

SOLAPUR UNIVERSITY, SOLAPUR
Semester pattern Syllabus for
B.Sc. Part – III
Chemistry
(w. e. f. June, 2015-16)
Semester V & VI

General Structure

Theory examination :

There will be four theory papers of 50 marks each for each Semester. Their titles and distribution of marks are as follows.

Semester – V

Paper - IX : Physical Chemistry - 50 marks

Paper - X : Inorganic Chemistry - 50 marks

Paper - XI : Organic Chemistry - 50 marks

Paper - XII : Analytical and Industrial Physical Chemistry - 50 marks

The duration of each theory paper examination will be of 2 hours.

Semester – VI

Paper - XIII : Physical Chemistry - 50 marks

Paper - XIV : Inorganic Chemistry - 50 marks

Paper - XV : Organic Chemistry - 50 marks

Paper - XVI : Analytical and Industrial Organic Chemistry - 50 marks

The duration of each theory paper examination will be of 2 hours

Practical examination : (Annual)

Practical examination will be of 200 marks. The distribution of marks will be as follows :

Physical Section : 65

Inorganic Section : 70

Organic Section : 65

Total : 200 Marks.

The duration of practical examination will be of three days - six and half hours per day.

For Organic Section: Schedule of examination should be as follows

- 1) Organic Mixture Analysis: Should be given at the beginning of the examination
- 2) Estimation/Preparation : at 12:30 pm
- 3) Derivative: at 02:30 pm

All answer sheets should be collected at the end of examination.

CHEMISTRY

Syllabus for B.Sc.-III

Theory

N. B. (i) Figures shown in bracket indicate the total lectures required for the respective topics.

(ii) The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective topics.

- (iii) All topics should be dealt with S.I. units.
- (iv) Industrial tour is prescribed.
- (v) Use of recent editions of reference books is essential.
- (vi) Use of scientific calculator is allowed.
- (vii) Values required for spectral problems should be provided in the question paper.

SEMESTER –V

PAPER-IX PHYSICAL CHEMISTRY

1. Phase Equilibria.

[10]

- 1.1 Introduction
- 1.2 Gibbs phase rule : Phase rule equation and explanation of terms involved in the equation.
- 1.3 Phase diagram, true and metastable equilibria.
- 1.4 One component systems : (i) Water system (ii) Sulphur system with explanation for polymorphism.
- 1.5 Two component systems : (i) Eutectic system : (Ag - Pb system); Desilverisation of lead, (ii) Formation of compound with congruent melting point (FeCl_3 - H_2O)

2. Electromotive force.

[23]

(Convention : Reduction potentials to be used)

- 2.1 Introduction
- 2.2 Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities.
- 2.3 Types of electrodes : Description in terms of construction, representation, half cell reaction and emf equation for,
 - i) Metal - metal ion electrode. ii) Amalgam electrode.
 - iii) Metal - insoluble salt electrode. iv) Gas - electrode.
 - v) Oxidation - Reduction electrode.
- 2.4 i) Reversible and Irreversible cells.
 - ii) Chemical cells without transference.
 - iii) Concentration cells
- a. Electrode concentration cell
 - I) Reversible to cation
 - II) Reversible to anion
- b. Electrolyte concentration cells without transference
- 2.5 Equilibrium constant from cell emf, Determination of the thermodynamic parameters such as ΔG , ΔH and ΔS .
- 2.6 Applications of emf measurements :
 - i) Determination of pH of solution using Hydrogen electrode.
 - ii) Solubility and solubility product of sparingly soluble salts (based on concentration cell).
- 2.7 Numerical problems.

3. Photochemistry.

[12]

- 3.1 Introduction
- 3.2 Difference between thermal and photochemical processes.
- 3.3 Laws of photochemistry : Grotthus - Draper law, Lambert law, Lambert - Beer's law (with derivation), Stark - Einstein law.
- 3.4 Quantum yield, Reasons for high quantum yield (e.g. H_2 - Cl_2) and low quantum yield. (e.g. Decomposition of HI and HBr).
- 3.5 Photosensitized reactions - Dissociation of H_2 , Photosynthesis.

3.6 Photodimerisation of anthracene.

3.7 Jablonski diagram depicting various processes occurring in the excited state :
Qualitative description of fluorescence and phosphorescence.

