

B.Sc.

Chemistry Department	
Programme Outcome	Students will exhibit mastery of major topics in all chemistry disciplines. Students will use critical thinking and the scientific method to plan, conduct, record, and analyse the findings of chemical experiments, as well as gain an understanding of chemistry's impact on the environment, society, and other cultures outside of the scientific community. Students will get a solid understanding of the basics and applications of current chemical and scientific ideas, including those in Organic, Inorganic, Physical, and Analytical Chemistry. Develop skills in the safe handling of chemicals and equipment. To become familiar with various industrial processes and their applications.
Programme Specific Outcome	Chemical terminology, structure, reactivity, and function in their specialised discipline of chemistry. The experiment's design and execution should demonstrate a comprehension of acceptable laboratory practises and the proper handling of chemical waste streams, as well as highlight how Chemistry applications connect to the real world. In laboratories, use appropriate techniques for qualitative and quantitative chemical analysis. Basic equipment handling, technical skills acquisition, and correct and effective communication of scientific ideas in graphic, oral, and written form exhibit knowledge and grasp of the subject's main facts, concepts, principles, and theories; Aid in the study of environmental pollution causes and the development of innovative pollution control technologies; improve analytical and problem-solving abilities that require the use of chemical principles

Course Outcome

Semester-I

Paper-I Inorganic & Physical Chemistry

UNIT : 01 : SOLID STATE

10 h

Definition of space lattice, Unit cell, Difference between crystalline and amorphous state, types of crystals with illustrations, Law of crystallography. Steno's law and laws of symmetry, lattice planes, Miller indices, Bravais indices, type of cubic system, diagrammatic representation of cubic system and d_{100} , d_{110} , d_{111} planes, Bragg's equation (X-ray diffraction), Crystal structure of NaCl, KCl. (Numerical based on Bragg's equation and Miller indices)

Reference Books :

1. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub : S. Chand
2. Advance physical chemistry by D. N. Bajpai, Pub : S. Chand
3. Numerical problems by Dogra and Dogra (for numerical)
4. A textbook of physical chemistry by A. S. Negi and S. C. Anand, Pub : New Age International (for numerical)

UNIT : 02

A. ACID – BASE THEORIES

04 h

Arrhenius theory, Lowry Bronsted theory, Lewis theory, Solvent – Solute concept of acid- base, Soft-Hard acid base and its application.

Reference Books :

1. Essentials of physical chemistry by A. S. Bahl and G. D. Tuli, Pub : S. Chand

B. Atomic Structure

06 h

Historical perspective of atomic structure; Ruatherford's atomic model, Bohr's theory and its limitation, Spectrum of Hydrogen atom (Lyman, Balmer, Paschen, Brackett & Pfund), Quantum numbers, Auf bau, Hund and Pauli exclusion principles, Penetration and shielding, Effective nuclear charge (Slater rule)

Reference Book :

1. University General Chemistry by C.N.R. Rao, Pub : McMillan
2. Principles of Physical Chemistry by Maron & Pruton, 4th edition, Pub: Oxford & IBH
3. Physical Chemistry by G. M. Barrow
4. Advance inorganic chemistry (Vol. II) by Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan; Pub. S. Chand

UNIT : 03 :

A. CHEMICAL KINETICS

06 h

Chemical kinetics and its scope, rate of reaction, factors affecting rate of reaction : temperature, concentration, pressure, solvent, light and catalyst, Molecularity of reaction, Classification of chemical reaction, Order of reaction with illustration (first order, second

order, third order, zero order, pseudo first order) reaction, : second order ($a=b$), half life and mean life.

Reference Books :

1. Essentials of physical chemistry by A. S. Bahl and G. D. Tuli, Pub : S. Chand
2. Advance physical chemistry by D. N. Bajpai, Pub : S. Chand
3. Numerical problems by D. V. S. Jain, Pub. McGraw Hill (for numerical)

B. PERIODIC PROPERTIES

04 h

Definition of atomic and ionic radii, ionisation energy, electron affinity and electron negativity, S-Block elements : Comparative study, diagonal relationship, salient features of hydrides.

Reference Books :

1. Modern inorganic chemistry by Gurdeep Raj
2. Principals of inorganic chemistry by Puri, Sharma and Kalia; Pub. Vishal publishing
3. Inorganic Chemistry by J. D. Le

Semester- I

Chemistry Practical

A) ORGANIC SPOTTING

Primary tests, Ignition test, Detection of Elements, Nature of the substance (solubility test), Functional group tests, C. T., Molecular formula, Structural formula & M. P./ B. P. of the given substance.

ACID – Benzoic, Phthalic acid, Succinic acid.

BASE – Aniline, p – Toluidine

PHENOL – Resorcinol, a Naphthol, b Naphthol

NEUTRAL –

CARBOHYDRATE – Glucose , Fructose

KETONE – Acetone, Acetophenone

ESTER – Methyl salicylate, Methylacetate

ALCOHOL – Methanol , Ethanol

HYDROCARBON – Toluene , Naphthalene

NITRO HYDROCARBON – Nitrobenzene, m-di-nitrobenzene

HALOGENATED HYDROCARBON – Carbon tetrachloride, Chlorobenzene,

AMIDE – Urea, Benzamide

ANILIDE – Acetanilide

N. B. Candidate should perform the analysis of at least 08 substances.

B) VOLUMETRIC EXERCISE

H_2SO_4	NaHCO_3	HNO_3
KMnO_4	$\text{H}_2\text{C}_2\text{O}_4$	KOH
KMnO_4	FeSO_4	$\text{K}_2\text{Cr}_2\text{O}_7$
$\text{K}_2\text{Cr}_2\text{O}_7$	$\text{Fe-NH}_4\text{-SO}_4$	KMnO_4
$\text{H}_2\text{C}_2\text{O}_4$	KMnO_4	FeSO_4

N. B. Candidate should perform at least 3 volumetric exercises.

F. Y. B.Sc. Chemistry; Semester – II
(Paper : 01 : Inorganic & Physical Chemistry)

UNIT : 01

A. CONDUCTANCE AND IONIC EQUILIBRIUM

06 h

Electrical conductance, Specific conductance, equivalent conductance, Molar conductance, Effect of dilution on concentration, Cell constant, Determination of Cell constant, Ostwald's dilution law and its limitations, Acid & Basic buffer actions (Henderson-Hasselbach equation), Buffer capacity, Numerical.

B. THERMODYNAMICS

04 h

Second law of thermodynamics (in detail), Carnot cycle and its efficiency, Entropy concept, Change of entropy for reversible isothermic, isobaric, isochoric and adiabatic processes. Entropy change for ideal gases (T & V as variables, P & T as variables), Numerical.

Reference Book :

1. Physical Chemistry by ArunBahl, B. S. Bahl and G. D. Tuli; Pub. S. Chand
2. Advance physical chemistry by D. N. Bajpai; Pub : S. Chand
3. Text book of physical chemistry by P. L. Soni, O. P. Dharma; Pub. S. Chand

UNIT : 02 :

04 h

A. BASIC PRINCIPLES OF QUALITATIVE ANALYSIS

[I] Dry Reaction : theory behind borax bead test with equation, Flame test (Theory, structure of non luminous Bunsen flame)

[II] Analysis of Cation : Application of common ion effect, solubility product constant. Complexometric reactions involved in qualitative analysis;

1. For identification [reaction between Cu(II) ion with ammonia, Fe(III) with thiocyanide, NH_4^+ with Nessler Reagent].
2. For masking [Cd^{+2} , Cu^{+2}].
3. Separation of two ions [Ag-Hg , Zn^{+2} , Mn^{+2}]

Reference Books :

1. Qualitative analysis by R. A. Day and A. L. Underwood
2. Vogel's qualitative Inorganic analysis

B. Coordination Chemistry

06 h

Shape of d-orbitals, CFT – Basic assumption, splitting of d-orbitals in Octahedral, Tetrahedral, Square planer complexes, distribution of d^x electrons in Octahedral and Tetrahedral complexes and CFSE.

Reference Book :

1. Inorganic chemistry by Wahid Malik, G. D. Tuli, R. D. Madan; Pub. S. Chand
2. Coordination Chemistry by GurdipChatwal, M. S. Yadav; Pub. Himalaya pub. house

3. Advance inorganic chemistry (Vol. II) by Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan; Pub. S. Chand

UNIT : 03 :

[A] CHEMICAL BONDING

05 h

Definition of chemical bonds (covalent, co-ordinate covalent, ionic, metallic, H-bond, Van der Waals forces of attraction), Polarizability (Fajan's rule), Molecular Orbital theory ; LCAO method, Bonding molecular orbital, non-bonding molecular orbital, anti-bonding molecular orbital, bond order, magnetic properties and molecular orbital energy level diagram of hetero diatomic molecule : CO and NO, VSEPR theory.

Reference Book :

1. Concise Inorganic Chemistry (5th ed.) by J. D. Lee
2. Basic Inorganic Chemistry by Cotton & Wilkinson.
3. Inorganic Chemistry – Principles of structure and reactivity by J. E. Huheey, E. A. Keiter; Pub. Person Education Publishers.

[B] PHYSICAL PROPERTIES AND CHEMICAL CONSTITUTION

05 h

Classification of physical properties (additive, constitutive, colligative, additive-constitutive), Atomic volume, Molar volume and Chemical constitution, Kopp's law, Surface tension, Drop number method, Parachor, Viscosity, Determination of viscosity by Ostwald viscometer, Define : Refraction, Specific refraction, molar refraction, Numerical.

Reference Book :

1. Principles of Physical chemistry by Puri, Sharma and Madan; Pub. Vishal publishing
2. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub : S. Chand
3. Advance physical chemistry by D. N. Bajpai, Pub : S. Chand

F. Y. B.Sc. Chemistry Practical syllabus 2019

Semester-II

A. INORGANIC QUALITATIVE ANALYSIS

LIST OF INORGANIC CHEMICALS

CHLORIDES : Cu^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+} .

BROMIDES : Sr^{+2} , Na^{+} , K^{+} , NH_4^{+} .

IODIDE : K^{+}

NITRATE : Pb^{+2} , Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+} .

SULPHIDE : Zn^{+2} , Sb^{+3} .

SULPHATE : Cu^{+2} , Al^{+3} , Fe^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+} .

CHROMATE : Na^{+} , K^{+}

CARBONATE : Cu^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

PHOSPHATE : Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

OXIDE : Sb^{+3} , Zn^{+2}

N. B. Candidate should perform the analysis of at least 8 compounds.

B. PREPARATIO OF STANDARD SOLUTION (BY STUDENTS) OF FOLLOWING.

1. 0.1 N succinic acid against NaOH
2. 0.1 N KHP against NaOH/KOH
3. 0.01 N $\text{Na}_2\text{S}_2\text{O}_3$ against I_2 solution
4. 0.1 N $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ against KMnO_4 solution
5. 0.1 N $\text{K}_2\text{Cr}_2\text{O}_7$ against $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ Or $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ solution

N. B. Candidate should perform at least 3 volumetric exercises.

F. Y. B. Sc. Semester- I Paper_II Organic Chemistry

UNIT I:(A) Alkanes and Cycloalkanes:

10 Hrs.

Alkanes : IUPAC nomenclature of branched and unbranched alkanes, Alkyl group, Classification of carbon atoms in alkanes. Isomerism in Alkanes, sources, methods of formation special reference to **Wurtz reaction, Kolbe reaction and Corey-House reaction and decarboxylation of carboxylic acids**). Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenations of alkanes: orientation, reactivity & selectivity.

(B) Cycloalkanes : Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (Cyclo propane and cyclo butane), Theory of strainless ring. The case of cyclo propane ring: banana bonds

UNIT II : Stereochemistry

10 Hrs.

- (a) Isomerism :- Optical activity , Chiral and Achiral molecules,
- (b) Optical isomerism of tartaric acid, Enantiomers, diastereomers(Threo&Erythro), Meso compounds Resolution of Racemates, inversion retention and racemization .
- (c) Geometrical Isomerism: Alkene derivative & oximes E & Z system of nomenclature.
- (d) Relative and absolute configuration, sequence rules. D & L and R & S system of nomenclature.

UNIT III (A) Heterocyclic compounds :

5 Hrs.

Nomenclature aromaticity , and synthesis properties uses and canonical structures of Pyrrol, Benzopyrrol Furan , Benzofuran, Thiophene, Benzothiophene.

(B) PolynuclearHydrocarbons :

3 Hrs.

Classification aromaticity and Industrial preparation, , properties, uses and canonical structures of Napthalene , Anthracene and Phenanthrene.

(C) Organic Qualitative Analysis

2 Hrs.

(I) Elemental Analysis (Lassaign's Test with equation)

(II) Solubility of Organic Compound (Ref. : Vogel's qualitative organic analysis)

Chemical Methods : Solubility in NaHCO_3 , NaOH and HCl , Acid, Base and Phenol and amphoteric compounds (Sulphanilic acid and Anthranilic acid)

F. Y. B. Sc. Semester- II

Paper-II

(Organic

Chemistry)

UNIT: I: Reaction mechanism :10 Hrs.

- (a) Homolytic and Heterolytic fission free radicals carbonium ions (carbocations) and carbanions reactive intermediates carbenes , arynes and nitrenes.
- (b) Types of reagents, electrophiles nucleophiles .
- (c) Electromeric, inductive, conjugative effect.
- (d) Types of reactions : Addition, substitution, elimination, rearrangements. Addition, and Substitution with respect to electrophilic and nucleophilic reaction, SN^1 SN^2
- (e) Mechanism of (i) addition reaction to alkenes and dienes (ii) substitution in benzene Ring, nitration , sulfonation, alkylation , acylation, halogenation., cyanohydrin formation and acetal formation,
- (f) Mechanism of Perkin reaction, Benzoin Condensation and Cannizzaro's reaction

UNIT II: (A) Empirical formula, Molecular formula, and Structural formula: 4 Hrs.

Determination of empirical formula and its relation with molecular formula
determination of molecular weight of (a) Organic acid by Silver salt method and
(b) organic base by chloroplatinate method and its limitations .
Numerical example.

(B) Carbohydrates:

6 Hrs.

Modern definition of carbohydrates, classification of carbohydrates, function of Carbohydrates, optical isomers,
Diastereoisomers, enantiomers, racemates of Glucose and Fructose, Structure of Glucose and Fructose isomers, mutarotation, glucoside linkage (Pyranose and Furanose) D & L isomers of Glucose and Fructose, derivatives of Monosaccharide, step up and stepdown synthesis, Kiliani synthesis, conversion of glucose to Fructose and conversion of Fructose to glucose.

UNIT – III (A) Alkenes, dienes and alkynes : 10Hrs.

- (a) Alkenes : Nomenclature, method of preparation, properties and uses of ethylene and propylene Markovnikov's rule and Saytzeff rule, polymerization of ethylene styrene and vinyl chloride. Alkenes. Reactions: Hydroboration, Oxidation, Epoxidation, Ozonolysis, Oxymercuration, Hydroxylation, Hydrohalogenation, Dehydrohalogenations, Hydration.
- (b) Dienes : Nomenclature, classification of dienes methods of formation of Butadiene chemical reactions 1,2 and 1,4 additions, Diels – Alder reaction.
- (c) Alkynes : Nomenclature , methods of formation, chemical reactions: Hydroboration, Oxidation, metal ammonia reduction, oxidation, polymerization. Electrophilic and nucleophilic addition reactions of acetylene.

Reference Books

- (1) Organic chemistry vol.I and vol. II by I.L.Finar (Longman group)
- (2) Organic chemistry by P.L.Soni
- (3) Organic chemistry by R.T.Morrison and Boyd Prentice Hall India.
- (4) Organic chemistry by B.K. Sharma.
- (5) Organic chemistry by Bahland Bahl
- (6) Organic reaction mechanism by Mukharji and singh
- (7) Fundamentals of Organic chemistry by Soloman, John Wiely
- (7)

S.Y.B.Sc. Sem-III

Paper-III Inorganic Chemistry

[A] Chemistry of Elements of first transition elements : [5 Hrs.]

Characteristics properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states.

[B] Electronic configuration of atom; L-S coupling: [5 Hrs.]

Introduction, L-S coupling, J-J coupling (introduction), Term symbol, Determination of microstate of P^2 , P^3 system, Term symbol of C, N, O, Ni, Ni^{2+} , Fe, Fe^{2+} , Fe^{3+} , Cr, Cr^{3+} , Co^{2+} , V , V^{3+} and Cl^- .

UNIT-II

[A] Purification of water [5 Hrs.]

Classification and composition of water (tap water, mineral water, portable water, distilled water). Different methods of purification of water for potable and industrial purposes, Soft and hard water. Desalination of sea water by reverse osmosis and electro dialysis.

[B] Paper chromatography : [5 Hrs.]

Principles of chromatography, Classification of chromatography according to mobile phase and stationary phase. Types of paper chromatography, one dimensional, two dimensional and radial paper chromatography, R_f value, Use of paper chromatography in inorganic analysis (I, IIA, IIIB, IV, and halides).

UNIT-III

Quantum Mechanics [10Hrs.]

[A] Derivation of the time independent Schrodinger equation, Wave function and probability function, Well behaved wave function, Particle in one –dimensional box and its importance.

[B] Operators (definition and derivation), Linear operators, Commutator operators, Vector operators, Laplacian operators, Hamiltonian operators, Hermitian operators. Derivation of Hamiltonian equation, Hamiltonian operators for H atom H_2^+ , He^{2+} and Li.

Reference Books:

1. Introductory Quantum Chemistry by A. K. Chandra, Tata Mc. Graw Hill Delhi.
2. Atomic Structure and Chemical Bond by Manos Chandra, Tata Mc. Graw Hill Pub. Co. Ltd.
3. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
4. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
5. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
6. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
7. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
8. Basic Concepts of Analytical Chemistry by S. M. Khopkar, Wiely Estern Ltd. New Delhi.
9. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
10. Instrumental Method of Analysis B. K. Sharma, Krishna Pub. House, Merrut.
11. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
12. Enviornmental Chemistry, By S. K. Banerji. Prentice Hall India Pvt. Ltd.
13. Progressive Inorganic Chemistry, Suratkar, Thatte, Pandit, Ideal Book Service, Poona.
14. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
15. Quantum Chemistry Ir. N. Levine, Prentice Hall.
16. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
17. Introduction to Chromatography Theory and Practice by V. K. Srivastava and K. K. Srivastava - S. Chand Pub.
18. Environmental Chemistry by. A. K. De.
19. Industrial Chemistry by B. K. Sharma
20. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3rd addition, Pearson publication.
21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.

S.Y.B. Sc. Semester-IV

Chemistry Paper-III Inorganic Chemistry

[A] Chemistry of Lanthanide and Actinide Elements : [10Hrs.]

(a) Lanthanide and Actinide Elements, Electronic configuration, Sources. Occurrence, Extraction by solvent and ion exchange, Properties (Spectral and Magnetic).

(b) Lanthanide contraction, Use of Lanthanide compounds. Industrial use Uranium and Plutonium, Misch metal.

UNIT-II

[A] Hydrogen Bonding : [4 Hrs.]

Theory of hydrogen bonding, classification, importance of hydrogen bonding in ice, Effect of hydrogen bonding in various fields.

[B] Metal Complexes: [6 Hrs.]

Introduction, Werner's coordination theory, CFSE, Factors affecting on CFSE, Application of CFT (Magnetic properties, Spectral properties)

Nomenclature of complexes (Nomenclature rules, Examples of Common monodentate and multidentate ligands).

UNIT-III

[A] Ion-exchange chromatography: [6Hrs.]

Synthesis and Characterization of ion exchanger, Basic requirements of ion exchange resin. Types of ion-exchange resin. Technique of ion exchange, Application of ion exchange for Separation.

[B] Non aqueous solvents : [4Hrs.]

Introduction, classification of solvents, Properties characterising of solvents, protonic non aqueous solvents (liquid ammonia, anhydrous sulphuric acid), aprotic solvents (liquid SO₂).

Reference Books:

1. Introductory Quantum Chemistry by A. K. Chandra, Tata Mc. Graw Hill Delhi.
2. Atomic Structure and Chemical Bond by Manos Chandra, Tata Mc. Graw Hill Pub. Co. Ltd.
3. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
4. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
5. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
6. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
7. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
8. Basic Concepts of Analytical Chemistry by S. M. Khopkar, Wiely Estern Ltd. New Delhi.
9. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
10. Instrumental Method of Analysis B. K. Sharma, Krishna Pub. House, Merrut.
11. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
12. Enviornmental Chemistry, By S. K. Banerji. Prentice Hall India Pvt. Ltd.
13. Progressive Inorganic Chemistry, Suratkhar, Thatte, Pandit, Ideal Book Service, Poona.
14. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
15. Quantum Chemistry Ir. N. Levine, Prentice Hall.
16. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
17. Introduction to Chromatography Theory and Practice by V. K. Srivastava and K. K. Srivastava - S. Chand Pub.
18. Environmental Chemistry by. A. K. De.
19. Industrial Chemistry by B. K. Sharma
20. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3rd addition, Pearson publication.
21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.

S.Y.B. Sc.; Semester-III

Chemistry Paper-IV [Organic Chemistry]

Unit-I

[A] Organic Nitrogen compounds: [6Hrs.]

- (i) Preparation and physical properties and chemical reactions of Nitriles, Isonitriles, Carbamates, Semicarbazides and their application in organic synthesis.
- (ii) Structure and nomenclature of amines, Preparation of aryl amines, physical properties and chemical reactions. Gabriel-phthalimide reaction, Bromamide reaction.

[B] Carboxylic acid and its derivatives: [4Hrs.]

Structure and nomenclature of acid chloride, ester, amides of monocarboxylic acid; Method of formation of monocarboxylic acid derivatives and chemical reactions.

Unit-II

[A] Heterocyclic compounds: [5Hrs.]

- (i) Classification and nomenclature :
- (ii) Synthesis, Chemical properties and reactions of pyridine.
- (iii) Skraup's synthesis and Friedlander synthesis of quinoline. Electrophilic substitution reactions, Nucleophilic substitution reactions, Oxidation reaction, Reduction reactions.
- (iv) Synthesis, Reactivity and importance of Imidazole and Benzimidazole.

[B] Polycyclic aromatic Hydrocarbons: [5Hrs.]

- (i) Classification and nomenclature :
- (ii) Linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of Tetracene, Pentacene and Hexacene.
- (iii) Non-linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of 1,2-benzanthracene, 1,2,5,6-di benzanthracene.

(iv) Ortho-perifused polycyclic hydrocarbons: Occurance, synthesis of of Pyrene, Perylene and Coronene.

Unit-III

[A] Diazonium salts:

[6Hrs.]

(i) Mechanism of diazotisation and method of preparation of diazonium salts.

(ii) Nomenclature of diazonium salts.

(iii) Reactions of diazonium salts., Replacement reactions in which nitrogen atom is eliminated and reactions in which nitrogen atoms are retained

Application of diazonium salts. In the synthesis of aromatic compounds.

(iv) Laws of coupling , coupling agents, Definition of diazoamino and aminoazo compounds.

(v) Synthesis and uses of : Methyl orang, Methyl red, congo red and Erichrome Black-T.

[B] Use of reagents:

[4Hrs.]

Synthesis and applications of following reagents.

- (i) Anhydrous aluminium chloride
- (ii) N-bromo succinimide
- (iii) Selenium dioxide
- (iv) Lithium aluminium hydride.

Reference books:

- (1) Organic Chemistry by R.T.Morison and R.N. Boyd, Prentice Hall India.
- (2) Organic Chemistry vol-I & II by I.L.Finar.
- (3) Organic Chemistry vol-I & II by B.K.Sharma, Goel pub. House, Merrut
- (4) Reaction and reagents In Organic synthesis by O.P.Agrawal Goel pub. House, Merrut.
- (5) Organic Chemistry by S.H.Pine
- (6) Reaction Mechanism In Organic chemistry by S.M. Mukharji & S.P. Singh.
- (7) Organic Chemistry by L.G. Wade Jr. Pretice Hall.

S.Y.B. Sc.; Semester-IV

Chemistry Paper-IV [Organic Chemistry]

Unit-I

[A] NAME REACTIONS: [7Hrs.]

General nature, Reaction mechanism and applications of the following reactions:

- (1) Fridle Craft reaction
- (2) Aldol condensation
- (3) Dickmann reaction
- (4) Michael reaction
- (5) Wolf-Kishner reduction
- (6) Mannich Reaction
- (7) Reimer Tiemann reaction
- (8) Wittig reaction

[B] Elimination reaction: [3Hrs.]

Introduction, β -elimination, E1-mechanism, E2-mechanism, Stereo chemistry of elimination reactions, Elimination v/s substitution,

α -elimination, Generation of carbenes and Ketenes.

Unit-II

[A] Carbohydrates: [5Hrs.]

- (a) General introduction:
- (b) Disaccharides: Structure elucidation of maltose, lactose and sucrose
- (c) Methods of methylating sugar.

[B] Compounds containing reactive methylene group: [5Hrs.]

- (a) Malonic ester: Preparation from acetic acid and its synthetic applications (n-butyric acid, n-caproic acid, succinic acid, adipic acid, cinnamic acid and barbituric acid)
- (b) Acetoacetic ester (Ethyacetoacetate): Preparation and synthetic applications

(butanone, 1,3 and 1,4-diketone, alicyclic compound.)

(c) Keto-enol tautomerism: Factors affecting keto-enol tautomerism and its mechanism.

Unit –III

[A] Organic Sulphur compounds:

[4Hrs.]

- (a) Aliphatic sulphur : Nomenclature, General methods of preparation and reactions of mercaptans, thioethers, sulfinic acid and sulfonic acids
- (b) Aromatic Sulfonic acid: Nomenclature, General methods of preparation and uses of sulfonic acids of toluene.

[B] Electromagnetic spectrum:

[6Hrs.]

UV and visible spectroscopy, Ultraviolet absorption spectroscopy, absorption laws, (Beer-Lambert law) terminology used in UV and visible spectra, Molar absorptivity, Types of electronic transitions, effect of conjugation, concept of chromophore and Auxochrome and hypsochromic shifts UV spectra of conjugated enes and enones, effect of solvent substitution on electronic transition. Problems based on calculation of λ_{max} for conjugated dienes and unsaturated carbonyl compounds and substituted benzene derivatives using relevant rule.

Reference books:

- (1) Organic Chemistry by R.T. Morrison and R.N. Boyd, Prentice Hall India.
- (2) Organic Chemistry vol-I & II by I.L. Finar.
- (3) Organic Chemistry vol-I & II by B.K. Sharma, Goel pub. House, Meerut
- (4) Reaction and reagents In Organic synthesis by O.P. Agrawal Goel pub. House, Meerut.
- (5) Organic Chemistry by S.H. Pine
- (6) Reaction Mechanism In Organic chemistry by S.M. Mukharji & S.P. Singh.
- (7) Organic Chemistry by L.G. Wade Jr. Prentice Hall.

S.Y.B. Sc. Semester-III

Chemistry Paper-V [Physical Chemistry]

Unit-I

[A] THEORIES OF REACTION RATE

[4Hrs.]

Derivation of Arrhenius equation. Collision theory of reaction rate, Energy of activation including determination, Effect of catalysis on energy activation.

Numerical problems

[B] PHOTOCHEMISTRY

[6Hrs.]

Introduction of photochemistry, Basics of electromagnetic radiations, Photons, Thermal and photochemical laws

- (a) Grothus Draper's law
- (b) Lambert Beer's law
- (c) Einstein's law of photochemical equivalence . Quantum yield or efficiency.
Experimental determination of Quantum yields. Reasons of low and high quantum yield. Numerical problems
Primary and secondary photochemical reactions. Factors affecting quantum yield. (i.e. temperature, light intensity and inert gases).
Isomeric changes, Polymerisation, Photosensitization, Photo physical process [Fluorescence, Phosphorescence]. Hemilunescence. Factor affecting Fluorescence, Phosphorescence.

Unit-II

ELECTROLYTES OR ELECTROCHEMISTRY

[10Hrs.]

Ions in solution, formation of ion in solution metallic conductance, Electrolytic conductance, Electrolysis migration of ions, Transport number of ions and its determination by moving boundary method.

Kohlraush law of ionic conductance. Application of Kohlraush law to

- (a) Determination of degree of dissociation of weak electrolyte.
- (b) Determination of equivalent conductivity of weak electrolyte at infinite dilution
- (c) Determination of solubility and solubility product of sparingly soluble salts.
- (d) Determination of ionic product of water.

Numerical problems

Unit-III

MOLECULAR SPECTROSCOPY

[10Hrs.]

Electromagnetic radiation with wave length and energy. Radio frequency, Microwave, IR, UV-visible region,

Pure rotational spectra, Vibrational and Vibrational-Rotational spectra. Raman spectra,

Rotational spectra, calculation of bond length. Vibrational rotational spectra, Hook's law, Vibrational energy level.

Numerical Problems.

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmilan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma.
[Pub. R.Chand]
5. Physical chemistry by Puri & Sharma[S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli &Bahl.
10. Elemental Physical chemistry byGlasston & Lewis.
11. Physical chemistry by K.K.Sharma, L.K.Sharma [Vikas Publication House, New Delhi.]

S.Y.B. Sc.; Semester-IV
Chemistry Paper-V [Physical Chemistry]

Unit-I

[A] PARTITION CO-EFFICIENT

[4Hrs.]

Explanation of Nernst distribution law and its conditions for the validity.

Complications arising in distribution law:

- (a) Association of solute in one of the phases.
- (b) Dissociation of solute in one of the phases.
- (c) Dissociation of solute in both the phases.

Derivation of distribution law from kinetic consideration

Explanation of solvent extraction process.

Numerical Problems

[B] ADSORPTION

[6Hrs.]

Adsorption and absorption, Heat of adsorption, Characteristics of adsorption, Physical adsorption and chemical adsorption.

Distinction between physical adsorption and chemical adsorption,

Freundlich's adsorption isotherm, Langmuir's adsorption isotherm. Catalysis, General features of catalysis.

Heterogeneous catalysis, Adsorption theory of catalysis.

Unit-II

THERMODYNAMICS :

[10Hrs.]

Free energy or work function [Gibbs free energy (G) and Helmholtz free energy (A).
Derivation of Gibbs-Helmholtz equation.

Derivation of $G = G_0 + RT \ln p$. Helmholtz equation, Relation of ΔG and equilibrium constant K_p (Van't Hoff isotherm and isochore)

Derivation of Clapeyron and Clausius-Clapeyron equation.

Application of Clapeyron-Clausius equation in the derivation of Molal elevation constant & Molal depression constant. Numerical problem

Unit-III

[A] CONDUCTOMETRIC TITRATIONS:

[5Hrs.]

Principle, Types of conductometric titrations:

- (a) Strong acid v/s strong base
- (b) Strong acid v/s weak base
- (c) Weak acid v/s strong base
- (d) Weak acid v/s weak base
- (e) Mixture of Strong acid and weak acid v/s strong base
- (f) Precipitation titration of
 - (i) BaCl_2 v/s K_2CrO_4
 - (ii) NaCl v/s AgNO_3

Advantages of conductometric titrations over indicator method

[B] IONIC EQUILIBRIA

[5Hrs.]

Relation between degree of hydrolysis, Hydrolysis constant and pH of solutions of:

- (a) Salts of weak acid v/s strong base
- (b) Salts of strong acid v/s weak base
- (c) Salts of weak acid v/s weak base

Theories of acid-base indicators. Oswald and Quinonoid theories,

Choice of indicators, Indicator exponent and useful range of pH of an indicator.

Numerical Problems

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmillan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma. [Pub. R.Chand]
5. Physical chemistry by Puri & Sharma [S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli & Bahl.
10. Elemental Physical chemistry by Glasston & Lewis.
11. Physical chemistry by K.K.Sharma, L.K.Sharma [Vikas Publication House, New Delhi.]

S.Y.B. Sc.; Semester-III

Industrial Chemistry

Generic Elective Course

Unit-I

[10Hrs.]

[A] Synthetic fibers with flowsheet diagram:

(1) Tetrafluoroethylene, Teflon (2) Nylon-6,10 (3) DMT, Ethyleneglycol, Terylene

[B] Synthetic rubbers with flow sheet diagram:

(1) Isoprene, Polyisoprene (2) Silicone Rubber (3) Polyurethane rubber

[C] Plastics and Resins with flow sheet diagram:

(1) Urea formaldehyde resin, Bakelite (2) Vinylchloride, PVC (3) Vinylalcohol, Polyvinyl alcohol (4) Melamine and melamine resin (5) Bisphenol-A, Epoxy resin (6) Propylene, Polypropylene

Unit-II

[10Hrs.]

[A] Detergents:

(1) Propylene tetramer (2) ABS (3) LAS

[B] Explosives:

(1) RDX (2) Nitrocellulose (3) Glyceryl trinitrate (4) Trinitro phenol (5) TNT (6) Ammitol

Unit-III

[10Hrs.]

[A] Synthetic drugs:

(1) Novacaine (2) Novalgin (3) Paludrine (4) Paracetamol (5) Sulphathiazole (6) Benadryl
(Diphenyl hydramine)

[B] Synthetic dyes:

(1) 3-phenyl, 7-methoxy coumarine (2) Blankophore-B (3) Eriochrome Black-T
(4) Eosin (5) Alizarine (6) Indanthrene khaki-GG

[C] Acetylene: (1) Wulff Process (2) Sachsse Process

S.Y.B. Sc.; Semester-IV

Industrial Chemistry

Generic Elective Course

Unit-I

[10Hrs.]

[A] Inorganic Chemicals:

(1) Red Phosphorus (2) Sodium hexametaphosphate

(3) PCl_5 (4) Phosphoric acid

[B] Industrial Preparation and uses of:

(1) Potassium permanganate (2) Bleaching powder by Bachmann's method

Unit-II

[10Hrs.]

[A] Fertilizers:

Definition and classification of fertilizers, Direct and indirect fertilizers, Natural and synthetic fertilizer, Symptoms of deficiency of some elements like N, K, and P.

Industrial Preparation of: Ammonium sulphate

Hazardous effect of use of fertilizers and its preventive measures, Mixed fertilizers, Complex fertilizers, Fertilizers grades, Fertilizers ratio, Fertilizers condition, Fertilizers filter.

Unit-III

[10Hrs.]

