Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crysta ls. Definition of unit cell & space lattice. Bravais lattices, crystal system. Xray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl. Liquid crystals: Difference between solids, liquids and liquid crystals, types of liquid crystals. Applications of liquid crystals.

BSN 109 : ELECTRICITY AND MAGNETISM

Max. Marks : 70

Internal Assessment : 30

Time : 3 Hrs.

Unit I

Mathematical Background : Scalars and Vectors, dot and cross product, Triple vector product, Scalar and Vector fields, Differentiation of a vector, Gradient of a scalar and its physical significance, Integration of a vector (line, surface and volume integral and their physical significance), Gauss's divergence theorem and Stocks theorem.

Unit II

Electrostatic Field : Derivation of field E from potential as gradient, derivation of Laplace and Poisson equations. Electric flux, Gauss's Law and its application to spherical shell, uniformly charged infinite plane and uniformity charged straight wire, mechanical force of charged surface, Energy per unit volume.

Unit III

Magnetostatistics : Magnetic Induction, magetic flux, solenoidal nature of Vector field of induction. Properties of B (i) .B = 0 (ii) xB= J.Cycle of Magnetisation - Hysteresis (Energy dissipation, Hysteresis loss and importance of Hysteresis curve).

Unit IV

Electromagnetic Theory -I: Maxwell equation and their derivations, Displacement Current. Boundary conditions at interface between two different media.

Unit V

Electromagnetic Theory –II : Propagation of electromagnetic wave (Basic idea, no derivation). Poynting vector and Poynting theorem.

References :

1.   Electricity and Magnetism by Reitz and Milford (Prentice Hall of India)

2.   Electricity and Magnetism by A.S. Mahajan and A.A. Rangwala (Tata McGraw Hill).

BSN 110: Chemistry Practicals

Max. Marks: 50
Time: 1 HRS
(Spread over two sessions)

Section-A (Inorganic)

Volumetric Analysis

1. Redox titrations: Determination of Fe_{2+}, C_2O_{42-} (using $KMnO_4$, $K_2Cr_2O_7$)

2. Iodometic titrations: Determination of Cu_{2+} (using standard hypo solution).

3. Complexometric titrations: Determination of Mg_{2+}, Zn_{2+} by EDTA.

Paper Chromatography

Qualitative Analysis of the any one of the following Inorganic cations and
anions by paper chromatography (Pb_{2+}, Cu_{2+}, Ca_{2+}, Ni_{2+}, Cl_-, Br_-, I_- and PO_{43-} and NO_{3-}).

Section-B (Physical)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate, ethyl acetate catalyzed by hydrogen ions at room temperature.

2. To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi – and trivalent anions.

3. To determine the surface tension of a given liquid by drop number method.

4. To determine the viscosity of a given liquid**.**

5. To determine the specific refractivity of a given liquid

SECTION – C (Organic)

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point

(i) Iodoform from ethanol (or acetone)

(ii) m-Dinitrobenzne from nitrobenzene (use 1:2 conc. HNO_3, H_2SO_4 mixture if fuming HNO_3 is not available)

iii) p-Bromoacetanilide from acetanilide

iv) Dibenzalacetone from acetone and benzaldehyde

v) Aspirin from salicylic acid

2. To study the process of sublimation of camphor and phthalic acid,

BSN 111: PHYSICS PRACTICALS(1ˢᵗ year)

Max. Marks : 50

Time : 1 Hrs.

SPECIAL NOTES

1.   Do any five experiments from section-I and Section-II.
2.   The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE:

1.   Each student has to peform a minimum number of experiments prescribed in the syllabus.
2.   After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3.   To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4.   The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

Section-I

List of Practicals :(Do any five experiments)

1.   **To d**etermine the diameter of a pen using Vernier Calliper.

2.   To find the diameter of a pen using screw gauge.

3.   Moment of Inertia of a fly-wheel.

4.   M.I. of an irregular body using a torsion pendulum.

5.   Modulus of rigidity by Maxwell's needle.

6.   Elastic constants by Searle's method.

7.   Viscosity of water by its flow through a uniform capillary tube.

8.   'g' by Bar pendulum.

Section-II

List of Practicals: (Do any five experiments)

1. Low resistance by Carey Foster's Bridge with calibration.

2. Frequency of A.C. mains and capacity by elctrical vibrator.

3. Frequency of A.C. mains by sonometer using an electromagnet.

4. Inductance (L) by Anderson Bridge (A.C. method)

5. To draw forward and reverse bias characteristics of a semiconductor diode.

6. Zener Doide voltage regulation characteristics.

7. Verification of Inverse square law by photo-cell.

8. To study the characteristics of a solar cell.

BSN 201: Environmental studies

Maximum marks:70
Time: 3 hrs

Unit 1: Introduction to environmental studies

Multidisciplinary nature of environmental studies; components of environment –
atmosphere, hydrosphere, lithosphere and biosphere.
Scope and importance; Concept of sustainability and sustainable development.

Ecosystems

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food
chains, food webs and ecological succession. Case studies of the following ecosystems :
Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams,
lakes, rivers, oceans, estuaries)

Unit -2 : Natural Resources : Renewable and Non--renewable Resources

Land resources and landuse change; Land degradation, soil erosion and desertification.
Deforestation: Causes and impacts due to mining, dam building on environment, forests,
biodiversity and tribal populations.
Water : Use and over--exploitation of surface and ground water, floods, droughts, conflicts
over water (international & inter--state).
Heating of earth and circulation of air; air mass formation and precipitation.

Energy resources : Renewable and non renewable energy sources, use of alternate energy
sources, growing energy needs, case studies.
Biodiversity and Conservation
Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones
of India; Biodiversity patterns and global biodiversity hot spots
India as a mega--biodiversity nation; Endangered and endemic species of India
Threats to biodiversity: Habitat loss, poaching of wildlife, man--wildlife conflicts, biological
invasions; Conservation of biodiversity: In--situ and Ex--situ conservation of biodiversity.
Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and
Informational value.

Unit 3 : Environmental Pollution

Environmental pollution : types, causes, effects and controls; Air, water, soil and noise
pollution
Nuclear hazards and human health risks
Solid waste management : Control measures of urban and industrial waste.
Pollution case studies
Environmental Policies & Practices
Climate change, global warming, ozone layer depletion, acid rain and impacts on human
communities and agriculture
Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act;
Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation
Act. International agreements: Montreal and Kyoto protocols and Convention on Biological
Diversity (CBD). The Chemical Weapons Convention (CWC).
Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 4 : Human Communities and the Environment

Human population growth: Impacts on environment, human health and welfare.
Resettlement and rehabilitation of project affected persons; case studies.
 Disaster management : floods, earthquake, cyclones and landslides.
Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 5 : Field work

 Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
 Visit to a local polluted site--Urban/Rural/Industrial/Agricultural.
 Study of common plants, insects, birds and basic principles of identification.
 Study of simple ecosystems--pond, river, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999.*Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.*Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science,* 339: 36--37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29--64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.*Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.*Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India. Tripathi 1992*.
14. Sengupta, R. 2003. *Ecology and economics*: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger*: *A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006.*The Creation: An appeal to save life on earth*. New York: Norton.