3.8 Chemiluminescence.

3.9 Numerical problems.

Recommended (Reference) Books: (Use recent editions)

1. Physical Chemistry by G. M. Barrow, International student Edition, Mc Graw Hill.
2. University General Chemistry by C.N.R. Rao, Macmillan.
3. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry by P. W. Atkins, Oxford.
5. Principles of Physical Chemistry by S. H. Maron, C. H. Prutton, 4th Edition.
6. Fundamentals of Photochemistry by K.K. Rohatgi-Mukerjee.
7. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Naginchand and Company, Jalandar.
8. Text Book of Physical Chemistry by S. Glasstone, Macmillan India Ltd.
9. Elements of Physical Chemistry by D. Lewis and S. Glassture (Macmillan).
10. Principles of Physical Chemistry by Maron and Lando (Amerind).
11. An Introduction to Electrochemistry by S. Glasstone.
12. Physical Chemistry by W. J. Moore.
13. Essentials of Physical Chemistry, Bahl and Tuli (S. Chand).

PAPER X – INORGANIC CHEMISTRY

1. Metal Ligand Bonding in Transition Metal Complexes

[13]

I Crystal Field Theory (CFT).

- 1) Introduction - What is CFT?
- 2) Basic concept of CFT.
- 3) Formation of complexes with Crystal field splitting of 'd' orbitals
 - I. Shapes of d orbitals and their electron density region
 - II. Formation of octahedral Complex with Crystal field splitting of 'd' orbitals
e.g. High spin and low spin octahedral complexes of Co(III).- $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$.
 - III. Formation of tetrahedral Complex with Crystal field splitting of 'd' orbitals
e.g. $[\text{CoCl}_4]^{2-}$
 - IV. Formation of square planar Complex with Crystal field splitting of 'd' orbitals
e.g. $[\text{Co}(\text{CN})_4]^{2-}$
- 4) Jahn - Teller distortion.
- 5) Factors affecting the Crystal - field splitting.
- 6) Crystal field stabilization energy (Δ): Calculation for octahedral complexes only.
- 7) Applications and limitations of CFT.

II Molecular Orbital Theory (MOT).

1. Introduction.
2. Basic concept
3. Symmetry classes of atomic orbitals
4. Formation of octahedral complex
 - a) Assumptions
 - b) M.O. energy level diagram for hypothetical octahedral complex.
5. Examples: octahedral complexes with sigma bonding only such as-
e.g. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, $[\text{FeF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Ni}(\text{NH}_3)_6]^{2+}$
6. Applications and limitations of MOT.
7. Comparison between CFT and MOT.

2. Nuclear Chemistry

[12]

- 1 Nuclear reaction and energetic of nuclear reactions.
- 2 Classification of nuclear reactions and Types of nuclear reactions-
 - i) Artificial transmutation.
 - ii) Artificial radioactivity.
 - iii) Projectile capture reaction.
 - iv) Projectile capture - particle emission reaction.
 - v) Nuclear fission.
 - vi) Nuclear fusion.
- 3) Use of Uranium, Thorium and Plutonium for:
 - a. Nuclear reactor
 - b. Atomic Bomb.
- 4) Applications of radioisotopes as tracers.
 - i) Chemical investigation - Esterification.

- ii) Structural determination - Phosphorus pentachloride.
- iii) Analytical Chemistry - isotopic dilution method for determination of volume of blood.
- iv) Age determination - Dating by C^{14} .

3. Bioinorganic Chemistry.

[08]

- 1) Essential and trace elements in biological process.
 - i) Essential elements
 - a) Macro / major elements
 - b) Micro/trace/minor elements
 - ii) Non-essential elements
- 2) Metalloporphyrins with special reference to haemoglobin and myoglobin.
 - i) Structure of Haemoglobin (Hb)
 - ii) Structure of Myoglobin (Mb)
 - iii) Function of Haemoglobin (Hb) and Myoglobin (Mb) as Oxygen transport from lungs to tissues
 - iv) Function of Haemoglobin as Carry back CO_2 to lungs
 - v) Co-operativity
 - vi) Oxygen binding curve
 - vii) Difference between Haemoglobin (Hb) and Myoglobin (Mb)
- 3) Role of alkali and alkaline earth metal ions with special reference to Na^+ , K^+ and Ca^{2+} .
 - i) Role of Na^+ and K^+
 - ii) Role of Ca^{2+}

4) Inorganic Polymers.