[A] Glasses: Classification, properties and uses of glasses

[B] Non Ferrous alloys : Monel metal, Duralumin, Wood metal, Babbit metal, Phosphorus bronze, Brass, German silver

S.Y.B. Sc.; Semester-III

Chemistry Practicals

Gravimetric Estimation of

- | | |
|---|---|
| (1) Fe^{2+} as Fe_2O_3 | (Given solution of $\text{Fe-NH}_4\text{-SO}_4 + \text{H}_2\text{SO}_4$) |
| (2) Ba^{2+} as BaSO_4 | (Given solution of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} + \text{HCl}$) |
| (3) Ni^{2+} as Ni (DMG)_2 | (Given solution of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O} + \text{HCl}$) |

VOLUMETRIC EXERCISE (Any three)

- (1) To determine the amount of Nickel by EDTA.
- (2) To determine the amount of Copper by EDTA.
- (3) To determine the amount of Zinc by EDTA.
- (4) Determination of total hardness of water by EDTA.

ORGANIC SPOTTING [Minimum 8 organic substances]

ACID : Salicylic acid, Cinnamic acid, Phenyl acetic acid, Sulphanilic acid.

PHENOL: α -Naphthol, β -Naphthol, o-Nitrophenol

BASE: o-Nitroaniline, m-Nitroaniline, p-Nitroaniline, p-Toludine, p-Chloroaniline,

Diphenyl amine, Dimethylaniline, Diethylaniline

NEUTRAL:

ALDEHYDE: Glucose, Benzaldehyde

KETONE: Methyl ethyl ketone, Acetophenone

ESTER: Ethyl acetate, Butyl acetate

ALCOHOL: Ethanol, Butanol

HYDROCARBON: Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON: m-Dinitrobenzene, Nitrobenzene

HALOGENATED HYDROCARBON: Chlorobenzene, Bromobenzene, p-Dichlorobenzene

AMIDE: Benzamide, Thiourea

ANILIDE: Acetanilide

PHYSICAL PRACTICALS:

1. pH metry: To determine the normality of weak acid pH-metrically using strong base.
[$\text{CH}_3\text{COOH} \rightarrow \text{NaOH}$]

2 Conductometric Titration:

(i) To determine the normality of strong acid conductometrically using strong base [$\text{HCl} \rightarrow \text{NaOH}$]

3 Conductometric Titration:

To determine the solubility of PbSO_4 .

4 Viscosity :

To determine the viscosity of the liquids and the % of unknown mixture 'C'.

5. Chemical kinetics- Ester hydrolysis:

To study the hydrolysis of methyl acetate at two different concentration in 0.5N HCl. [mono molecular reaction]

6 . Partition co-efficient

Minimum 3 experiments should be performed in a semester.

At least one electrical instrumental exercise should be performed per Semester.

S.Y.B. Sc.; Semester-IV

Chemistry Practicals

INORGANIC QUALITATIVE ANALYSIS: [Minimum 8 inorganic mixtures]

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS:

CHLORIDES: Bi^{+3} , Cu^{+2} , Cd^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} ,
 Na^{+} , K^{+} , NH_4^{+}

BROMIDES: Sr^{+2} , Na^{+} , K^{+} , NH_4^{+}

IODIDES: K^{+}

NITRITES: Na^{+} , K^{+}

NITRATES: Bi^{+3} , Pb^{+2} , Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+}

SULPHITES: Na^{+}

SULPHIDE: Zn^{+2} , Sb^{+3}

SULPHATES: Cu^{+2} , Cd^{+2} , Fe^{+2} , Al^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Zn^{+2} , Mg^{+2} , Na^{+} , K^{+} ,
 NH_4^{+}

CARBONATES: Pb^{+2} , Bi^{+3} , Cu^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} ,
 Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

PHOSPHATES: Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} ,
 Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

Inorganic qualitative analysis of mixture containing four radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid excluding Arsenite, Arsenate, Chromates and Borate.

The following exercises should not be asked in the university examination

1. Calibration of burette 50ml., Pipette 5ml, 10ml. & 25 ml., Measuring flasks 100 ml. & 250 ml.

ORGANIC ESTIMATIONS (Any 3 estimations should be done)

1. To determine the amount of acetamide in the given solution hydrolysis by NaOH.
2. To determine the amount of phenol/ Aniline in the given solution by bromination.
3. To determine the number of -COOH group of given carboxylic acid.
4. Percentage purity of l-ascorbic acid (Vitamin-c)

*Organic Preparation: (Minimum 3 should be done)

1. Anthraquinone from Anthracene
2. m-Dinitrobenzene from Benzene
3. p-Bromoacetanilide from Acetanilide
4. Naphthalene picrate from Naphthalene.

N.B. Preparation should be submitted with sample and justification (M.P. & C.T.)

OR

*Type of water insoluble organic solid mixture (Any four type)

PHYSICAL PRACTICALS:

1. pH metry: To determine the normality of given mix acid in $\text{HAc}^- + \text{HCl}$ pH-metrically using strong base.
- 2 Conductometric Titration:
 - (i) To determine the normality of given mixture ($\text{HAc}^- + \text{HCl}$) solution by Conductometric titration with the given 0.1N NaOH solution.
- 3 Heat of solution

To determine the heat of solution of organic acid (benzoic acid, phthalic acid) by finding the solubility of the acid at two different temperature
- 4 Surface Tension:

To determine the parachor of $-\text{CH}_2$ group of liquid: (Benzene, Toluene, Xylene)
5. Adsorption:

To study the adsorption of given organic acid (Acetic acid/ oxalic acid) on animal charcoal..
6. Relative strength:

To study the relative strength of two acids H_2SO_4 and HCl.
7. pH metry: Determination of K_a of weak acid

To determination of ionisation constant of weak acid

Minimum 3 experiments should be performed in a semester.

Atleast one electrical instrumental exercise should be performed per semester.

Third Year B. Sc. Semester -V
Chemistry Paper – VI (Inorganic Chemistry)

UNIT – I

Topic –1: Quantum Mechanics: 5 Hrs

Postulates of Quantum mechanics, particles in three dimensional box, Schrodinger's wave equation in polar coordinates, its separation in to R, θ and ϕ . Discussion of solution of schrodinger equation to same model system e.g. the one dimensional harmonic oscillator

Topic –2: Boron Hydride: 5 Hrs

Boron hydride and its classification, Wade's Rule, preparation and properties and Bonding in di borane, tetra Borane (10), penta borane (9) penta borane (11) hexaborane and dodeca borane (12) anion.

UNIT – II

Topic –1: Thermodynamic and Kinetic Aspects of metal complexes: 5 Hrs

A brief out line of thermodynamic stability of metal complexes and factors affecting a stability of metal complexes. Lability and inertness, Factors affecting lability of metal complexes. Trans effect, Theories of Trans effect (i) Electrostatic Polarization Theory (ii) π -Bond Theory. labile and inert complexes on the basis of VBT and CFT.

Topic –2: Bonding in Transition Metal Complexes: 5 Hrs

Jahn Teller Theorem , Distortation in octahedral complexes. Ligand Field Theory. Molecular energy level diagram and magnetic properties for $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3-}$, $[\text{FeF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{3-}$. π - bonding in octahedral complexes.

UNIT – III

Topic –1: Metal Carbonyls: 5 Hrs

Definition, classification, nature of bonding in metal carbonyls, structure and IR spectra in $\text{Ni}(\text{CO})_4$; $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$, $\text{Mn}_2(\text{CO})_{10}$, $\text{Cr}(\text{CO})_6$, $\text{Co}_2(\text{CO})_8$.

Topic –2: Corrosion and its Protection: 5 Hrs

Definition and importance of corrosion, Types of corrosion: uniform, pitting, inter crystalline and stress cracking corrosion, electro-chemical theory of corrosion. Protection methods: Coating, Inhibitors (Organic, Inorganic, anodic, cathodic), anodic and cathodic protection.

Reference Books:

- (1) Introduction to quantum chemistry, by A. K. Chandra, Tata Mc.Graw Hill, Delhi.
- (2) Quantum mechanics in chemistry by M. H. Hanna
- (3) Theoretical Inorganic chemistry by Day & Selbin , Affiliated East West Publ. Pvt. Ltd.
- (4) Advanced Inorganic Chemistry by Cotton and Wilkinson, John Wiley.
- (5) Uni. Chemistry by B. H. Mohan
- (6) Structural Inorganic chemistry by A. F. Wells.

- (7) Chemical Bonding - an introduction By Rawal, Patel & Patel.
- (8) Environmental Chemistry by Amritha anand and Sugumar.
- (9) Basic Inorganic Chemistry by Cotton and Wilkinson
- (10) A Text book of Inorganic Chemistry by P.L.Soni
- (11) Introduction to Inorganic Chemistry by Durrant and Durrant
- (12) Modern Co-ordination Chemistry by R. Lewis and R.G. Wilkinson.
- (13) Inorganic Chemistry- Principles of structure and reactivity by J.E. Huhhey and E.A. Keiter.
- (14) Application of Group Theory to Chemistry by P.K.Bhattacharya., Himalaya Publishing House, Mumbai.
- (15) Quantum Rasayan, University Granth Nirman Board (Gujarat).
- (16) Environmental Chemistry by A.K. De.
- (17) The corrosion and oxidation of metals by Evans U.R. (1961), Arnold, London.
- (18) Corrosion, Causes and Prevention, Speller. F.,Mc Grqw Hill,New york.
- (19) Dhatvik Ksharan, Part-I & II by M.N. Desai, Uni. Granth Nirman Board (Gujarat).
- (20) Corrosion and Corrosion Control, Uhlig H., Wiley.
- (21) Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw Hi

Third Year B. Sc. Semester -V
Chemistry Paper – VII (Organic Chemistry)

UNIT – I

(A) Reaction Mechanism:

7 Hrs

- (a) Different types of mechanism for Esterification and Hydrolysis: B_{AC}^2 , A_{AC}^2 , A_{AC}^1 , A_{AL}^1
- (b) Mechanism of formation and hydrolysis of amides.
- (c) Pyrolytic elimination : Cope and Chugaev reaction.
- (d) Organic Name Reaction: Knoevenagel Reaction, Reformatsky Reaction, Claisen Condensation Reaction.

(B) Aromaticity:

3 Hrs

Introduction to Aromaticity, Huckel's Rule, Aromatic Character of Arenes, Definition & Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds (Benzenoids and Non-Benzenoids).

UNIT - II

(A) Alkaloids:

5 Hrs

The occurrence, Classification, General methods to determine their structure, Analytical and Synthetic evidence to prove the structure of Nicotine and Papavarine.

(B) Vitamins and Hormons:

5 Hrs

General Introduction, Classification, Structural determinations and Synthesis of Pyridoxine, Vitamin – C, Thyroxine and Adrenalene.

UNIT – III

(A) Synthetic Drugs:

5 Hrs

Classification, based on pharmacological action, synthesis and uses of Amylnitrate, Chloroquine, Primethamine, Sulpha Pyrimidine, Diazepam, Lidocaine, Chlorpropamide, Dapsone, Isoniazide, 5-Fluoro Uracil.

(B) Polypeptides:

5Hrs

Definition & Structures of Amino acid, Synthesis of peptide by Merry Field Method, End group analysis, N-terminal determination, Sanger's method, Edman method, C-terminal determination by generation of amino alcohol and using digestive enzymes. End group analysis, selective hydrolysis of peptides classical levels of protein structure, Protein denaturation / renaturation.

Reference Books:

- (1) Mechanism and Structure in organic chemistry-Goulde. S.
- (2) Reaction mechanism in organic chemistry by Mukhargy & Singh

- (3) Principles of reaction mechanism in organic chemistry by Dharmaraha & Chawla
- (4) Organic reaction mechanism by Bansal Tata Mac. Hill
- (5) Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar.
- (6) Organic Chemistry by Hendrickson, Cram & Hammond
- (7) Organic Chemistry by Brown R. F.
- (8) Organic Chemistry by Solomon W. Graham
- (9) Principles of Organic Synthesis- R. O. C. Norman
- (10) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin
- (11) May's Chemistry of synthetic Drugs by Dyson.
- (12) Chemistry of drugs , Ener and Caldwell
- (13) Synthetic drugs by Tyagi and Yadav.
- (14) Chemistry of synthetic Dyes Vol. I & II by Venkatraman
- (15) Synthetic Organic Chemistry by O. P. Agarwal
- (16) Synthetic Dyes by Chatwal & Anand
- (17) Chemistry of synthetic Dyes by I. G. Vashi
- (18) Organic Chemistry by Morrison and Boyd.
- (19) Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
- (20) Chemistry of synthetic drugs by Trivedi
- (21) Green Chemistry, Environmentally Vergin Reactions by V. K. Ahuwallia published by Ane books India.
- (22) Principles of Medicinal Chemistry Vol. I & II by S. S. Kadam, K. R. Mahadik, K. G. Bothara (Nirali Prakashan)
- (23) Medicinal Chemsitry By Asuthosh kar 4/e
- (24) Organic reactions & their mechanism by P. S. Kalsi, New age international publishers
- (25) Organic Name Reactions by Gautam Brahmachari, Narosa Publishing House, New Delhi.
- (26) Organic Chemistry, 8th edition by Paula Yurkanis Bruice, University of California, Santa Barbara

Third Year B. Sc. Semester -V
Chemistry Paper – VIII (Physical Chemistry)

UNIT – I

A - OPEN SYSTEM THERMODYNAMICS

5 Hrs

Partial molal free energy, (chemical potential), Derivation of Gibb's Duhem Equation, chemical potential in case of a system of ideal gases. Concept of fugacity, Fugacity function, Fugacity at low pressures, Physical significance of fugacity, Graphical method for determination of fugacity, Lewis fugacity rule. Activity and activity coefficient (Only concept). Standard state, Standard state of Solid, Liquid and Gas, Numerical problems.

B - THE THIRD LAW OF THERMODYNAMICS

5 Hrs

The Nernst Heat Theorem (NHT), limitations of NHT, Statement of The third law of Thermodynamics, Consequence of third law of thermodynamics, Determination of absolute entropy of gases and liquids and solid, Applications of third law of thermodynamics, Concept of residual entropy, Exceptions to the third law of thermodynamics, Numerical problems.

UNIT-II

A - BASICS OF ELECTRODICS

4 Hrs

Concept of Oxidation and Reduction, Electrochemical series (Reduction series), definition of electrode, half cell and cell, single electrode potential, sign of electrode potential, standard electrode potential (oxidation and reduction potential), Electrochemical process, Galvanic cell with example of Daniel cell, EMF of a cell and its measurements, Standard Weston cell, Different types of reversible electrodes, Determination of single electrode potential, Calculation of standard EMF of cell and Determination of cell reaction, Standard Hydrogen Electrode, Calomel electrode and Ag –AgCl electrode. Numerical problems.

B CLASIFICATION OF ELECTROCHEMICAL CELL AND THERMODYNAMICS

6 Hrs

Chemical and concentration cell, electrode and electrolyte concentration cell, liquid junction potential (LJP), salt bridge in elimination of LJP, concentration cell with and without transference [with derivation of equation for emf of cell and LJP]

Free energy change and Electrical energy, Prediction of spontaneity of cell reaction, Relation of standard free energy change with equilibrium constant, Temperature coefficient of EMF of a cell, Entropy change and Enthalpy change of cell reaction. Numerical problems.

UNIT - III

NUCLEAR CHEMISTRY

10 Hrs

Stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods, Bainbridge velocity focusing mass spectrograph, Dempsters direction focusing mass spectrograph

Particle accelerators : Linear accelerator, Cyclotron, Discovery of artificial disintegration, Classification of nuclear reaction based on overall energy transformations and - particles used as projectiles, Merits and demerits of different projectiles, Numerical problems

REFERENCE BOOKS:

1. Elements of physical chemistry by Glasstone and Lewis
2. Physical chemistry by G.M. Barrow
3. Physical chemistry by W. Moore
4. Physical chemistry by Atkins
5. Physical chemistry by G.K.Vemulapalli
6. Physical chemistry by B.K.Sharma
7. Physical chemistry by Gurdeep raj
8. Physical chemistry by Puri, Pathania, Sharma
9. Essential of Physical chemistry by Bahl and Bahl
10. Physical chemistry by Negi and Anand
11. Physical chemistry by K.L. KapoorVol 1-5.
12. Physical chemistry by Baliga,Dhavale and ZaveriVol 1-3.
13. Physical chemistry by Dr. S. Pahari
14. Nuclear chemistry by Arnikar
15. Electro chemistry by S. Glasstone
16. Electrochemistry by B.K.Sharma
17. Modern Electrochemistry by J'omBockris and Reddy

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

Chemistry Paper – IX (Industrial Chemistry)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT-I

(A) Manufacture with flowsheet & uses of

6 Hrs

Acrylonitrile (Sohio Process), Bisphenol-A, Styrene, Industrial manufacture and uses of Polyolifines: Poly ethylene (HDPE & LDPE) and Polypropylene.

(B) Fluorocarbons

4 Hrs

Nomenclature of chloro fluoro derivatives of Methane & Ethane, General methods of preparation, Properties and Uses of Fluoro carbons, Manufacture of Freon-12 from fluorspar, Manufacture of Freon-12 from Vinylidene fluoride. Pollution hazards of Fluoro carbons.

UNIT-II

Unit Processes in Organic Chemistry

10 Hrs

(A) Nitration

Definition, Nitrating agent, Reaction mechanism of Nitration. Nitration of Acetylene, Benzene, Toluene and Naphthalene.

Artificial perfumes: Musk xylene, Musk ketone, Musk ambrette.

Explosives: Trinitrophenol, Trinitrotoluene, Trinitro glycerine, Emitol.

(B) Amination

Definition, Amination by reduction: Metal - Acid reduction (strong and weak), Metal - Alkali reduction (strong and weak), Catalytic reduction, Sulphide reduction.

Amination by ammonolysis : Amination of Chlorobenzene, Phenol & Benzene sulphonic acid.

Importance of amination in industry in the manufacture of Bismark brown dye from m-Phenylene diamine, Synthetic fibre (Nylon 6,6) from HMDA, Methyl Red Indicator from Anthranilic acid, Cyclonite explosive from Hexamethylene tetramine.

(C) Sulphonation - Definition, Sulphonating agents, Mechanism of sulphonation. Sulphonation of Benzene, Toluene and Anthracene. Preparation of Phenol and Resorcinol from benzene.

Importance of Sulphonation reaction in industry in the manufacture of Saccharine, Chloramine T and Alizarine Red.

UNIT-III

Metallurgy of different metals (occurrence, extraction, properties and uses) 10 Hrs

(A) (1) Tungsten (2) Molybdenum (3) Chromium (4) Aluminium

(B) Some small scale preparation of

(1) Safety matches

(2) Naphthalene balls

- (3) Wax candles
- (4) Shoe polish
- (5) Writing/ fountain pen ink
- (6) Chalk crayons
- (7) Plaster of paris.

Reference books:

1. Shreve Chemical Process Industries 5 ed. George. T. Austin . Mag. Hill. Book Agency
2. Reigel's Industrial Chemistry Ed. By James A. Kent.
3. Unit Process in Organic Synthesis by D. H. Groggins.
- 4, An Introduction to Industrial Chemistry by Peter Wiseman , Applied Science Pub. Ltd. London.
5. Industrial Chemistry by B. K. Sharma Goel Pub.
6. Quantitative Analysis by R.A.Day & A L Underwood, 6th ed. Pub.Prentice Hall of India ltd.
7. Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

Chemistry Paper – X (Analytical Chemistry)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT-I

(A)INTRODUCTION TO ANALYTICAL CHEMISTRY:

03Hrs

Chemical and Instrumental Analysis (advantages and disadvantages) Overview of methods used in Quantitative analysis (classification of classical and instrumental analysis), Factors affecting the choice of analytical methods (in brief), Step in quantitative analysis (Flow diagram), Analytical methods on the basis of Sample size (in brief), Sampling methods..Sampling in different physical states

(B)TREATMENT OF ANALYTICAL DATA

Significant figures and rules of computation.

07 Hrs

Error Definition, Types of errors: Determinates errors, indeterminate errors, constant and proportional errors. Define and explain the following terms – Accuracy and Precision, mean, median, deviation, average deviation, standard deviation, variance, coefficient of variation, relative mean deviation, range, absolute errors, relative errors. Minimization of determinates errors, Normal error curve. Rejection of result from a set of results, 2.5 d rule, 4.0 d rule and Q-test. (Problems based on above topics)

UNIT-II

GRAVIMETRIC ANALYSIS :

10 Hrs

Factors affecting solubility of precipitates. (1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation (With Numerical problems) The precipitation process,. Nucleation growth. Von Weimarn's theory of relative super saturation . Digestion of precipitates Factor affecting quality of precipitate: Co-precipitation and post precipitation Precipitation from homogeneous solution with illustration of Barium and Aluminum. Thermogravimetry, general principle,

General applications of TGA : Determination of purity and thermal stability of primary and secondary standards, determination of correct drying temperature, determination of curie point, automatic determination of mixtures, analysis of alloys, Specific application in analysis of (1) CaC_2O_4 , H_2O (2) MgC_2O_4 , $2\text{H}_2\text{O}$ [No instrumentation] (3) mixture of carbonates

UNIT-III

10 Hrs

TITRIMETRIC ANALYSIS :

General classification of titrimetric methods.

(A) ACID BASE TITRATION :

05 Hrs

Different terms for titrant, titrand, analyte, end point and equivalence

point. Theory of acid base indicators. Indicator range. Selection of proper indicators Calculation of pH at different stages of titrations of monobasic and dibasic acid with strong base Construction of titration curve, Titration of carbonate mixture and amino acids. Problems

(B) COMPLEXOMETRIC TITRATIONS:

EDTA titration, Absolute and conditional stability constant, Distribution of various species of EDTA as function of pH. Absolute and conditional stability constants. Derivation of factors : α_4 for effect of pH, β_4 for the effect of auxiliary complexing agent. Construction of Titration curves: Theory of metallochromic indicators, Masking, Demasking and kinetic masking. Types of EDTA titrations. Problems

05 Hrs

Reference Books:

- 1 Quantitative Analysis by R. A. Day & A. L. Underwood, 6 th ed. Pub. Prentice Hall of India ltd.
- 2 Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.
- 3 Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
- 4 Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- 5 Holler F.J.Instrumental Methods of Analysis by B. K. Sharma
- 6 Instrumental analysis by R.D.Braun Mc Graw Hill.
- 7 Analytical ChemistryGary Christian
- 8 Instrumental methods of chemical analysis Dr.H.Kaur. Pragati prakashan Meerut.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

Chemistry Paper – XI (General Chemistry)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT - I

IR spectroscopy

10 Hrs.

IR absorption spectroscopy: Terms, Instrumentation, Molecular vibrations, Hook's law, Selection rules, Intensity and position of IR bands. Measurement of IR spectrum, Finger print region, Characteristics absorption of various functional groups. Application of IR spectra. Factors influencing IR vibrational frequency.

UNIT- II

[A] LABORATORY HYGENE AND SAFETY

03 Hrs.

1. Handling of chemicals [Carcinogenic chemical, Toxic and poisonous chemicals], List of Hazardous chemicals.
2. General procedure for avoiding accidents [Apron, Safety goggles, Gloves pipetting process]
3. First aid technique [Organic substance in skin, Acid on clothing, Burns in eyes, Inhalation of toxic vapors etc...]
4. Color codes and symbols for safety in chemical plants (i) classification of color codes and symbols (ii) color codes for gas cylinders and (iii) color codes for pipelines.

Reference Books:

- Industrial safety management, by L.M. Desmukh, Tata Mc Graw Hill, New Delhi, 2006
- Industrial safety, Health & Environment management, Sunil S. Rao, R.K. Jain. Khanna Publishers, New Delhi, 2006

[B] CHEMISTRY OF COSMETICS & PERFUMES

07 Hrs.

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK.
2. P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. *Industrial Chemistry*, Goel Publishing House, Meerut (1996).

UNIT- III

10 Hrs.

Definitions of terms: Solute, Solvent, and Solution Composition of solution- normal solution, molar solution, molal solution, mole fraction,% solution, saturated, unsaturated and

supersaturated solution and solubility. Effect of temp. on various units of concentration. Interconversion of one unit into another unit. Preparation of solutions of some primary standard substances (e.g. Oxalic acid, succinic acid, KHP, $K_2Cr_2O_7$, As_2O_3)

Standardisation of the following solution using primary standard solutions/ standardised solution.

1. NaOH/KOH
2. I_2 solution
3. $KMnO_4$
4. Acids
5. $Na_2S_2O_3$ solution.

Reference books:

1. Quantitative analysis by R.A. Day and A.L. Underwood
2. Elements of Analytical Chemistry by R. Gopalan ; P.S.Subramanian and K. Rengarajan
3. Elementary Organic Spectroscopy by Y.L.Sharma
4. Organic Spectroscopy by B.K.Sharma
5. Environmental Chemistry by H.Kaur.
6. <http://www.fssi.gov.in/Portals/0/pdf/Final-test-manual-part-II>
7. Vogel's qualitative inorganic analysis.
8. Vogel's qualitative organic analysis.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

General elective subject (Petrochemicals)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT – I

Topic-1: Source of Petrochemicals:

4 Hrs

(a) Natural gas: Composition, Natural gas as Petrochemical feed stock.

(a) Crude oil: Composition, Distillation and Refining, Utilization of various fractions (oil product)

Topic-2: Classification of Petrochemicals:

6 Hrs

First, Second and Third generation petrochemicals.

Conversion process: Cracking reforming, Isomerisation, Hydrogenation, Alkylation and Hydrodealkylation, Dehydrocyclisation of petroleum products, Polymerization of gaseous hydrocarbons.

UNIT – II

Topic-1:

5 Hrs

Petrochemicals obtained from C1 cut of petroleum manufacture and application of Methanol, Synthesis gas, Ammonia, HCN, Formaldehyde, Hexamethylene tetramine, Chlorinated methanes, Perchloro ethylene.

Topic-2:

5 Hrs

Synthesis and uses of H-acid, J-acid, Neville Winther's acid, DASDA, Procion Red dye, Cellitone scarlet-B, Indanthrene Khakhi GG, Blankophor B, Sulphamylon, Chloramphenicol

UNIT – III

Topic-1:

7 Hrs

Petrochemicals obtained from C2 cut of petroleum [Ethylene and Acetylene]

Manufacture and industrial applications of chemicals obtained from Ethylene: Ethanol, Acetaldehyde (Wacker-Chemie process), Ethylene Oxide, Ethylene Glycol, Ethanolamines, Acrylonitrile, Styrene, Vinyl acetate. Manufacture and industrial applications of chemicals obtained from Acetylene, Acrylic acid, Acrylonitrile, Vinylchloride, Vinylacetate, Acetaldehyde, Chloroprene, Trichloroethylene, Methyl vinyl ether.

Topic-2:

3 Hrs

Industrial Fuels: Natural fuels, Synthetic fuels, Hydrogen- Fuel of tomorrow, Fuel for rocket (Hydrazine)

Reference Books:

- (1) Introduction to petrochemicals by Sukumar Maiti oxford and IBH pubs co. New Delhi.
- (2) A text on petrochemicals by Dr. B. K. Bhaskar Rao, Khanna pubs. New Delhi.
- (3) Chemicals from petroleum by A. L. Wadams (ELBS and John Murray London)
- (4) Petrochemicals by S. L. Venkatewarn (Colour pubs. Pvt. Ltd. Bombay)

- (5) Petrochemicals digest by MGK Manon (Asia Publishing house Bombay)
- (6) Hand book of industrial chemicals Vol-I by K. M. Shah (Multi tech publishing co. 15 Yogesh, Hingwala lane, Ghatkoper (E) Bombay-400077)
- (7) Industrial chemistry including chemical engineering by B. K. Sharma, Goel pubs house, Meerut.
- (8) Hand Book of Synthetic Dyes and Pigments (Vol. II) By K. M. Shah, Multi-tech Publishing Co.
- (9) Synthetic dyes by G. R. Chatwal, Himalaya Publishers.
- (10) Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

General elective subject (Dyes)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

Topic –1: Dyes intermediates:

4 Hrs

Name and structure of Benzene, naphthalene and anthraquinone intermediates useful in the dyestuff industry, synthesis of 4-amino -2-methoxy toluene, 2,3- diamino anthraquinone, Chromotropic acid, Bromamine acid.

Topic –2: Diazotisation and coupling: (AZO dyes)

6 Hrs

Definition and mechanism of diazotization, common method of diazotization, common and special coupling components, laws of coupling reaction with phenols and amines of benzene and naphthalene series, monoazo dyes, synthesis of Direct black EW, Orange - II, Orange – IV, Orange – III, Eriochrome Black – A.

UNIT – II

Topic –1: Disperse Dyes:

5 Hrs

Definition, classification of disperse dyes with examples, application of disperse dyes, synthesis of Cellitone Scarlet B, Dispersol Blue, Golden yellow VIII.

Topic –2: Dyes and pigments:

5 Hrs

Relation between colour and chemical constitution with reference to Witt's theory, definition of dyes & pigments, difference between dyes & pigments.

Classification of dyes based on,

(a) Chemical constitution with illustrative example.

(b) Methods of application to fibres, synthesis of Pigment yellow G, Benzidine orange, Pigments Orange VI.

UNIT – III

Topic –1: Vat dyes:

10 Hrs

(a) Definition and general account of vat dyes, Indigo obtained from natural source, Synthesis of Indigo by Heumann process and Sand Meyer process. Halogen derivatives of Indigo (Brilliant Indigo – 4B, Brilliant indigo -4G, 5;5- dibromoindigo vat blue -35) Synthesis of thioindigo by anthranilic acid, halogen derivatives of Thioindigo, Indanthrene Red Violet RRN.

(b) Anthraquinone vat dyes: Bohn's discovery of Anthraquinone Vat dyes, classification with reference to anthraquinone derivatives synthesis of Caledon Jade-green, Indanthrene yellow 5 GK, Indanthrene Brilliant Scarlet –RK.

Reference books:

(1) Synthetic organic chemistry by O.P. Agrawal

(2) The chemistry of synthetic dyes and pigments by H. A. Lubes

(3) Chemistry of synthetic dyes VOL I to VII by K. Venkatraman

(4) An introduction to synthetic dyes by D. W. Ranghekar & P. P. Singh

- (5) A hand book of synthetic dyes and their application by C. T. Bhastana, V. H. Raichura & others
- (6) Chemistry of dyes & Principles of dyeing Vol II by V. A. Shehai
- (7) Chemistry of synthetic dyes by I. G. Vashi
- (8) Chemistry of dyes and pigments by K. M. Shah
- (9) Synthetic dyes by G. R. Chatwal
- (10) Synthetic dyes and pigments by E. N. Abrahart.
- (11) High tech Dyes by Smith.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

General elective subject (Drugs)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT-I

Topic – 1: Drugs: Classifications-Terminology

05 Hrs

Definition of the term drug. Drugs obtained from plants. Different class of the drugs.

Explanation of the following terms: Agonist, Antagonist, Receptors, Pharmacophore, Pro-drug, Soft-drug, CNS depressants, CNS stimulants, Mode of action. Brief accounts of the following agents giving the name and structures of two important drugs in each case (1) Antifungal agents (2) Antiviral agents (3) Anti-cancer or Cytotoxic drugs (4) Non-Steroidal Anti-Inflammatory Drugs (NSAIDS).

Topic – 2: Micro-organism and Diseases

05 Hrs

Brief account of microbes: Bacteria, Fungi, Protozoa, Virus. Classification of the bacteria based on shape, Gram staining and Ziehl–Neelsen staining. Names of at least two diseases in case of each of the following types of infection and also the name of microbes responsible for the same: (1) Respiratory tract infections (2) Gastro intestinal tract infections (3) Urinary tract infections (4) Urethritis and sexually transmitted diseases (5) Skin and soft tissue infections (6) Cardio vascular system infections (7) Central nervous system infections. Name of important drug for each of the following diseases: (1) Typhoid (2) Dysentery (3) Pneumonia (4) Meningitis (5) Gastroenteritis (6) Actinomycosis.

UNIT-II

Topic – 1: Antibiotics

05 Hrs

Definition. History of discovery of penicillin. Structural variations in penicillin. Broad spectrum antibiotics and their therapeutic uses. Sources, Structural formula and Therapeutic uses of Streptomycin, Tetracycline, Doxycycline, Cycloserine, Chloramphenicol and Some recent antibiotics. Synthesis of Ampicillin.

Topic – 2: Sulfa drugs

05 Hrs

History of discovery and development of sulfa drugs. Structural variations among sulfonamides. Mode of action of Sulfonamides. Therapeutics uses and antimicrobials activity of sulfonamides. Synthesis and uses of Sulfadimidine, Sulfaguanidine, Sulfisoxazole (Sulfafurazole), Sulfacetamide, Succinyl sulfathiazole, Sulfanilamide, Sulfadiazine, Sulfapyridine.

UNIT-III

Topic – 1: Coagulants and Anti coagulants

05 Hrs

Definition, Fibrin-Fibrinogen, thrombin prothrombin role of calcium in blood clotting. Classification and structural variations. Blood coagulants, Vitamin K group as blood coagulants. Synthesis and uses of Warfarin, Dicoumarol, Bromindone.

Topic – 2: Analgesics

05 Hrs

Definition, classification and structural variations. Synthesis and uses of Meperidine (Pethidine), Ibuprofen, Aspirin, Meclofenamate sodium, Oxyphenbutazone, Paracetamol, Novalgin.

Reference Books:

1. May's Chemistry of synthetic Drugs by Dyson.
2. Chemistry of drugs, Ener and Caldwell.
3. Synthetic drugs by Tyagi and Yadav.
4. Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.
5. The Organic Chemistry of Drug Synthesis by Daniel Lednicer & L.A.Mitscher.
6. Drugs by V.K.Ahluwalia Pub. Ane Books Pvt. Ltd.
7. Medicinal Chemistry by Balkishan Razdan, Pub. CBS Publishers.
8. Pharmaceutical Organic Chemistry by S.K.Dewan, Pub. Narosa.
9. Medicinal Chemistry - a Molecular and Biochemical Approach, by Thomas Nogrady & Donald F Weaver.
10. Pharmaceutical Organic Chemistry by Shyam Singh Pub. Himalaya Publishers.
11. Medicinal Chemistry by G Patrick. Pub. Viva Books.
12. Burger's Medicinal Chemistry & Drug Discovery. Ed. by D. J. Abraham.

VEER NARMAD SOUTH GUJARAT UNIVERSITY
Third Year B. Sc. Semester -V
Chemistry Practicals
Proposed syllabus from June 2021

1. INORGANIC QUALITATIVE ANALYSIS

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS

CHLORIDES- Cu^{+2} , Cd^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Na^{+1} , K^{+1} , NH_4^{+1} .

BROMIDES- Sr^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

IODIDE – K^{+1}

NITRITE – Na^{+1} , K^{+1}

NITRATE – Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

SULPHITE – Na^{+1}

SULPHIDE – Zn^{+2} , Sb^{+3}

SULPHATE – Cu^{+2} , Cd^{+2} , Al^{+3} , Fe^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

CARBONATE – Cu^{+2} , Cd^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

PHOSPHATE - Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

BORATE- Boric Acid

Inorganic qualitative analysis of mixture containing six radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid including Chromate and Borate.