BSN 202: Number Theory and Trigonometry

Max. Marks: 70
Time: 3 Hrs.

Section – I :

Divisibility, G.C.D.(greatest common divisors), L.C.M.(least common multiple)

Primes, Fundamental Theorem of Arithemetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse.

Section – II :

Complete residue system and reduced residue system modulo m. Euler's ø function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols.

Section – III:

Lemma of Gauss; Gauss reciprocity law. Greatest integer function [x]. The number of divisors and the sum of divisors of a natural number n (The functions d(n) and σ(n)).

Section - IV :

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Section – V:

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity.

Gregory's series. Summation of Trigonometry series.

Books Recommended :

1. S.L. Loney : Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla : Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Ivan Ninen and H.S. Zuckerman. An Introduction to the Theory of Numbers.

BSN 203: Ordinary Differential Equations

Max. Marks: 70
Time:2 Hrs.

Section – I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x,y,p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Section – II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves.. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous linear ordinary differential equations.

Section – III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Section – IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators x (d/dx) or t (d/dt) etc. Simultaneous equation of the form dx/P = dy/Q = dz/R.

Section – V

Total differential equations. Condition for Pdx + Qdy +Rdz = 0 to be exact. General method of solving Pdx + Qdy + Rdz = 0 by taking one variable constant. Method of auxiliary equations.

Books Recommended :

1. D.A. Murray : Introductory Course in Differential Equations. Orient Longaman (India) . 1967

2. A.R.Forsyth : A Treatise on Differential Equations, Machmillan and Co. Ltd. London
3. E.A. Codington : Introduction to Differential Equations.
4. S.L.Ross: Differential Equations, John Wiley & Sons

BSN 204: Inorganic Chemistry

Max. Marks: 70
Time: 2 Hrs.

UNIT 1

Hydrogen Bonding & Vander Waals Forces

Hydrogen Bonding – Definition, Types, effects of hydrogen bonding on properties of substances application Brief discussion of various types of Vander Waals Forces

Metallic Bond and Semiconductors

Metallic Bond- Brie f introduction to metallic bond, band theory of metallic bond Semiconductors- Introduction, types and applications.

UNIT 2

S-Block Elements

Comparative study of the elements including ,diagonal relationships salient features of hydrides (methods of preparation excluded), solvation and complexation tendencies including their function in biosystems.

UNIT 3

Chemistry of Noble Gases

Chemical properties of the noble gases with emphasis on their low chemical reactivity, chemistry ofxenon, structure and bonding of fluorides, oxides & oxyfluorides of xenon.

UNIT 4

p-Block Elements

Emphasis on comparative study of properties of p-block elements(including diagonal relationship and excluding methods of preparation).

Boron family (13th gp)

Diborane – properties and structure (as an example of electron –deficient compound and multicentre bonding), Borazene – chemical properties and structure Trihalides of Boron Trends in lewis acid character structure of aluminium (III) chloride.

Carbon Family (14th group)

Catenation, p-pi d-pi bonding (an idea), carbides, fluorocarbons, silicates (structural aspects), silicons – general methods of preparations, properties and uses.

UNIT 5

Nitrogen Family (15th group)

Oxides – structures of oxides of N,P. oxyacids – structure and relative acid strengths of oxyacids of Nitrogen and phosphorus. Structure of white, yellow and red phosphorus.

Oxygen Family (16th group)

Oxyacids of sulphur – structures and acidic strength H_2O_2 –structure, properties and uses.

Halogen Fami l y (17th group) Basic properties of halogen, interhalogens types properties, hydro and oxyacids of chlorine – structure and comparison of acid strength
.

BSN 205: Organic Chemistry

Max. Marks: 70
Time: 2 Hrs.

UNIT 1

Alkenes

Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration–oxidation, oxymercuration reduction, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$,

UNIT 2

Arenes and Aromaticity

Nomenclature of benzene derivatives : Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, anti-aromatic and non-aromatic compounds. Aromatic electrophilic substitution general pattern of the mechanism, mechansim of nitration, halogenation, sulphonation, and Friedel -Crafts reaction. Energy profile diagrams. Activating ,deactivating substituents and orientation.

UNIT 3

Dienes and Alkynes

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of butadiene, Chemical reactions 1,2 and 1,4 additions (Electrophilic &free radical mechanism),

UNIT 4

Diels-Alder reaction, 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 of alkynes.

UNIT 5

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation , chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides ,S_N2 and S_N1 reactions with energy profile diagrams. Methods of formation and reactions of aryl halides, The addition elimination and the elimination-addition mechanisms of
nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and arylhalides.

BSN 206 : PROPERTIES OF MATTER, KINETIC THEORY AND RELATIVITY

Max. Marks : 70

Time : 2 Hrs.

Unit - I

Properties of Matter (Elasticity) : Elasticity, Hooke's law, Elastic constants and their relations, Poisson's ratio, torsion of cylinder and twisting couple. Bending of beam (bending moment and its magnitude) .

Unit - II

Kinetic Theory of Gases -I: Assumptions of Kinetic Theory of gases, Law of equipartition of energy and its applications for specific heats of gases. Maxwell distribution of speeds and velocities (derivation required), Experiomental verification of Maxwell's Law of speed distribution : most probable speed, average and r.m.s. speed, mean free path.

Unit - III

Kinetic Theory of Gases –II : Transport of energy and momentum, diffusion of gases. Brownian motion (qualitative), Real gases, Van der Waal's equation.

Unit - IV

Theory of Relativity-I : Reference systems, inertial frames, Gallilean invariance and Conservation laws, Newtonian relativity principle, Michelson - Morley experiment : Search for ether.

Unit - V

Theory of Relativity-II: Lorentz transformations length contraction, time dilation, velocity addition theorem, variation of mass with velocity and mass energy equivalence.

References

1.   Properties of Matter by D.S. Mathur.
2.   Heat and Thermodynamics (Vth Edition) by Mark W. Zemansky.
3.   Berkeley Physics Course, Vol.-I Mechanics by E.M. Purchell.

BSN 207: ELECTRO MAGNETIC INDUCTION AND ELECTRONIC DEVICES

Max. Marks : 70

Time : 3 Hrs.

Unit I

Electromagnetic Induction : Growth and decay of current in a circuit with (a) Capacitance and resistance (b) resistance and inductance (c) Capacitance and inductance (d) Capacitance resistance and inductance.

AC circuit analysis using complex variables with (a) capacitance and resistance, (b) resistance and inductance (c) capacitance and inductance (d) capacitance, inductance and resistance. Series and parallel resonant circuit. Quality factor (Sharpness of resonance).