N. B. Candidate should perform the analysis of at least 08 mixtures.

2.ORGANIC ESTIMATIONS

- 1.
2. Determination of saponification value of an oil
3. Determination of percentage purity of Aspirin
4. Determination of amount of Formaldehyde in given solution
5. Determination of amount of Ethyl acetate in the given solution
6. Determination of amount of Glycine in the given solution
(Instead of sample weighing , solutions to be given)

3.CHROMATOGRAPHY

Chromatographic separation of amino acid mixture by ascending paper chromatography

1. Glycine + Methionine
2. Alanine + Methionine
3. Alanine + Valine

4. PHYSICAL EXERCISE

1. To investigate rate of reaction between $K_2S_2O_8$ and KI, $a = b$, $a \neq b$.
2. To investigate rate of reaction between H_2O_2 and KI, $a = b$, $a \neq b$.
3. Polarimetry: Determination of angle of rotation of given substance using three different dilutions and determination of concentration of unknown solution. Sugar, Glucose, Tartaric acid.
4. pH metry: To measure pH of different buffer solution and to study the buffer capacity.
5. pH metry: To determine the dissociation constant of weak acid (CH_3COOH) and weak base (NH_4OH) by different dilutions.
6. Conductometry: To determine the amount of $BaCl_2$ in the given solution using K_2CrO_4 solution.
7. Conductometry: To determine the amount of $NaCl$ in the given solution using $AgNO_3$ solution.
8. Potentiometry: To determine the normality of given HCl solution using $0.5N$ $NaOH$.
9. Potentiometry: To determine the solubility and solubility product of sparingly soluble salt $AgCl$ by the titration of $AgNO_3$ and $NaCl$. **(Any SIX including one kinetic experiment should be performed.)**

Third Year B. Sc. Semester -VI

Paper-VI (Inorganic Chemistry)

UNIT - I

Topic-1: Molecular Symmetry:

10 Hrs

Introduction and importance of symmetry, Symmetry elements and Symmetry operations, Classification of molecules in to point groups. Point group of simple molecules like CO_2 , HCl , H_2O , NH_3 , BF_3 , $[\text{PtCl}_4]^{2-}$, PF_5 , C_6H_6 , C_5H_5^- , CH_4 , SF_6 , Bromo benzene ($\text{C}_6\text{H}_5\text{Br}$), Cyclobutane, Boric acid (H_3BO_3), (Cis and Trans Dicboreethylene ($\text{C}_2\text{H}_2\text{Cl}_2$), Staggered and Eclipsed Ethane (C_2H_6). Law of multiplications, Construction of multiplication table for C_{2v} , C_{3v} , C_{2h}

UNIT - II

Topic-1: Metal Complexes (Inorganic Reaction Mechanism):

6 Hrs

Reaction mechanisms of ligand substitution in octahedral complexes (i) $\text{S}_{\text{N}}1$ (ii) $\text{S}_{\text{N}}2$ Acid hydrolysis & Base hydrolysis -Redox (Single Electron Transfer) reactions, Substitution reaction without breaking M-L bond.

Topic-2: Hybridization:

4 Hrs

Bond angles in sp , sp^2 and sp^3 hybrid orbital using wave function (fully mathematical calculations).

UNIT-III

Topic-1: Organo-metallic compounds:

5 Hrs

Definition, classification, Structure and bonding in ferrocene, dibenzene chromium, Zeise ion and gaseous dimethyl beryllium, Tetramethyl lead.

Topic-2: Water Pollution:

5 Hrs

Types of water pollutants, Trace elements in water and their effects; Determination of BOD, COD, DO, Total hardness, Total dissolved solids, Ozon treatment process for wastewater.

Reference Books:

- (1) Introduction to quantum chemistry, by A. K. Chandra, Tata Mc. Graw Hill, Delhi,
- (2) Quantum mechanics in chemistry by M. H. Hanna
- (3) Theoretical Inorganic chemistry by Day & Selbin, Affiliated East West
- (4) Advanced Inorganic Chemistry by Cotton and Wilkinson, John Wiley
- (5) Uni. Chemistry by B. H. Mahan
- (6) Structural Inorganic chemistry by A. F. Wells.
- (7) Chemical Bonding- an introduction By Rawal, Patel & Patel. Sugumar.
- (8) Environmental Chemistry by Amritha Anand
- (9) Basic Inorganic Chemistry by Cotton and Wilkinson
- (10) A Text book of Inorganic Chemistry by P.L.Soni
- (11) Introduction to Inorganic Chemistry by Durrant and Durrant
- (12) Modern Co-ordination Chemistry by R. Lewis and R.G. Wilkinson.
- (13) Inorganic Chemistry- Principles of structure and reactivity by J.E. Huheey and E.A. Keiter.
- (14) Application of Group Theory to chemistry by P.K.Bhattacharya., Himalaya Pub. House, Mumbai.
- (15) Quantum Rasayan, University Granth Nirman Board (Gujarat).
- (16) Environmental Chemistry by A.K. De. U.R. (1961), Arnold, London.
- (17) The corrosion and oxidation of metals by Evans
- (18) Corrosion, Causes and Prevention, Speller. F., Mc Graw Hill, New York.
- (19) Dhatvik Ksharan, Part-I & II by M.N. Desai, Uni, Granth Nirman Board (Gujarat).
- (20) Corrosion and Corrosion Control, Uhlig H. Wiley.
- (21) Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw Hill. Publ. Pvt. Ltd.
- (22) Wiley online library.

Third Year B. Sc. Semester -VI Chemistry
Paper-VII (Organic Chemistry)

UNIT - I

Topic : 1 : MolecularRearrangements **6 Hrs**

Mechanism of rearrangements involving C to C migrations as illustrated by Wagner – Meerwein and Pinacol-Pinacolone rearrangements.

Mechanism of rearrangements involving C to N migrations as illustrated by Hoffmann, Curtius, and Beckmann rearrangements.

Topic : 2 : Catalysis and Green Chemistry **4 Hrs**

Catalysis in organic reaction, nucleophilic catalysis, Metal-ion catalysis, Intermolecular catalysis, Phase transfer catalysis. Green Chemistry : Fundamental Principle of GreenChemistry.

(ii) Green synthesis of (i) Ibuprofen (ii) Paracetamol

UNIT-II

Topic : 1 : Terpenoids (Isoprenoids) : **5 Hrs**

Their occurrence , classification , isoprene and special isoprene rule , general methods to determine their structure , analytical and synthetic evidences for the structure of Camphor & Citral.

Topic : 2 : SyntheticPolymers: **5 Hrs**

Basic concepts, Degree of polymerization, Classification of polymerization reaction. Mechanism of Addition or chain growth polymerization, free radical vinyl polymerisation and Ionic vinyl polymerisation, Ziegler – Natta Polymerisation and Vinyl polymers, Condensation or step growth Polymerization, Polyesters, Polyamides, Biodegradable polymers- Introduction, Classification and Application.

UNIT-III

Topic : 1 Conformational Analysis:**5 Hrs**

Conformation, Conformational analysis, Conformations of ethane, Butane and Cyclohexane. Conformational analysis of cyclohexane. Axial and equatorial Hydrogen in cyclohexane. Stability of monosubstituted cyclohexane.

Topic : 2 Synthetic dyes: (Colour and constitution electronic concepts)**5 Hrs**

Definition and difference between dyes and pigments, classification of dyes, color and constitution – Witt's theory, synthesis and uses of Crystal violet, Indigo, Alizarine, Phenolphthalein, Tetrazine, Acriflavine, Procion Brilliant. Red M-2B.

Reference Books:

- (1) Mechanism and Structure in organic chemistry-Goulde.S.
- (2) Reaction mechanism in organic chemistry by Mukhargy &Singh
- (3) Principles of reaction mechanism in organic chemistry by Dharmaraha &Chawla
- (4) Organic reaction mechanism by Bansal Tata Mac.Hill
- (5) Organic Chemistry by Hendrickson, Cram &Hammond
- (6) Organic Chemistry by Brown R.F.
- (7) Organic Chemistry by Solomon W.Graham
- (8) Principles of Organic Synthesis- R. O. C.Norman
- (9) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A.Benjamin
- (10) May's Chemistry of synthetic Drugs byDyson.
- (11) Chemistry of drugs, Ener and Caldwell
- (12) Synthetic drugs by Tyagi andYadav.
- (13) Chemistry of synthetic Dyes Vol. I & II byVenkatraman
- (14) Synthetic Organic Chemistry by O. P.Agarwal
- (15) Synthetic Dyes by Chatwal &Anand
- (16) Chemistry of synthetic Dyes by I. G.Vashi
- (17) Organic Chemistry by Morrison andBoyd.
- (18) Chemistry of organic Natural Product Vol. I & II by O. P.Agarwal.
- (19) Chemistry of synthetic drugs byTrivedi
- (20) Green Chemistry, Environmentally Vergin Reactions by V. K. Ahuwalia pub. by Ane booksIndia.

- (21) Principles of Medicinal Chemistry Vol.I & II by S.S.Kadam, K.R.Mahadik, K.G.Bothara (NiraliPrakashan)
- (22) Medicinal Chemsitry By Asuthosh kar4/e
- (23) Organic reactions & their mechanism by P. S. Kalsi, New age internationalpublishers.
- (24) Polymer Science Gowariker
- (25) Handbook of biodegradable polymer, isolation, synthetic charactrisation and application by Andras, Lendiein and adam sissom.
- (26) Stereochemistry Conformation and Mechanisam, 10th Ed. by P. S. Kalsi, New age internationalpublishers

Third Year B. Sc. Semester -VI Chemistry
Paper-VIII (Physical Chemistry)

UNIT - I

Topic : 1 : PHASE EQUILIBRIA

6 Hrs

Statement and meaning of the terms phase, component, degree of freedom, phase rule, phase equilibria, of one component system- water, CO₂ , sulphur system, phase equilibria of two component system- simple eutectic-, Pb-Ag systems, desilverisation of lead, KI- Water system, freezing mixtures. Solid solutions: compounds with congruent and incongruent melting point (Only definition and example), Three component solid-liquid systems p.no 690-691*

Topic : 2 : BINARY LIQUID MIXTURES

4 Hrs

Liquid-liquid mixtures, ideal liquid mixtures, Raoult's law, non ideal or real solutions, positive and negative deviations from Raoult's law, temperature composition curves for ideal and non ideal binary solutions of miscible liquids, azeotropes, partially miscible liquids: Phenol-water systems, immiscible liquids, steam distillation. Chemical Potential of Ideal and non ideal solutions, p.no 756-757* Numerical problems.

57 th edition, Principal of physical Chemistry, By Puri, Sharma, Pathania
Vishal Publishing co.

UNIT-II

Topic : 1 : APPLICATION OF ELECTRO MOTIVE FORCE

10 Hrs

Application of measurements of EMF in the determination of

- (1) Solubility product and solubility of sparingly soluble salts
- (2) Ionic product of water by galvanic cell
- (3) Transport number of ions
- (4) Equilibrium constant
- (5) pH by Hydrogen, Glass and Quinhydrone electrodes
- (6) Energy sources Ni-Cd Cell and Li- ion Cell, Lithium - Polymer Cell, Numerical problems.

UNIT-III

Topic : 1 : APPLICATIONS OF NUCLEAR CHEMISTRY

10 Hrs

Application of radio isotopes as tracers in medicines, agriculture, in studying reaction mechanism in photosynthesis and age determination by Carbon- Dating method. Geiger Muller Counter, Q-value of nuclear reactions, Chemical and physical atomic weight scale, Mass defect and Binding energy, Packing fraction and its relation with the stability of the nucleus, Nuclear fission, Atom bomb, Nuclear reactor for power generation and Critical mass, Stellar energy and Hydrogen bomb, Hazards of nuclear radiation. **Numerical problems on** Q- value, Binding energy, Packing fraction, and Energy released during nuclear reactions.

Reference Books:

- (1) Elements of physical chemistry by Glasstone and Lewis
- (2) Physical chemistry by G.M. Barrow
- (3) Physical chemistry by W. Moore
- (4) Physical chemistry by Atkins
- (5) Physical chemistry by G.K. Vemulapalli
- (6) Physical chemistry by B.K. Sharma
- (7) Physical chemistry by Gurdeepraj
- (8) Physical chemistry by Puri, Pathania, Sharma
- (9) Essential of Physical chemistry by Bahl and Bahl
- (10) Physical chemistry by Negi and Anand
- (11) Physical chemistry by K.L. Kapoor Vol1-5.
- (12) Physical chemistry by Baliga, Dhavale and Zaveri Vol1-3.
- (13) Physical chemistry by Dr. S. Pahari
- (14) Nuclear chemistry by Arnikar
- (15) Electro chemistry by S. Glasstone
- (16) Electrochemistry by B.K. Sharma
- (17) Modern Electrochemistry by J'om Bockris and Redd

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Paper-IX (Industrial Chemistry)

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

Topic : 1 : Fermentation Industry

6 Hrs.

Definition, condition favourable for fermentation process (pH, temperature, presence of other substances, absence of preservatives, concentration). Manufacture of ethanol, citric acid, acetone and butanol, Acetic acid, Lactic acid from molasses, manufacture of penicillin-G.

Topic : 2: Pulp and Paper industry

4 Hrs

Type of pulp, Manufacture of chemical pulp by Sulphate pulp process, Sulphite pulp process, manufacture of paper (conversion of pulp into paper, beating process, importance of fillings, sizing, colouring materials in manufacture of paper and calendaring).

UNIT-II

Topic : 1 : Insecticides and Fungicides

5 Hrs.

Introduction, Inorganic insecticides, Natural and synthetic insecticides, organic insecticides, Eldrin, Dieldrin, BHC, Tetra ethyl pyrophosphate (TEPP), Introduction of Fungicides like Bordeaux mixture, Dithiocarbamates, Baygon, Termik, Zineb

Topic : 2 : Detergents:

Introduction, Principles of detergency, classification of surface active agents, Anionic detergents, Cationic detergents, Non-ionic detergents, Amphoteric detergents, Suds regulators, Builders and Additives.

UNIT-III

Topic : 1 : Sugar Industry

5 Hrs.

Introduction, Manufacture of sugar from sugarcane: Extraction of juice, Purification of juice, Concentration & crystallisation of purified juice, Refining of sugar.

Topic : 2 : Industrial manufacturing process with flow diagram & their uses**5 Hrs.**

- (1) Preparation of methanol from synthesis gas.
- (2) Preparation of Isopropanol from propylene.
- (3) Preparation of acetone from isopropanol.
- (4) Preparation of formaldehyde from methanol by oxidation dehydration process.
- (5) Acetylene from natural gas.

Reference Books:

- (1) Shreve Chemical Process Industries, 5ed., George.T. Austin. MacGraw Hill, Book Agency
- (2) Reigel's Industrial Chemistry, Ed. By James A. Kent.
- (3) Unit Process in Organic Synthesis by D.H. Groggins.
- (4) An Introduction to Industrial Chemistry, by Peter Wiseman, Applied Science Pub. Ltd. London.
- (5) Industrial Chemistry by B.K.Sharma, Goel Pub.
- (6) Quantitative Analysis by R.A.Day & ALUnderwood, 6th ed. Pub. Prentice Hall of India ltd.
- (7) Vogel's Text Book Inorganic Quantitative Analysis, 6th ed.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Paper-X (Analytical Chemistry)

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

SPECTROSCOPY:

10 Hrs

Types of spectrum, Process involved in interaction with matter (Fluorescence, Phosphorescence), Components of spectrophotometer-Sources, Grating and Prism as dispersing device, Sample handling, Detectors- Photo tube, Photomultiplier tube. Block diagram and working of single beam and double beam spectrophotometer. Terms involved in Beer's law (no derivation). Causes of deviation from Beer's law. Analysis of unknown by calibration curves method, standard addition method, and ratio method.

Determination of Cu^{+2} , Fe^{+3} , NO_2^{-1} , F^- using spectrophotometer. (Only principles - no detailed method), Problems based on quantitative analysis

UNIT-II

SEPARATION TECHNIQUE

6 Hrs.

Topic : 1 : Gas Chromatography:

Classification of chromatography, Principles of GC separation. Components of GC, Sample introduction system, Columns: Packed column Capillary Column (WCOT, SCOT), Carrier gas and its selection - stationary phases: Solid adsorbents, Inert supports (Selection criteria, Diatomaceous earths) and liquid stationary phases, Detectors: FID, TCD. Qualitative and quantitative analysis using GC.

Topoic : 2 : Liquid Chromatography:

4 Hrs.

Limitation of conventional liquid chromatography (no detail method). Technique of HPLC. Elementary idea about technique and layout diagrams of instrument. Components of instrument of HPLC technique, Pumps with merits and demerits, Detector: UV absorption, Refractive Index, Elementary idea of TLC.

UNIT-III

Topic : 1 : Precipitation Titrations:**5 Hrs.**

Titration involving Silver salts.

Detection of end points by Mohr's method, Volhard's method, Adsorption indicators. Construction of titration curves. Problems.

Topic : 2 : Redox Titrations:**5 Hrs.**

Formal Potential, Redox reaction: $\text{FeSO}_4\text{-KMnO}_4$, $\text{K}_2\text{Cr}_2\text{O}_7\text{-FeSO}_4$, $\text{Fe}^{+2} - \text{Ce}^{+4}$, Principle of redox indicators, Structural chemistry of indicators (Diphenyl amine, Ferroin). Construction of titration curves for titration of Fe^{2+} with Ce^{4+} .

Nernst equation and calculation of equilibrium constants for redox system, Types of indicators, Theory of true Redox indicators.

Reference Books:

- (1) Quantitative Analysis by R. A. Day & A. L. Underwood, 6th ed. Pub. Prentice Hall of India Ltd
- (2) Vogel's Text Book Inorganic Quantitative Analysis, 6th ed.
- (3) Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
- (4) Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- (5) Instrumental Methods of Analysis by B. K. Sharma
- (6) Instrumental analysis by R.D.Braun Mc Graw Hill.
- (7) Analytical Chemistry....Gary Christian
- (8) Analytical Chemistry....Day and Underwood.
- (9) Modern Analytical Chemistry by David Harvey, McGraw Hill Higher Education
- (10) College Analytical Chemistry, Mangaonkar, Teckchandani, Sathe, Ghalsasi, Jain, Himalaya Publishing House
- (11) Analytical Chemistry by Alka L. Gupta, Pragati Prakashan.
- (12) Instrumental Methods of Chemical Analysis by H. Kaur, Pragati Prakashan.

Third Year B. Sc. Semester -VI Chemistry

Paper-XI (General Chemistry)

UNIT-I

Topic : 1 : Chemistry in Consumer Protection :

10 Hrs.

Define Adulteration; Reasons of Adulteration, Types of Adulterants, Discussion Methods for detection of different adulterants in some common food items

(1) Milk

(2) Milk products: Sweet curd, Rabdi, Khoa & its product, Chhana or Paneer, Ghee, Cottage cheese, condensed milk, Khoa, Ghee, Butter

(3) Oil and Fats Oil and Fats, Mustard oil, Edible oil, Coconut oil

(4) Sweetening agents: Sugar, Pithi sugar, Honey, Jaggery, Bura sugar

(5) Food grain and their product: (Wheat, Rice, Maize, Jowar, Bajra, Chhana and Barley etc.), Maida, Wheat flour, Besan, Suji (Rawa) Dal whole and Split, pulses

(6) Spices: Whole spices, Black Pepper, Cloves, Mustard seed and Powdered spices

(7) Turmeric whole and Turmeric powder

(8) Chilli powder, Asafoetida,

(9) Miscellaneous Product: Common salt, Tea, Coffee powder,

UNIT-II

10 Hrs.

Topic : 1 : Nano particles:

Introduction of Nano particles, properties of nano particles, Semi conductors, Ceramic nano particles, Catalytic aspects of nano particles, Carbon nano tubes. Applications of Nano particles,

Topic : 2 : Environmental pollution:

Introduction types of Pollutions (1) Gaseous pollution in air, Acid rain, Green house effect and ozone depletion. (2) radiation pollution cause, effect and control, Uses of radioactive isotopes in medicine, food safety and industry (Cobalt-60, Iodine-131, Carbon-11, Carbon-14, Sodium-24, Thallium-201, Technetium-99m, Americium- 241, Iridium-192, Uranium-235, Californium-252) (3) Noise pollution and their effect and control (4) Oil pollution and their control.

UNIT-III

Topic : 1 : NMR spectroscopy

10 Hrs.

Nuclear Magnetic Resonance Spectroscopy – Proton Magnetic Resonance (^1H NMR)

Spectroscopy - Nuclear Shielding and Deshielding – Chemical Shift and Molecule Structure, Spin-Spin splitting and Coupling constants - Intensities of signals – Interpretation of NMR spectra of simple organic molecule such as Ethyl bromide, Acetaldehyde, 1,1,2-tribromoethane, Ethylacetate, Toluene, Acetophenone, Nitrobenzene, Cyclopropane, Isomers of Pentane, Hexane and Dibromo propane.

Reference Books:

- (1) Quantitative analysis by R.A. Day and A.L. Underwood
- (2) Elements of Analytical Chemistry by R. Gopalan ; P.S.Subramanian and K. Rengarajan
- (3) Elementary Organic Spectroscopy by Y.L.Sharma
- (4) Organic Spectroscopy by B.K.Sharma
- (5) Environmental Chemistry by H.Kaur.
- (6) [.http://www.fssi.gov.in/Portals/0/pdf/Final-test-manual-part-II](http://www.fssi.gov.in/Portals/0/pdf/Final-test-manual-part-II)
- (7) Vogel's qualitative Inorganic analysis
- (8) Vogel's qualitative Organic analysis

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Chemistry-Generic elective subject–Petrochemicals

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

Topic : 1 : Petrochemicals obtained from C3-cut of petroleum. 6 Hrs.

Manufacture and industrial applications of chemicals obtained from Propylene: Isopropyl alcohol, Acetone (Wacker-Chemieprocess), Propyleneoxide (Halcon process), Acrylonitrile, Glycerol and Isoprene, Propylene tetramer, Acrylic acid, n-Butyraldehyde (Oxoprocess), Methyl isobutyl ketone, Methylmethacrylate.

Topic : 2 : 4 Hrs.

General account of petrochemicals used as monomers in the manufacture of polyester fibers, manufacture of DMT, Terphthalic acid, Phthalic anhydride, Maleic anhydride, 1:4 Butanediol and other monomers like Pentaerithritol and Di-isocyanates.

UNIT-II

Topic : 1 : The method for the large scale production with flow diagram and uses of: 5 Hrs.

(i) Acetoacetanilide (ii) Anthraquinone (iii) β -naphthol from naphthalene (iv) Benzoic acid (v) Aspirin (vi) Chloramphenicol (vii) Paracetamol (viii) p-Aminophenol.

Topic : 2 : Miscellaneous petrochemicals 5 Hrs.

Definition of synthetic detergents, hard and soft detergents. Synthesis of DDBS. Synthesis of Fluorescein, Malachite Green, Chrysoidine and Indigo. Definition of Explosive, list of basic raw materials for explosives and list of explosives derived from these raw materials. Synthesis of Tetryl, PETN and Dynamite. Definition of insecticides, classification of insecticides on basis of mode of action. Synthesis of Methoxychlor, Captan, Parathion, Malathion.

UNIT-III

Topic : 1 : Chemicals obtained from C4 & C5 cut of petroleum. **4 Hrs.**

Manufacture and industrial applications of Butadiene, Butylalcohols, Methylterbutyl ether (MTBE), Cyclopentadiene, Sulpholane.

Topic : 2 : BTX aromatic : **6 Hrs.**

Recovery process of BTX, manufacture and industrial applications of benzene, toluene, xylene, naphthalene, phenol, styrene.

Reference Books:

- (1) Introduction to petrochemicals by Sukumar Maiti, Oxford and IBH Pubs Co. New Delhi.
- (2) A text on petrochemicals by Dr.B.K. Bhaskar Rao, Khanna Pubs. New Delhi.
- (3) Chemicals from petroleum by A.L.Wadams (ELBS and John Murray London)
- (4) Petrochemicals by S.L.Venkatewarn (Colour Pubs. Pvt. Ltd. Bombay)
- (5) Petrochemicals digest by MGK Manon (Asia Publishing house Bombay)
- (6) Hand book of industrial chemicals Vol-I by K. M. Shah (Multi tech publishing co. 15 yogesh, hingwala lane, ghatkoper (E) Bombay-400077)
- (7) Industrial chemistry including chemical engineering by B.K.Sharma, Goel Pubs. House, Meerut.
- (8) Hand Book of Synthetic Dyes and Pigments (Vol.II) By K.M.Shah, Multi-tech Publishing Co.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Chemistry-Generic elective subject–Drugs

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

Topic – 1: Sedatives, Hypnotics and Anticonvulsant drugs **5 Hrs.**

Definition; Introduction; Classification and Structural variations of Sedatives, Hypnotics and Anticonvulsant drugs; Synthesis and Therapeutic Uses of Luminal (Phenobarbital), Diazepam, Meprobamate, Imipramine, Veronal.

Topic – 2: Anaesthetics **5 Hrs.**

Definition; Introduction of General and Local Anaesthetics, Name and Structures of different General Anaesthetics, Classification and Structural Variation among Local Anaesthetics; Synthesis and Therapeutic Uses of Alpha-Eucaine, Benzocaine, Orthocaine, Lidocaine, Halothane.

UNIT-II

Topic – 1: Antihistamines (Anti-allergic drugs) **4 Hrs.**

Definition; Introduction; General account of Histamine and Anti-allergic drugs; Classification and Structural Variations among Antihistamines; Synthesis and Therapeutic Uses of Antergan, Benadryl (Diphenhydramine), Promethazine (Phenergan), Pyribenzamine, Chlorpheniramine.

Topic – 2: Antidiabetic Drugs (Hypoglycemic agents) **3 Hrs.**

Definition; Introduction; Hypoglycemia; Role of insulin in diabetes; Oral Hypoglycemic agents; Structural Variations among Biguanide and Sulfonylurea derivatives showing Hypoglycemic activity; Synthesis and Therapeutic Uses of Tolbutamide, Metformin.

Topic – 3: Antitubercular and Antileprotic drugs **3 Hrs.**

Definition; Introduction; General account of Tuberculosis and Leprosy; Structural Variations among Antitubercular and Antileprotic Drugs; Synthesis and Therapeutic Uses of Isoniazid, Ethambutol, Dapsone (DDS).

UNIT-III

Topic – 1: Antimalarial drugs

4 Hrs.

Definition; Introduction; Name and modes of transition of Plasmodium Parasites responsible for Malaria in Human; General Classification of Antimalarial Drugs; Synthesis and Therapeutic Uses of Chloroquine, Mefloquine, Amodiaquine (Camoquine), Primaquine.

Topic – 2: Antiseptics and Disinfectants

3 Hrs.

Definition; Introduction; Classification and Structural variations among Antiseptics and Disinfectants; Synthesis and Therapeutic Uses of Mercurochrome (Merbromin), *n*-Hexylresorcinol, Halazone, Dichloramine-T.

Topic – 3: Diuretics

3 Hrs.

Definition; Introduction; Classification and Structural Variations of Diuretics; Mercurial Diuretics and Non-Mercurial Diuretics; Synthesis and Therapeutic Uses of Sorbitol, Acetazolamide, Hydroflumethiazide.

Reference Books:

- (1) May's Chemistry of synthetic Drugs by Dyson.
- (2) Chemistry of drugs, Ener and Caldwell.
- (3) Synthetic drugs by Tyagi and Yadav.
- (4) Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.
- (5) The Organic Chemistry of Drug Synthesis by Daniel Lednicer & L.A. Mitscher.
- (6) Medicinal Chemistry by V.K. Ahluwalia Pub. Ane Books Pvt. Ltd.
- (7) Medicinal Chemistry by Ashutosh Kar, New Age International Publisher.
- (8) Medicinal Chemistry by Balkishan Razdan, Pub. CBS Publishers.
- (9) Pharmaceutical Organic Chemistry by S.K. Dewan, Pub. Narosa.
- (10) Medicinal Chemistry - a Molecular and Biochemical Approach, by Thomas Nogrady & Donald F Weaver
- (11) Pharmaceutical Organic Chemistry by Shyam Singh Pub. Himalaya Publishers.
- (12) Medicinal Chemistry by G Patrick. Pub. Viva Books.
- (13) Burger's Medicinal Chemistry & Drug Discovery. Ed. by D. J. Abraham.

Third Year B. Sc. (SEM –VI)
Chemistry - Generic elective subject – DYES

UNIT – I

Topic –1: Fluorescent brightening agents:

7 Hrs

General account, classification of FBA base on chemical constitution with examples, Stillbene and Coumarin derivatives of FBA, synthesis of Tinopal BV, Blankophor-B, Blankophor-G , 3-Phenyl-7-methoxy coumarin, 4 Methyl –3 phenyl-7-amino coumarin, Brilliant Yellow, 3-Phenyl 7-Acetylamino coumarin, 4-Acetylamino-N-butyl Naphthalimide.

Topic –2: Sulphur dyes:

3 Hrs

General account of sulphur dyes. (a) Sulphur Black (b) Sulphur brown (c) Sulphur red (d) Sulphur blue (e) Vat blue -43

UNIT – II

Topic –1: Reactive dyes:

5 Hrs

Definition, general account of reactive dyes based on monochlorotriazinyl, dichlorotriazinyl and vinyl sulphone system. Application of reactive dyes, Synthesis of Procion Brilliant red H-3B , Procion Brilliant Yellow M-6G, Remazole Black B, Procion Brilliant – Blue M-R, Reactive Red-B.

Topic –2: Mordant dyes:

5 Hrs

(i) Definition, classification of mordant dyes with examples, application of mordant dyes synthesis of alizarin and Mordant yellow 2 G
(ii) Heterocyclic Dyes: Introduction Azine dyes, Thiazine dyes, and Cyanine dyes. Synthesis of Safranine – T, Methylene blue, Astrazone pink-FG.

UNIT – III

Topic –1: Azoic dyes:

4 Hrs

Definition, general account of azoic dyes, fast bases, fast salts, rapid fast colors, rapidogens and rapidazole, synthesis of naphthol AS, Fast blue B base (Dianisidine), Fast Orange GGD, Naphthol ASRL, Fast Orange LG- Base.

Topic –2: Non-textile application of dyes:

6 Hrs

Food colors, Cosmetic dyes , Dyes for paper and printing inks , Dyes for paints, Dyes for leather and polishes, synthesis of Amaranth , Lithol Rubine, Lithol Red, Crystal violet, Bismark brown G, Eosin, Orange-I, Prontosil, Pyridium, Neutral Red, Mercurochrome. General account of medicinal dyes.

Reference books:

- (1) Synthetic organic chemistry by O.P. Agrawal
- (2) The chemistry of synthetic dyes and pigments by H. A. Lubes
- (3) Chemistry of synthetic dyes VOL I to VII by K. Venkatraman
- (4) An introduction to synthetic dyes by D. W. Ranghekar & P. P. Singh
- (5) A hand book of synthetic dyes and their application by C. T. Bhastana & V. H. Raichura & others
- (6) Chemistry of dyes & Principles of dyeing Vol II by V. A. Shehai
- (7) Chemistry of synthetic dyes by I. G. Vashi
- (8) Chemistry of dyes and pigments by K. M. Shah
- (9) Synthetic dyes by G. R. Chatwal
- (10) Synthetic dyes and pigments by E. N. Abrahart.

B. Sc.

Botany

Botany	
Program Out Come	Botany is the study of plants as a science. It entails investigating their structure, how they grow, how they may be successfully classified, and the factors that influence their development, among other things. Botany is a field of biology concerned with the study of all living things. Students with a B.Sc. in Botany will be able to: -Recognise cryptogamic plants. -Apply nursery management knowledge to the proliferation of economically important plants; - Identify and use some basic therapeutic plants -Produce some basic food crops -Recognise and control plant diseases; -Recognise and control weed plants -Recognise and control phanerogamic plants
Programe Specific Outcome	-Students learn about the strategies employed in the production of industrially relevant plant products. -Students gain conceptual knowledge of entrepreneurship in mushroom farming, the manufacturing of bio-fertilizers and bio-pesticides, fermentation, and other areas. -Recognize the diversity of plants and their structural organisation, such as monocots and dicots; -Learn about plant structures in relation to their physiological and metabolic processes.

B.Sc. SEMESTER - IBOTANY
PAPER - 101
(Effective from June 2018)

BOT - 101 : PLANT DIVERSITY

Unit - I Introduction to Plant Diversity

- Concept, Plant Kingdom(Eichler system)- cryptogams and phanerogams, diversity in plant kingdom, position of plants in five kingdom system.
- Prokaryotic and Eukaryotic cell structure

Unit - II Microbes

- Bacteria : Discovery, general character, structure and importance
- Virus: Discovery, general character, structure and importance

Unit - III Algal diversity

- Occurrence, classification, thallus, cell structure, pigments, reserve food material and reproduction of *Nostoc* and *Spirogyra*

Unit - IV Fungal diversity

- Occurrence, classification, thallus, cell structure, nutrition and reproduction of *Mucor* and *Agaricus*

Unit - V Lichen

- Classification, general characters, external and internal characters, reproduction and economic importance of *Lichen*

B.Sc. SEMESTER - IBOTANY PAPER

- 102

(Effective from June 2018)

BOT - 102 : PLANT DIVERSITY, NURSERY MANAGEMENT AND UTILIZATION

Unit - I Bryophytes

- Study of life history, occurrence, thallus structure, reproduction and sporophyte diversity (external and internal) of *Funaria*.

Unit - II Pteridophytes

- Study of life history, sporophyte, gametophyte (external and internal) and reproduction of *Nephrolepis*.

Unit - III Nursery Management

- Introduction, types of nurseries
- Plant propagation- cutting, budding, grafting and layering
- Fertilizer and pesticides
- Methods of irrigation: drip and sprinkler,

Unit - IV Plant Morphology

- **Root:** Definition, parts of root, types of root, functions and modification of root.
- **Stem:** Definition, characters of stem, shape and surface of stem, types of stem, functions & modification of stem,
- **Leaf:** Definition, characters & parts of leaf, types of stipules, venation, types of leaf, functions and modification of leaf.
- **Flower:** Definition, structure of typical flower, arrangement of floral leaf, types of flower.

Unit - V Food plants

- Cultivation of the following crops in relation to their origin, distribution, climate, soil, propagation, method of cultivation and uses.
- Sugar cane, Paddy, Mango, Brinjal

B.Sc. SEMESTER - IBOTANY
PRACTICAL - 103
(Effective from June 2018)

BOT - 103 : PLANT DIVERSITY, NURSERY MANAGEMENT AND UTILIZATION

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

- Practical :1 **T0** study microscopic examination of curd.
Permanent slides of Bacteria
Chart/Specimen of different types of Virus.
- Practical :2 **Nostoc:**
To study thallus structure and akinets in Nostoc.
- Practical :3 **Spirogyra:**
To study the thallus structure, Scalariform conjugation and Lateral conjugation in Spirogyra.
(Permanent slides of thallus W.M, Scalariform conjugation, Lateral Conjugation.)
- Practical :4 **Mucor :**
To study the thallus structure and reproductive structure.
Permanent slides of Mucor vegetative W.M., Mucor sporangia, Mucor Zygosporangium.
- Practical :5 **Agaricus:**
To study the vegetative structure, basidiocarp, gills, basidia and basidiospores.
Permanent slides : Stipe T.S.; Pileus T.S.
- Practical :6 **Lichen:**
To study external features and internal structures of Usnea
(Permanent slides of Lichen thallus T.S., Lichen apothecium V.S., Lichen soredia)
- Practical :7 **Moss (Funaria):**
To study the external features of gametophyte and sporophyte.
(Permanent slides of Funaria antheridia W.M.; Funaria archegonia W.M.)
- Practical :8 **Nephrolepis :**
Preparation of slides from the fresh material of T.S of Stolon & T.S. of Rachis by the students.
(Permanent slides: T.S. of Stolon, T.S. of Rachis, T.S. of leaflet passing through sori, Nephrolepis prothallus, Fern sori W.M., prothallus with antheridia, prothallus with archegonia, prothallus with sporophyte.)

Practical :9 **Nursery Management**

- i) Study of methods of propagation with the help of suitable materials - tubers, bulbs, rhizomes, corms, suckers and runners.
- ii) Propagation of horticultural plants by stem cuttings, air layering, grafting and 'T' budding.

Practical :10 **Roots:**

- To study different types of roots:
 - ❖ Tap root- *Vinca*
 - ❖ Fibrous- *Grass*
 - ❖ Adventitious- *Sugarcane*
- To study modification of root:
 - ❖ Prop root- *Banyan tree*
 - ❖ Stilt root- *Maize*
 - ❖ Pneumatophores- *Avicennia*
 - ❖ Storage root- *Carrot, sweet potato*

Practical :11 To study different types of stem

- To study Aerial stem
 - ❖ Cudex-*Palms*,
 - ❖ Clum-*Bamboo*,
 - ❖ Scape- *Canna and Onion*
 - ❖ Excurrent- *Polyalthialongifolia, Casurina*
 - ❖ Deliquescent- *Mango*
 - ❖ Weak stem: *Ipomoea*
- To study underground stem
 - ❖ Rhizome- *Ginger, Turmeric*
 - ❖ Tuber- *Potato*
 - ❖ Bulb- *Onion*
 - ❖ Corm- *Amorphophollus*
- To study Specialized stem
 - ❖ Phylloclade- *Opuntia*
 - ❖ Cladode- *Asparagus*

Practical :12 Leaf:

- To study different types of leaf:
 - ❖ Simple leaf: *Banyan, Mango*
 - ❖ Pinnate Compound Leaf:
 - ✓ Unipinnate: *Cassia, Rose*
 - ✓ Bipinnate: *Mimosa, Caesalpinia*
 - ✓ Tripinnate: *Moringa*
 - ✓ Decompound: *Coriander*
 - ❖ Palmately Compound Leaf
 - ✓ Unifoliote: *Citrus*
 - ✓ Bifoliolate: *Balanites, Bauhinia*
 - ✓ Trifoliolate: *Crotalaria, Oxalis*
 - ✓ Quadrifoliolate: *Marsilea*
 - ✓ Multifoliolate: *Bombax*

Practical :13 Flower:

- To study different types of flower:
 - ❖ Regular flower: *Ipomoea*
 - ❖ Irregular flower: *Clitoria, Caesalpinia*
 - ❖ Unisexual flower: *Coccinia*
 - ❖ Bisexual flower: *Hibiscus*

Practical :14 Botanical name, family, origin, distribution and uses of the following crops.

- *Sugarcane*
 - *Paddy*
 - *Mango*
 - *Sapota(Chikoo)*
 - *Brinjal*
 - *Tomato*
-

B.Sc. SEMESTER - IIBOTANY PAPER

- 201

(Effective from June 2018)

BOT - 201 :PLANT PHYSIOLOGY, PLANT ECOLOGY, PLANT ANATOMY, MEDICINAL PLANTS AND PLANT PATHOLOGY

Unit - I Plant Physiology

- Imbibition and Osmosis
- Plant Movement: Definition and types of movements
- Photosynthesis: Definition, pigments, light and dark reaction, C₃ and C₄ cycle, factors affecting photosynthesis

Unit - II Plant Ecology

- Ecological adaptations, morphological and anatomical characters of Hydrophytes, Mesophytes and Xerophytes with appropriate examples

Unit - III Plant Anatomy

- Tissue system: Meristematic and Permanent tissue
- Vascular Bundle: Definition and types
- Stele: Definition and types
- Ergastic matters: starch grain, raphides, sphaerephides, aleurone grain and cystolith

Unit - IV Medicinal Plants

- Scientific name, family, part use and medicinal uses of following:
 - ❖ *Ocimum sanctum*
 - ❖ *Adhatodavasica*
 - ❖ *Aloe barbedense*
 - ❖ *Azadirachtaindica*
 - ❖ *Abrusprecatorius*
 - ❖ *Zingiberofficinale*

Unit - V Plant Pathology

- Causal organisms, symptoms and control measures of the following plant diseases:
 - ❖ Leaf spot of Mango
 - ❖ Red rot of Sugarcane
 - ❖ Bacterial blight of Paddy
 - ❖ Little leaf of Brinjal
 - ❖ Citrus canker

B.Sc. SEMESTER - IIBOTANY PAPER
- 202
(Effective from June 2018)

BOT - 202 :PLANT DIVERSITY AND WEED MANAGEMENT

Unit - I Weed management

- Introduction
- Invasive weeds: concept and causes of their dominance
- Weed control: Physical, chemical and biological methods
- Sustainable use of weeds

Unit - II Gymnosperm

- Classification, external morphology, internal structure, reproduction and alternation of generation in Cycas.

Unit - III Morphology

- Phyllotaxy: Definition and Types with examples.
- Aestivation: Definition and types with examples
- Inflorescence: Definition and Types: Racemose and Cymose
- Placentation: Definition and Types with examples.

Unit - IV ANGIOSPERMS

- Classification as per Bentham & Hooker's system of Classification, general characters, economic and medicinal importance, Botanical name of common important plants of the following families.

- ❖ Malvaceae
- ❖ Apocynaceae
- ❖ Convolvulaceae
- ❖ Nyctaginaceae
- ❖ Amarillidaceae

Unit - V Conservation of plant diversity

- Concept and need, Methods of in-situ and Ex-situ conservation
- Botanical garden
- Forests: Importance of forests and their conservation.

B.Sc. SEMESTER - II BOTANY
PRACTICAL - 203
(Effective from June 2018)

**BOT - 203 : PLANT PHYSIOLOGY, PLANT ECOLOGY, PLANT ANATOMY,
MEDICINAL PLANTS AND PLANT PATHOLOGY, PLANT
DIVERSITY AND WEED MANAGEMENT**

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

Practical :1 Plant physiology (Experiment to be demonstrated)

- (i) Imbibition and Imbibition force
 - ❖ Test tube experiment.
 - ❖ Indicator experiment
- (ii) Plant movements
 - ❖ Geotropism
 - ❖ Phototropism
 - ❖ Hydrotropism
- (iii) Photosynthesis
 - ❖ Mohl's half leaf experiment
 - ❖ Light is necessary for photosynthesis

Practical :2 Plant ecology (Fresh specimens to be shown to the students):

- Hydrophytes:
 - ❖ Hydrilla, Vallisneria, Eichhornia, Pistia, Nymphaea, Marsilea.
- Mesophytes:
 - ❖ Coriander, Trigonella, Garlic (Entire plants)
- Xerophytes:
 - ❖ Solanum xanthocarpum, Casuarina, Aloe vera, Opuntia, Euphorbia tiruculli

Practical :3 Tissue: To study following permanent slides:

- i Root apex
- ii Shoot apex
- iii Parenchyma
- iv Aerenchyma
- v Chlorenchyma
- vi Collenchyma
- vii Sclerenchyma
- viii Xylem- Spiral vessels, Pitted vessels
- ix Phloem elements

Practical :4 **Stele:** Study of stele from permanent slides:

- Actinostele
- Plectostele
- Amphiphloic siphonostele
- Eustele
- Atactostele

Practical :5 **Vascular Bundles:** Study of various types of Vascular bundles from Permanent slides.

- Radial
- Amphicribal (Hadrocentric)
- Collateral and open
- Collateral and closed
- Bicollateral

Practical :6 **Non living cell contents:** Slides are to be prepared by the students from given materials.

- Starch grains: Potato tuber, Wheat or Rice, Euphorbia tiruculli.
- Mineral Crystals:
 - (a) Raphides: Pothos, Colocasia petiole
 - (b) Sphaeraphides: Opuntia, Nerium leaf

Practical :7 **Medicinal plants:** Scientific name, family, part use and medicinal uses of following:

- Ocimum sanctum
- Adhatodavasica
- Aloe barbedense
- Azadirachta indica
- Abrus precatorius
- Zingiber officinale

Practical :8 **Plant pathology:** Causal organisms, symptoms and control measures of the following plant diseases

- Leaf spot of Mango
- Red rot of Sugarcane
- Bacterial blight of Paddy
- Little leaf of Brinjal
- Citrus Canker

Practical :9 **Weed Management:** Observation of weeds with reference to Botanical Name, Family, Morphological peculiarities:

- Native – Cynodon, Cyperus, Amaranthus, Panicum
- Exotic/Invasive – Alternanthera, Desmodium, Euphorbia, Malabar nut

Practical :10 Gymnosperms (Cycas)

- Preparation of slides from the fresh material by the students -:
 - ❖ T.S. of Rachis
 - ❖ T.S. of Leaflet
- Permanent Slides: T.S. of Leaflet, T.S. of Rachis, T.S. of Coralloid root, T.S. of Microsporophyll, T.S. of Megasporophyll, L.S. of Ovule
- Preserve Specimen: Coralloid root, Microsporophyll and Megasporophyll

Practical :11 **Phyllotaxy:**

- (i) Distichous phyllotaxy
- (ii) Tristichous
- (iii) Pentastichous
- (iv) Opposite superpose
- (v) Opposite decussate
- (vi) Verticillate or Whorled
- (vii) Leaf mosaic
- (viii) Heterophylly

Practical :12 **Aestivation**

- Valvate: Calyx of *Hibiscus rosasinensis*
- Twisted: Corolla of *Hibiscus rosasinensis*
- Imbricate: Corolla of *Caesalpinia pulcherrima*
- Quincuncial : Corolla of *Antigonon leptopus*
- Vexillary : Corolla of *Clitoria ternatea*

Practical :13 **Inflorescence:**

- RACEMOSE
 - (a) Raceme: *Caesalpinia pulcherrima*, *Brassica juncea*
 - (b) Spike: *Achyranthes aspera*, *Polianthes tuberosa*
 - (c) Spadix: *Colocasia*

- (d) Catkin: Acalyphahispida
- (e) Spikelets: Poaceae (any plant)
- (f) Corymb: Cassia, Ixora
- (g) Umbel: Coriandrum
- (h) Capitate: Acacia, Albizzia
- (i) Capitulum: Helianthus, Tridax

➤ **CYMOSE**

Unbranched:

- (a) Solitary Terminal: Datura
- (b) Solitary Axillary: Hibiscus

Branched:

- (c) Helicoid: Hamelia
- (d) Scorpioid: Heliotropium
- (e) Dichasial or Biparous: Clerodendrum, Nyctanthus, Jasminum
- (f) Polychasial or Multiparous: Nerium, Calotropis

Practical :14 **Placentation:** Study of Placentation to be demonstrated by permanent slides.

- (i) Marginal
- (ii) Axile
- (iii) Free central
- (iv) Parietal
- (v) Superficial
- (vi) Basal

Practical :15 **Angiosperm: (Families)**

- Study of Morphological characters, floral dissection, T.S. of Ovary and floral formulae of following families.
 - (i) Malvaceae : *Hibiscus rosasinensis*, *Thespesia*, *Gossypium*
 - (ii) Convolvulaceae: *Ipomeapalmeta*
 - (iii) Apocynaceae : *Nerium*, *Allamanda*, *Catharanthusroseus*
 - (iv) Nyctaginaceae : *Bougainvallia*, *Mirabilis*
 - (v) Amaryllidaceae : *Crinum*, *Polianthes*

- XXXXXXXX -

B.Sc. SEMESTER - III & IV BOTANY
(Effective from June 2019)

Semester	Paper No.	Title	
III	301	Plant Physiology and Plant Ecology	
	302	Plant Anatomy, Plant Embryology and Genetics	
	303	Diversity of Gymnosperms and Angiosperms	
	Pra. 304	Practical 304	
	ID	Nutrition and Dietetics (I.D.)	
IV	401	Lower Cryptogams	
	402	Higher Cryptogams	
	403	Plant Geography, Economic Botany, Seed Plants and Plant Pathology	
	Pra. 404	Practical 404	
	ID	Biodiversity (I.D.)	

B.Sc. SEMESTER - III BOTANY PAPER - 2

(Effective from June 2019)

BOT 301 : Plant Physiology and Plant Ecology

Unit - I Plant Physiology I

- (A) Water Potential and Root Absorption
 - Method, path and types of root absorption
 - Factors affecting root absorption
- (B) Ascent of Sap
 - Introduction
 - Ascent of sap by xylem
 - Root pressure theory
 - Dixon's theory of Cohesion of water
- (C) Transpiration
 - Introduction
 - Types and structure of Stomata
 - Mechanism of stomatal transpiration
 - Significance of transpiration
 - Factors affecting transpiration

Unit - II Plant Physiology II

- (A) Respiration
 - Introduction
 - Types of respiration
 - Mechanism of respiration
 - (i) Glycolysis
 - (ii) Kreb's cycle
 - Oxydative phosphorylation
 - ATP synthesis in aerobic respiration
 - Factors affecting respiration

Unit - III Plant Ecology I

- (A) Ecosystem
 - Concept of Ecosystem
 - Types & Components of Ecosystem
 - Food chain, Food webs and Ecological Pyramids
 - Energy flow in ecosystem

Unit - IV Plant Ecology II

- (A) Plant communities:
 - Halophytes
 - Epiphytes
 - Lithophytes
- (B) Ecological Factors: Climatic and Edaphic factor
- (C) Soil erosion and conservation:
 - General introduction, types of soil erosion, factors responsible for soil erosion, control of soil erosion.

B.Sc. SEMESTER - III BOTANY PAPER

-3

(Effective from June 2019)

BOT 302 : Anatomy, Embryology and Genetics

Unit - I Anatomy I

- Primary tissue structure in Roots
 - Monocot Root
 - Dicot Root
- Primary tissue structure in Stems
 - Monocot Stem
 - Dicot Stem
- Primary tissue structure in Leaf
 - Monocot Leaf
 - Dicot Leaf

Unit - II Anatomy II

- Definition and Study of normal & anomalous secondary growth seen in the following plants.
(i) Bignonia (ii) Nyctanthus (iii) Boerhaavia (iv) Dracena.

Unit - III Embryology I

- Microsporangium and Male gametophyte
 - Structure of Microsporangium, Microsporogenesis and Male Gametophyte.
- Megasporangium and Female gametophyte
 - Structure of Megasporangium, Megasporogenesis and Female Gametophyte.
- Fertilization

Unit - IV Genetics

- Heredity
 - Mendel's experiments
 - Mendel's laws of inheritance
 - Linkage and Crossing over
- Genetic material and its Structure
 - Chemical Composition of gene
 - Nucleic Acids
 - Structure of DNA
 - Types of RNA

B.Sc. SEMESTER - III

BOTANY PAPER - 4

BOT 303 : Diversity of Gymnosperm and Angiosperms

Unit - I Gymnosperm

- Classification with reason, External Morphology, Internal Structure, Reproduction, (Except development) Male gametophyte, Female gametophyte, Fertilization, Germination of seed of following:

- (i) Pinus
- (ii) Gnetum

Unit - II Plant Structure I

- Weak stem plants
- Bracts
- Special types of inflorescence
- Fruits

Unit - III Plant Structure II

- **Pollination**
Pollination Definition, Self-pollination and Cross pollination;
Pollination in Salvia, Ficus, Orchids and Vallisneria
- Defensive devices of plants

Unit - IV Angiosperm

- Plant taxonomy : Principle of Plant taxonomy
- Classification with reasons (according to Bentham and Hooker system), general and distinguishing characters and examples (scientific name) of important plants of the following families.
 1. Brassicaceae
 2. Papilionaceae
 3. Caesalpiniaceae
 4. Mimosaceae
 5. Rubiaceae
 6. Asclepiadaceae
 7. Euphorbiaceae
 8. Pontideriaceae

B.Sc. SEMESTER – III
BOTANY PRACTICAL - 304

BOT - 304 :

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

Practical : 1 To study Physiological experiments for demonstration.

1. To demonstrate anaerobic respiration
2. Release of CO₂ during aerobic respiration. (Conical flask method).
3. To demonstrate that energy is released in the form of heat during respiration.
4. To demonstrate the phenomenon of transpiration. (Bell-jar method)
5. Demonstration of the stomatal transpiration by four leaves method.
6. To demonstrate that water moves through the xylem.

Practical : 2 To Study principle and working method of ecological instruments.

1. Thermograph
2. Hygrograph
3. Anemometer
4. Rain gauge
5. Sling Psychrometer
6. Soil thermometer.

Practical : 3 To study ecological peculiarities of Orchid Root and Leaf.

Practical : 4 To study ecological peculiarities of Avicennia Root and Leaf.

Practical : 5 To study primary tissue structure in stem of Sunflower and Maize.

Practical : 6 To study anomalous secondary growth in Bignonia.

Practical : 7 To study anomalous secondary growth in Nyctanthus.

Practical : 8 To study anomalous secondary growth in Boerhaavia.

Practical : 9 To Study permanent slides of Anatomy.

1. Sunflower root T.S.
2. Maize root T.S.
3. Sunflower stem T.S.
4. Maize stem T.S.
5. Sunflower leaf T.S.
6. Maize leaf T.S.
7. Bignonia old stem T.S.
8. Boerhaavia old stem T.S.
9. Nyctanthus old stem T.S.
10. Dracina old stem T.S.

- Practical : 10 To Study permanent slides of Embryology.
1. T.S. of young anther
 2. T.S. of mature anther showing dehiscence
 3. Pollen tetrad
 4. Germination of pollen grain
 5. Pollinia
 6. L.S. of ovule showing megasporogenesis
- Practical : 11 (A) To study external morphology and anatomy of pinus needle (leaf).
(Preparation of slides from the fresh/Preserved material by the students)
(B) To Study permanent slides of Pinus.
1. Pinus young stem T.S.
 2. Pinus needle T.S.
 3. Pinus male cone T.S.
 4. Pinus male cone L.S.
 5. Pinus female cone T.S.
 6. Pinus female cone L.S.
- Practical : 12 (A) To study external morphology and anatomy of Gnetum.
{Preparation of slides from the fresh/Preserved material (twig, male cone and female cones) by the students}.
(B) To study Permanent slide of Gnetum.
1. Gnetum young stem T.S.
 2. Gnetum old stem T.S.
 3. Gnetum Leaf T.S.
 4. Gnetum male cone T.S.
 5. Gnetum male cone L.S.,
 6. Gnetum Female cone T.S.
 7. Gnetum Female cone L.S.
 8. Gnetum ovule L.S.
- Practical : 13 To study weak stem plants.
1. Creepers: Cynodon, Centella
 2. Trailers: Boerhaavia diffusa
 3. Twiners: Ipomea carica (Ipomea palmeta)
 4. Dolichos lablab
 5. Tendril climber: Passion flower, Vitis sp., Pisum Sp., Clemitis, Tropeolum, Gloriosa superb, Smilax, Antigonon
 6. Root climbers: Pothos
 7. Scramblers and hook climbers: Rose, Cane, Artobotrys, Zizyphus
 8. Adhesive climber: Ficus repens
- Practical : 14 To study Bracts.
1. Foliaceous- Adhatoda
 2. Petaliod- Bougainvillia
 3. Spathy- Colocasia
 4. Involucral -Halianthus/Tridex
 5. Scaly- Halianthus/Tridex (disk florets)
 6. Cupule- Hibiscus
 7. Glumes- Maize, grass
- Practical : 15 To study special types of inflorescence.
1. Hypanthodium: Ficus
 2. Cyathium: Euphorbia
 3. Coenanthium: Doerstanina
 4. Verticillaster: Ocimum

Practical : 16 To study defensive devices of plants.

1. Thorns- Carissa, Bougainvillea
2. Spines – Zizyphus, Accacia, Opuntia
3. Prickles- Rose, Smilax
4. Stinging hair- Urtica
5. Glandular hairs – Jatropha
6. Sticky latex – Euphorbia, Calotropis

Practical : 17 To Study Morphological characters, floral dissection, T.S. of Ovary and floral formulae of following families (any local plants of these family)

1. To study family Brassicaceae
2. To study family Papilionaceae
3. To study family Caesalpiniaceae
4. To study family Mimosaceae
5. To study family Rubiaceae
6. To study family Asclepiadaceae
7. To study family Euphorbiaceae
8. To study family Pontederiaceae

B.Sc. SEMESTER - IV BOTANY PAPER

- 401

BOT 401: Fungi & Algae

Unit - I Phytoplankton and Algae

- General characters, structure and importance of Phytoplankton
- Occurrence, general characters, thallus structure, economic importance of Algae
- Outline of algal classification given by G.M. Smith

Unit - II Life history of Algae

- Classification, occurrence, thallus & cell structure and reproduction of following algal genera:
 - (i) Oscillatoria
 - (ii) Oodogonium
 - (iii) Ectocarpus
 - (iv) Batrachospermum

Unit - III Fungi

- Occurrence, general characters, vegetative structure, economic importance of Fungi.
- Outline of fungal classification given by C.J. Alexopoulos.

Unit - IV Life history of Fungi

- Classification, occurrence, vegetative structure and reproduction of following fungal genera:
 - (i) Pythium
 - (ii) Aspergillus
 - (iii) Peziza
 - (iv) Puccinia

B.Sc. SEMESTER - IV
BOTANY PAPER
- 402

BOT 402 - Higher Gymnosperms

Unit - I Bryophytes

- General characters
- Classification
- General account of Hepaticopsida, Anthocerotopsida and Bryopsida
- Amphibian adaptation of Bryophytes
- Economic importance of Bryophytes
- Ecological aspects of Bryophyta

Unit - II Life history of following Bryophytes

- Classification and life history of following types.(except development)
 - (i) Riccia
 - (ii) Anthoceros

Unit - III Pteridophytes

- Habit and Habitate
- General characters
- Classification
- General account of Lycopsida, Sphenopsida, Pteropsida

Unit - IV Life history of following Pteridophytes

- Classification and life history of following types.(except development)
 - (i) Equisetum
 - (ii) Marsellia
 - (iii) Sellaginella

B.Sc. SEMESTER - IV BOTANY PAPER

- 403

BOT 403: Plant Geography, Economic Botany, Seed Plants and Plant Pathology

Unit - I Plant Geography

- Minor forest products of gujarat
- Cultivation of the following crops in relation to their origin, distribution, climate, soil, propagation, method of cultivation and uses.
(i) Wheat (ii) Lady's finger (iii) Chilly (iv) Rose

Unit - II Economic Botany

- Scientific name, family, parts used and medicinal uses of the following plants.
 - i.) Tylophora indica (Dam vel)
 - ii.) Hemidesmus indicus (Anant mool)
 - iii.) Achyranthes aspera (Aghedo)
 - iv.) Mucuna pruriens (Kavach)
 - v.) Aloe barbedense (Kuvarpathu)
 - vi.) Terminalia belerica (Behda)
 - vii.) Embelica officinalis (Ambla)
 - viii.) Centella asiatica (Bhrami)
 - ix.) Helicteres isora (Marda singh)
 - x.) Santalum album (Chandan)
- Rubber and its products :
Chemical properties, tapping, grading, packing, marketing and uses

Unit - III Seed plants

- Classification with reasons (according to Bentham and Hooker system), general and distinguishing characters and examples (scientific name) of important plants of the following families.
 - 1. Anonaceae
 - 2. Rosaceae
 - 3. Combretaceae
 - 4. Myrtaceae
 - 5. Asteraceae
 - 6. Loranthaceae
 - 7. Liliaceae
 - 8. Arecaceae

Unit - IV Plant pathology

- Pathogen (Scientific name) and symptoms of following diseases
- (a) Late blight of potato
 - (b) Tikka disease of ground nut
 - (c) White rust of Crucifer
 - (d) Red stripe of Sugarcane
 - (e) Soft rot of apple
 - (f) Tobacco Mosaic Virus (TMV)

B.Sc. SEMESTER - IV BOTANY
PRACTICAL - 404
(Effective from June 2019)

BOT - 404 :

- The candidates should study the typical vegetation in natural condition and should record their observation in journals. Excursion should be arranged during the year to local places.
- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically. At the end of the semester candidate shall produce certified journal during the practical examination.

- Practical : 1 To study thallus structure and hormogonia of algae *Oscillatoria*.
(Permanent slides of *Oscillatoria* thallus W.M.)
- Practical : 2 To study thallus structure, oogonium and antheridium of algae *Oodogonium*.
(Permanent slides of *Oodogonium* thallus W.M.; oogonium and antheridium.)
- Practical : 3 To study thallus structure, unilocular and plurilocular sporangium of algae *Ecocarpus*.
(permanent slides of *Ectocarpus* thallus W.M.; Unilocular sporangium, Plurilocular sporangium.)
- Practical : 4 To study thallus structure and cystocarp of algae *Batrachospermum*.
(Permanent slides of *Batrachospermum* thallus structure; cystocarp)
- Practical : 5 To study vegetative structure of fungi *Pythium*.
(Permanent slide of *Pythium* W.M.)
- Practical : 6 To study vegetative structure of fungi *Aspergillus*.
(Permanent slide of *Aspergillus* W.M.; Conidia)
- Practical : 7 To study structure of *Peziza*.
(Permanent slide of *Peziza* Apothecia V.M.)
- Practical : 8 To study the stages on wheat leaf (Uredospore and Teleuto spore)
(Permanent slide of Uredospore, Teleuto spore, Pycnidiospores, Aecidiospores)
- Practical : 9 To study external features of gametophytes, anatomy of thallus and sporophytes of *Anthoceros*.
(Permanent slides of *Anthoceros* thallus T.S., *Anthoceros* antheridia, *Anthoceros* archegonia, *Anthoceros* sporophyte)
- Practical : 10 To study external features of gametophytes, anatomy of thallus and sporophytes of *Riccia*.
(Permanent slides of *Riccia* thallus T.S., *Riccia* sporophyte).
- Practical : 11 To study external morphology, anatomy of internode of aerial stem and cone of *Equisetum*.
(Permanent slides of *Equisetum* stem T.S., *Equisetum* cone T.S. and L.S.)

- Practical : 12 To study external morphology and anatomy of Marsellia plant with structure of spore producing organs.
(Permanent slides of Marsellia stem T.S., petiole T.S., Sporocarp T.S. and L.S.)
- Practical : 13 To study external morphology of Selaginella and anatomical characters of stem, leaf and strobilus.
(Permanent slides of Root T.S., Leaf T.S., Stem T. S. Strobilus L.S., Microsporangium L.S. and Megasporangium L.S.)
- Practical : 14 To study following minor forest products.
- i. Gum (Acacia gum)
 - ii. Bidee wrappers (Diospyros sp.)
 - iii. Fiber (Jute)
 - iv. Match box
 - v. Paper
 - vi. Dye (Bixa orellana)
 - vii. Baj (Butea monosperma)
- Practical : 15 To study Botanical name, family, origin and distribution of the following.
- i. Wheat
 - ii. Lady's finger
 - iii. Chilly
 - iv. Rose
- Practical : 16 To study Scientific name, family, parts used and medicinal uses of the following plants.
- i.) Tylophora indica (Dam vel)
 - ii.) Hemidesmus indicus (Anant mool)
 - iii.) Achyranthes aspera (Aghedo)
 - iv.) Mucuna pruriens (Kavach)
 - v.) Aloe barbedense (Kuvarpathu)
 - vi.) Terminalia belerica (Behda)
 - vii.) Embelica officinalis (Ambla)
 - viii.) Centella asiatica (Bhrami)
 - ix.) Helicteres isora (Marda singh)
 - x.) Santalum album (Chandan)
- Practical : 17 To Study Morphological characters, floral dissection, T.S. of Ovary and floral formulae of following families (any local plants of these family)
1. To study family Anonaceae
 2. To study family Rosaceae
 3. To study family Combretaceae
 4. To study family Myrtaceae
 5. To study family Asteraceae
 6. To study family Loranthaceae
 7. To study family Liliaceae
 8. To study family Arecaceae

Practical : 18 To study Pathogen (Scientific name) and symptoms of following diseases.

- (a) Late blight of potato
- (b) Tikka disease of ground nut
- (c) White rust of Crucifer
- (d) Red stripe of Sugarcane
- (e) Soft rot of apple
- (f) Tobacco Mosaic Virus (TMV)

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17. A text book of Botany: The Algae by Brahma Prakash Pandey; Jai Prakash Nath and Co.
18. A class book of Algae by G.L. Chopra; S. Hagin and Co.
19. A text book on Algae by H.D. Kumar and H.S. Singh; East-west press.
20. Fungi, Bacteria and Viruses by H.C. Dube; Vikas publishing house
21. The fungi, bacteria and viruses by Lokendra Singh; Rastogi Publications
22. Botany [for degree students] Bryophyta by B.R. vashishta; S.Chand and Co.
23. Botany for degree students: Pteridophyta by P. C. Vasishta; S. Chand and Co (Pvt.) Ltd.
24. Plant Physiology by Taiz and ZeigerSinauer Associates inc. publishers
25. A text book of Plant Ecology R.S. Ambasht 1st Edi. 1969 Students friends & co., Varanasi
26. Plant Anatomy B.P. Pandey 1st Edi 1978 S. Chand & Company, New delhi.

27. Plant Physiology by Frank B. Salisbury.

28. Plant Pathology by R.S. Mahrotra

29. Economic Botany Albert F. Hill 2nd Edi. 1976 Tata McGRAW Hill, New Delhi

30. Plant pathology R.S. Mehrotra 4th Edi. 1987 Tata McGRAW Hill, New Delhi

31. A Brief Course in Algae K.P.Saxena 1965 Prakashan Kendra, Lucknow.

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B.Sc. SEMESTER - III
NUTRITION AND DIETETICS (I.D.)

Unit: 1 - Definition of Food, Nutrition And Nutrients.

- Function of Food, Classifications Food Groups, Importance of Food

Group and Nutritive Value of Food Groups. (i) Cereals, (ii) Pulses (iii) Fruits and Vegetables (iv) Milk (v) Sugar And Jaggery (vi) Fats and Oil.

- Concept of Balance Diet, use of food group in planning balance diet.
- Use of recommended dietary intake (RDIs) in planning balance diet, factors affecting RDIs.

Unit: 2

Macronutrients:

- Carbohydrate: Definition, sources, functions and deficiency symptoms.
- Protein: Definition, sources, functions and deficiency symptoms.
- Fat and lipids: Definition, sources, functions and deficiency symptoms.

Micronutrients:

- Vitamins: Definition, sources, functions and deficiency symptoms.
- Minerals: Definition, sources, functions and deficiency symptoms.
- Water: As a nutrient, requirements, and functions

Unit: 3 Food preservation -Introduction and Definition

- Importance and Principles of food preservation
- Methods for food preservation -Food spoilage.

Unit: 4 Meal planning Definition and principles

- Factors to be considered in meal planning,
- meal planning for School children, teen age and during travel,

B.Sc. SEMESTER - IV
BIODIVERSITY (I.D.)

Unit-1. - Introduction and scope of biodiversity.

- Importance and values of biodiversity.

Unit-2 - General pattern of vegetation of Gujarat.

- Deciduous forest. - Scrub forest
- Vegetation of ponds and ditches.
- Vegetation of river bank.
- Vegetation along Sea shore and saline ground.

Unit-3. - Conservation of biodiversity.

- Endangered, endemic, threatened and rare species of Gujarat and efforts for its conservation.

Unit-4. - Biodiversity of flora, fauna, mangroves and medicinal Plants of Gujarat.

- In-situ & Ex-situ conservation
- Biodiversity act.
- Biological hot-spots.