Unit II

Semiconductor Diodes : Energy bands in solids. Intrinsic and extrinsic semiconductor, Hall effect, P-N junction diode and their V -I characteristics. Zener and avalanche breakdown. Resistance of a diode, Light Emitting diodes (LED). Photo conduction in semiconductors, photodiode, Solar Cell.

Diode Rectifiers : P-N junction half wave and full wave rectifier. Zener diode as voltage regulator, simple regulated power supply.

Unit III

Transistors : Junction Transistors, Bipolar transistors, working of NPN and PNP transistors, Transistor connections (C-B, C-E, C -C mode), constants of transistor. Transistor characteristic curves (excluding h parameter analysis), advantage of C-B configuration.

Unit IV

Transistor Amplifers : Transistor biasing, methods of Transistor biasing and stabilization. D.C.load line. Common -base and common-emitter transistor biasing. Common-base, common-emitter amplifers. Classification of amplifers. Resistance-capacitance (R-C) coupled amplifer (two stage; concept of band width, no derivation). Feed-back in amplifers, advantage of negative feedback Emitter follower.

Unit V

Oscillators : Oscillators, Principle of Oscillation, Classification of Oscillator. Condition for self sustained oscillation : Barkhousen Criterion for oscillations.. Hartley oscillator. Colpitt's oscillator.

References :

1.   Electricity and Magnetism by Reitz and Milford (Prentice Hall of India)
2.   Electricity and Magnetism by A.S. Mahajan and A.A. Rangwala (Tata McGraw Hill).
3.   Basic Electronics and Linear circuits by N.N. Bhargava, D.C. Kulshreshtha
        and S.C. Gupta (TITI, CHD).
4.   Soild State Electronics by J.P. Agarwal, Amit Agarwal (Pragati Prakashan, Meerut).
5.   Electronic Fundamentals and Applications by J.D. Ryder (Prentice Hall India).

BSN 208: Physical Chemistry

Max. Marks: 70
Time: 3 Hrs.

UNIT 1

Kinetics-I Rate of reaction, rate equation, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, second and third order reaction. Half life period of a reaction. Methods of determination of order of reaction,

UNIT 2

Kinetics-II

Effect of temperature on the rate of reaction – Arrhenius equation. Theories of reaction rate – Simple collision theory for unimolecular and bimolecular collision. Transition state theory of Bimolecular reactions.

UNIT 3

Electrochemistry-I

Electrolytic conduction, factors affecting electrolytic conduction, specific, conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization,

UNIT 4

Ostwald's Dilution Law. Debye -Huckel – Onsager's equation for strong electrolytes (elementary treatment only) Transport number, definition and determination by Hittorfs methods, (numerical included),

UNIT 5

Electrochemistry-II

Kohlarausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlarausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pK_a, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.

BSN 209: Vector Calculus

Section – I
Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives.

Section – II
Gradient of a scalar point function, geometrical interpretation of grad , character of gradient as a point function. Divergence and curl of vector point function, characters of Div *f* and Curl *f* as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Section – III
Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence,

Section – IV
Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Section – V
Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorms.

Books Recommended:
1. Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murrary R. Spiegal : Vector Analysis, Schaum Publisghing Company, New York.
3. N. Saran and S.N. NIgam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
    4. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

BSN 301: Advanced Calculus

Max.Marks:70
Time: 3 Hrs.

Section – I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Intermediate forms, change of variables.

Section – II

Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations.Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives.

Section – III

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Section – IV

Differentiability of real valued functions of two variables.Schwarz and Young's theorem. Implicit function theorem.Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Section – V

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

Books Recommended:

1. C.E. Weatherburn : Differential Geometry of three dimensions, Radhe Publishing House, Calcutta

2. Gabriel Klaumber : Mathematical analysis, Mrcel Dekkar, Inc., New York, 1975
3. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
4. Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad
5. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan : A Course in Mathemtical Analysis, S.Chand and company, New Delhi

7. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

BSN 302: Partial Differential Equations

Max.Marks:70
Time: 2 Hrs.

Section – I

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution

Section – II

Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

Section – III

Linear partial differential equations of second and higher orders, Linear and non-linear homogenious and non-homogenious equations with constant co-efficients, Partial differential eqution with variable co-efficients reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Equations reducible to linear equations with constant co-efficients.

Section – IV

Classification of linear partial differential equations of second order, Hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order.

Section – V

Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Books Recommended:

1. D.A.Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967
2. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
3. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.

BSN 303: Statics

Max. Marks : 70

Time : 3 Hrs.

Section – I

Composition and resolution of forces. Parallel forces. Moments and Couples.

Section – II

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

Section – III

Virtual work. Forces in three dimensions.

Section – IV

Poinsots central axis. Wrenches.

Section – V

Null lines and planes. Stable and unstable equilibrium.

Books Recommended:

1. S.L. Loney : Statics, Macmillan Company, London

2. R.S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad

BSN 304: Computer Programming, Thermodynamics

Max. Marks : 70

Time : 2 Hrs.

Unit-I

Computer Programming : Computer organisation, Binary representation, Algorithm development, flow charts and their interpretation.

Fortran Preliminaries: Integer and floating point arithmetic expression, built in functions executable and non -executable statements, input and output statements, Formats, I.F. DO and GO TO statements.

Unit-II

Thermodynamics-I : Second law of thermodynamics, Carnot theorem, absolute scale of temperature, Absolute Zero, Entropy, show that $dQ/T=O$, T-S diagram Nernst heat law.

Unit-III

Joule's free expansion, Joule Thomson (Porous plug) experiment. Joule - Thomson effect. Liquefication of gases.

Unit-IV

Thermodynamics-II : Derivation of Clausius - Claperyron latent heat equation. Phase diagram and triple point of a substance. Development of Maxwell thermodynamical relations.

Unit-V

Application of Maxwell relations in the derivation of relations between entropy, specific heats and thermodynamic variables. Thermodynamic functions : Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them.

References :

1.   Rajaraman, Fortran Programming.
2.   Schaum Series, Fortran 77.

3.   Ram Kumar, Programming with Fortran - 77.
4.   S. Lokanathan and R.S., Gambir, Statistical and Thermal Physics (An Introduction), Prentice Hall of India, Pvt., Ltd. (1991, New Delhi).
5.   J.K. Sharma and K.K. Sarkar, Thermodynamics and statistical Physics, Himalaya Publishing House (1991, Bombay.)

6.   M.W. Zemansky and R. Dittman, Heat and Thermodynamics, McGraw Hill, New York (1981).

BSN 305: Inorganic Chemistry

UNIT 1

Chemistry of Elements of Ist transition series:
Definition of transition elements, position in the periodic table, General characteristics & properites of Ist transition elements,

UNIT 2

Structures & properties of some compounds of transition elements–TiO_2, $VOCl_2$, $FeCl_3$, $CuCl_2$ and $Ni(CO)_4$

UNIT 3

Chemistry of Elements of IInd & IIIrd transition series
General characteristics and properties of the IInd and IIIrd transition elements
Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic radii, oxidation state, magnetic and Spectral properties and stereochemistry

UNIT 4

Coordination Compounds
Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes

UNIT 5

Non-aqueous Solvents
Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

BSN 306: Organic Chemistry

Max. Marks : 70
Time : 2 Hrs.