T.Y. B. Sc. Botany Syllabus (As per CBCS System)

Subject wise credit

SEM	Course	Paper No.	Hours/Week	Credit		Practical No.	Hours/Week	Credit
V	Core I	BOT 501	2	2		XI	2	2
		BOT 502	2	2			2	
		BOT 503	2	2		XII	2	2
		BOT 504	2	2			2	
		BOT 505	2	2		XIII	2	2
		BOT 506	2	2			2	
	F.C. (English)		3	2		-	-	-
	E.C. CAN	Horticulture	3	2		-	-	-
	NSS/NCC/Saptadhara		3	2		-	-	-
VI	Core I	BOT 601	2	2		XIV	2	2
		BOT 602	2	2			2	
		BOT 603	2	2		XV	2	2
		BOT 604	2	2			2	
		BOT 605	2	2		XVI	2	2
		BOT 606	2	2			2	
	F.C. (English)		3	2		-	-	-
	E.C. CAN	Gardening	3	2		-	-	-
	NSS/NCC/Saptadhara		3	2		-	-	-

T.Y. B. Sc. Botany Syllabus (As per CBCS System)

T.Y.B.Sc. (To be implemented from June-2013) Theory Courses			
Paper	Semester –V	Paper	Semester-VI
BOT-501	Algae and Fungi	BOT-601	Pteridophytes and Paleobotany
BOT-502	Plant Pathology and Bryophyte	BOT-602	Gymnosperms, Fossil Gymnosperms And Botanical Techniques
BOT-503	Plant Biotechnology, Biostatistics And Molecular Biology	BOT-603	Cell Biology And Genetics
BOT-504	Plant Physiology And Biochemistry	BOT-604	Plant Ecology And Phyto-Geography
BOT-505	Anatomy and Embryology	BOT-605	Economic Botany And Pharmacognosy
BOT-506	Elective Paper: Angiosperm Morphology Systematic Botany & Environmental Issue	BOT-606	Elective Paper: Angiosperm Taxonomy & Palynology
CAN	Horticulture	CAN	Gardening

Practicals based on theory papers-

Pra. XI	Algae, Fungi, Bryophyte & Plant Pathology	Pra. XIV	Pteridophytes, Gymnosperms, Paleobotany & Botanical Techniques
Pra. XII	Plant Physiology, Biochemistry & Embryology	Pra. XV	Plant Ecology, Phyto-Geography, Cell Biology And Genetics
Pra. XIII	Angiosperm & Anatomy	Pra. XVI	Economic Botany, Pharmacognosy, Palynology & Angiosperm Taxonomy

T.Y.B.Sc.
SEMESTER V
BOTANY

T.Y. B. SC. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-V

BOTANY PAPER-501

BOT-501: ALGAE AND FUNGI

UNIT-1

General introduction of Algae

- Habit and habitat
- Thallus organization
- Classification according to Smith, General characters, structure and reproduction of the following classes:

- I. Cyanophyta**
- II. Chlorophyta**
- III. Phaeophyta**
- IV. Rhodophyta**

UNIT-2

Life History of Algae

- Life history of the following types on the basis of their classification with reasons, occurrence, thallus structure, cell structure and reproduction (Excluding development)

- I. Cyanophyceae - *Rivularia* & *Tolypothrix***
- II. Chlorophyceae- *Volvox* & *Chara***
- III. Phaeophyceae - *Sargassum***
- IV. Phodophyceae- *Polysiphonia***
- V. Bacillariophyceae- *Navicula***

UNIT-3

General introduction of Fungi

- Classification (Aim worth), and general characters of fungi
- Habitat, thallus, cell-structure, Nutrition, growth and reproduction in division Eumycota

UNIT-4

Life history of Fungi

- Life history of the following types on the basis of their classification with reasons, occurrence, vegetative structure and reproduction (Excluding development).

I. Mastigomycotina- *Albugo*

II. Zygomycotina- *Pilobolus*

III. Ascomycotina- *Penicillium*

IV. Basidiomycotina- *Agaricus*

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)
SEMESTER-V
BOTANY PAPER-502
BOT-502 PLANT PATHOLOGY AND BRYOPHYTE

UNIT-1

Plant Pathology

- Introduction & History of Plant Pathology
- Indian Plant Pathologist
- Reasons for plant diseases
- Origin of plant diseases
- Identification and characters of plant diseases
- Principles of control of plant diseases
- Fungicides
- Biopesticides

UNIT-2

Plant diseases according to plant pathogen

- **Bacterial diseases**
 - Wilt disease of potato
 - Leaf spot of mango
- **Fungal diseases**
 - Tikka disease of groundnut
 - Wilt of cotton
 - Powdery mildew of barley
 - Blast disease of Rice

- **Viral diseases**
 - Leaf curl of papaya
 - Yellow vein disease of Bhindi
 - Bunchy top banana

UNIT-3

General accounts of Bryophytes

- Amphibian adaptation of Bryophytes
- General characters and Classification
- General account of Hepaticopsida, Anthocerotopsida, Bryopsida
- Ecological aspects of Bryophyta
- Economic importance of Bryophytes

UNIT-4

Life History of Bryophytes

- Classification, life history of the following types (Excluding development)

- I. Hepaticopsida : Marchentia and Porella***
- II. Anthocerotopsida: Notothylus***
- III. Bryopsida: Sphagnum***

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)
SEMESTER-V
BOTANY PAPER-503
BOT: 503- PLANT BIOTECHNOLOGY, BIOSTATISTICS AND
MOLECULAR BIOLOGY

UNIT-1

Molecular Biology

- r-DNA methods- Merits, Demerits and Application
- Restriction endonuclease and Ligase
- Cloning vectors
- DNA- Finger printing
- PCR (Polymerize Chain Reaction)

UNIT-2

Plant Biotechnology-I

- Definition, History and Importance of Biotechnology
- Somatic Hybridization
- Artificial seed
- Anther culture
- Embryo culture

UNIT-3

Plant Biotechnology-II

- Clonal Propagation
- Genetic engineering of plant

- Genetic manipulation in plant cell
- Uses of biotechnology

UNIT-4

Biostatistics

- History of Biostatistics
- Definition, function and limitation of Biostatistics
- Importance of statistical methods in Biology
- Classification: Meaning, Important characters and types
- Measure of Central Tendency
 - Meaning
 - Characters
 - Mean, Mode and Median
- Standard deviation

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)
SEMESTER-V
BOTANY PAPER-504
BOT: 504- PLANT PHYSIOLOGY AND BIOCHEMISTRY

UNIT-1

Plant Physiology-I

- Diffusion, Osmosis, Plasmolysis
- Absorption- Active and Passive
- Ascent of sap- Including theories
- Translocation- Upward, downward and lateral
- Photosynthesis
- Respiration

UNIT-2

Plant Physiology-II

- Growth
- Mineral nutrition
- Plant growth substance
 - **Growth promoter- Auxin, Gibberellins and Cytokinin**
 - **Growth retardant- ABA and Ethylene**

UNIT-3

Physiological instrument

- I. Isotop
- II. Colorimeter
- III. Spectrophotometer

- IV. Ultracentrifuge
- V. pH Meter
 - Chromatography

UNIT-4

Biochemistry

- pH and Buffer
- Solution and colloidal system
- Protoplasm as a colloidal system
- **Enzymes**
 - Definition, Classification, properties
 - Factor affecting rate of enzymatic activities and mechanism of enzyme action.
- **Amino acids**
- **Carbohydrate**

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-V

BOTANY PAPER-505

BOT: 505- ANATOMY AND EMBRYOLOGY

UNIT-1

Plant Anatomy-I

- Laticiferous tissues
 - Introduction, Latex cells- Structure and function
 - Articulated laticifers
- Root- stem transition
- Vascular cambium
 - General development and Structure of the vascular cambium
 - Types of cambium
 - Seasonal activity of cambium
- Nodal anatomy

UNIT-2

Plant Anatomy-II

- Periderm- Origin, Structure and Function
- Lenticell
- Leaf abscission
- Anomalous Secondary Growth
 - **Stem:-** Bouganvilliea, Mirabilis, Tinospora
 - **Root:-** Radish, Beet

UNIT-3

Embryology-I

- Megasporogenesis
- Types of embryo sacs
- **Monosporic (Polygonum- eight nucleated types)**
- **Bisporic (Allium-Eight nucleated types)**
- **Tetrasporic (Fritillaria- Eight nucleated types)**
- Fertilization (Double fertilization) and Significance of double fertilization
- Endosperm

UNIT-4

Embryology-I

- Embryo
- Embryogenesis in Dicot (Nicotiana)
- Embryogenesis in Monocot (Poa)
- Nutrition of embryo
- Polyembryony
 - Types (Factor for polyembryony),
 - Causes of polyembryony,
 - Experimental induction of polyembryony,
 - Classification of polyembryony
 - Practical value of polyembryony

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)
SEMESTER-V
BOTANY PAPER-506
BOT: 506- ELECTIVE PAPER
ANGIOSPERM MORPHOLOGY, SYSTEMIC BOTANY AND
ENVIRONMENTAL ISSUES

UNIT-1

Plant Morphology

- Leaf: Shape, margin, apex of lamina
- Calyx: Modification of Calyx
- Corolla: Form of corolla
- Seed
- Apiphyte, Parasite and Saprophyte

UNIT-2

Introduction of Plant Taxonomy

- History of Taxonomy
- Types of classification: Natural, Artificial and Phylogenetical
- Fundamentals of nomenclature
- Definition, need for nomenclature, common name and scientific name
- Binomial nomenclature and ICBN

UNIT-3

Angiosperm Families

- Taxonomical studies of the following families with references to their geographical distribution, systematic position, floral variations and economic importance.

- | | |
|---------------------|-------------------|
| I. Ranunculaceae | VIII. Acanthaceae |
| II. Annonaceae | IX. Polygonaceae |
| III. Menispermaceae | X. Loranthaceae |
| IV. Tiliaceae | XI. Musaceae |
| V. Vitaceae | XII. Poaceae |
| VI. Apiaceae | |
| VII. Sapotaceae | |

UNIT-4

Environmental Issue

- Global warming
- Greenhouse effects
- Ozon depletion
- Acid rain
- Environmental act: Environmental protection act, The air act, The water act, Wildlife protection act, forest conservation act
- Plant and pollution control

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-V

CAN SUBJECT : HORTICULTURE

Unit-1

Introduction of Horticulture

- Definition, Aims, Branches and importance of horticulture
- Propagation Methods
 - Cutting
 - Layering
 - Through Specialized structures (Corm, Rhizome, bulb, tuber, runner, sucker)
 - Budding,
 - Grafting

Unit-2

Preservation

- Definition, principles, different methods of preservation and storage of fruits and vegetables.
- Preparation of Jam, Jelly and Sauce.
- Causes of spoilage of fruits
- Role of Hormones in Horticulture

Unit-3

Cultivation of Fruit plants

- Cultivation of following fruit crops with reference to their origin, distribution, climate, soil, propagation, method of cultivation, harvesting and at least three varieties of each crop

- | | |
|-------------|------------|
| I. Mango | V. Coconut |
| II. Banana | VI. Lemon |
| III. Sapota | VII. Guava |
| IV. Papaya | |

Unit-4

Cultivation of Vegetable plants

- Cultivation of following vegetable crops with reference to their origin, distribution, climate, soil, propagation, method of cultivation, harvesting and at least three varieties of each crop

- | | |
|-------------------|-------------|
| I. Carrot | V. Cucumber |
| II. Potato | VI. Cabbage |
| III. Brinjal | VII. Methi |
| IV. Lady's finger | |

T.Y. B. SC. BOTANY Practical SYLLABUS (AS PER CBCS)

SEMESTER-V

BOT PRA. XI : Algae, Fungi, Bryophyte & Plant Pathology

(A) ALGAE :

(1) *Rivularia* :

To study the thallus structure and heterocyst.

(2) *Tolypothrix* :

To study the thallus structure.

(3) *Volvox* :

To study the Volvox colony.

(4) *Chara* :

To study the specimen of Chara, T.S. of the main axis and Sex organs.

(5) *Sargassum* :

To study the plants of Sargassum, Anatomy of main axis, leaf and air bladder.

(6) *Polysiphonia* :

To study the thallus structure and cystocarp.

(To study the permanent slides of the above types.)

(B) FUNGI :

(1) *Albugo* :

To study vegetative structure.

(Permanent slide of Albugo conidia, Reproductive organs and Oospores.)

(2) *Pilobolus*:

To study vegetative structure.

(Permanent slide of *Pilobolus* WM, Reproductive organs)

(3) *Penicillium* :

To study the vegetative structure and Conidiophores.

(Permanent slide of *Penicillium* vegetative Conidiophores with conidia.)

(4) *Agaricus* :

To study the Basidiocarp.

(Permanent slide of T.S. of Stipe, T.S. of Pileus, Button stage v.s. of Agaricus.)

(C) BRYOPHYTA :

(1) *Marchentia*

To study the external morphology of *Marchentia* plant.

(Permanent slide of *Marchentia* veg., W.M. and L.S. of sporophyte.)

(2) *Porella* :

To study the external morphology of *Porella* plant.

(Permanent slide of *Porella* veg. W.M. and L.S. of sporophyte.)

(2) *Nothothylus* :

To study the external morphology of *Nothothylus* plant.

(Permanent slide of *Nothothylus* W.M. and L.S. of sporophyte.)

(3) *Sphagnum* :

To study the external morphology of *Sphagnum*.

(Permanent slide of *Sphagnum* W.M. and L.S. of sporophyte.)

(D) PLANT DISEASES :

Casual organism and Symptoms of following plant diseases.

- Bacterial diseases

- Wilt disease of potato
- Leaf spot of mango

- Fungal diseases

- Tikka disease of groundnut
- Wilt of cotton
- Powdery mildew of barley
- Blast disease of Rice

- Viral diseases

- Leaf curl of papaya
- Yellow vein disease of Bhindi
- Bunchy top banana

T.Y. B. SC. BOTANY Practical SYLLABUS (AS PER CBCS)

SEMESTER-V

BOT PRA. XII : Plant Physiology, Biochemistry & Embryology

(A) PHYSIOLOGY :

Following physiological experiments are to be set up by the student.

(Requirements to be submitted by the students.)

- (1) To find out rate of photosynthesis by bubble counting method.
- (2) To find out effect of CO_2 concentration on rate of Photosynthesis.
- (3) To find out effect of light intensity on the rate of Photosynthesis.
- (4) Experiments on enzyme action:
 - (i) Amylase (ii) Invertase.
- (5) To study the activity of enzyme Urease and the factors effecting the activity.
(Concentration and Time)
- (6) Estimation of total sugar and reducible sugar.
- (7) Separation of amino acids by paper chromatography.
- (8) Uses of colorimeter and PH meter.
- (9) Estimation of Amino acid by Colorimetric method.
- (10) Estimation of Phosphorus by Colorimetric method.
- (11) Estimation of Ethyl acetate.

(B) Following physiological experiments are for demonstration only.

- (1) Experiment to demonstrate the process of transpiration.
- (2) Demonstration of the stomatal transpiration by four leaves method.
- (3) To demonstrate that oxygen is used during respiration.
- (4) To measure the growth rate by lever auxanometer.
- (5) To demonstrate that separation of chloroplast pigments by thin layer Chromatography.

(C) PHYSIOLOGICAL INSTRUMENTS:

Study of physiological instruments:

- (i) Colorimeter (ii) Spectrometer
- (iii) ultracentrifuge (iv) pH meter.

(D) BIOCHEMISTRY:

- **Test for reducing sugar**
 - Fehling's test
 - Benedict's test
 - Barfoed's test
 - Trommer's test
 - Moore's test
- **Test for non- reducing sugar**
 - Fehling's test
 - Benedict's test
- **Test for Amino acid**
 - Ninhydrin test
 - Test for Tyrosine
 - Test for tryptophan
 - Test for Cysteine

(E) EMBRYOLOGY:

(1) Embryo mounting in any available dicot plant.

(2) Permanent slide of the following:

(a) EMBRYOLOGICAL STAGES:

- (i) T.S. of Anther Showing Four Mature Pollen Sacs
- (ii) T.S. of Mature Anther Showing Dehiscence
- (iii) Pollen Tetrads
- (iv) Pollinia
- (v) Germination of Pollengrain.

(b) Megasporangium:

- (i) Two celled stage of Megaspore Mother Cell
- (ii) Ovule with Binucleate Embryo-sac
- (iii) Ovule with 4-nucleate Embryo-sac
- (iv) Ovule with 8-nucleate Embryo-sac

(c) Embryo:

- (i) Globular embryo
- (ii) Heart-shaped embryo
- (iii) Mature embryo

T.Y. B. SC. BOTANY Practical SYLLABUS (AS PER CBCS)

SEMESTER-V

BOT PRA. XIII : Angiosperm & Anatomy

(A) ANGIOSPERM:

(a) Leaf Shape:

- Linear : *Grasses*
- Lanceolate: *Nerium*
- Elliptical: *Guava*
- Ovate: *China rose*
- Obovate: leaflet of *Cassia obtusifolia*
- Oblong: *Banana*
- Reniform: *Centilla asiatica*
- Cordate: *Betel*
- Sagittate: *Sagittaria sagittifolia*

(b) Leaf margin:

- Entire: *Mango*
- Sinuate: *Polyalthia*
- Serrate: *China rose*
- Dentate: *Melon*
- Denticulate: *Coccinia cordifolia*
- Lobed: *Ranunculus*

(c) In taxonomic studies of angiosperms, plants available in the local area should be given.

- (i) Ranunculaceae
- (ii) Annonaceae
- (iii) Menispermaceae
- (iv) Tiliaceae
- (v) Vitaceae

- (vi) Apiaceae
- (vii) Sapotaceae
- (viii) Acanthaceae
- (ix) Polygonaceae
- (x) Loranthaceae
- Xi) Musaceae
- (xii) Poaceae

(B) ANATOMY :

- (1) T.S. of the following stem for anomalous secondary growth.
 - (i) *Bougainvillea*, (ii) *Mirabilis*, (iii) *Tinospora*.
 - Permanent slide: (i) *Bougainvillea* stem T.S. (ii) *Mirabilis* stem T.S.
 - (iii) *Tinospora* stem T.S.
- (2) T.S. of the following root for anomalous secondary growth.
 - (i) Beet (ii) Radish (iii) Carrot
 - Permanent slide: (i) Beet root T.S. (ii) Radish root T.S.
 - (iii) Carrot root T.S.
- (3) Preparation of permanent slide. (Safranin - Fast Green Combination)
- (4) To measure the dimensions of common microorganisms by calibration and standardization of microscope using stage micrometer and ocular micrometer.
- (5) Measurement of microscopic structure and sketching with camera lucida.
- (6) Permanent slide of the following :
 - (i) Laticiferous tissue
 - (ii) Periderm
 - (iii) Lenticell
 - (iv) Leaf fall
 - (v) Latex cell.
- (7) Preparation of slides for nodal anatomy.
 - (i) Unilacunar
 - (ii) Trilocular.

X_____X_____X_____X_____X_____X_____X_____X_____X

T.Y.B.Sc.
SEMESTER VI
BOTANY

VEER NARMAD SOUTH GUJARAT, UNIVERSITY, SURAT

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

EFFECTIVE FROM JUNE-2013

SEMESTER-VI

BOTANY PAPER-601

BOT: 601- PTERIDOPHYTES AND PALEOBOTANY

UNIT-1

General introduction of Pteridophyte

- General character of pteridophytes
- Classification of pteridophytes according to G.M. Smith and Riemers
- General character of following classes
 - I. Psilophytopsida**
 - II. Psilotopsida**
 - III. Lycopsidea**
 - IV. Sphenopsida**
 - V. Pteropsida**
- Habit and Habitat, body structure, internal characters, Reproduction, Gamatophytic phase and Alternation of generation in pteridophytes

UNIT-2

Life History of Pteridophyte

Classification and life history of following types

- I. Lycopsidea- Selagenella***
- II. Pteropsida- Ophioglossum and Azolla***

UNIT-3

Paleobotany

- Introduction
- Fossilization and types of fossils
- Nomenclature of fossils
- Geological time table

UNIT-4

Life History of Pteridophyte

Classification and life history of the following types (Excluding development)

- I. Psilophytopsida- Rhynia***
- II. Psilotopsida- Psilotum***
- III. Lycopside- Lepidodendron***
- IV. Sphenopsida- Sphenophyllum***

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PAPER-602

**BOT: 602- GYMNOSPERM, FOSSIL GYMNOSPERM AND BOTANICAL
TECHNIQUES**

UNIT-1

Gymnosperm-I

- Introduction and General characters of
- Affinities of gymnosperm with pteridophytes and angiosperm
- Classification and importance characters of following orders

- | | |
|---------------------------|-----------------------|
| I. Cycadofilicales | V. Coniferales |
| II. Bennettitales | VI. Ginkgoales |
| III. Cycadales | VII. Gnetales |
| IV. Corditales | |

UNIT-2

Gymnosperm-II

- Classification and life histories of following types (Excluding development)
- I. Taxus***
 - II. Ginkgo***
 - III. Ephedra***

UNIT-3

Fossil Botany

General accounts of following types

- I. Cycadofilicales- Lyginopteris***
- II. Cycadeoidales- Cycadeoidea***
- III. Corditales- Cordaites***

UNIT-4

Botanical techniques

- **Herbarium techniques**
 - Introduction
 - Field and collection techniques
 - Function of herbaria
- **Micro techniques**
 - Fixative and fixation
 - Dehydration
 - Infiltration
 - Microtomy
 - Stains
- **Whole mount of minute object**
- **Camera lucida**

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PAPER-603

BOT: 603- CELL BIOLOGY AND GENETICS

UNIT-1

Cell Biology-I

- Ultra structure and function of following organelles

- | | |
|-------------------|--------------------------------|
| I. Cell-wall | V. Lysosomes |
| II. Chromosomes | VI. ER (Endoplasmic reticulum) |
| III. Ribosome | VII. Nucleus |
| IV. Golgi complex | |

UNIT-2

Cell Biology-II

- Cell-cycle
- Mitosis
- Meiosis

UNIT-3

Genetics- I

- Nucleic acids
- Introduction
- Structure and types of DNA and RNA
- DNA- Replication
- Transformation and transduction

UNIT-4

Genetics-II

- Genetic code
- Mutation
- Lac-operan
- Chromosomal aberrations
- Protein synthesis (Transcription and translation)

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)
SEMESTER-VI
BOTANY PAPER-604
BOT: 604- PLANT ECOLOGY AND PHYTO-GEOGRAPHY

UNIT-1

Ecology

- Introduction, Definition and Brief account of ecological factor.
- Soil as an Edaphic factor
 - Composition of soil
 - Origin and development of soil
 - Soil moisture
 - Soil profile
- Biotic factor- Relationship among the organisms

UNIT-2

Plant community

- Definition, Characteristics and classification of plant community
- Characters of plant community (Analytical and Synthetical)
- Ecological niche
- Methods of studying vegetation
 - Quadrature
 - Transect

UNIT-3

Plant succession

- Definition and Causes of succession
- Process in succession
- Kinds of succession
- Rate of succession
- Limiting factors and trend in succession
- Hydrosere and xerosere

UNIT-4

Phyto-geography

- Forest vegetation of Gujarat
- Mangrove vegetation
- Desert of Gujarat
- Vegetation types of Himalaya
- Remote sensing
- Biological clock or Ecological clock

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PAPER-605

BOT: 605- ECONOMIC BOTANY AND PHARMACOGNOSY

UNIT-1

Plants and their utilization

- Fibers
 - Introduction and classification of fibers
 - Plant fibers: Cotton, Jute and Coir
- Timber and firewood species
 - Definition and properties of wood
 - Types of wood
 - Uses of wood
- Distribution, botanical name, family and uses of following timber and firewood plants

I. <i>Accacia nilotica</i>	V. <i>Anogeissus letifolia</i>
II. <i>Azadirachta indica</i>	VI. <i>Dalbergia latifolia</i>
III. <i>Gmelina arborea</i>	VII. <i>Mitragyna pervifolia</i>
IV. <i>Tectona grandis</i>	VIII. <i>Terminalia chruulata</i>

UNIT-2

Beverages and Beverage plants

- Classification of Beverage plants
- Origin, Botanical description, cultivation, preparation and uses of following beverage plants
 - **Non Alcoholic Beverages:- Tea, Coffee and Cocoa & Chocolate**
 - **Alcoholic Beverages:- Wine, Beer and Tadi**

UNIT-3

Introduction of Pharmacognocny

- Evaluation of drugs by following methods
 - Organoleptic evaluation

- Microscopic evaluation
- Biological evaluation
- Chemical evaluation
- Physical evaluation
- Classification of drugs
 - Classification of drug on the basis of Taxonomy
 - Classification of drug on the basis of Chemical present
 - Classification of drug on the basis of mode of action

UNIT-4

Plant drugs

- Drugs obtained from root: Cochicum
- Drugs obtained from bark: Holarrhena
- Drugs obtained from leaves: Adhatoda
- Drugs obtained from fruits: Dill (Sowa) and Poppy
- Drugs obtained from seeds: Nux vomica
- Underground drugs: Gum and Aloes

Medicinal Plants

- Scientific name, family, distribution, parts used and uses of following medicinal plants

I. *Agele marmelos*

II. *Cassia tora*

**III. *Trigonella foenum-
graecum***

**IV. *Andrographis
peniculata***

V. *Aristolochia bracteolate*

VI. *Enicostema axillare*

VII. *Rauwolfia serpentine*

VIII. *Withania somnifera*

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PAPER-606

BOT: 606- ELECTIVE PAPER- TAXONOMY AND PALYNOLOGY

UNIT-1

Botanical garden

- Aims of Botanical garden
- Prerequisite of Botanical garden
- Various Botanical gardens of World and India
 - Royal Botanical Garden - Kew
 - New York Botanical Garden- New York
 - Indian Botanical Garden-Calcutta
 - Loyd Botanical Garden- Darjeeling

BSI (Botanical Survey of India)

- Introduction and main objectives of BSI

UNIT-2

Major system of classification of following Botanist and its merits and demerits

- ▶ Angler and Prantl
- ▶ John Hutchinson
- ▶ Bessey

UNIT-3

Angiosperm Families

- Taxonomical studies of the following families with references to their geographical distribution, systematic position, floral variations and economic importance.

I. Papavaraceae	VII. Lythraceae	XII. (12)
II. Portulacaceae	VIII. Oliaceae	Hydrocheritacea
III. Rutaceae	IX. Boraginaceae	e
IV. Rhamnaceae	X. Basalaceae	XIII. (13)Orchidacea
V. Sepindaceae	XI. (11)Casuranace	e
VI. Anacardiaceae	ae	

UNIT-4

Palynology

- Introduction
- Pollen morphology
- Ancient applied aspects of palynology
- Importance of pollen: In food, In medicine, In agriculture and In breeding
- Pollen allergy: Diseases, allergens and control

T.Y. B. Sc. BOTANY SYLLABUS (AS PER CBCS)

SEMESTER-VI

CAN SUBJECT : GARDENING

Unit-1

- **Soil :-** Definition, types, components and merits of soil analysis
- **Land scaping**
- **Garden:-** Definition and types of garden, Lawn, Kitchen garden

Unit-2

- **Plough:-** Definition, care taken during plough and merits
- **Manure:-** Organic manure, fertilizer, vermicompost
- **Irrigation:-** Definition, types and importance

Unit-3

- **Pruning:-** Definition, principles, aims, effect on growth and care taken during pruning
- **Framing:-** Definition, types and importance of framing
- **Fencing:-** Definition, types of fencing i.e thorny, wall, wire, wind breaker and importance of fencing

Unit-4

- **Flower arrangement:** Flower and flower arrangement, Importance of flower in home decoration, Types and principles of flower arrangement, Law of flower arrangement, Selection of flower vase, flower and place of arrangement
- **Cultivation of following flowering plants**
 - I. Rose
 - II. Marigold
 - III. Gerbera
 - IV. Crinum
 - V. Chrysanthemum

T.Y. B. Sc. BOTANY PRACTICAL SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PRACTICAL –XIV

Pteridophytes, Gymnosperms, Paleobotany and Botanical Techniques

(A) Pteridophytes

(1) Selaginella

To study the external morphology of *Selaginella* and anatomical characters of stem, leaf and strobilus

(Permanent slides of Root T.S., Leaf T.S., Stem T. S. Strobilus L.S., Microsporangium L.S. and Megasporangium L.S.)

(2) Ophioglossum

To study the external morphology of *Ophioglossum* anatomical characters of stem, leaf and Fertile Spike of *Ophioglossum*

(Permanent slide of *Ophioglossum* stem T. S. and *Ophioglossum* Spike L.S.)

(3) Azolla

To study the external morphology of *Azolla* plant with spore producing organs, anatomy of stem and sporocarp (Permanent slide of *Azolla* stem T.S., Sporocarp T.S. and L.S.)

(B) Fossil Pteridophytes

To study following Fossil Slides

(1) Rhynia: (I) T.S. of stem

(2) Lepidodendron

(I) T.S. of *Lepidodendron* Stem (II) T.S. of *Lepidophyllum* (III) L.S. of *Lepidostrobus* (IV) T.S. of *Stigmaria* rootlet (V) T.S. of *Stigmaria* rootlet with secondary xylem.

(3) Sphenophyllum: (I) T.S. of *Sphenophyllum* Stem (II) T.S. of *Bowmanites*

(4) *Calamites* : (I) T.S of *Calamites* stem

To study following Fossil Stone

(I) *Calamites* stem and *Annularia*

(C) Gymnosperms

(1) *Taxus*

To study the external morphology of *Taxus* stem, leaf and cone (Permanent slide of *Taxus* Stem T.S., Wood T.S., Leaf T.S., Female cone T.S. and Male cone T.S.)

(2) *Ginkgo*

To study the external morphology of *Ginkgo* Stem, Leaf and Cone

(3) *Ephedra*:

To study the external morphology of *Ephedra* Stem and male and female cone (Permanent slide of *Ephedra* stem and root T.S., male and female cone L.S.)

(D) Fossil Gymnosperms

To study following Fossil Slides

(I) *Lyginopteris* Stem T.S.

(II) *Laglnostoma* L.S.

(III) *Cordaitea* root T.S.

(IV) *Cordaitea* leaf T.S.

To study following Fossil Stone

(I) *Cordaitea* leaf

(II) *Pterophyllum*

T.Y. B. Sc. BOTANY PRACTICAL SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PRACTICAL –XV

Plant Ecology, Phyto-Geography, Cell Biology

Plant Ecology

- (A) To study communities by quadrat method and to determine % Frequency, Density and Abundance.
- (B) To study the biotic components of a pond ecosystem.
- (C) Following ecological experiments are to be set up by the student.
(Requirements to be submitted by the students.)
 - (1) To determine the amount of dissolved oxygen in the pond water.
 - (2) To determine the total dissolved solids (TDS) in water.
 - (3) To determine the amount of chlorides in the water.
 - (4) To find out the moisture percentage of the soil.
 - (5) To find out the total hardness of the water.
 - (6) To determine the amount of calcium in the water.
 - (7) To determine the amount of magnesium in the water.
 - (8) To determine the amount of total alkalinity in the water.

(A) Study of ecological Instruments

- (1) Psychrometer
- (2) Prismatic compass
- (3) Rain gauge
- (4) Soil thermometer

(C) Cytology

- (1) To study the mitosis by preparing squash of onion root tip.
- (2) To study the meiosis by preparing slide of *Aloe vera* Anther

To study different stages of Mitosis and Meiosis by Chart/ Permanent Slides/ Model.

T.Y. B. Sc. BOTANY PRACTICAL SYLLABUS (AS PER CBCS)

SEMESTER-VI

BOTANY PRACTICAL –XVI

Economic Botany, Pharmacognosy and Angiosperm Taxonomy

(A) Economic Botany

(1) Fibers :

Distribution, Botanical name, Family and uses of following.

(I) Cotton (II) Jute (III) Coir

(2) Timber:

Botanical name, family and uses of following :

(I) *Accacia nilotica* (II) *Anogessus latifolia*

(III) *Azadirechta indica* (IV) *Dalbergia latifolia*

(V) *Gmelina arborea* (VI) *Mitragyna parvifolia*

(VII) *Tectona grandis* (VIII) *Terminalia chrunulata*

(3)Beverages:

Distribution, Botanical name, Family and uses of following beverages

(I) Tea (II) Coffee (III) Cocoa

(B) Pharmacognosy:

Botanical name, Family, plant part used and uses of following plant drugs

(I) Colchicum (II) Holarrhena (III) Adhatoda

(IV) Dill (V) Poppy (VI) Nux vomica

(C) Medicinal Plant:

Scientific name, family and uses of following medicinal plants

- | | |
|--|-------------------------------------|
| (I) <i>Agele marmelos</i> | (II) <i>Cassia tora</i> |
| (III) <i>Trigonella foenum-graecum</i> | (IV) <i>Andrographis peniculata</i> |
| (VI) <i>Aristolochia bracteolate</i> | (VI) <i>Enicostema axillare</i> |
| (VII) <i>Raulfia serpentina</i> | (VII) <i>Withania somnifera</i> |

(E) Angiosperm Taxonomy:

In taxonomic studies of angiosperms, plants available in the local area should be given

- | | | |
|---------------------------|-------------------------------|---------------------------|
| (I) Papavaraceae | (VII) Lythraceae | (XIII) Orchidaceae |
| (II) Portulacaceae | (VIII) Oliaceae | |
| (III) Rutaceae | (IX) Boraginaceae | |
| (IV) Rhamnaceae | (X) Basalaceae | |
| (V) Sepindaceae | (XI) Casuranaceae | |
| (VI) Anacardiaceae | (XII) Hydrocheritaceae | |

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B. Sc.

Mathematics

Mathematics	
Program Out Come	Mathematical abilities and knowledge are valued for their intrinsic beauty, efficacy in developing analytical thinking skills, and application in modelling and addressing real-world situations. Students must constantly develop and practise their analytical talents in order to responsibly live within and contribute in the transformation of a rapidly changing, complicated, and interdependent society. Students who have learned to logically question assertions, recognise patterns, and distinguish the essential and irrelevant aspects of problems can think deeply and precisely, nurture the fruits of their imagination into reality, and share their ideas and insights while seeking and benefiting from the knowledge and insights of others can think deeply and precisely, nurture the products of their imagination into reality, and share their ideas and insights while seeking and benefiting from the knowledge. B.Sc (Mathematics) Programme students will be able to -Demonstrate the value of mathematics by investigating real-world situations and learning how to apply mathematical concepts and models to them. - Recognize the types of abstract mathematical problems and solve them, as well as provide geometrical interpretations of various notions. - Recognize mathematical links across diverse subjects. - Research and apply mathematical problems and answers in a range of situations in science, technology, commerce, and industry, and depict these results using symbolic, quantitative, or graphical approaches. -Appreciate the value of abstraction and generalisation, and do investigative mathematical work with independent judges. -Conduct self-evaluation and lifelong learning to continue to enrich them
Programe Specific Outcome	-Assist students in improving their soft skills and computing abilities. -Enable pupils to acquire knowledge of numerous ideas involved in single-variable functions. -Enable pupils to get understanding of various Calculus and geometry ideas.

Course Outcomes

B.Sc.(MATHEMATICS)

Semester: I,II

Semester	Paper	Title of the Paper	Hours	Credit	Marks
I	MTH-101	Mathematics-I	3	3	70 (20 Internal + 50 External)
	MTH-102	Mathematics-II	3	3	
II	MTH-201	Mathematics-III	3	3	
	MTH-202	Mathematics-IV	3	3	

B.Sc.(MATHEMATICS)

SEMESTER –I

MTH-101

MATHEMATICS-I

Unit –I

De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments.

Unit-II

Euler's expressions, Evaluation of Indeterminate forms by using Euler's expressions, Hyperbolic functions for real arguments and their inverses.

Unit-III

Exponential, Circular and Hyperbolic functions for complex variables and their identities, Euler's Theorem, Relations between circular and Hyperbolic functions.

Unit-IV

Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.