UNIT 1

Alcohols

Monohydric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb (OAc)$_4$ and HIO$_4$] and pinacol - pinacolone rearrangement.

UNIT 2

Epoxides

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides

UNIT 3

Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions.

UNIT 4

Ultraviolet (UV) absorption spectroscopy

Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome.Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.UV spectra of conjugated enes and enones,Woodward- Fieser rules,calculation of Lemda$_{max}$ of simple conjugated dienes and unsaturated ketones. Applications of UV Spectroscopy in structure elucidation of simple organic compounds.

UNIT 5

Carboxylic Acids & Acid Derivatives

Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids.Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of carboxylation.Structure,nomenclature and preparation of acid chlorides,esters,amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and ydrolysis(acidic and basic).

UNIT 1

Thermodynamics-I

Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work .Zeroth Law of thermodynamics,

UNIT 2

First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule – Thomson coefficient for ideal gas and real gas : and inversion temperature.

UNIT 3

Thermodynamics-II

Calculation of w. q. dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchoffs equation. Bond energies and applications of bond energies.

UNIT 4

Chemical Equilibrium

Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm.Le-Chatetier's principle and its applications Clapeyron equation and Clausius – Clapeyron equation its applications.

UNIT 5

Distribution Law

Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination. Applications of distribution law: (i)Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride.(ii)Determination of equilibrium constant of potassium tri-iodide complex and process of extraction.

BSM 308: Computer Fundamental

Max. Marks : 70
Time : 3 Hrs

UNIT I   **[Lectures-6]**

Basics of Computer: Characteristics of Computers, Input-output Devices (Hardware, Software, Human ware and Firmware), Functions of Different Units of Computer, Classification of Computers.

Computer Memory: Primary memory (ROM and RAM), Secondary Memory (Hard Disk, Optical Disk).

UNIT II   **[Lectures-6]**

Computer Software: Types of Software, Introduction to Operating System, Functions of OS, Types off OS, Booting Procedure, Start-up Sequence.

Windows OS: Introduction to GUI, Important Terms like directory, File, Volume, Label, and Drive Name.

Translators & Languages: Complier, Interpreter and Assembler, Types of computer languages.

UNIT III   **[Lectures-8]**

Desktop Components: Introduction to MS Office, Ms-Word & Ms-Power point, MS-Excel & Ms-Access.

UNIT IV   **[Lectures-8]**

Internet & Email: Understanding Internet, Effective use of Internet, Search Engine & study of famous Search Engines, Various techniques of Searching, Web Browser & study of famous Web Browser, WWW & Basics of Email & Email etiquette.

UNIT V   **[Lectures-6]**

Computer Networks and IT applications: Data communication, Concept of Computer Networks, Internet, Intranet, Extranet, Network topologies, Networking devices, OSI Model.

UNIT VI   **[Letures-6]**

Digital Technology and Society: Basics of Digital Marketing, Digital Payments- Platforms and process, Effective use of technology in the present era, Application of information technology in Railways, Airlines, Banking, Online Banking System, Insurance, Inventory Control, Financial systems, Hotel management, Education, Entertainment and health, Security issues in information technology.

SUGGESTED READINGS

- Computer Fundamentals, Pradeep K. Sinha, Priti Sinha [BPB]
- Leon and Leon, (2nd Ed., 2012), Introduction to Information Technology, Vikas Publishing House.
- Behl R. (2nd Ed. 2012), Information Technology for Management, McGraw Hill Education.
- Dhingra S and Tondon A, (1st Ed., 2015), Introduction to Information Technology, Galgotia Publishing House.
- Goyal, Anita (2012) Computer Fundamentals, Pearson Education.

BSN 309: Optics – I

Max. Marks : 70
Time : 3 Hrs.

Unit-I

Fourier Analysis and Fourier Transforms : Speed of transverse waves on a uniform string. Speed of longitudinal waves in a fluid, superposition of waves (physical idea).

Unit-II

Fourier Analysis of complex waves and its application for the solution of triangular and rectangular waves, half and full wave rectifier out puts. Fourier transforms and its properties. Application of fourier transform to following

function.

(I) $f(x)$ = $e_{-x2/2}$

(II) $f(x)$ = $I [x] <a$

$0 [x] >a$

Unit-III

Geometrical Optics : Matrix methods in paraxial optics, effects of translation and refraction, derivation of thin lens and thick lens formulae, unit plane, nodal planes, system of thin lenses

Unit-IV

Chromatic, spherical coma, astigmatism and distortion aberrations and their remedies.

Unit-V

Interference : Interference by Division of Wavefront : Fresnel's Biprism and its applications to determination of wave length of sodium light and thickness of a mica sheet, Lioyd's mirror, phase change on reflection.

Reference

1. 1 Theory and Problems of Laplace Transforms by Murrari R. spiegel, McGraw Hill Book Company.
2. Optics by Ajay Ghatak, Tata McGraw Hill 1977.

3. Introduction of Optics by Frank L. Pedrotti and Leno S. Pedrotti, Prentice Hall 1987.

.

SECTION – I (Inorganic)

Gravimetric Analysis

Quantitative estimations of, Cu_{2+} as copper thiocyanate and Ni_{2+} as Ni – dimethylglyoxime.

Colorimetry:

To verify Beer - Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/K_2Cr_2O_7$ solution.Preparations: Preparation of Cuprous chloride, prussion blue from iron fillings, tetraammine cupric sulphate, chrome alum,potassium trioxalatochromate (III).

Section-B (Physical)

1. To determine the CST of phenol – water system.
2. To determine the solubility of benzoic acid at various temperatures and to determine the H of the dissolution process
3. To determine the enthalpy of neutralisation of a weak acid/weak base vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
4. To determine the enthalpy of solution of solid calcium chloride
5 .To study the distribution of iodine between water and CCl_4.

Section-C (Organic)

Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds: Naphthalene ,anthracene, acenaphthene, benzyl chloride, *p*-dichlorobenzene,*m*-dinitrobenzene*, p*-nitrotoluene, resorcinol , hydroquinone, naphthol, benzophenone, ethyl methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicyclic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide, benzanilide, aniline hydrochloride, p-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, *o-, m-, p*nitroanilines, thiourea.

BSN 311: Physics Practicals (2nd year)

Max. Marks : 50
Time : 1 Hrs.

Special Notes
1. Do any five experiments from each section.
2. The students are required to Calculate the error involved in a particular experiment (Percentage error).

NOTE:

1. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded on their practical note book. These marks will contribute the lab Record.
2. To complete the final marks for lab. Record a separate register for each class of B.Sc. will be maintained. The students will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained will be divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.