The course is covered by the following reference books:

1. S. L. Loney: Plane Trigonometry, Part I and II, Mc Millan and Co. London.
2. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. E. Kreyszig: Advanced Engineering Mathematics, Wiley India Pvt. Ltd.
4. N.P.Bhamore and et al: College Aadhunik Ganit shastra, Popular Prakashan, Surat

B.Sc. (MATHEMATICS)

SEMESTER –I

MTH-102

MATHEMATICS-II

Unit –I

Successive differentiation, Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions), Leibnitz theorem and its applications

Unit-II

Rolle's Theorems and its geometrical interpretation, Lagrange's Theorem and its geometrical interpretation, Cauchy theorem, Maclaurin and Taylor series expansions

Unit-III

Curvature and radius of curvature (except Polar form), Increasing and Decreasing functions, Asymptotes, Concavity and Convexity

Unit-IV

Reduction formulae for integration of

$\sin^n x, \cos^n x, \tan^n x, \cot^n x, \operatorname{cosec}^n x, \sin^p x \cos^q x, x^m \cos nx, x^m \sin nx$

The course is covered by the following reference books:

1. Shantinayakan: Differential Calculus, Revised Edition December-2004 , S. Chand and Co. New Delhi.
2. Shantinayakan: Integral Calculus, S. Chand and Co. New Delhi.
3. Gorakhprasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad.
5. M. R. Spiegel: Theory and Problems of Advanced Calculus, Schaum's Publishing Co., New York.
6. N. P. Bhamore and et al: College Aadhunik Ganit shastra, Popular Prakashan, Surat.

B.Sc. (MATHEMATICS)

SEMESTER –II

MTH-201

MATHEMATICS-III

Unit-I

Different types of matrices, Operations on matrices, Properties of operations of matrices, Elementary row operations,

Unit-II

Row-reduced echelon forms, Inverse of matrix by Row –Reduced Echelon form. Row rank of a matrix, Quadratic forms.

Unit-III

Trace of matrix and its properties, Solution of homogeneous system of linear equations using row – reduced echelon forms.

Unit-IV

Characteristic equation of a matrix, Method to find Characteristic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem and its application to find an inverse of a matrix, Method of diagonalization.

The course is covered by the following reference books:

- 1. Krishnamurthy, Mainra and Arora: An Introduction to linear Algebra, Affiliated West Press Pvt. Ltd., New Delhi.**
- 2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India (P) Ltd., 2009.**
- 3. B.S. Vasta and Suchi Vasta: Theory of Matrices; 4th Edition -2014, New Age International (P) Ltd. Publishers, New Delhi.**
- 4. Shantinayakan: Text book of Matrices, S. Chand and Co., New Delhi.**
- 5. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., New Delhi.**
- 6. N.P. Bhamore and et al: College Adhunik Ganit shastra, Popular Prakashan, Surat.**

B.Sc. (MATHEMATICS)

SEMESTER –II

MTH-202

MATHEMATICS-IV

Unit-I

Curve Tracing: Equation of the form $y = f(x)$, Equation of the form $y^2 = f(x)$, Parametric equations,

Unit-II

Application of Integral calculus: Length of a curve, Intrinsic equation (except polar coordinates).

Unit-III

Bernoulli's equation, Exact differential equation, Differential equations of first order and higher degree: Solvable for x , y , p and Lagrange's equation, Clairaut's equation.

Unit-IV

Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution, Method for finding Particular Integral specially for e^x , $\sin ax$, $\cos ax$, polynomial in terms of x , $e^{ax}V$ and xV , where V is a function of x .

The course is covered by the following reference books:

1. Shantinarayan: Differential calculus, 4th edition -2001, Shyamlal Charitable Trust, Ram nagar New Delhi, S. Chand and Company LTD.
2. Shantinarayan: Integral Calculus, Revised Edition-2009, S.Chand and Co., New Delhi.
3. Gorakhprasad: Integral Calculus, Pothishala Pvt.Ltd., Allahabad.
4. D.A.Murray: Differential Equations, Tata Mc Graw Hills.
5. Frank Ayres: Theory and problems on Differential Equations, Mc Graw Hill Book Co., New York.
6. N.P.Bhamore and et al: College Aadhunik Ganit shastra, Popular Prakashan, Surat.

B. Sc.(MATHEMATICS)
Semester:III,IV

B. Sc.	Paper	NameofthePaper	Hours	Credit	Marks
Semester III	MTH-301	Mathematics-V	3	3	70 (20Internal + 50 External)
	MTH-302	Mathematics-VI	3	3	
	MTH-303	Mathematics-VII	3	3	
	EG-3001	Mathematical Methods	2	2	
	EG-3002	Group of Symmetries-I	2	2	
Semester IV	MTH-401	Mathematics-VIII	3	3	
	MTH-402	Mathematics-IX	3	3	
	MTH-403	Mathematics-X	3	3	
	EG-4001	Mathematical Modeling	2	2	
	EG-4002	Group of Symmetries -II	2	2	

B. Sc. (MATHEMATICS)
SEMESTER- III
MTH-301
(Mathematics-V)

Unit I:

Limits and Continuity of a function of two variables, Partial Differentiation, Total Differential, Composite function, Homogeneous functions.

Unit II:

Euler's theorem for Homogeneous functions, Taylor's theorem for functions of two variables, Maclaurian's expansions in power series, Jacobian.

Unit III:

Maxima-Minima for functions of two variables: Necessary and sufficient conditions for extreme points.

Unit IV:

Vector point function, Differentiation of a Vector point function, Gradient, Divergence and Curl and their properties, Line Integral.

The course is covered by the following reference books:

1. Shantinarayan, P.K. Mittal: A course of Mathematical Analysis, S. Chand and Co., New Delhi.
2. Hari Kishan: Vector Algebra and Calculus, Atlantic Pub. & Distributors (P) Ltd., New Delhi.
3. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi.
4. S.C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi.
5. N.P. Bhamore & etel: Mathematics Paper III-IV, Popular Prakashan, Surat.

B. Sc. (MATHEMATICS)
SEMESTER-III
MTH-302
(Mathematics-VI)*

Unit I:

Error estimation: Errors and their computations, A general error formula.

Unit II:

Numerical Solution of Algebraic and Transcendental Equations: Bisection Method, Method of False position, Iteration Method, Newton-Raphson's Method.

Unit III:

Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials.

Unit IV:

Newton's Forward and Backward Formulae, Gauss' Interpolation formulae.

The course is covered by the following reference books:

1. S.S. Sastry: Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 5th Edition.
2. M.K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel, Mittal: Numerical Analysis, Pragati Prakashan, Meerut.
4. Kaiser A. Kunz: Numerical Analysis, McGraw Hill Book Co., London.
5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London.
6. P. C. Biswal: Numerical Analysis, Prentice-Hall of India, 2008.
7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chand and Co., 2005.

*Use of Scientific non-programmable calculator is allowed.

B. Sc. (MATHEMATICS)
SEMESTER-III
MTH-303
(Mathematics-VII)

Unit I:

Linear Differential Equations with variable coefficients, Homogeneous Differential Equations, Legendre's Differential Equation.

Unit II:

Second order Differential Equations: Solution in terms of known Integral, Solution by method of removal of first order derivatives, Method of Changing Independent Variable.

Unit III:

Formation of Partial Differential Equation, Solution of Partial Differential Equations, Equations solvable by direct integral.

Unit IV:

Partial Differential Equations of first order, Nonlinear Partial Differential Equations of first order, Some special methods.

The course is covered by the following reference books:

1. D.A. Murray: An Introductory Course in Differential Equations, Orient Longmans, Bombay.
2. I.N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company.
3. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. Gorakh prasad : Differential Equations, Pothishala Pvt. Ltd., Allahabad.
5. M. D. Rai Singhania: Differential Equations, S. Chand & Co., New Delhi.
6. Nita H. Shah: Ordinary and Partial Differential Equations: Theory and Applications, PHI Learning Pvt. Ltd, New Delhi.
7. N.P. Bhamore & etel.: Mathematics Paper III-IV, Popular Prakashan, Surat.

B. Sc. (MATHEMATICS)
SEMESTER-III
Elective Generic
EG-3001
(Mathematical Methods)*

Unit I:

Notationsoffinitedifferencecalculus, Operators $E, \Delta, \nabla, \delta$, Relationsbetween differentoperatorsandtheirprosperities, Relationbetween differenceand differentialoperators, Methodofconstructing differencetables, Findingthemissing terms.

Unit II:

Factorialnotation, Expressionofpolynomialsinfactorialnotationbyusing finite differences, Method ofunknowncoefficients.

Unit III:

Differenceequations: Orderanddegreeofadifferenceequation, Solutionof differenceequations, Homogeneousdifferenceequationswithconstantcoefficients.

Thecourseiscoveredbythefollowingreferencebooks:

1. S.S.Sastry: Introductorymethodsof NumericalAnalysis, Prentice-Hallof IndiaPvt. Ltd.; 4th Edition.
2. M.K.Jain, Iyenger, Jain: NumericalMethodsforScientificandEngineering Computations, New Age InternationalLtd.
3. Goel, Mittal: Numerical Analysis, PragatiPrakashan, Meerut.
4. Kaiser A. Kunz: Numerical Analysis, McGraw Hill Book Co., London.
5. JamesI. Buchanan, PeterR. Turner: NumericalMethods&Analysis, McGraw Hill BookCo., London.

*Useof Scientificnon-programmablecalculator isallowed.

B. Sc.(MATHEMATICS)
SEMESTER-III
Elective Generic
EG-3002
(Group of Symmetries-I)

Unit I:

Definition of a group

and its elementary properties, Order of a group, Order of an element of a group, Group multiplication tables, Examples of groups including finite groups and infinite groups, Abelian groups, Cyclic groups.

Unit II:

Subgroup, Condition that a subset is a subgroup, Examples of subgroups, Basic concept of symmetry, Symmetry elements and symmetry operations in a space, Identity symmetry operation.

Unit III:

Symmetry planes and reflection symmetry, Inversion centre and inversion symmetry, Rotation axes and rotation symmetry, Improper axes and improper rotation symmetry, Product of symmetry operations.

The course is covered by the following reference books:

1. F. A. Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi.
2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher.
3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi.

B. Sc. (MATHEMATICS)
SEMESTER-IV
MTH-401
(Mathematics-VIII)

Unit I:

Beta-Gamma functions: Relation between Beta and Gamma functions, Properties, Applications of Beta-Gamma function.

Unit II:

Double and Triple Integrals: Change of order of Double integrals, Area.

Unit III:

Laplace Transforms: Laplace Transform of elementary functions, Properties of Laplace Transform, Differentiation and Integration of Laplace Transform, Laplace Transform of derivatives and integrals.

Unit IV:

Inverse of Laplace Transform: Method of Partial fractions, Properties of inverse Laplace Transform.

The course is covered by the following reference books:

1. David V. Widder : Advanced Calculus, PHI Learning Pvt. Ltd, New Delhi
2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999.
3. Shantinarayan, P.K. Mittal: A course of Mathematical Analysis, S. Chand and Co., New Delhi.
4. N.P. Bhamore & et al: Mathematics Paper III-IV, Popular Prakashan, Surat.

B. Sc. (MATHEMATICS)
SEMESTER-IV
MTH-402
(Mathematics-IX)*

Unit I:

Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula.

Unit II:

Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae.

Unit III:

Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule.

Unit IV:

Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.

The course is covered by the following reference books:

1. S. S. Sastry: Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition.
2. M. K. Jain, Iyengar, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel, Mittal: Numerical Analysis, Pragati Prakashan, Meerut.
4. Kaiser A. Kunz: Numerical Analysis, McGraw Hill Book Co., London.
5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London.

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B. Sc.(MATHEMATICS)
SEMESTER-IV
MTH-403
(Mathematics-X)

Unit I:

Sets and elements, Operations on sets, Functions, Real-valued functions.

Unit II:

Countable & Uncountable sets, Greatest lower bound and least upper bound.

Unit III:

Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences.

Unit IV:

Divisors, Greatest common divisor, Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic, Congruence relation, Equivalence classes.

The course is covered by the following reference books:

1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co.
2. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006.
3. I. H. Sheth : Abstract Algebra, Nirav Prakashan, Ahmedabad.
4. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi.
5. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi.
6. Shantinayakan : Modern Algebra, S. Chand and Co., New Delhi.

SYLLABUS FOR B. Sc. (MATHEMATICS)
SEMESTER-IV
Elective Generic
EG-4001
(Mathematical Modeling)*

Unit I:

Mathematical modelling through ordinary differential equation of first order, Linear growth models; Linear decay models, Models for growth of Science and scientists.

Unit II:

Non-linear growth and decay models, Model of Logistic law of population, Spread of technological innovation, Spread of infectious diseases.

Unit III:

Mathematical models of geometrical problems through ordinary differential equation of first order, Simple geometrical problems, Orthogonal trajectories.

The course is covered by the following reference books:

1. J.N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi.
2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999.
3. J. K. Sharma: OR Theory & Applications, Mac Millan India Ltd., 1998.
4. G. Hadley: Linear Programming, Narosa Publishing House, New Delhi, 1995.
5. G. Paria: Linear Programming, Transportation, Assignment, Game, Books & Allied Pvt. Ltd. Calcutta.

*Use of Scientific non-programmable calculator is allowed.

B. Sc.(MATHEMATICS)
SEMESTER-IV
Elective Generic
EG-4002
(Group of Symmetries-II)

Unit I:

Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects):

1. An isosceles triangle (cyclic group C_2 of order 2)
2. An equilateral triangle (the group S_3 of order 6)
3. A rectangle (the group V_4)
4. A square (the group D_4)

Unit II:

Formation of groups of symmetries of the following Chemical Molecules (Configuration of atoms).

1. H_2O (the group V_4)
2. H_2O_2
3. Trans- N_2-F_2 (the group V_4)
4. NH_3 , PCl_3 , $CHCl_3$ (the group S_3)

Unit III:

Concept of isomorphism of groups, Isomorphism of multiplicative group with the group C_2 of the symmetries of an isosceles triangle, Isomorphism of multiplicative group with the group V_4 of the symmetries of a rectangle, Isomorphism of group V_4 of the symmetries of a rectangle with the group of symmetries of H_2O , Isomorphism of group S_3 of the symmetries of an equilateral triangle with the group of symmetries of NH_3 , PCl_3 , $CHCl_3$.

The course is covered by the following reference books:

1. F. A. Cotton: Chemical application of group theory, Wiley Inter Science Wiley Eastern Ltd., New Delhi.
2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher.
3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006.

B.Sc. (MATHEMATICS)
Semester: V, VI

Semester	Paper	Name of the Paper	Hours	Credit	Marks
V	MTH-501	Group Theory	3	3	Total marks 70 (50 External +20 Internal)
	MTH-502	Linear Algebra – I	3	3	
	MTH-503	Real Analysis – I	3	3	
	MTH-504	Real Analysis – II	3	3	
	MTH-505	Graph Theory	3	3	
	MTH-506	Number Theory – I	3	3	
	E.G.	5001-Operations Research – I	2	2	
5002-Computer Oriented Numerical Methods – I					
5003-Fourier Series					
VI	MTH-601	Ring Theory	3	3	Total marks 70 (50 External +20 Internal)
	MTH-602	Linear Algebra – II	3	3	
	MTH-603	Real Analysis – III	3	3	
	MTH-604	Real Analysis – IV	3	3	
	MTH-605	Discrete Mathematics	3	3	
	MTH-606	Number Theory – II	3	3	
	E.G.	6001-Operations Research – II	2	2	
6002-Computer Oriented Numerical Methods – II					
6003-Fourier Transform and its Applications					

B.Sc. (MATHEMATICS)
SEMESTER –V
MTH – 501
(Group Theory)

Unit 1:

Definition of a Group, Examples of Group, elementary properties of a Group, Finite Groups. Subgroups, Cyclic Groups, Order of an element.

Unit 2:

Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle.

Unit 3:

Normal subgroups & Quotient groups, Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem of homomorphism, Automorphisms, Cayley's theorem.

Unit 4:

Permutation Groups, Orbit & Cycles, Even permutation, Odd permutation, Alternating Group.

The course is covered by the following reference books:

1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983.
2. I. H. Sheth : Abstract Algebra, Nirav Prakashan, Ahmedabad.
3. N. S. Gopal Krishnan : University Algebra, Wiley Eastern Ltd.
4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997.
5. Shantinayakan : Modern Algebra, S. Chand & Co.
6. Serge Lang : Algebra, Addition Wesley, 1993.
7. Surjeet & Kazi Zameeruddin : Modern Algebra, Vikas Publishing House.

B.Sc. (MATHEMATICS)
SEMESTER – V
MTH – 502
(Linear Algebra – I)

Unit 1:

Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Illustrations.

Unit 2:

Span of a set, union and intersection of subspaces, Sum and Direct sum of subspaces.

Unit 3:

Linearly dependent and independent vectors, Verification of Linear dependence or independence.

Unit 4:

Dimension and Basis of a vector space, Extension of a linearly independent set to a basis, Dimension of sum.

The course is covered by the following reference books:

1. V. Krishnamurthy, V. P. Mainra & J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi.
2. I. H. Sheth : Linear Algebra, Nirav Prakashan.
3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000.
4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.).
5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.

B.Sc. (MATHEMATICS)
SEMESTER – V
MTH – 503
(Real Analysis – I)

Unit 1:

Bounded sequences, Monotone sequences, Operations on convergent sequences.

Unit 2:

Operations on divergent sequences, Concepts of limit superior and inferior, Cauchy sequence.

Unit 3:

Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence.

Unit 4:

Tests for absolute convergence, Series whose terms form a non-increasing sequence.

The course is covered by the following reference books:

1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co.
2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi.
3. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi.
4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.

B.Sc. (MATHEMATICS)
SEMESTER – V
MTH – 504
(Real Analysis – II)

Unit 1:

Revision of Limit and Continuity of a function on the real line, Definition & examples of Metric spaces.

Unit 2:

Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics.

Unit3:

Open ball in $\mathbb{R}^1$, Open ball in metric space, Functions continuous on metric spaces.

Unit 4: Open sets, More about open sets.

The course is covered by the following reference books:

1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.
4. D. Som Sundaram & B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968.
7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.

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B.Sc. (MATHEMATICS)
SEMESTER – V
MTH – 505
(Graph Theory)

Unit 1:

Graphs, Various type of graphs, Incidence and Degree, Isolated and pendent vertices, Subgraphs, Isomorphism between two graphs.

Unit 2:

Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs, Components of graphs.

Unit 3:

Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Applications of graphs: Königsberg Bridge Problem, Seating Arrangement Problem, Utility Problem.

Unit 4:

Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees.

The course is covered by the following reference books:

1. Narsingh Deo : Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd.,2000.
2. R. J. Wilson : Introduction to Graph Theory, Academic Press, New York, 1972.
3. E. Harary : Graph Theory, Addison Wesley Pub. Co.,1969.
4. C. Berge : The Theory of Graphs and its Applications, John Wiley & Sons, 1962.

B.Sc. (MATHEMATICS)
SEMESTER – V
MTH – 506
(Number Theory – I)

Unit 1:

Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm, Relation between Greatest Common Divisor and Least Common Multiple of two integers.

Unit 2:

Computation of the solutions of Linear Diophantine Equations in two variables, Primes and Composite numbers, Fundamental Theorem of Arithmetic, Pythagorean theorem for the irrationality of $\sqrt{p}$, for any prime p .

Unit 3:

Sieve of Eratosthenes, Infinitude of primes, Upper Bound for the primes, Theory of Congruences.

Unit 4:

Basic Properties of Congruence, Divisibility tests of 9 and 11.

The course is covered by the following reference books:

1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006.
2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi.
3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991.
4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.

B.Sc. (MATHEMATICS)
SEMESTER – V
Elective Generic – 5001
(Operations Research – I)

Unit 1:

Graphical solution of Linear Programming Problem (LPP). Definition of the Dual Problem, General rules for converting any Primal Problem into its dual, The symmetric Dual Problems.

Unit 2:

Basic concept of Basic, Non-basic, Degenerate, Non-degenerate and Basic feasible solutions of LPP, Slack & Surplus variables, LPP in the standard matrix form, Slack & Surplus variables, Solution of LPP using Simplex method.

Unit 3:

Solution of LPP using Two Phase Simplex method and Big-M method.

The course is covered by the following reference books:

1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998.
2. Kanti Swaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998.
3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995.
4. S. D. Sharma : Operations Research, Kedarnath Ramnath & Co.
5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta.
6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications.
7. Goel & Mittal : O.R., Pragati Prakashan, Meerut.

B.Sc. (MATHEMATICS)
SEMESTER – V
Elective Generic – 5002
(Computer Oriented Numerical Methods–I)

Unit 1:

Flow charts and symbols, More flow charting examples.

FORTRAN language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Type declaration for integer and real, Arithmetic expression (real and integer expressions), Hierarchy of operations in expressions, Examples of Arithmetic expression.

Unit 2:

Arithmetic statement, Mode of Arithmetic expression, Special function, Examples of use of functions, Program preparation preliminaries.

Unit 3:

Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program, FORTRAN programming examples.

The course is covered by the following reference books:

1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI.
2. V. Rajaraman : Computer Oriented Numerical Methods, PHI.
3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd.
4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd.
5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta.
6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, New Delhi.

B.Sc. (MATHEMATICS)
SEMESTER – V
Elective Generic – 5003
(Fourier Series)

Unit 1:

Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion.

Unit 2:

Functions having points of discontinuity, Change in intervals, Even and Odd functions, Expansion of Even or Odd Periodic functions.

Unit 3:

Half range series, Typical wave forms, Parseval's formula, Root mean square value, Complex form of Fourier series.

The course is covered by the following reference books:

1. B. S. Grewal : Higher Engineering Mathematics, Khanna Prakashan, New Delhi.
2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi.
3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
4. R. V. Churchill : Fourier series and Boundary value problems, McGraw Hill ISE.
5. Vashishtha and Gupta : Integral Transforms, Krishna Publications, Meerut.

B.Sc. (MATHEMATICS)

SEMESTER – VI

MTH – 601

(Ring Theory)

Unit 1:

Definition of a Ring, Examples of Ring, Integral Domain, Field, Boolean Ring.

Unit 2:

Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal.

Unit 3:

Euclidean rings, Divisibility in commutative ring, GCD of two elements in a ring, Units and Associates in rings.

Unit 4:

Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring.

The course is covered by the following reference books:

1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983.
2. I. H. Sheth : Abstract Algebra, Nirav Prakashan, Ahmedabad.
3. N. S. Gopal Krishnan : University Algebra, Wiley Eastern Ltd.
4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997.
5. Shantinarayan : Modern Algebra, S. Chand & Co.
6. Serge Lang : Algebra, ed. Addition Wesley, 1993.
7. Surjeet & Kazi Zameeruddin : Modern Algebra, Vikas Publishing House.

B.Sc. (MATHEMATICS)
SEMESTER – VI
MTH – 602
(Linear Algebra – II)

Unit 1:

Definition and examples of Linear transformation, Range and kernel of a linear transformation.

Unit 2:

Rank-Nullity Theorem, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem, Composition of linear transformations.

Unit 3:

Matrix associated with Linear transformations, Linear transformation associated with a matrix, Application of Rank-Nullity Theorem for matrix.

Unit 4:

Inner product spaces, Norm of a vector, Cauchy-Schwarz's inequality, Triangular inequality, Orthogonal vectors, Vector Projection, Gram-Schmidt Orthogonalization Process, Orthonormal Set.

The course is covered by the following reference books:

1. V. Krishnamurthy, V. P. Mainra & J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi.
2. I. H. Sheth : Linear Algebra, Nirav Prakashan.
3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000.
4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.).
5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.

B.Sc. (MATHEMATICS)

SEMESTER – VI

MTH – 603

(Real Analysis – III)

Unit 1:

Summability of sequences, Addition and subtraction of $(C, 1)$ summable sequences, $(C, 2)$ summable sequences, $(C, 1)$ Summability of series.

Unit 2:

Sequences of functions, Pointwise convergence of Sequences of functions, Uniform convergence of Sequences of functions.

Unit 3:

Sets of measure zero, Definition of the Riemann Integral, Algebraic properties of Riemann Integral.

Unit 4:

Non-Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus, Mean-value Theorems of Integral Calculus.

The course is covered by the following reference books:

1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi.
2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.
4. Louis Leithold : Calculus with analytic Geometry, Harper and Collins Pub. Co.
5. J. B. Thomas and Finney : Calculus with analytic Geometry.
6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968.
7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.

B.Sc. (MATHEMATICS)
SEMESTER – VI
MTH – 604
(Real Analysis – IV)

Unit 1:

Limit points, Closure of a set, Closed sets, Homeomorphism of metric spaces, Dense set.

Unit 2:

Connected sets, Bounded sets, Totally bounded sets.

Unit 3:

Complete metric spaces, Contraction mapping, Picard's fixed-point theorem.

Unit 4:

Compact metric spaces, Open covering, Heine-Borel property, Finite Intersection property.

The course is covered by the following reference books:

1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi.
2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.
4. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi.
5. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
6. Copson : Metric Spaces, Cambridge University Press, 1968.
7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.

B.Sc. (MATHEMATICS)
SEMESTER – VI
MTH – 605
(Discrete Mathematics)

Unit 1:

Binary relations, Properties of binary relations, Equivalence relation, Partial ordered relation, Partially ordered sets, Upper bounds, Lower bounds, GLB & LUB of sets, Totally ordered sets, Well ordered sets, Hasse Diagram, Lattices and its properties.

Unit 2:

Lattices as Algebraic Systems, Lattice Homomorphism, Different types of lattices.

Unit 3:

Boolean Algebra as an algebraic system, Boolean expressions (forms), Sum of Products Canonical form and Product of Sums Canonical forms of Boolean expressions.

Unit 4:

Representation and Minimization of Boolean functions by Karnaugh Map method and Quine- McCluskey Algorithm, AND, OR & NOT gates, Reduction of switching circuit diagram.

The course is covered by the following reference books:

1. J. P. Tremblay & R. Manohar : Discrete mathematical Structures with Applications to Computer Science., McGraw Hill Book Co., 1999.
2. B. Kolman, R. C. Busby & S. Ross : Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd., 3rd ed., 2001.
3. Elements of Discrete Mathematics, C. L. Liu, D. P. Mohapatra, Tata McGraw Hill, 2008.
4. Discrete Mathematics with Applications, Thomas Koshy, Academic Press, 2004.

B.Sc. (MATHEMATICS)
SEMESTER – VI
MTH – 606
(Number Theory – II)

Unit 1:

Computation of the solutions of linear congruence, Chinese Remainder Theorem.

Unit 2:

Fermat's little theorem, Pseudo-primes, Wilson's theorem.

Unit 3:

The number of positive divisors and sum of all positive divisors of an integer, Basic properties and Multiplicative nature of these functions, The Möbius Inversion formula, Greatest integer function.

Unit 4:

Introduction of Euler's Phi-function, Multiplicative nature, Euler's Theorem.

The course is covered by the following reference books:

1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006.
2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi.
3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991.
4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.

B.Sc. (MATHEMATICS)
SEMESTER – VI
Elective Generic – 6001
(Operations Research – II)

Unit 1:

Transportation problem, methods for finding initial basic feasible solution, Solution of Transportation problem by MODI method, Unbalanced Transportation problem.

Unit 2:

Assignment problems, The Hungarian method, Balanced & Unbalanced Assignment problems.

Unit 3:

Competitive Games, Two-person zero-sum game, Maximin and Minimax principle, Saddle points and the value of the game (based on pure strategies), Mixed strategies, Solution of Games with Saddle point, Game without saddle points, Dominance rule, Solution of $m \times 2$ and $2 \times n$ Games using graphical method.

The course is covered by the following reference books:

1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998.
2. Kanti Swaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998.
3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995.
4. S. D. Sharma: Operations Research, Kedarnath Ramnath & Co.
5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta.
6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications.
7. Goel & Mittal : O.R., Pragati Prakashan, Meerut.

B.Sc. (MATHEMATICS)
SEMESTER – VI
Elective Generic – 6002
(Computer Oriented Numerical Methods – II)

Unit 1:

Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement. Statement labels, GOTO statement, Examples of use of Logical IF statement.

Unit2:

Nested logical IF statement, Computed GO TO statement, DO statement, Examples of DO statement, Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted Expression, Dimension statement, DO type notation for input/output statement, FORMAT specification.

Unit3:

FORMAT specification for a numerical data, Iterative methods, Numerical integrations and differentiations, Numerical solution of ordinary differential equations.

The course is covered by the following reference books:

1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI.
2. V. Rajaraman : Computer Oriented Numerical Methods, PHI.
3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd.
4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd.
5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta.
6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, New Delhi.

B.Sc. (MATHEMATICS)
SEMESTER – VI
Elective Generic – 6003
(Fourier Transform and Its Applications)

Unit 1:

Integral transforms, Fourier Transforms, Properties of Fourier Transform and its application.

Unit 2:

Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform.

Unit 3:

Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function, Fourier transform and its applications.

The course is covered by the following reference books:

1. B. S. Grewal : Higher Engineering Mathematics, Khanna Prakashan, New Delhi.
2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi.
3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
4. R. V. Churchill : Fourier series and Boundary value problems, McGraw Hill ISE.
5. Vashishtha and Gupta : Integral Transforms, Krishna Publications, Meerut.

B. Sc.

Physics	
Program Out Come	The ability to think creatively in order to provide fresh ideas for explaining facts or solving issues. To have experience using scientific instruments, designing and conducting laboratory experiments, and drawing logical conclusions from them. To raise environmental awareness among faculty and students. To comprehend the essential concepts, principles, and scientific theories behind numerous scientific phenomena, as well as their application in everyday life.
Programe Specific Outcome	The student who completes the B. Sc. (Physics) programme will be able to: -Exhibit the ability to translate a physical description into a mathematical equation and explain the physical meaning of mathematics, portray fundamental parts of physics using graphs and diagrams, and solve problems using geometric arguments -Problem-solving in general, with a focus on qualitative and quantitative data, with applications to circumstances where evaluations must be made with little information. be able to do numerical, computational, and data-processing tasks. -Apply fundamental physics knowledge, such as basic concepts and principles in 1) Newtonian Mechanics, Classical Mechanics, Optics, Electronics, Electrodynamics, Thermodynamics, Quantum Mechanics, Solid State Physics, and 2) Mathematical (analytic and numerical) Methods and Experimental Methods for Physics, to pursue further study in various branches of physics.

Course Outcomes

In force from: June -2019

Veer Narmad South Gujarat University, Surat

Syllabus for F. Y. B. Sc. Sem I

Physics Paper I (PH – 101)

Unit 1	Vector analysis (Vector analysis by Murray Spiegel Schaum's Outline 2nd Ed. McGraw-Hill, 2009)
	Dot or scalar product, Cross or vector product, Triple product, reciprocal sets of vectors (Ch. 2), Ordinary derivatives of vectors, space curves, continuity and differentiability, differentiation formulae, Partial derivatives of vectors, differentials of vectors, differential geometry (Ch. 3), The vector differential operator ∇ , the gradient, the divergence and the curl, formulae involving ∇ , invariance (Ch. 4) Ordinary integrals of vectors, line integrals, surface integrals and volume integrals (Ch. 5), The divergence theorem of Gauss, Stokes' theorem, Green's theorem in the plane, related integral theorems, integral operator form for ∇ (Ch. 6) (Theorem statements only)
Unit 2	Force and Newton's laws and Force and Newton's laws (Physics by Halliday, Resnick and Krane, Vol. 1, 5th Ed. Wiley)
	Classical Mechanics (3.1), Newton's first law (3.2), Force (3.3), Mass (3.4), Newton's second law (3.5), Newton's third law (3.6), Weight and mass (3.7), Applications of Newton's laws in one dimension (3.8), Motion in three dimensions with constant acceleration (4.1), Newton's laws in three dimensional vector form (4.2) Projectile motion (4.3), Drag forces and the motion of projectile (4.4), Uniform circular motion (4.5), Relative motion (4.6)
Unit 3	Momentum and System of particles (Physics by Halliday, Resnick and Krane, Vol. 1, 5th Ed. Wiley)
	Collisions (6.1), Linear momentum (6.2), Impulse and momentum (6.3), conservation of momentum (6.4), two body collisions (6.5), Two particle systems (7.2), many particle systems (7.3), centre of mass of solid objects (7.4), conservation of momentum in a system of particles (7.5), system of variable mass (7.6), rotational motion (8.1), The rotational variables (8.2), Rotational quantities as vectors (8.3), rotation with constant angular acceleration (8.4), relationships between linear and angular variables (8.6)
Unit 4	Elasticity (Properties of Matter by D. S. Mathur, S Chand & Co., 2009)
	Introduction (8.1), Load, stress and strain (8.2), Hooke's law (8.3), ductility, brittleness and plasticity (8.4), elastic behaviour of solids in general (8.5), factors affecting elasticity (8.7), three types of elasticity (8.8), equivalence of a shear to a compression and an extension at right angles to each other (8.9), deformation of a cube – bulk

	modulus (8.12), modulus of rigidity (8.13), Young's modulus (8.14), relations connecting the elastic constant (8.15), Poisson's ratio (8.16), relations for K and n in terms of Poisson's ratio (8.17), limiting values of σ (8.18)
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Suggested Books:

1. Mathematical Methods for Physics and Engineering by Riley, Hobson and Bence, Cambridge University Press, 1998.
2. Mechanics (Berkley Physics Course 1 by C Kittle, W D Knight, M Alvine and A Ruderman, Tata McGraw-Hill, 1991.
3. University Physics by Young and R. Freedman, Pearson 13th Ed., 2013.