The Lab. Record register will be presented to the external practical examiners for lab. Record marks. The external examiner will verify the record randomly.

Electronics (SECTION-I)
Do any five experiments :

1. To draw common base characteristics of a transistor and calculate transistor characteristics parameters.

2. To draw common emitter characteristics of a transistor and calculate transistor characteristics parameters.

3. To study the ripple factor in a.d.c. power supply.
4. To draw frequency response curve of transistorised R.C. coupled amplifier.

5. To find out the frequency of a tuning fork by Melde's experiment.

6. Study of series and parallel resonance circuits.
7. Electronic Voltmeter measurement of peak, average & R.M.S. valus of signal.

8. Study of voltage doubler and trippler circuits.

Computer Experiments (SECTION-II)
Do any five experiments using C language.

1. To print out all natural (even/odd) number between given limits using computer.
2. To find maximum, minimum and range of a given set of numbers using computer.

3. To evaluate sum of finite series. For example, S=.
4. Find the roots of a quadratic equation.
5. To find intergration of a definite integral by trapezoidal rule.
6. To find the area of a triangle, sphere and cylinder.

7. Given value for a,b,c and d and a set of values for the variable x evaluate the function defined by
    F(x)= ax2+bx+c if x<d
    F(x)= O if x=d

    F(x)= ax2+bx-c   if x>d

    For each value of x, and print the value of x and (fx). Write a program for an arbitary number of x values.

SECTION-II (Do any five experiments)

1. To measure the (a) area of a window (b) height of an inaccesible object.
2. Refractive index and dispersive power of a prism material by spectrometer.
3. To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source.
4. Determination of wave length of Na light and the number of lines per cerntimeter using a diffraction grating.

5. Wave length by Newton's Rings.
6. Resolving power of a telescope.
7. Comparision of Illuminating Powers by a Photometer.
8. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.

9. Ordinary and extra ordinary refractive indices for calcite or quartz.
10. To find the equivalent focal length of a lens system by nodal slide assembly.

BSN 401: Statistical Mechanics

Max. Marks : 70

Time : 2 Hrs.

Unit-I

Probability, some probability considerations, combinations possessing maximum probability, combinations possessing minimum probability, distribution of molecules in two boxs.

Unit-II

Case with weightage (general). Phase space, microstates and macrostates, statistical fluctuations, constraints and accessible States, Thermodynamical probability.

Unit-III

Postulates of Statistical Physics. Division of Phase space into cells, Condition of equilibrium between two system in thermal contact. b -Parameter.

Unit-IV

Entropy and Probability, Boltzman's distribution law. Evaluation of A and b. Bose-Einstein statistics, Application of B.E. Statistics to Plancks's radiation law, B.E. gas.

Unit-V

Fermi-Dirac statistics, M.B. Law as limiting case of B.E. Degeneracy and B.E., Condensation. F.D. Gas, electron gas in metals. Zero point energy. Specific heat of metals and its solution.

References

1.   B.B. Laud, "Introduction to Statistical Mechanics" (Macmillan 1981).
2.   F. Reif, "Statistical Physics' (McGraw Hill 1988).
3.   K. Huang, "Statistical Physics" (Wiley Eastern 1988).

BSN 402: Optics – II

Max. Marks : 70

Time : 3 Hrs.

Unit-I

Interference by Division of Amplitude :Colour of thin, films, wedge shaped film, Newton's rings. Interferometers: Michelson's interferometer and its application to (I) Standardisation of a meter (II) determination of wave length.

Unit-II

Fresuel's Diffraction : Fresnel's half period zones, zone plate, diffraction at a straight edge, rectangular slit .

Unit-III

Fraimhoffer diffraction: One slit diffraction, Two slit diffraction N-slit diffraction, Plane transmission granting spectrum, Dispersive power of a grating , Limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating.

Unit-IV

Polarization :Polarisation and Double Refraction : Polarisation by reflection, Polarisation by scattering, Malus law, Phenomenon of double refraction, Huygen's wave theory of double refraction (Normal and oblique incidence)

Unit-V

Analysis of Palorised light : Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii)Elliptically polarized light, Optical activity, Fresnel's theory of rotation, Specific rotation, Polarimeters (half shade and Biquartz).

References

1.   Optics by Ajay Ghatak, Tata McGraw Hill 1977.
2.   Introduction of Optics by Frank L. Pedrotti and Leno S. Pedrotti, Prentice Hall 1987.

BSN 403: SEQUENCES AND SERIES

Max. Marks : 70

Time : 3 Hrs.

Section – I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

Section – II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits.

Section – III

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

Section – IV

Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

Section – V

Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's

theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only) Convergence and absolute convergence of infinite products.

Books Recommended:

R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi

Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

BSN 404: Special Functions and Integral Transforms

Max. Marks : 70
Time : 3 Hrs.

Section – I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

Section – II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

Section – III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem.

Section – IV

Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.
Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem.

Section – IV

Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

Books Recommended:

Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999

A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.

I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry.

W.W. Bell : Special Functions for Scientists & Engineers.
I.N. Sneddon: the use of integral transform, McGraw Hill, 1972
Murray R. Spiegel: Laplace transform, Schaum's Series.

BSN 405: Inorganic Chemistry

Max. Marks:70
Time: 2 Hrs.

UNIT 1

Chemistry of f – block elements Lanthanides
Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

UNIT 2

Chemistry of f – block elements Actinides
General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U.

UNIT 3

Comparison of properties of Lanthanides and Actinides and with transition elements.

UNIT 4

Theory of Qualitative and Quantitative Inorganic Analysis-I
Chemistry of analysis of various acidic radicals, Chemistry of identification of acid radicals in typical combinations, Chemistry of interference of acid radicals including their removal in the analysis of basic radicals.

UNIT 5

Theory of Qualitative and Quantitative Inorganic Analysis-II
Chemistry of analysis of various groups of basic radicals, Theory of precipitation, co-precipitation, Post- precipitation, purification of precipitates.

BSN 406: Organic Chemistry

Max. Marks:70
Time: 2 Hrs

UNIT 1

Infrared (IR) absorption spectroscopy

Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteris tic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Applications of IR spectroscopy in structure elucidation of simple organic compounds.

UNIT 2

Amines

Structure and nomenclatu re of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel phthalimide reaction, Hofmann bromamide reaction. electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

UNIT 3

Diazonium Salts

Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO_2 and CN groups, reduction of diazonium salts to hyrazines, coupling reaction and its synthetic application.

UNIT 4

Nitro Compounds

Preparation of nitro alkanes and nitro arenes and their chemical reactions. Mechanism of electrophilic substitution reactions in nitro arenes and their reductions in acidic, neutral and alkaline medium.

UNIT 5

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate.,Physical properties. Comparison of reactivities of aldehydes and ketones.Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations.Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction.Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones,Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.