Syllabus for F. Y. B. Sc. Sem I

Physics Paper II (PH – 102)

Unit 1	Electrostatics I (Physics by Halliday, Resnick and Krane, Vol. 2, 5thEd. Wiley)
	Coulomb's law (25.4), what is a field? (26.1), the electric field (26.2),), electric field of point charges (26.3),), electric field of continuous charge distributions (26.4), electric field lines (26.5), a point charge in an electric field (26.6) What is Gauss' law all about? (27.1), the flux of a vector field (27.2), the flux of the electric field (27.3), Gauss' law (27.4), applications of Gauss' law (27.5), Gauss' law and conductors (27.6), experimental tests of Gauss' law and Coulomb's law (27.7)
Unit 2	Electrostatics II (Physics by Halliday, Resnick and Krane, Vol. 2, 5thEd. Wiley)
	Potential energy (28.1), electric potential energy (28.2), electric potential (28.3), calculating the potential from the field (28.4), potential due to point charges (28.5), electric potential of continuous charge distributions (28.6), calculating the field from the potential (28.7), equi-potential surfaces (28.8), Electric current (31.1), electromotive force (31.2), analysis of circuits (31.3), RC circuits (31.7)
Unit 3	Diode circuits (Electronic principles by A. P. Malvino, 6th Ed. Tata McGraw-Hill)
	The half-wave rectifier (4.1), the transformer (4.2), the full-wave rectifier (4.3), the bridge rectifier (4.4), the choke input filter (4.5), the capacitor input filter (4.6), peak inverse voltage and surge current (4.7), clippers and limiters (4.10), clampers (4.11)
Unit 4	Optics (Optics by AjoyGhatak, 6thEd. McGraw-Hill Education)
	Introduction (3.1), laws of reflection and refraction from Fermat's principle (3.2), introduction (4.1), refraction at a single spherical surface (4.2), reflection by a single spherical surface (4.3), the thin lens (4.4), the principle foci and the focal length of a lens (4.5), the Newton's formula (4.6), lateral magnification (4.7), aplanatic points of a sphere (4.8), The matrix method (5.2), Unit planes (5.3), Nodal planes (5.4), A system of two thin lenses (5.5)

Suggested Books:

1. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
2. Electricity and Magnetism by A S Mahajan and A R Rangwala 7th Ed. Tata McGraw-Hill, 2003.
3. University Physics by H. D. Young, R. A. Freedman and A. Lewis Ford, 13th Ed. Pearson Education, 2013
4. Fundamentals of Optics by F. Jenkins and H. White, 4th Ed. McGraw Hill Education, 2017

Syllabus for F. Y. B. Sc. Sem I

Practical (PH – 103)

List of experiments

	Group A
1	Error analysis and least square fit
2	To verify the parallel axes theorem of moment of inertia
3	To verify the perpendicular axes theorem of moment of inertia
4	Modulus of rigidity of a wire using torsional pendulum
5	Modulus of rigidity of a rod by Searle's apparatus
6	Poisson's ratio of rubber

	Group B
1	Low resistance by Wheatstone's bridge method of projection
2	Study of decay of current in RC circuit
3	Study of rectifiers (Half wave and full wave rectifier)
4	Resistivity of the material of a conductor using Ohm's law
5	Cardinal points of a lens system placed in air
6	To determine angle of prism using spectrometer

Suggested Books

1. D.C.Tayal ,University Practical physics,Edited by Ila Agarwal ,Himalayan Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2 hours duration.
3. It is recommended that there should not be more than 20 students per batch in the external exam.

Structure for B.Sc. Syllabus

Inforce from June 2019

B. Sc. (PHYSICS)

Sr. No.	Course Code	Course Title	Credits
1	PH-201	Physics Paper I	2
2	PH-202	Physics Paper II	2
3	PH-203	Practical	2

Faculty Code: **Science**

Subject Code: **PH**

Name of Program: **B.Sc.**

Subject: **PHYSICS**

External Examination Time Duration: **02 Hours**

Name of Exam	Semester	PAPER No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B.Sc.	1	PH-101		02	20	50	70
		PH-102		02	20	50	70
		PH-103	Practical	02	20	40	60

Syllabus for F. Y. B. Sc. Sem II

Physics Paper I (PH – 201)

Unit 1	Angular momentum and Gravitation (Physics by Halliday, Resnick and Krane, Vol. 1, 5th Ed.)
	Torques (9.1), rotational inertia and Newton's second law (9.2), rotational inertia of solid bodies (9.3), torque due to gravity (9.4), equilibrium applications of Newton's laws for rotation (9.5) Angular momentum of a particle (10.1), systems of particles (10.2), angular momentum and angular velocity (10.3), conservation of angular momentum (10.4), the spinning top (10.5), Origin of the law of gravitation (14.1), Newton's law of universal gravitation (14.2), the gravitational constant G (14.3), gravitation near the earth's surface (14.4), the two shell theorems (14.5), gravitational potential energy (14.6), the gravitational field (14.7), modern developments in gravitation (14.8)
Unit 2	Oscillation and Waves (Oscillation and Waves by Suresh Garg, C. K. Ghosh and Sanjay Gupta)
	Introduction (3.1), principle of superposition and linearity (3.2), superposition of two collinear SHOs of same frequency (3.3), superposition of two collinear SHOs of nearly equal frequencies (3.4), superposition of two mutually perpendicular harmonic oscillations (3.6), describing wave motion (7.3), phase of a wave (7.4), energy transported by a progressive wave (7.5), intensity of a wave (7.6)
Unit 3	Particle properties of waves (Concepts of Modern Physics by A. Beiser)
	Blackbody radiation (2.2), photoelectric effect (2.3), what is light (2.4), X-rays (2.5), X-ray diffraction (2.6), Compton effect (2.7), pair production (2.8), photons and gravity (2.9)
Unit 4	Elasticity (Properties of Matter by D.S. Mathur, S Chand & Co., 2009)
	Twisting couple on a cylinder (8.22), torsional pendulum (8.26), determination of coefficient of rigidity (n) for a wire (8.27), bending of a beam (8.39), the cantilever (8.30), transverse vibrations of a loaded cantilever (8.32), depression of a beam supported at the ends (8.33), determination of Y by bending of beams (8.34), determination of elastic constants by Searle's method (8.36)

Suggested Books:

1. Mechanics (Berkley Physics Course I by C Kittle, W D Knight, M Alvine and A Ruderman, Tata McGraw-Hill, 1991.
2. Modern Physics by Kenneth S Krane Wiley India Edition, 2016
3. Vibrations and Waves by A. P. French, CBS; 1st Ed., 2003

Syllabus for F. Y. B. Sc. Sem II

Physics Paper II (PH – 202)

Unit 1	Magneto-statics and electromagnetic induction (Physics by Halliday, Resnick and Krane, Vol. 2, 5thEd.)
	Magnetic interactions and magnetic poles (32.1), the magnetic force on a moving charge (32.2), circulating charges (32.3), the magnetic force on a current carrying wires (32.5), the torque on a current loop (32.6), Faraday's experiments (34.1), Faraday's law of induction (34.2), Lenz's law (34.3), motional emf (34.4), generator and motor (34.5)
Unit 2	Thermodynamics (Physics by Halliday, Resnick and Krane, Vol. 2, 5thEd.)
	Temperature and thermal equilibrium (21.1), thermal expansion (21.4), the ideal gas (21.5), a molecular view of pressure (22.2), the mean free path (22.3), the distribution of molecular speeds (22.4), equations of state for real gas (22.6), heat: energy and transit (23.1), the transfer of heat (23.2), the first law of thermodynamics (23.8), the application of the first law of thermodynamics (23.8), defining entropy change (24.2), entropy change for irreversible process (24.3), the second law of thermodynamics (24.4), entropy and the performance of engines (24.5), entropy and the performance of refrigerators (24.6), the efficiency of real engines (24.7)
Unit 3	Special purpose diodes and Bipolar Junction Transistors (Electronic principles by A. P. Malvino, 6th Ed. Tata McGraw-Hill Ltd.)
	The zener diode (5.1), the loaded zener regulator (5.2), optoelectronic devices (5.8), The unbiased transistor (6.1), the biased transistor (6.2), transistor currents (6.3), the CE connection (6.4), the base curve (6.5), collector curves (6.6)
Unit 4	Optics (Optics by Ajoy Ghatak, 6thEd. McGraw-Hill Education)
	Introduction (12.1), Huygens' theory (12.2), rectilinear propagation (12.3), introduction (13.1), superposition of two sinusoidal waves (13.5), introduction (14.1), coherence (14.3), interference of light waves (14.4), the interference pattern (14.5), the intensity distribution (14.6), introduction (18.1), single slit diffraction pattern (18.2)

Suggested Books:

1. Electricity and Magnetism by A S Mahajan and A R Rangwala 7thEd. Tata McGraw-Hill, 2003.
2. University Physics by H. D. Young, R. A. Freedman and A. Lewis Ford, 13th Ed. Pearson Education, 2013
3. Fundamentals of Optics by F. Jenkins and H. White, 4th Ed. McGraw Hill Education, 2017

Syllabus for F. Y. B. Sc. Sem II

Practical (PH – 203)

List of experiments

	Group A
1	Force constant (k) of a spring
2	Elastic constants (Y , η , K & σ) by Searle's method
3	Characteristics of photocell
4	"Y" by cantilever
5	"Y" by bending of a beam supported at two ends & loaded in the middle
6	Thermal conductivity of a bad conductor by Lee's method

	Group B
1	Study of magnetic field due to Solenoid
2	Characteristics of BJT (CE configuration)
3	Wattage of a lamp
4	Newton's rings experiment
5	To determine refractive index of the material of prism using spectrometer
6	Zener diode as a voltage regulator

Suggested Books

1. D.C.Tayal ,University Practical Physics, Edited by Ila Agarwal ,Himalayan Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2 hours duration.
3. ~~It is recommended that~~ There should not be more than 20 students per batch in the external exam.

Evaluation:

Pattern of end-semester examination

For Semesters I and III

1. The question paper will comprise of objective type questions totalling 50 marks.
2. There shall be negative marking of 25% marks per wrong questions attempted.
3. No marks will be deducted for not attempting a question.

For Semesters II, IV, V and VI

1. The question paper will be of 50 marks.
2. There shall be five questions carrying 10 marks each.
3. Question 1 will consist of 12 short answer questions of 1 mark each. A student can answer any 10 questions. Question 1 will cover the whole syllabus and 3 short answer questions will be asked from each unit.
4. Question 2 will be asked from unit 1, question 3 from unit 2, question 4 from unit 3 and question 5 from unit 4.
5. Question 2 onwards, each question will consist of option (a) or (b). Each question will include two sub-questions. Each sub-question will have theory based questions of 6 marks followed by one problem or application of 4 marks. A student should attempt any one of the two options (a) or (b).

Structure for B. Sc. Syllabus

B. Sc. (PHYSICS)

Sr. No.	Course Code	Course Title	Credits
1	PH – 303	Physics Paper III	02
2	PH – 304	Physics Paper IV	02
3	PH – 305	Physics Paper V	02
4	PH – 306	Practicals	02

Faculty code: Science

Subject code: PH

Name of the Program: B. Sc.

Subject: PHYSICS

External Examination Time Duration: 2 hrs.

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	III	PH – 303	Theory	02	20	50	70
		PH – 304	Theory	02	20	50	70
		PH – 305	Theory	02	20	50	70
		PH – 306	Practical	02	20	40	60

S. Y. B. Sc. SemIII

Physics Paper III (PH – 303)

Unit 1	Kinetic theory of gases (Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt Ltd. Chennai, 2012)
	Classical theory of heat capacities of gases (1.4), Distribution of Molecular velocities in a perfect gas (1.5), Energy distribution of a Maxwellian gas (1.6), Experimental verification of Maxwell's distribution law (1.7)
Unit 2	Damped Oscillations (Oscillations and Waves by Garg, Bansal and Ghosh, 2nd Ed., PHI Learning Pvt Ltd. New Delhi, 2009)
	Introduction (4.1), Types of Damping forces (4.2), Equation of motion of a 1-D Damped Oscillator (4.3), Solutions of the Equation of motion of a 1-D Damped Oscillator (4.4), Non-mechanical damped system (4.5), Energy of a weakly damped system (4.6), Characterising weak damping (4.7)
Unit 3	Forced Oscillations(Oscillations and Waves by Garg, Bansal and Ghosh, 2nd Ed., PHI Learning Pvt Ltd. New Delhi, 2009)
	Introduction (5.1), Free and forced scillations: Resonance (5.2), Forced oscillations of a 1-D weakly damped oscillator (5.3), Steady state behaviour of a 1-D weakly damped forced oscillator (5.4), Amplitude and resonance (5.5), Power absorbed by a weakly damped forced oscillator (5.6), Quality factor: Sharpness of resonance (5.7), A resonant LCR circuit (5.8)
Unit 4	Charged Particles in Electromagnetic Fields (Electricity and Magnetism by D C Tayal, 4th Revised Ed., Himalaya Publishing House, India, 2019)
	Charged particles in crossed electric and magnetic fields(11.8)(i)velocity selector, (ii)Hall effect, (iii) e/m by Thomson method, (iv) Mass spectrograph, Aston mass spectrograph(11.9), Dempster's mass spectrograph(11.10), Bainbridge's mass spectrograph(11.11), Electron optics (Electron microscope)(11.12).

Suggested books

1. Heat & Thermodynamics by Zemansky and Dittman, 8th Ed., McGraw Hill Education Pvt. Ltd. New Delhi, 2011.
2. Fundamentals of Statistical and Thermal Physics by F.Reif, 1st Indian Ed., Levant Books, 2010.
3. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
4. Electricity and Magnetism by A S Mahajan and A R Rangwala 7thEd. Tata McGraw-Hill, 2003.

S. Y. B. Sc. Sem III

Physics Paper IV (PH – 304)

Unit 1	Wave Properties of Particles (Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)
	De Broglie Waves (3.1), Waves of What? (3.2), Describing a Wave (3.3), Phase and Group Velocities (3.4), Particle Diffraction (3.5), Particle in a Box (3.6), Uncertainty Principle-I (3.7), Uncertainty Principle-II (3.8), Applying the Uncertainty Principle (3.9).
Unit 2	Atomic Structure (Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)
	Atomic Structure (4.3), The Bohr Atom (4.4), Energy levels and Atomic Spectra (4.5), Correspondence Principle (4.6), Nuclear Motion (4.7), Atomic Excitation (4.8), The Laser (4.9).
Unit 3	Fraunhofer Diffraction (Optics by Ajoy Ghatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)
	Diffraction by a Circular Aperture (18.3), Resolving Power of a Microscope (18.5.1), The Diffraction Grating (18.8), The Grating Spectrum (18.8.1), Resolving Power of a Grating (18.8.2), Resolving Power of a Prism (18.8.3), Oblique Incidence (18.9), X-ray Diffraction (18.10).
Unit 4	Aberrations (Optics by Ajoy Ghatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)
	Introduction (6.1), Chromatic aberration (6.2), The achromatic doublet (6.2.1), Removal of chromatic aberration of a spherical doublet (6.2.2), Monochromatic aberrations (6.3), Spherical aberration (6.3.1), Coma (6.3.2), astigmatism and curvature of field (6.3.3), Distortion (6.4)

Suggested books

1. Modern Physics by Kenneth Krane
2. Fundamentals of Optics by Jenkins and White
3. Optics by Eugene Hecht

S. Y. B. Sc. Sem III

Physics Paper V (PH – 305)

Unit 1	Fourier Series (Mathematical Physics by B. S. Rajput, PragatiPrakashan, India, 2013)
	Definition (7.1), Dirichlet's condition (7.2), Graphical representation of a function (7.3), Extension of the interval (7.4), Complex form of Fourier series (7.5), Advantages of Fourier series (7.6), Properties of Fourier series (7.7)
Unit 2	Thermoelectricity (Electricity and Magnetism by D C Tayal, 4th Revised Ed., Himalaya Publishing House, India, 2019)
	Seeback Effect(9.1), Peltier Effect(9.2), Thomson Effect(9.3), Measurement of thermos emf(9.8), Applications of thermos emf (9.9) (i)Thermopyle (ii) Bolometer (iii)Boy's radio micrometer (iv) Duddle thermos galvanometer (v) Thermoelectric pyrometer (vi) Thermomilliameter.
Unit 3	Transistor Biasing and AC Models (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)
	Voltage Sources(1.3), Current Sources (1.4), Thevinin's Theorem(1.5), Norton's Theorem(1.6), Voltage Divider Bias(8.1), Accurate VDB analysis(8.2), VDB load line & Q point(8.3), Two-Supply Emitter Bias(8-4), Other types of Biases(8.5), Troubleshooting (8.6), PNP transistors (8.7), Base-Biased Amplifier(9.1), Emitter-Biased Amplifier (9.2), Small-Signal operation(9.3), AC Beta(9.4), AC Resistance of the Emitter Diode(9.5), Two Transistor Models(9.6), Analyzing an Amplifier (9.7), AC quantities on the Data Sheet (9.8).
Unit 4	Voltage and Power Amplifiers (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)
	Voltage gain (10.1), The loading effect of input inpedance (10.2), Multistatgeamplifier (10.3), Swamped amplifier (10.4), Two stage feedback (10.5) Amplifier terms (11.1), Two load lines (11.2), Class A operation (11.3), Class B operation (11.4), Class C operation (11.5), Class C formulas (11.6), Transistor power rating (11.7)

Suggested books

1. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
2. Electricity and Magnetism by A S Mahajan and A R Rangwala 7th Ed. Tata McGraw-Hill, 2003.
3. Electronic Devices and Circuit Theory by Boylestad
4. Mathematical Methods in the Physical sciences: Mary L. Boas Wiley India, 3rd ed.

S. Y. B. Sc. Sem III

PH-306

LIST OF EXPERIMENTS

	GROUP A
1	To Study Simple and Damped Harmonic Motion
2	To study the oscillations of a bar pendulum
3	To determine the Boltzmann's constant using V-I characteristics of PN diode
4	To verify Stefan's fourth power law
5	To study the variation of thermo-emf with temperature
	GROUP B
1	To determine wavelength of spectral lines by plane transmission grating.(Minimum Deviation Method)
2	To determine the resolving power of a Prism
3	To study spherical aberration of a Plano-convex lens
4	To study diffraction by cylindrical obstacle.
5.	To find Cauchy's Constant.
	GROUP C
1	To find band gap of a semiconducting material
2	To determine temperature coefficient of resistance of the given thermistor
3	To Verify Thevenin's theorem and to find equivalent Voltage of source circuit
4	To Verify Norton's theorem and to find equivalent Norton's components
5	To study series resonance in LCR circuit

Suggested books:

1. D.C.Tayal ,University Practical physics,Edited by Ila Agarwal ,Himalaya Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Three such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform three experiments, one from each group. Each experiment will be of 2 hours duration.
3. There shall not be more than 20 students per batch in the external exam.

Structure for B. Sc. Syllabus

B. Sc. (PHYSICS)

Sr. No.	Course Code	Course Title	Credits
1	PH – 403	Physics Paper III	02
2	PH – 404	Physics Paper IV	02
3	PH – 405	Physics Paper V	02
4	PH – 406	Practicals	02

Faculty code: Science

Subject code: PH

Name of the Program: B. Sc.

Subject: PHYSICS

External Examination Time Duration: 2 hrs.

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	IV	PH – 403	Theory	02	20	50	70
		PH – 404	Theory	02	20	50	70
		PH – 405	Theory	02	20	50	70
		PH – 406	Practical	02	20	40	60

S. Y. B. Sc. Sem IV

Physics Paper III (PH – 403)

Unit 1	Thermodynamic relations, free energies and Thermodynamic equilibrium (Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt Ltd. Chennai, 2012)
	The Maxwell relations (8.2), Thermodynamic relations involving heat capacities (8.3), The TdS equations (8.4), The energy equations (8.5), Heat of reaction: Gibbs-Helmholtz equation (8.6) General condition for a natural change (9.2), An adiabatic process (9.2.1), An isothermal process (9.2.2), Free energies and Maxwell relations (9.3), Thermodynamic mnemonic diagrams (9.4), General conditions for thermodynamic equilibrium (9.5), An adiabatic process (9.5.1), An isothermal process (9.5.2), equilibrium between phases (9.6), One component system (9.6.1), Multi-component systems: Gibbs phase rule (9.6.2)
Unit 2	Production of low temperatures (Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt Ltd. Chennai, 2012)
	Ordinary methods of cooling (10.2), Adiabatic cooling (10.3), Joule-Thomson effect (10.4), Joule-Kelvin effect: An isenthalpic process (10.4.1), Adiabatic demagnetisation (10.5), The third law of thermodynamics (10.9), consequences of the third law (10.9.1)
Unit 3	Crystal Structure (Introduction to Solid State Physics by Charles Kittel, 8th Ed., John Wiley and Sons, 2005)
	Chapter 1 (includes subtopics) Periodic array of atoms, Fundamental types of lattices, index systems for crystal planes, simple crystal structures, direct imaging of atomic structure, Non ideal crystal structures Chapter 2 (includes subtopics) Diffraction of waves by crystals, Brillouin zones
Unit 4	Crystal Vibrations (Introduction to Solid State Physics by Charles Kittel, 8th Ed., John Wiley and Sons, 2005)
	Chapter 4 (includes subtopics) Vibrations of crystals with monoatomic bases, two atoms per primitive bases

Suggested books

1. Heat and Thermodynamics by Zemansky and Dittman, Wiley India
2. Solid State Physics by A Dekker

S. Y. B. Sc. Sem IV

Physics Paper IV (PH – 404)

Unit 1	Quantum Mechanics ((Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)
	Quantum Mechanics(5.1), Wave Equation(5.2), Schrodinger's Equation: Time Dependent Form(5.3), Linearity and Superposition(5.4), Expectation Values(5.5), Operators(5.6).
Unit 2	Quantum Mechanics ((Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)
	Schrodinger's Equation: Steady- State Form (5.7), Particle in Box(5.8), Finite Potential(5.9), Tunnel Effect(5.10), Harmonic Oscillator (5.11)
Unit 3	Polarization and Double Refraction (Optics by Ajoy Ghatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)
	Introduction (22.1), Malus' Law (22.2), The Wire Grid Polarizer and the Polaroid (22.3.1), Polarization by Reflection(22.3.2), Polarization by Double Refraction(22.3.3), Polarization by Reflection(22.3.4), Analysis of Polarized Light(22.7), Optical Activity(22.8), Theory of Optical Activity (22.16)
Unit 4	Lasers: An Introduction and Optical Fiber Basics (Optics by Ajoy Ghatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)
	Introduction(27.1), Spontaneous and Stimulated Emission(27.1.1), Main Components of the Lasers(27.1.2), Understanding Optical Amplification: The EDFA(27.1.3), The Resonator(27.1.4), The Lasing Action(27.1.5), The Fiber Laser(27.2), The Ruby Laser(27.3), The He-Ne Laser(27.4), Introduction(28.1), Total Internal Reflection(28.3), The Optical Fiber(28.4).

Suggested books

1. Modern Physics by Kenneth S. Krane
2. Optics by Eugene Hecht
3. Fundamentals of Optics by Jenkins & White
4. An Introduction to Laser Theory and Applications by M. N. Avadhanulu

S. Y. B. Sc. Sem IV
Physics Paper V (PH – 405)

Unit 1	Complex variable (Mathematical Physics by B. S. Rajput, PragatiPrakashan, India, 2013)
	Function of complex variable (4.7), Analytical Function (4.8), Complex integration (4.11), Some special integrals (without proof) (4.12), Cauchy's theorem (without proof) (4.13), Cauchy's integral formula (without proof) (4.14), zeroes and singularities of complex functions (4.19), Residue (4.20), Cauchy's residue theorem (without proof) (4.21)
Unit 2	Thermoelectricity (Electricity and Magnetism by D C Tayal, 4th Revised Ed., Himalaya Publishing House, India, 2019)
	Impedance Bridge(17.18), Measurement of Inductance(17.19) (a) Maxwell's Impedance Bridge (b) Maxwell's LC bridge (c) Owen's Bridge: (d) Anderson's Bridge, Measurement of Capacitance(17.21) (a) De Sauty's Bridge (b) Wien's Bridge (c) Schering Bridge, Measurement of frequency (low)(17.22).
Unit 3	Emitter Follower (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)
	CC amplifier (12.1) Output impedance (12.2), Maximum peak to peak output (12.3), Darlington connections (12.4), Class B push-pull emitter follower (12.5), Biasing Class B amplifiers (12.6), Class B driver (12.7), Voltage regulation (12.8)
Unit 4	JFETs (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)
	Basic Ideas(13.1), Drain curves(13.2), The Transconductance curve(13.3), Biasing in the Ohmic region(13.4), Biasing in the active region (13.5), Transconductance (13.6), JFET amplifiers (13.7), The JFET analog switch (13.8), other JFET applications (13.9)

Suggested books

1. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
2. Electricity and Magnetism by A S Mahajan and A R Rangwala 7th Ed. Tata McGraw-Hill, 2003.
3. Electronic Devices and Circuit Theory by Boylestad

S. Y. B. Sc. Sem IV

PH - 406

LIST OF EXPERIMENTS

	GROUP A
1	To study characteristics of Solar cell
2	To study divergence of LASER beam
3	To determine lattice parameters of a cubic single crystals structure.(From XRD pattern)
4	To find stopping potential using photocell
5	Y by bending
	GROUP B
1	Verification of Malus's Law
2	Verification of Brewster's Law
3	To determine wavelength of LASER beam using plane transmission grating.
4	To determine wavelength of spectral lines by plane transmission grating (Normal Incident Method)
5	To determine the specific rotation of a cane sugar by Laurent's half shade polarimeter
	GROUP C
1	To determine k_B/e using Transistor
2	To study FET characteristics
3	To determine figure of merit of Ballistic galvanometer
4	To determine the self-inductance of a coil by Owen's bridge.
5	To determine the dielectric constant of a given liquid by Schering bridge.

Suggested books:

1. D C Tayal, University Practical Physics, Edited by Ila Agarwal, Himalaya Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), S. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Three such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform three experiments, one from each group. Each experiment will be of 2 hours duration.
3. There shall not be more than 20 students per batch in the external exam.

B. Sc.
B. Sc. (PHYSICS)
Semester V

Sr. No.	Course Code	Course Title	Credits
1	PH – 506	Physics Paper VI	02
2	PH – 507	Physics Paper VII	02
3	PH – 508	Physics Paper VIII	02
4	PH – 509	Physics Paper IX	02
5	PH – 510	Physics Paper X	02
6	PH – 511	Physics Paper XI	02
7	PH – 512	Practical	06
8	Elective Course	Elective Paper 1 or 2 or 3	02

Faculty code: Science

Subject code: PH

Name of the Program: B. Sc. (Physics)

Subject: PHYSICS

External Examination	Time Duration
Theory Examination	2 Hrs. per paper
Practical Examination	2 Hrs. per practical

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	V	PH – 506	Theory	02	20	50	70
		PH – 507	Theory	02	20	50	70
		PH – 508	Theory	02	20	50	70
		PH – 509	Theory	02	20	50	70
		PH – 510	Theory	02	20	50	70
		PH – 511	Theory	02	20	50	70
		PH – 512	Practical	06	60	120	180
		Elective Course	Theory	02	20	50	70

Note:

1. Student must opt one Elective Paper in each semester (V & VI) out of different Elective Papers offered by the College. (Choice of the Elective Paper number exercised by student shall remain same in both the semesters)
2. College can offer more than one Elective Paper as a choice to the students depending on the available staff and infrastructure.

T. Y. B. Sc. Sem V

Physics Paper VI (PH – 506)

Classical Mechanics and Solid State Physics

Unit 1	Motion in Central Force Field (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hill Edu. (India) Pvt. Ltd., 2017)
	Equivalent one-body problem (5.1), Motion in a central force field (5.2), General features of the motion (5.3), Motion in an inverse-square law force field (5.4), Equation of the orbit (5.5), Kepler's laws of planetary motion (5.6)
Unit 2	Lagrangian Formulation (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hill Edu. (India) Pvt. Ltd., 2017)
	Constraints (8.1), Generalised coordinates (8.2), D'Alembert's principle (8.3), lagrange's equations (8.4), General expression for kinetic energy (8.5), Symmetries and laws of conservation (8.6), Cyclic or ignorable coordinates (8.7), Velocity-dependent potential of electromagnetic field (8.8), Reyleigh's dissipation function (8.9)
Unit 3	Free Electron Fermi Gas (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)
	Ch:6 Energy levels in one dimension, Effect of temperature on the fermi dirac distribution, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Electrical conductivity and Ohm's law, Motion in magnetic field, Thermal conductivity of metals (Including subtopics)
Unit 4	Energy Bands (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)
	Ch:7 Nearly free electron model, Bloch functions, Kronig – Penny model, Wave equation of electron in periodic potential, Number of orbitals in a band (Including subtopics)

Additional References:

1. An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow, McGraw Hill Edu. 2017
2. Classical Mechanics by G. Aruldas, PHI, 2015
3. Solid State Physics by S O Pillai, New Age International Publishers, 2018.

T. Y. B. Sc. Sem V

Physics Paper VII (PH – 507)

Electrodynamics and Optics

Unit 1	Electric Fields in Matter (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)
	Ch – 4 Electric Fields in Matter 1 Polarization: Dielectrics (1.1), Induced dipoles (1.2), Alignments of polar molecules (1.3), Polarization (1.4) 2 The field of a polarized object: Bound Charges (2.1), Physical interpretation of bound charges, The field inside a dielectric (2.3) 3 The electric displacement: Gauss's law in presence of dielectrics (3.1), A deceptive parallel (3.2), Boundary conditions (3.3) 4 Linear dielectrics: Susceptibility, permittivity, Dielectric constant (4.1), Boundary value problems with linear dielectrics(4.2), Energy in dielectric systems(4.3), Forces on dielectrics (4.4)
Unit 2	Magnetic Fields in Matter (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)
	Ch – 6 Electric Fields in Matter 1 Magnetization: Diamagnets, paramagnets, ferromagnets (1.1), Torques and forces on magnetic dipoles (1.2), Effect of magnetic field on atomic orbits (1.3), Magnetization (1.4) 2 The field of a magnetized object: Bound currents (2.1), Physical interpretation of bound currents (2.2), The Magnetic field inside matter (2.3) 3 The Auxiliary Field H: Ampere's law in magnetized materials (3.1), A deceptive parallel (3.2) 4 Linear and Non-linear media: Magnetic susceptibility and permeability (4.1), Ferromagnetism (4.2)
Unit 3	Multiple Beam Interferometry (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed. 2017)
	Introduction (16.1), Multiple reflections from a plane parallel film (16.2), The Fabry-Perot etalon (16.3), The Fabry-Perot interferometer (16.4), Resolving power (16.5), The Lummer-Gehrcke plate (16.6), Interference filters (16.7) (Including subtopics)
Unit 4	Holography (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed. 2017)
	Introduction (21.1), Basic theory (21.2), Requirements (21.3), Some applications of Holography (21.4) (Including subtopics)

Additional References:

1. Electricity and Magnetism by D C Tayal, Himalaya Publishing House, 2014
2. Fundamentals of Optics by F A Jenkins and H E White, McGraw Hill, 2017
3. Optics by Eugene Hecht and A. R. Ganeshan, Pearson Education, 2019

T. Y. B. Sc. Sem V
Physics Paper VIII (PH – 508)

Atomic and Nuclear Physics

Unit 1	Quantum Theory of Hydrogen Atom (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6th ed., 2006)
	Schrodinger's equation for the hydrogen atom (6.1), Separation variables (6.2), Quantum numbers (6.3), Principal quantum number (6.4), Orbital quantum number (6.5), Magnetic quantum number (6.6)
Unit 2	Quantum Theory of Hydrogen Atom (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6th ed., 2006)
	Electron probability density (6.7), Radiative transitions (6.8), Selection rules (6.9), Zeeman effect (6.10), Electron spin (7.1), Exclusion principle (7.2), Symmetric and antisymmetric wave functions (7.3)
Unit 3	Nuclear Models (Introduction to Nuclear and Particle Physics by V.K. Mittal, R.C. Verma, S.C. Gupta, PHI, 3rd ed., 2014)
	Introduction (2.1), Liquid drop model (2.2), Shell model (2.3), Fermi gas model (2.4), Collective model (2.5) (Including subtopics)
Unit 4	Radioactivity (Introduction to Nuclear and Particle Physics by V.K.Mittal, R.C. Verma, S.C. Gupta, PHI, 3rd ed., 2014)
	Alpha emission (3.5), Beta decay (3.6) Gamma decay (3.7), Artificial or induced radioactivity (3.8), Applications of radioactivity (3.9) (Including subtopics)

Additional References:

1. Quantum Physics by Robert Eisberg & Robert Resnick, Wiley, 2006
2. Nuclear Physics by D C Tayal, Himalaya Publications, 2017.
3. Nuclear and Particle Physics by Satadal Bhattacharyya, University Press (India) Private Ltd., 2019

T. Y. B. Sc. Sem V

Physics Paper IX (PH – 509)

Statistical Mechanics and Special Relativity

Unit 1	Blackbody radiation (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)
	Blackbody radiation as a thermodynamics system (11.4), The Stefan-Boltzmann law (11.4.1), Isothermal and adiabatic expansion of blackbody radiation (11.4.2), Spectral distribution of radiant energy (11.5), Wien's law (11.5.1), Rayleigh-Jeans law (11.5.2), Planck's law (11.5.3)
Unit 2	Basic concepts of Statistical Mechanics (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)
	Introduction (12.1), Bridging microscopic and macroscopic behaviours (12.2), Phase space and quantum states (12.3), Specification of the state of the system (12.4), Macrostate and microstates (12.5), Probability calculations (12.6), Types of Ensembles (12.7), Entropy and probability (12.8) (Including subtopics)
Unit 3	The Experimental Background of the Theory of Special Relativity (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd., 2007)
	Introduction (1.1), Galilean transformations (1.2), Newtonian relativity (1.3), Electromagnetism and newtonian Relativity (1.4), Attempts to locate the absolute frame; the Michelson-Morley experiment (1.5), Attempts to preserve the concept of a preferred ether frame; the lorentz-fitzgerald contraction hypothesis (1.6), Attempts to preserve the concept of a preferred ether frame; the ether-drag hypothesis (1.7), Attempts to modify electrodynamics (1.8), The postulates of special relativity theory (1.9)
Unit 4	Relativistic Kinematics (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd., 2007)
	The relativity of simultaneity (2.1), Derivation of the Lorentz transformation equations (2.2), Some consequences of the Lorentz transformation equations (2.3), The relativistic addition of velocities (2.6), Aberration and Doppler effect of relativity (2.7)

Additional References:

1. Fundamentals of Thermal and Statistical Physics by Fredrick Reif, Sarat Book Distributors, 2010
2. The Special Theory of Relativity by S Banerji and Asit Banerjee, PHI Learning Pvt. Ltd. New Delhi, 2012

T. Y. B. Sc. Sem V

Physics Paper X (PH – 510)

Analog and Digital Electronics

Unit 1	MOSFET, Thyristor & UJT (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed., 2017)
	MOSFETS: The Depletion-mode MOSFET (14.1), D-MOSFET curves (14.2), Depletion-Mode MOSFET amplifiers (14.3), The Enhancement-mode MOSFET (14.4), The Ohmic region (14.5), Digital switching (14.6), CMOS (14.7), Power FETs (14.8), E-MOSFET amplifiers (14.9) Thyristors: The Four – Layer diode (15.1), The Silicon controlled rectifier (15.2), The SCR crowbar (15.3), SCR phase control (15.4), Bidirectional thyristors (15.5), Other thyristors (15.7)
Unit 2	Differential Amplifier (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed., 2017)
	Differential amplifier (17.1), DC analysis of a differential amplifier (17.2), AC analysis of differential amplifier (17.3), Input characteristic of an Op Amp (17.4), Common mode gain (17.5), Integrated circuits (17.6), The current mirror (17.7), The loaded diff amp (17.8)
Unit 3	Digital logic and combinational logic circuit (Digital Principles and Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd. 7th ed., 2010)
	Digital Logic: The Basic gates-NOT, OR, AND (2.1), Universal logic gates (2.2), AND –OR invert gates (2.3) Combinational Logic Circuit: Boolean law and theorems (3.1), Sum of product method (3.2), Truth table to karnaugh map (3.3), Pairs, quads And octets (3.4) Karnaugh simplifications (3.5), Don't care conditions (3.6), Product of sum method (3.7), Product of sum simplification (3.8)
Unit 4	Digital logic and combinational logic circuit (Digital Principles and Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd 7th ed., 2010)
	Multiplexer (4.1), Demultiplexer (4.2), 1 of 16 Decoder, BCD to decimal decoders (4.4), Encoders (4.6), Exclusive OR gate (4.7), Parity generators and checkers (4.8), Magnitude comparator (4.9), Binary number system (5.1), Binary to decimal conversion (5.2), Decimal To binary conversion (5.3), Octal number (5.4), Hexadecimal numbers (5.5)

Additional References:

1. Functional Electronics by K.V. Ramanan – McGraw Hill Edu. (India) Pvt. Ltd Publication
2. Electronics Devices and Circuits by Allen Mottershed – PHI Publication.
3. Modern Digital Electronics by R P Jain, McGraw Hill Education, New Delhi, 2009.

T. Y. B. Sc. Sem V
Physics Paper XI (PH – 511)

Mathematical Methods of Physics and C-Programming

Unit 1	Vector Analysis : (Mathematical Method for Physicists by Arfken and Weber, Academic Press, 6th ed., 2010)
	Orthogonal coordinates in R^3 (2.1), Differential vector operators (2.2), Spatial coordinate system; Introduction (2.3), Circular cylindrical coordinates (2.4), Spherical polar coordinates (2.5)
Unit 2	Numerical Methods (Introductory Methods of Numerical Analysis by S.S.Sastry, PHI publication, 4th ed., 2006)
	Solutions of algebraic equations: Introduction (2.1), The bisection method (2.2), The method of false position (2.3), The iteration method (2.4), Newton-Raphson method (2.5) Interpolation: Introduction (3.1), Errors in polynomial interpolation (3.2), Finite differences (3.3), Forward differences (3.3.1), Backward differences (3.3.2), Central differences (3.3.3), Symbolic relations and separation of symbols (3.3.4), Detection of errors by use of difference tables (3.4), Differences of a polynomial (3.5), Newton's formula for interpolation (3.6) Divided differences and their properties (3.10), Newton's general interpolation formula (3.10.1)
Unit 3	C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))
	Numerical Constant and Variables: Constants (5.1), Scalar variable (5.2), Declaring variable names (5.3), Defining constants (5.4) Arithmetic Expressions: Arithmetic operators and modes of expressions (6.1), Integer expressions (6.2), Floating point expressions (6.3), Operator precedence in expressions (6.4), Examples of arithmetic expressions (6.5), Assignment statements (6.6), Defining variables (6.7), Arithmetic conversion (6.8), Assignment expressions (6.9), Increment and decrement operators (6.10), Multiple assignments (6.11)
Unit 4	C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))
	Input and Output in C Programs Output function (7.1), Input function (7.2) Conditional Statements Relation Operators (8.1), Compound statement (8.2), Conditional statements (8.3), Example programs using conditional statements (8.4) Implementing Loops in Programs The <i>while</i> loop (9.1), The <i>for</i> Loop (9.2), The <i>do while</i> loop (9.3)

Additional References:

1. Mathematical Physics by H K Dass and Dr. Rama Verma, S.Chand Co.7th ed., 2019
2. Let us C by Y. Kanetkar, BPB Publications, 17th ed., 2017
3. Numerical Method for Scientists and Engineers by K. S. Rao, PHI, 2001.
4. Numerical Mathematical analysis by J. B. Scarborough, John Hopkin Press, 1930.

Practicals for T. Y. B. Sc. Sem V

PH-512

LIST OF EXPERIMENTS

	GROUP A
1	To determine Young's modulus of a wire using optical lever.
2	To determine Gravitational acceleration by Kater's pendulum
3	To study Measurement of susceptibility of paramagnetic material
4	To determine Elastic constants for the material of flat spiral spring
5	To determine angle of contact and surface tension of mercury by Quinck's method.
6	To determine Moment of Inertia by Bifilar suspension.
	GROUP B
1	To determine wave length of light by constant deviation spectrometer
2	To determine the cardinal points of a lens system using turn table.
3	To determine separation between plates of a Fabry Perot Etalon.
4	To determine the resolving power of a telescope.
5	To determine Hartman formula using prism.
6	To determine refractive index of a liquid by total internal reflection.
	GROUP C
1	To determine activation energy of semiconductor
2	To determine electronic charge 'e' using photo – emissive cell.
3	To determine absorption coefficient of liquid using photo cell.
4	To determine dielectric constant of a dielectric material with frequency.
5	To determine value of Planck's constant using LEDs of at least 4 different colors.
6	To determine thermal conductivity of Rubber Tubing
	GROUP D
1	Study of Parallel resonance using LCR circuit.
2	To determine Temperature Coefficient of Resistance for Platinum using Carey-Foster's bridge
3	To determine self-inductance by Anderson's bridge
4	To determine absolute value of capacitance using ballistic galvanometer.
5	Comparison of capacitance by the method of mixture.
6	To determine figure of merits of ballistic galvanometer.
	GROUP E
1	Design built and test adder/ subtractor using IC 741
2	Design built and test astable multivibrator using IC-555/Op-Amp
3	Design built and study Wien bridge oscillator
4	Design built and test Integrator and differentiator using IC 741.
5	Design built and test AND, OR, NOT gates using NAND/NOR gates.
6	Design built and test two stage RC coupled amplifier.
	GROUP F
1	C-program for calculation of days between two dates of a year
2	C-program to solve the sum of the sine and cosine series and print out the curve.
3	C-program to convert a given integer into binary and octal systems and vice versa.
4	C-program to find Inverse of a matrix
5	Find roots of $f(x) = 0$ by using Newton-Raphson method

6	Find roots of $f(x) = 0$ by using iteration method
7	Use of Newton's forward, backward and general interpolation formula
8	Use of Newton's interpolation formula to estimate the first order and the second order differentials numerically.

Additional References:

1. D.C.Tayal ,University Practical physics, Edited by Ila Agarwal, Himalaya Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note (for Sem-V Practical) :

1. The duration of each experiment is of 2 hours.
2. In the external exam, a student shall perform six experiments, one from each group. Each experiment will be of 2 hours duration.
3. There shall not be more than 20 students per batch in the external exam.
4. The external exam of each batch should be completed in two days by arranging three sessions of 2 hours each in a day.

T. Y. B. Sc. Sem V

Elective Paper - I

Modern Digital and Analog Communication System-I

Unit 1	Introduction : Communication System (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)
	Communication systems (1.1), Analog and digital messages (1.2), Channel effect, Signal-to-Noise ratio and capacity (1.3), Modulation and detection (1.4) (Including subtopics)
Unit 2	Amplitude Modulations and Demodulations (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)
	Baseband versus carrier communications (3.1), Double-Sideband amplitude modulation (3.2), Amplitude modulation (AM) (3.3), Bandwidth-Efficient amplitude modulations (3.4), Amplitude modulations: vestigial sideband(VSB) (3.5), Local carrier synchronization (3.6), Frequency division multiplexing (FDM) (3.7), Phase-Locked loop and some applications (3.8) (Including subtopics)
Unit 3	Angle Modulation and Demodulation (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)
	Nonlinear modulation (4.1), Bandwidth of Angle-Modulated waves (4.2), Generating FM waves (4.3), Demodulation of FM signals (4.4), Effects of nonlinear distortion and interference (4.5), Superheterodyne analog AM/FM receivers (4.6), FM broadcasting system (4.7)
Unit 4	Sampling and analog-to-Digital Conversion (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)
	Sampling theorem (5.1), Pulse code modulation (PCM) (5.2), Digital telephony: PCM in T1 carrier systems (5.3), Digital multiplexing (5.4), Differential pulse code modulation (DPCM) (5.5), Adaptive differential PCM (ADPCM) (5.6), Delta modulation (5.7) Vocoders and video compression (5.8) (Including subtopics)

Additional References:

1. Electronic Communications by Ruddy and coolen, Pearson Education, 4th ed., 2008
2. Introduction to Analog & Digital Communications : Simon Haykin & Michael Moher, 2014
3. Electronic Communication system by G. Kennedy & B. Devis, McGraw Hills Education, 6th ed., 2017.

T. Y. B. Sc. (Physics) Sem V
Elective Paper 12

Astrophysics-I

Unit 1	Astronomical Instruments (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)
	Optical telescopes (1.3), Radio telescopes (1.4), The hubble space telescope (HST) (1.5), Astronomical spectrograph (1.6), Spectrophotometry (1.9)
Unit 2	Star (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)
	Magnitudes, Motions, and Distances of Stars Stellar magnitude sequence (3.1), Absolute magnitude and the distance module (3.2), Radiometric magnitudes (3.5), The colour index of a star (3.6), Luminosities of star (3.7) Spectral Classification of Stars Introduction (4.1), Boltzmann's formula (4.2), Saha's equation of thermal ionization (4.3), Importance of ionization theory in astrophysics (4.6)
Unit 3	The Sun (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)
	Sun- A typical star (5.1), The photosphere: limb- darkening (5.2), Solar granulation (5.3), The chromosphere (5.5), Solar corona (5.6), Prominences (5.7), The 11 Year solar cycle and sunspots (5.8), The solar magnetic fields (5.9), Theory of sunspots (5.10), Solar flares (5.11), Radio emission from the sun (5.12), Solar wind (5.13), The solar neutrino puzzle (5.14)
Unit 4	Binary and Multiple Stars (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)
	Introduction (7.1), Visual binary (7.2), Spectroscopic binary (7.3), Eclipsing binary (7.4), Multiple stars (7.5), Origin of binary stars (7.6), Stellar masses and mass luminosity relation (7.7), Mass transfer in close binary systems (7.8)

Additional References:

1. Astrophysics: Stars and Galaxies by K D Abhyankar, Unievrsity Press, 2001
2. Introduction to Cosmology by Jayant Narlikar, Cambridge University Press, 2002.

T. Y. B. Sc. (Physics) Sem V
Elective Paper 13

Measurements and Instrumentation-I

Unit 1	Optoelectronic measurement (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Introduction (19.1), Monochromatic light (19.2), Polarized wave shape (19.3), Refraction and refractive index (19.4), Reflection, Absorption and transmission (19.5), Radiometry and photometry (19.6), Terms relating to photometry (19.7), Laws of illumination (19.11), Terms relating to radiometry (19.12), Photometry/radiometry measurement systems (19.13), Optical sources (19.14), Optical detectors (19.15).
Unit 2	Electronic Instruments (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Introduction (20.1), Electronic voltmeter and their advantages (20.2), Vacuum tube voltmeter (20.3), Differential amplifier (20.4), Difference amplifier type of electronic voltmeter (20.5), Source follower types of electronic voltmeter (20.6), DC voltmeter with direct-coupled amplifier (20.7), Chopper stabilized amplifier (20.8), Electronic voltmeter using rectifier (20.9)
Unit 3	Cathode Ray Oscilloscope (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Introduction (21.1), Cathode ray tube (21.2), Electron gun (21.3), Electrostatic focusing (21.4), Electrostatic deflection (21.5), Post deflection acceleration of electron beam (21.6), Effect of beam transit time and frequency limitations (21.7), Deflection plates (21.8), Graticule (21.10), Time base generator (21.13), Oscilloscope amplifiers (21.14), Vertical input and sweep generator signal synchronization (21.15), Attenuators (21.16), Basic CRO circuits (21.17), Observation of waveform on CRO (21.18), Measurements of voltage and currents (21.19), measurements of phase and frequency (21.20)
Unit 4	Transducers (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Transducers (25.6), Electric-transducers (25.7), Classification transducers (25.8), Characteristics and choice of transducers (25.9), Summary of factors influencing the choice of transducers (25.10), Resistive transducers (25.11), Potentiometers (25.12), Materials used for potentiometer (25.14), Advantages and disadvantages of resistance potentiometer (25.15)

Additional References:

1. Electrical and electronic measurements and instrumentation By R.K.Rajput, S.Chand Publication
2. Electronic instrumentation by H.S.Kalsi, Mc Graw Hill (third Edition), 2017
3. Electrical and electronic measurements and instrumentation by Syed Imam and Vibhav Kumar Published by Wiley, 2020

Structure for B. Sc. Syllabus

Inforce from June 2021

B. Sc. (PHYSICS)

Semester VI

Sr. No.	Course Code	Course Title	Credits
1	PH – 606	Physics Paper VI	02
2	PH – 607	Physics Paper VII	02
3	PH – 608	Physics Paper VIII	02
4	PH – 609	Physics Paper IX	02
5	PH – 610	Physics Paper X	02
6	PH – 611	Physics Paper XI	02
7	PH – 612	Practicals	06
8	Elective Course	Elective Paper 1 or 2or 3	02

Faculty code: Science

Subject code: PH

Name of the Program: B. Sc. (Physics)

Subject: PHYSICS

External Examination	Time Duration
Theory Examination	2 Hrs. per paper
Practical Examination	2 Hrs. per practical

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	VI	PH – 606	Theory	02	20	50	70
		PH – 607	Theory	02	20	50	70
		PH – 608	Theory	02	20	50	70
		PH – 609	Theory	02	20	50	70
		PH – 610	Theory	02	20	50	70
		PH – 611	Theory	02	20	50	70
		PH – 612	Practical	06	60	120	180
		Elctive Course	Theory	02	20	50	70

T. Y. B. Sc. Sem VI

Physics Paper VI (PH – 606)

Classical Mechanics and Solid State Physics

Unit 1	Moving Coordinate Systems (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hills Edu. Pvt. Ltd., 2017)
	Coordinate system with relative translational motion (9.1), Rotating coordinate system (9.2), The Coriolis force (9.3), Motion on the Earth (9.4), Effect of Coriolis force on a freely falling particles (9.5)
Unit 2	Motion of a Rigid Body (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hills Edu. Pvt. Ltd., 2017)
	Euler's theorem (10.1), Angular Momentum and Kinetic Energy (10.2), the inertia tensor (10.3), Euler's equations of motion (10.4), Torque-free motion (10.5), Euler's angles (10.6), Motion of a symmetric top (10.7)
Unit 3	Fermi Surfaces and Metals (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)
	Ch: 9 Reduced zone scheme, Periodic zone scheme, Construction of fermi surfaces, Electron orbits, Hall orbits and open orbits, Calculation of energy bands, Experimental methods in fermi surface studies (including of subtopics)
Unit 4	Superconductivity (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)
	Ch:10 Experimental Survey, Theoretical Survey, High Temperature Superconductors (including subtopics)

Additional References:

1. An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow, McGraw Hill Edu. 2017
2. Classical Mechanics by G. Aruldas, PHI, 2015
3. Solid State Physics by S O Pillai, New Age International Publishers, 2018.

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Physics Paper VII (PH – 607)

Electrodynamics and Optics

Unit 1	Electrodynamics (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)
	Ch-7 Electrodynamics 1 Electromotive Force: Ohm's law (1.1), Electromotive force (1.2), Motional emf (1.3) 2 Electromagnetic Induction Faraday's law (2.1), The induced electric field (2.2), Inductance (2.3), Energy in magnetic field (2.4)
Unit 2	Electrodynamics (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)
	Ch-7 Electrodynamics 3 Maxwell's Equations : Electrodynamics before maxwell (3.1), How maxwell fix Ampere's law (3.2), Maxwell's equation (3.3), Magnetic charge (3.4), Maxwell's equations in matter (3.5), Boundary conditions (3.6) Conservation laws: The continuity equation (1.1), Poynting's theorem (1.2)
Unit 3	Reflection and Refraction of Electromagnetics Waves (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed., 2017)
	Introduction (24.1), Reflection and refractions at an interface of two media (24.2), Normal incidence on a medium (24.3), Oblique incidence: E Parallel to the plane of incidence (24.4), Polarization by reflection: Brewster's law (24.5), Total internal reflection and the evanescent wave (24.6), Oblique incidence: E perpendicular to the plane of incidence (24.7), Expressions for reflectivity and transmittivity (24.8)
Unit 4	Optical Fiber Basics using Ray Optics (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed., 2017)
	Why glass fibers? (28.5), The coherent bundle (28.6), The numerical aperture (28.7), Attenuation in optical fibers (28.8), Multimode fibers (28.9)

Additional References:

1. Electricity and Magnetism by D C Tayal, Himalaya Publishing House, 2014.
2. Fundamentals of Optics by F A Jenkins and H E White, McGraw Hill, 2017.
3. Optics by Eugene Hecht and A. R. Ganeshan, Pearson Education., 2019.

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Physics Paper VIII (PH – 608)

Atomic and Nuclear Physics

Unit 1	Many Electron Atoms (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6 ed., 2006)
	Periodic table (7.4), Atomic structures (7.5), Explaining the Periodic table (7.6), Spin-Orbit Coupling (7.7), Total Angular Momentum (7.8), X-Ray spectra (7.9)
Unit 2	Molecular Physics (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6 ed., 2006)
	The Molecular bond (8.1), Electron sharing (8.2), The H ₂ ⁺ Molecular ion (8.3), The Hydrogen molecule (8.4), Complex molecules (8.5), Rotational energy levels (8.6), Vibrational energy levels (8.7), Electronic spectra of molecules (8.8)
Unit 3	Particle Accelerators and Radiation Detectors (Introduction to Nuclear and Particle Physics by V. K. Mittal, R. C. Verma, S. C. Gupta, PHI, 3rd ed., 2014)
	Introduction (6.1) Cockcroft and Walton accelerator (6.2), Tandem accelerator (6.4), Linear Accelerator (LINAC) or Drift Tube accelerator (6.5), Introduction (7.1), Gas-Filled detectors (7.2), Ionizations chamber (7.3), Proportional counters (7.4), Geiger-Muller (GM) counters (7.5), Scintillations detectors (7.6), Semiconductors radiations detectors (7.7), Cloud chamber (7.8), Cerenkov counters (7.12) (Including subtopics)
Unit 4	Particle Physics (Introduction to Nuclear and Particle Physics by V. K. Mittal, R. C. Verma, S. C. Gupta, PHI, 3rd ed., 2014)
	Introduction (8.1), Productions of elementary particles (8.2), Types of interaction (8.3), Classification of elementary particles (8.4), Mass spectra and decays of elementary particles (8.5), Quantum numbers (8.6), Conservation laws (8.7) (Including subtopics)

Additional References:

1. Quantum Physics by Robert Eisberg & Robert Resnick, Wiley, 2006
2. Nuclear Physics by D C Tayal, Himalaya Publications, 2017
3. Nuclear and Particle Physics by Satadal Bhattacharyya, University Press (India) Private Ltd, 2019

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Physics Paper IX (PH – 609)

Statistical Mechanics and Special Relativity

Unit 1	Classical and Quantum Statistics (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)
	Classical and quantum statistics (12.9), Distribution functions (12.9.1), Partition function and thermodynamics properties of a system (13.2), The partition function for an ideal monatomic gas (13.3), Single partition function (13.3.1), N-particle partition function and thermodynamic variables (13.3.2), Some deductions from MB statistics (13.4), Distribution law for molecular speeds (13.4.1), specific heat capacity of gases (13.4.2), partition function of a diatomic molecule (13.4.3), specific heat capacity of hydrogen (13.4.5)
Unit 2	Specific Heat Capacity of Solids (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)
	Specific heat capacity of solids (13.5), Einstein's theory (13.5.1), Debye theory (13.5.2), Thermodynamic functions of systems with finite number of energy levels (13.6), negative temperatures (13.6.1), transition between states: Einstein's formulation of spontaneous and stimulated emission of radiation (13.6.2), Laser action (13.6.3)
Unit 3	Relativistic Dynamics (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd.)
	The need to redefine momentum (3.2), Relativistic momentum (3.3), Alternative views of mass in relativity (3.4), The relativistic force law and the dynamics of a single Particle (3.5), The equivalence of mass and energy (3.6)
Unit 4	Relativity and Electromagnetism (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd.)
	Introductions (4.1) The interdependence of electric and magnetic fields (4.2), The transformation for E and B (4.3), The field of a uniformly moving point charge (4.4), Forces and fields near a current carrying wire (4.5), Forces between moving charges (4.6), The invariance of Maxwell's equations (4.7), The possible limitations of Special Relativity (4.8)

Additional References:

1. Fundamentals of Thermal and Statistical Physics by Fredrick Reif, Sarat Book Distributors, 2010
2. The Special Theory of Relativity by S Banerji and Asit Banerjee, PHI Learning Pvt. Ltd. New Delhi, 2012

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Physics Paper X (PH – 610)

Analog and Digital Electronics

Unit 1	Operational Amplifiers and Linear Op-Amp circuits (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed.)
	Introduction : Introduction to OP Amps (18.1), The 741 Op Amp (18.2), The inverting amplifiers (18.3), The Non-inverting amplifiers (18.4), Two Op-Amp applications (18.5) Inverting-amplifier circuits (20.1), Noninverting-amplifier circuits (20.2), Inverter/Noninverter circuits (20.3), Differential amplifiers (20.4), Instrumentation amplifiers (20.5), Summing amplifier circuits (20.6)
Unit 2	Feedback & Oscillators (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed.)
	Feedback: Four types of negative feedback (19.1), VCVS Voltage gain (19.2) Oscillators: Theory of sinusoidal oscillators (23.1), The Wein Bridge oscillator (23.2), Other RC oscillators (23.3), The Colpitt oscillator (23.4), Other LC oscillators (23.5), The 555 timer (23.7), Astable operation of 555 timer (23.8), 555 circuits (23.9)
Unit 3	Arithmetic Circuits (Digital Principles And Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd, 7th ed., 2010)
	Clock waveforms (7.1), TTL clock (7.2), Schmitt trigger (7.3), 555 timer – Astable (7.4), 555 timer – monostable (7.5), Monostables with input logic (7.6), Pulse-forming circuits (7.7)
Unit-4	Flip-Flop (Digital Principles And Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd, 7th ed., 2010)
	RS Flip-Flop (8.1), Gated Flip-Flops (8.2), Edged-Triggered RS Flip-Flops (8.3), Edged-Triggered D Flip-Flops (8.4), Edged-Triggered, Jk Flip-Flops (8.5), Flip-Flops Timing (8.6), Edge Triggering through input lock out (8.7), JK Master-Slave Flip-Flops (8.8).

Additional References:

1. Functional Electronics by K.V. Ramanan – McGraw Hill Edu. Pvt. Ltd, New Delhi Publication
2. Electronics Devices and Circuits by Allen Mottershed – PHI Publication.
3. Modern Digital Electronics by R P Jain, McGraw Hill Education, New Delhi, 2009.

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Physics Paper XI (PH – 611)

Mathematical Method of Physics and C-Programming

Unit 1	Differential equations (Mathematical Method for Physicists by Arfken and Weber, Academic Press 6th ed., 2010)
	Partial Differential Equations (9.1), First order Differential Equations (9.2), Separation of variables (9.3), Singular Points (9.4) Series solutions-Frobenius method (9.5)
Unit 2	Matrices (Mathematical Method for Physicists by Arfken and Weber, Academic Press 6th ed., 2010)
	Matrices Basic Definitions, Rank, Equality, Addition, Subtraction, Multiplication by Scalar, Matrix Multiplication- inner product, Direct product, Diagonal matrices, Matrix inversion, Orthogonal Matrices Direction cosines, Applications to vectors, Orthogonality conditions: Two Dimensional case, Transpose matrix 3.5 Diagonalization of Matrices: Moment of inertia matrix, Eigen vector, Eigen values, Hermitian matrices, Anti-Hermitian matrices, Functions of matrices, Diagonal matrices
Unit 3	C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))
	Defining and Manipulating Arrays: Array Variable (10.1), Syntax rules for arrays (10.2), Use of multiple subscripts in array (10.3), Reading and writing multidimensional arrays (10.4), Examples of for Loops with arrays (10.5) Logical Expressions and More Control Statements: Introduction (11.1), Logical operators and expressions (11.2), Precedence rules for logical operators (11.3), Some example of use of logical expressions (11.4), The switch statement (11.5), The break statement (11.6), The continue statement (11.7)
Unit 4	C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))
	Functions: Introduction (13.1), Defining and using functions (13.2), Syntax rules for function declaration (13.3), Array in functions (13.4), Global local and static variables (13.5)

Additional References:

1. Mathematical Physics by H K Das and Dr. Rama Verma, S. Chand Co., 7th ed., 2019
2. Mathematical Physics by P K Chattopadhyaya, New Age International publishers, 2006
3. Let us C by Y. Kanetkar, BPB Publications, 17th ed., 2017

Practicals for T. Y. B. Sc. Sem VI

PH-612

LIST OF EXPERIMENTS

	GROUP A
1	To determine Young's modulus by Koeing's method.
2	To study Resonance Pendulum
3	To study coupled oscillator
4	To determine the oscillation of mass in the case of combination of two spring.
5	To determine Young's modulus by the method of vibration
6	To determine the moment of inertia of a flywheel
	GROUP B
1	To determine refractive index of liquid using hollow prism
2	To determine the wavelength of light using Fresnel's biprism
3	To determine the resolving power of diffraction grating
4	To determine cardinal points of a lens system using Searle's goniometer
5	To determine the wavelength of light using Lloyd's mirror
6	To determine wavelength of light using Edser butler plate
	GROUP C
1	To determine the constants of thermocouple
2	To determine e/m by Thomson's method
3	To determine the constants of BG using solenoid
4	To study LDR
5	To study Colpitt's oscillator
6	To study Hartley's oscillator
	GROUP D
1	To determine high resistance using method of leakage
2	To determine mutual inductance by Carey-Foster's method
3	To determine self-inductance of a given coil by Rayleigh's method
4	To determine self-inductance of a given coil using Maxwell's Induction bridge
5	To determine the ratio of capacities using Desauty's method
6	To determine mutual inductance using ballistic galvanometer

References:

1. University Practical Physics by D C Tayal, Edited by Ila Agarwal, Himalaya Publishing House
2. Advanced Practical Physics by B. L. Worsnop and H. T. Flint, Asia Publishing House, New Delhi.
3. A Laboratory Manual of Physics for Undergraduate Classes by P. Khandelwal, Vani Publication House, New Delhi.
4. BSc Practical Physics by Geeta Sanon, S. Chand & Co., 1st ed. 2007

Note (for Sem-VI Practical):

1. The duration of each experiment is of 2 hours.
2. In the external exam, a student shall perform four experiments, one from each group. Each experiment will be of 2 hours duration.
3. The experiments in Sem-VI divided in four groups (A,B,C and D) carrying 4 credits (8hrs/week) as per list attached above.
4. In addition to experiments, students have to perform project work (4 hr/week, 2 credits) under the guidance of a faculty as per the guidelines mentioned below:
5. There shall not be more than 20 students per batch in the external exam.
6. The external exam of each batch of 20 students should be completed in two days by arranging three sessions of 2 hours each in a day. Last two sessions per batch shall be allotted for evaluation of project work.

Guidelines for Project Work:

It is expected that,

1. As project work the student does work equivalent to twelve hours laboratory experiments through sixth semester under the guidance of faculty.
2. A project shall be carried out either individually or in a group of not more than four students. The Head of the Department shall assign one teacher per project. The equivalent workload should be credited to the teacher who has been assigned the project guideship and must be added in the time schedule of practical.
3. The project work is a practical course and it is intended to develop a set of skills pertaining to the laboratory work apart from the cognition of students. Therefore, the guides should not permit projects that involve no contribution on part of student.
4. The project must have a clear and strong link with the principles of basic physics and/or their applications.
5. The theme chosen should be such that it promotes better understanding of physics concepts and brings out the creativity in the students.
6. The evaluation of the project work must give due credit to the amount of the project work actually done by a student, skills shown by the student, understanding of the physics concepts involved and the presentation of the final report at the time of viva voce.
7. Any ready-made material used in the report (such as downloaded pages from the web) must be clearly referred to and acknowledged.
8. Time schedule for project work shall be decided by the guide in such a way that the final report submission is completed along with submission of journal of laboratory work.
9. Any non-adherence to this norm should attract a penalty by way of deduction in the marks awarded to a student.

Minimum 4 hours per student/group should be spent by the faculty member for the guidance of project work to the students which shall be considered as work load of practical.

Evaluation of the project work:

The following points shall be considered during evaluation of project work:

1. Working model (Experimental or Concept based simulation)
2. Understanding of the project
3. Data collection
4. Data Analysis
5. Innovation/difficulty
6. Report.

Scheme of external examination: (Total 120 marks)

1. The University (external) examination for Practical shall be conducted at the end of each Semester and the evaluation of Project work at the end of the sixth semester along with practical examination.
2. The candidates shall appear for external examination of Practical course carrying
 - (i) 120 marks at the end of fifth semester (Six practical of two hours each)
 - (ii) 80 marks (Four sessions of two hours each) + 40 marks project work.
3. The evaluation of project work should be conducted based on presentation and report. Extra care must be taken in the evaluation of projects done in a pair or group. Delegation of the work done by individuals must be sought from the students in such cases.
4. The candidate shall prepare and submit a certified Journal for practical examination based on the practical course with at least 80% of total experiments from each group.
5. At the time of practical examination, the candidate must also submit the certified Project Report prepared as per the guidelines given in the Syllabus.
6. A candidate will be allowed to appear for the practical examination in each semester only if the candidate submits a certified journal of that semester or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of that semester as per the minimum requirements and a project completion report duly certified by the project in-charge and Head of the Department.
7. The scheme for internal marks (total 60 marks) shall also be followed to include project work evaluation.
8. During the external practical examination the number of students per batch should be twenty (20).

T. Y. B. Sc. Sem VI

Elective Course – I

Modern Digital and Analog Communication System-II

Note: The prerequisite for this course is that a student should have taken the Elective paper: Modern Digital and Analog Communication System-I in Semester V.

Unit 1	Principles of Digital Data Transmission (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017))
	Digital communication systems(8.1), Line coding (8.2), Pulse shaping (8.3) (Including subtopics)
Unit 2	Principles of Digital Data Transmission (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017))
	Scrambling (8.4), Digital receivers and regenerative repeaters (8.5), Eye diagrams: An important tool (8.6), PAM: Many baseband signalling for higher data rate (8.7), Digital carrier systems (8.8), Many digital carrier modulation (8.9)
Unit 3	Performance Analysis of Digital Communication Systems (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017))
	Optimum linear detector for binary polar signaling (9.1), General binary signaling (9.2), Coherent receivers for digital carrier modulations (9.3), Signal space analysis of optimum detection (9.4), Vector decomposition of white noise random processes (9.5) (Including subtopics)
Unit 4	Performance Analysis of Digital Communication Systems (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017))
	Optimum receiver for white gaussian noise channels (9.6), General expression for error probability of optimum receivers (9.7), Equivalent signal sets (9.8), Nonwhite (Colored) Channel noise (9.9), Other useful performance criteria (9.10), Noncoherent detection (9.11) (Including subtopics)

Additional References:

1. Electronic Communications by Ruddy and Coolen, Pearson Education, 4th ed., 2008
2. Introduction to Analog & Digital Communications : Simon Haykin & Michael Moher, 2014
3. Electronic Communication system by G. Kennedy & B. Devis, McGraw Hills Education, 6th ed., 2017.

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Elective Paper 25

Astrophysics-II

Note: The prerequisite for this course is that a student should have taken the Elective paper: Astrophysics-I in Semester V.

Unit 1	Structure and Evolution of Stars (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)
	Introduction (14.1), The equation of state for stellar interior (14.3), Mechanical and thermal equilibrium in stars (14.4), Energy generation in stars (14.6), Stellar evolution (14.7) White dwarfs (14.8)
Unit 2	Pulsars, Neutron Stars and Black Holes (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)
	Discovery of pulsars (15.1), Rotating neutron stars model of pulsars (15.2), Period distribution and loss of rotational energy (15.3), Binary pulsars (15.7), Black holes (15.8)
Unit 3	Quasars (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)
	The discovery (20.1), Radio properties (20.2), Optical properties (20.3), The redshift of quasars (20.4), Active galactic nuclei (20.5)
Unit 4	Cosmology (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)
	Introduction (21.1), Redshift and the Expansion of the Universe (21.2), Matter Density in the universe and the deceleration parameter (21.3), The Cosmological Principle: The perfect Cosmological principle (21.4), Fundamental equations of cosmology (21.5), The Cosmic Microwave Background Radiation (21.8)

Additional References:

1. Astrophysics: Stars and Galaxies by K D Abhyankar, University Press, 2001
2. Introduction to Cosmology by Jayant Narlikar, Cambridge University Press, 2002.

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Elective Paper 26

Measurements and Instrumentation-II

Note: The prerequisite for this course is that a student should have taken the Elective paper: Measurements and Instrumentation-I in Semester V.

Unit 1	Primary Sensing Elements and Transducers 1 (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Resistance Thermometer (25.19), Thermistors (25.20), Integrated circuits temperature transducers (25.22), Variable inductance transducers (25.23), Linear Variable Differential Transformer (LVDT) (25.24), Rotary Variable Differential Transformer (RVDT) (25.25), Synchros (25.26), Resolvers (25.27)
Unit 2	Primary Sensing Elements and Transducers 2 (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Capacitive transducers (25.28), Piezo-electric transducers (25.29), Hall effect transducers (25.30), Magneto-Resistors (25.31), Magneto-elastic and magnetostrictive transducers (25.32), Optoelectronic transducers (25.33)
Unit 3	Display Devices (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Introduction (28.1), Electrical indicating instruments (28.2), Digital instruments (28.3), Electronic counters (28.4), Digital display methods (28.5), Digital display units (28.6), Segmental displays (28.7), DOT matrices (28.8), Rear projection display (28.9), Light emitting diode (28.11), Liquid crystal diodes (28.12), Nixie tubes (28.13), Segmental gas discharge displays (28.14), Decade counting assemblies (DCAs) (28.15), Display systems (28.16)
Unit 4	Modern Sensors and Chemical Sensors (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)
	Types of modern sensors (32.2), Nano-sensors (32.3), Biosensors (32.4), Introduction (34.1), Probe analysers (34.2), Differential refractometers (34.3), Spectrophotometers (34.4), Detectors (34.5), Filters (34.6), Chromatography (34.7), Electrochemical sensors (34.8),

Additional References:

1. Electrical and electronic measurements and instrumentation By R.K.Rajput, S.Chand Publication
2. Electronic instrumentation by H.S.Kalsi, Mc Graw Hill (third Edition), 2017
3. Electrical and electronic measurements and instrumentation by Syed Imam and Vibhav Kumar Published by Wiley, 2020