BSN 407: Physical Chemistry

Max. Marks:70
Time: 3 Hrs

UNIT 1

Thermodynamics-III
Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorm, Thermodynamics 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, entropy as a criteria of spontaneity and equilibrium.Entropy change in ideal gases and mixing of gases.

UNIT 2

Thermodynamics-IV
Third law of thermodynamics: Nernst heat theorem, statement of 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, Vand T.

UNIT 3

Electrochemistry-III
Electrolytic and Galvanic cells – reversible & Irreversible cells, conventional representation of electrochemical cells.EMF of cell and its measurement,Weston standard cell, activity and activity coefficients.

UNIT 4

Calculation of thermodynamic quantities of cell reaction (G,H& K).Types of reversible electrodes – metal- metal ion gas electrode, metal –insoluble salt- anion and redox electrodes. Electrode reactions, Nernst equations, derivation of cell EMF and single electrode potential. Standard Hydrogen electrode, reference electrodes, standard electrodes potential, sign conventions, electrochemical series and its applications.

UNIT 5

Electrochemistry-IV
Concentration cells with and without transference, liquid junction potential, application of EMF measurement i.e. valency of ions, solubility product activity coefficient, potentiometric titration(acid- base and redox). Determination of pH using Hydrogen electrode, Quinhydrone electrode and glass electrode by potentiometric methods.

BSN 408: Programming in C and Numerical methods

Max. Marks : 70
Time : 2 Hrs.

Section – I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions.

Section – II

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

Section – III

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions.

Section – IV

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods.

Section – V

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Books Recommended:

1. B.W. Kernighan and D.M. Ritchie : The C Programming Language, 2nd Edition
2. V. Rajaraman : Programming in C, Prentice Hall of India, 1994

3. Byron S. Gottfried : Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998

4. M.K. Jain, S.R.K.Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996

5. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
6. Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd.
7. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.

8. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.
9. Babu Ram: Numerical Methods, Pearson Publication.
10. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.

BSN 501: Real Analysis

Max. Marks:70
Time: 3 Hrs

Section – I

Riemann integral, Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Section – II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and

integrability of an integral of a function of a parameter.

Section – III

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics.

Section – IV

Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category

theorem, contraction Principle.

Section – V

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness , components, continuity in relation with connectedness.

Book s Recommended:

P.K. Jain and Khalil Ahmad: Metric Spaces, 2nd Ed., Narosa, 2004
T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970
D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997

Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi
E.T. Copson, Metric Spaces, Cambridge University Press, 1968.

G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw Hill, 1963.

BSN 502: Groups and Rings

Max. Marks:70
Time: 3 Hrs

Section – I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups,

Section – II

cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Largrage's theorem and its consequences, Normal subgroups, Quotient groups.

Section – III

Homoomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations.

Section – IV

Alternating groups, Cayley's theorem, Center of a group and derived group of a group. Introduction to rings, subrings, integral domains and fields, Characteristics of a ring.

Section – V

Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975

2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2nd edition).

3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.

4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House. 5. J.B. Gallian: Abstract Algebra, Narosa Publishing House.

BSN 503: Numerical Analysis

Section – I

Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula.

Section – II

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula. Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution: Mean, Variance and Fitting.

Section – III

Numerical Differentiation: Derivative of a function using interpolation formulae as studied in Sections –I & II. Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method, QR method, Lanczos method.

Section – IV

Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's onethird and three-eighth rule, Chebychev formula, Gauss Quadrature formula.

Section – V

Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method.

Books Recommended:

1. Babu Ram: Numerical Methods, Pearson Publication.

2. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.

BSN 504: SOLID STATE PHYSICS

Max. Marks : 70

Time : 3 Hrs.

Unit-I

Crystalline and glassy forms, liquid crystals. Crystal structure, lattice and basis, crystal translational vectors and axes.

Unit-II

Unit cell and primitive cell, Winger Seitz primitive Cell, symmetry operations for a two dimensional crystal, Bravais tattices in two and three dimensions.

Unit-III

Crystal planes and Miller indices, Interplanner spacing, Crystal structures of Zinc sulphide, Sodium Chloride and diamond, X-ray diffraction, Bragg's Law and experimental x-ray diffraction methods, K-space.

Unit-IV

Reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c and f.c.c.

Unit-V

Specific heat : Specific heat of solids, Einstein's theory of specific heat, Debye model of specific heat of solids.

References

1. Introduction to solid state Physics (5th Ed.) by kittel, Wiley eastern Limited

BSN 505: Inorganic Chemistry

Marks: 70

Time: 2 Hrs

UNIT 1

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral complexes.

UNIT 2

Crystal field splitting in tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

UNIT 3

Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt(II).

UNIT 4

Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, u_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3dmetal complexes.

UNIT 5

Electron Spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d_1 and d_9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]_{3+}$ complex ion.

BSN 506: Organic Chemistry

Mar ks: 70

Time: 2 Hrs

UNIT 1

NMR Spectroscopy-I
Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and non equivalent protons positions of signals and chemical shift, shielding and deshielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons..

UNIT 2

NMR Spectroscopy-II
Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds.

UNIT 3

Carbohydrates-I
Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose in to mannose. Formation of glycosides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation.Structures of ribose and deoxyribose.

UNIT 4

Carbohydrates-II
An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

UNIT 5

Organometallic Compounds
Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

BSN 507: Physical Chemistry

UNIT 1

Quantum Mechanic s-I
Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics , quantum mechanical operator, commutation relations, Hamiltonial operator, Hermitian operator,

UNIT 2

average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

UNIT 3

Physical Properties and Molecular Structure
Optical activity, polarization – (clausius – Mossotti equation).Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Applica tion of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetics.

UNIT 4

Spectroscopy-I
Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Bornoppenheimer approximation, Degrees of freedom.
Rotational Spectrum: Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution(Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.

UNIT 5

Spectroscopy-II
Vibrational spectrum
Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.
Raman Spectrum: Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra.

BSN 508: QUANTUM MECHANICS

Max. Marks : 70

Time : 3 Hrs.

Unit-I

Failure of (Classical) E.M. Theory. quantum theory of radiatio (old quantum theory), Photon, photoelectric effect and Einsteins photoelectric equation compton effect (theory and result). Inadequancy of old quantum theory, de-Broglie hypothesis. Davisson and Germer experiment.

Unit-II

G.P. Thomson experiment. Phase velocity group velocity, Heisenberg's uncertainty principle. Time-energy and angular momentum, position uncertainty Uncertainty principle from de-Broglie wave, (wave-partice duality). Gamma Ray Maciroscope, Electron diffraction from a slit.

Unit-III

Derivation of time dependent Schrodinger wave equation, eigen values, eigen functions, wave functions and its significance.

Unit-IV

Normalization of wave function, concept of observable and operator. Solution of Schrodinger equation for harmomic oscillator ground states and excited states.

Unit-IV

Application of Schrodinger equation in the solution of the following one-dimensional problems : Free particle in one dimensional box (solution of schrodinger wave equation, eigen function, eigen values, quantization of energy and momentum, nodes and antinodes, zero point energy).

i) One-dimensional potential barrie $E>V_0$ (Reflection and Transmission coefficient.

ii) One-dimensional potential barrier, $E>V_0$ (Reflection Coefficient, penetration of leakage coefficient, penetration depth).

References :

1.   Quantum Mechanics by L.I. Schiff, McGraw Hill Book Company, Inc.

2.   Quantum Mechanics by B. Crasemand and J.D. Powel (Addison Wesley.
3.   Quantum Mechanics by A.P. Messiah.

BSN 509: Chemistry Practical

<div align="right">

Max. Marks : 50

Time : 1 Hrs.

</div>

SECTION – I (Inorganic)

Semimicro qualitative analysis of mixture containing not more than four radicals (including interfering, Combinations and excluding insoluables):

Pb_{2+}, Hg_{2+}, Hg_{2+}, Ag_{+}, Bi_{3+}, Cu_{2+}, Cd_{2+}, As_{3+}, Sb_{3+}, Sn_{2+}, Fe_{3+}, Cr_{3+}, Al_{3+}, Co_{2+}, Ni_{2+}, Mn_{2+}, Zn_{2+}, Ba_{2+}, Sr_{2+}, Ca_{2+}, Mg_{2+}, NH_{4+}, $CO_2{}^-$, $S_2{}^-$, $SO_3{}^{2-}$, $S_2O_3{}^{2-}$, $NO_2{}^-$, CH_3COO^-, Cl^-, Br^-, I^-, $NO_3{}^-$, $SO_{42}{}^-$, $C_2O_4{}^{2-}$, $PO_4{}^{3-}$, $BO_3{}^{3-}$

Section-B (Physical)

1. To determine the strength of the given acid solution (mono and dibasic acid) conductometrically.

2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically

3. To determine the strength of given acid solution (mono and dibasic acid)/$KMnO_4$ – Mohr salt potentiometrically.

4. To determine the molecular weight of a non-volatile solute by Rast method.

5. To standardize the given acid solution (mono and dibasic acid) pH metrically.

Section-C (Organic)

1. Laboratory Techniques

(a) Steam distilla tion (non evaluative)

Naphthalene from its suspension in water

Separation of *o*-and *p*-nitrophenols

(b) Column chromatography (non evaluative)

Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

2. Chromatography Method

Determination of R_f values and iden tification o f organic compunds

(a) Separation of green leaf pigments (spinach leaves may be used)by paper chromatographic method

(b) Separation of a mixture of coloured organic compounds using common organic solventsby TLC.

3. Synthesis of the following organic compounds:

(a) To prepare o-chlorobenzoic acid from anthranilic acid.

(b) To prepare p-bromoaniline from p-bromoacetanilide.

© To prepare m-nitroaniline from m-dinitrobenzene.

(d) To prepare S-Benzyl-iso-thiouronium chloride from thiourea.

BSN 510: Physics Practical

Max. Marks : 50

Time : 1 Hrs.

Special Notes

1. Do any five experiments from each section.
2. The students are required to calculate the error involved in a particular experiment (percentage error).
3. Use of simple non-programmable scientific calculate is allowed.

Note :

1Each student has to perform a minimum number of experiments prescribed in the syllabus.

II.   After the completion of a practical the teacher concerned will check the note-book and conduct the Viva-voce of each student to find out how much concept related to the theoretical and experimental part of the experimental part of the experiment he/she has under stood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the lab. Record.

III.   To complete the final marks for lab. Record a separate register for each class of B.Sc. will be maintained. The student will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded While taking the final average the total marks obtained will be divided by the total no of required practicals instead of the number of practicals performed by the student. This

record will be signed by the concerned teacher.

IV. The lab. Record register will be presented to the external practical examiner for lab. Record marks. The external examiner will verify the record randomly.

 This course will consist of two parts :

i) Solid State Electronics
ii) Computer Experiments

Student have to perform a minimum of four experiments from each part.

SECTION-I

Solid State Electronics

Do any five experiments:

1. e/m by Thomson method.
2. Transistor as voltage Amplifier in C-B Configuration.
3. Transistor as voltage Amplifier in C-E Configuration.
4. Study of B-H Curve by C.R.O.
5. Study of Hartley Oscillator (Calibration of Gang Condenser).

6. To study Hall effect.
7. Measurement of Energy Gap of Four Probe Method.
8. a) To Draw the Plateau of G.M. Counter.
   b) To Determine the Mass Attention Coefficient by G.M.Counter.

(SECTION-II)

ii) **Computer Experiment (Using "C"Language)**
   Do any five experiments :
1. Program of compute product of two matrics A and B of different dimensions. This is an exercise to illustrate the use of subscripted variable and implied Do loops.

2. Evaluate the difine integral 1=h $\int$ f(x)dx. through Simpson's one. third rule.

3. USe of the least-quare curve fitting to fit a straight line to a given set of data.
4. Consider and array X with subscripted variables x; i = 1. 2
   ....N.

   It is desired to find the average and the standard deviation using the formulas.

5. Compute the sum of an infinite series upto three significant figures. For example, compute for different x using Do loops. Calculate factorials through function subprogram.
6. Let there be N(Say=100) students in a class. Arrange their marks in descending or ascending orders.
7. Write a Program which evaluates v and y as function of   verying between

   and increments of using the relation.

SECTION-III

Do any five experiments :

1.Wave length of Sodium light by fresnel's biprism.

2.Conversion of a galvanometer into an ammeter and calibrate it.

3.Diameter of Lycopodium powder particies by Carona rings.

4.To determine the Numerical Aperture of an optical fiber.

5. Conversion of a galvanometer into an voltmeter and calibrate it.

6.Young's modulus by Newtons rings method.

7.To determine the wavelength of He-Ne laser beam using diffraction grating.

8.Thickness of a thin plate using air wedge.

9.Resolving Power of plane transmission grating.

10. To determine the band gap of a semiconductor- diode

BSN 601: Real and Complex Analysis

Marks: 70

Time: 2 Hrs

Section – I

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

Section – II

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even

and odd functions, Half range series, Change of Intervals.

Section – III

Plane, Stereographic projection of complex numbers, continuity and complex functions, Analytic functions, Cauchy-Riemann equations.

Section – IV

Mappings by elementary functions: Translation, rotation, Magnification and Inversion.

Section – V

Conformal Mappings, Mobius transformations. Fixed pints, Cross ratio, Inverse Points and critical mappings.

Books Recommended:

1. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985

2. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970

3. D. Somasundaram and B. Choudhary : A First Course in Mathematical, Analysis, Narosa Publishing House, New Delhi, 1997

4. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi

5. R.V. Churchill & J.W. Brown: Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990

BSN 602: Linear Algebra

Marks: 70

Time: 3 Hrs

Section – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space.

Section – II

Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Section – III

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimentional vactor spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

Section – IV

Algebra of Liner Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

Section – V

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-

Schmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations.

Books Recommended:

9. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975

10. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2nd edition).

11. Vivek Sahai and Vikas Bist : Algebra, Narosa Publishing House.

12. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Narosa Publishing House.

BSN 603: Dynamics

Marks: 70

Time: 3 Hrs

Section – I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

Section – II

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.

Section – III

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane.

Section – IV

Vector angular velocity. General motion of a rigid body. Central Orbits, Kepler laws of motion.

Section – V

Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems.

Books Recommended:

1. S.L.Loney : An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956

2. F. Chorlton : Dynamics, CBS Publishers, New Delhi

3. A.S. Ramsey: Dynamics Part-1&2, CBS Publisher & Distributors.

BSN 604 : ATOMIC MOLECULAR AND LASER PHYSICS

Max. Marks : 70

Time : 3 Hrs.

Unit -I

Vector atom model, quantum numbers associated with vector atom model, penetrating and non-penetrating orbits (qualitiative description),LS or Russel-Saunder Coupling jj coupling (expressions for inteaction energies for LS and jj coupling required).

Unit-II

Zeeman effect (normal and Anormalous) Zeeman pattern of D_1 and D_2 lines of Na-atom, Paschen, Back effect of a single valence electron system.

Unit-III

Weak field Stark effect of Hydrogen atom. Discete set of electronic energies of molecules. Quantisation of Vibrational and rotiational energies Raman effect (Quantitative description) Stoke's and anti Stoke's lines.

Unit-IV

Main features of a laser : Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients , momentum transfer, life time of a level, kinetics of optical absorption.

Unit-V

Threshold condition for laser emission, Laser pumping, He-Ne laser and RUBY laser (Principle, Construction and Working). Applications of laser in the field of medicine and industry.

References

1. Introduction to Atomic and Molecular Spectroscopy by V.K.Jain, Narosa (2007)

2. Introduction to Atomic Spectra by H.B. White.
3. Atomic spectra by G. Herzberg.
4. Molecular Spectra and Molecular Structure by G. Herzberg.
5. Fundamentals of molecular spectroscopy by Colin N. Banwell and Elaine M.Mc-Cash.

6. Lassers, Theory and Application (2nd Ed.) by Thagrajan and Ajay Ghatak.
7. Laser and Nonlinear Optics by B.B. Laud (2_{nd} Ed.)
8. Introduction to Optics by Frank L. Pedrotti and Lens S. Pedrotti, Prentice Hall, 1987.

BSN 605: Inorganic Chemistry

Max. Marks : 70

Time : 2 Hrs.

UNIT 1

Organometallic Chemistry
Definition, nomenclature and classification of organometallic compounds. Preparation, properties, and bonding of alkyls of Li, Al, Hg, and Sn a brief account of metal-ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT 2

Acids and Bases, HSAB Concept
Arrhenius, Bronsted – Lowry, the Lux – Flood, Solvent system and Lewis concepts of acids & bases, relative strength of acids & bases,

UNIT 3

Concept of Hard and Soft Acids & Bases. Symbiosis, electronegativity and hardness and softness

UNIT 4

Bioinorganic Chemistry
Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca_{2+}. Nitrogen fixation.

UNIT 5

Sil icones and Phosphazenes
Silicones and phosphazenes, their preparation, properties, structure and uses

BSN 606: Organic Chemistry

Max. Marks : 70

Time : 2 Hrs

.

UNIT 1

Heterocyclic Compounds-I
Introduction: Molecular orbital picture and aromatic characteristsics 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

UNIT 2

Heterocyclic Compounds-II
Introduction to condensed five and six- membered heterocycles. Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline

UNIT 3

Organosulphur Compounds
Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids,sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates.

UNIT 4

Organic Synthesis *via* Enolates
Acidity of-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Synthetic Polymers
Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

UNIT 5

Amino Acids, Peptides& Proteins
Classification, of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation of -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid–phase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure.

BSN 607: Physical Chemistry

Max. Marks : 70

Time : 3 Hrs

UNIT 1

Spectroscopy-III
Electronic Spectrum
Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck- Condon principle. Qualitative description of sigma and pie and n molecular orbital (MO) their energy level and respective transitions.

UNIT 2

Photochemistry
Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthus-Drapper law, Stark-Einstein law (law of photochemical equivalence) Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).

UNIT 3

Solutions:
Dilute Solutions and Colligative Properties
Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, Colligative properties, Raolut's law, relative lowering of vapour pressure, molelcular weight determination, osmosis law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point,

UNIT 4

Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

UNIT 5

Phase Equillibrium
Statement and meaning of the terms – phase component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system –Example – water and Sulphur systems.Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system, desilerisation of lead

BSN 608: NUCLEAR PHYSICS

Max. Marks : 70

Time : 3 Hrs.

Unit-I

Nuclear mass and binding energy, systematics nuclear binding energy, nuclear stability, Nuclear size, spin, parity, statistics magnetic dipole moment, quadrupole moment (shape concept), Determination of mass by Bain-Bridge, Bain-Bride and Jordan mass spectrograph, Determination of charge by Mosley law Determination of size of nuclei by Rutherford Back Scattering.

Unit-II
Interaction of heavy charged particles (Alpha particles), alpha disintegration and its theory Energy loss of heavy charged particle (idea of Bethe formula, no derivation), Energetics of alpha -decay, Range and straggling of alpha particles. Geiger-Nuttal law.

Unit-III

Introduction of light charged particle (Beta-particle), Origin of continuous beta - spectrum (neutrino hypothesis) types of beta decay and energetics of beta decay, Energy loss of beta-particles (ionization), Range of electrons, absorption of beta-particles.

Interaction of Gamma Ray, Nature of gamma rays, Energetics of gamma rays, passage of Gamma radiations through matter (photoelectric, compton and pair production effect) electron position anhilation. Asborption of Gamma rays (Mass attenuation coefficient) and its application.

Unit-IV
Nuclear reactions, Elastic scattering, Inelastic scatting, Nuclear disintegration, photonuclear reaction, Radiative capture, Direct reaction, heavy ion reactions and spallation Reactions, conservation laws. Q-value and reaction threshold.

Unit-V
Nuclear Reactors General aspects of Reactor design. Nuclear fission and fusion reactors (Principles, construction, working and use), Linear accelerator, Tendem accelerator, Cyclotron and Betatron accelerators. Ionization chamber, proportional counter, G.M. counter detailed study, scintillation counter and semiconductor detector.

References :

Atomic and nuclear Physics, Vol. II by S.N. Ghashal.

Nuclear Physics by D.C. Tayal, Umesh Prakashan, 125, Goblind Dev Khurja (UP).

Concept of Modern physics by arther Besier, Tata McGraw Hill Publications.
Nuclear Physics by W.E. Burcham.
\ Nuclear Radiation Detectors by S.S. Kapoor

Experimental Nuclear Physics by M. Singru.