[08]

- 1) Introduction.
- 2) Basic concept and definition.
 - i) polymer
 - ii) Monomer
 - iii) Polymerization
 - iv) copolymer
 - v) degree of polymerization
- 3) Classification of polymers on the basis of -
 - a) origin
 - b) composition
 - c) properties
 - d) use
- 4) Comparison between organic and inorganic polymers.
- 5) Polymer back bone.
- 6) Homoatomic polymer containing - Phosphorus.
- 7) Heteroatomic polymers –
 - (i) Silicones
 - (ii) Phosphonitrilic compounds
 - (iii) Fluorocarbons.

5. Nanotechnology

[04]

1. Introduction
2. Properties of nanoparticles
3. Applications of nanoparticles

Recommended(Reference) Books :

1. Concise Inorganic Chemistry (ELBS, 5th Edition) - J. D. Lee.
2. Inorganic Chemistry (ELBS, 3rd Edition) D. F. Shriver, P. W. Atkins, C. H. Lang Ford, Oxford University Press, 2nd Edition.
3. Inorganic Chemistry (Harper International, 3rd edition) J. E. Huheey Harper and Row.
4. Basic Inorganic Chemistry : Cotton and Wilkinson.
5. Advanced Inorganic Chemistry (4th Edn.) Cotton and Wilkinson.
6. Concepts and Models of Inorganic Chemistry : Douglas and Mc. Daniel. 3rd Edition. John Wiley publication.
7. Fundamental concepts of Inorganic Chemistry by E. S. Gilreath.
8. Structural principles in inorganic compounds. W. E. Addison.
9. T. B. of Inorganic analysis - A. I. Vogel.
10. Theoretical principles of Inorganic Chemistry - G. S. Manku.
11. Theoretical Inorganic Chemistry by Day and Selbine.
12. Co-ordination compounds S F A Kettle.
13. Modern Aspects of Inorganic Chemistry. E. Sharpe.
14. New guide to Modern Valence Theory by G. I. Brown.
15. Essentials of Nuclear Chemistry by H. J. Arnikar.
16. Organometallic Chemistry by R. C. Mahrotra A. Sing, Wiley Eastern Ltd. New Delhi.
17. Inorganic Chemistry by A. G. Sharpe, Addison - Wisley Longman - Inc.
18. Principles of Inorganic Chemistry by Puri, Sharma and Kalia, Vallabh Publication. Pitampur Delhi.
19. Text book of Inorganic Chemistry by K. N. Upadhyaya Vikas Publishing House - New Delhi.
20. Progress in inorganic polymer by Laport and Leigh.
21. Co-ordination compounds by Baselo and Pearson.
22. Organometallic Chemistry by P. L. Pauson.
23. Advanced inorganic chemistry, Vol. I and II Satyaprakash, G. D. Tuli, S. K. Basu and Madan (S Chand)
24. Selected Topics in inorganic chemistry by W U Malic, G. D. Tuli, R. D. Madan. (S. Chand)
25. Industial chemistry part I and II by A. K. De
26. Industrial chemistry by B. K. Sharma
27. Nanomaterials and nanostructure, Laura Castlow, April Feter (Dominant Publisher,2007)
28. Nansocale materials in Chemistry K,J, Kalbunde Wiley Interscience (2001)
29. Introduction to Nansocience and Nanotechnology K.K. Chattopadhya, A.N. Banerjee, PHI Learning Pvt. Ltd. New Delhi,2009.
30. Introdution to Nanotechonology – Charles P.PooleJr., Frank J Owens, Wiley Student Edition 2008.
31. Nanotechonology – A Future Techonology with Futures BPB Publication New Delhi.

Paper – XI Organic Chemistry

1 Spectroscopic Methods.

[20]

1.1. Infrared Spectroscopy :

- 1.1.1 Introduction,
- 1.1.2 Principle of IR spectroscopy,
- 1.1.3 Double beam IR spectrophotometer- Schematic diagram.
- 1.1.4 Fundamental modes of vibration,
- 1.1.5 Types of vibration
- 1.1.6 Hooke's law,
- 1.1.7 factors affecting values of vibrational frequencies,
- 1.1.8 conditions for absorption of radiation and selection rule,
- 1.1.9 fundamental group regions of IR spectrum,
- 1.1.10 Functional group region, Finger print region,
- 1.1.11 characteristic absorption of various functional groups,
- 1.1.12 Applications of IR spectroscopy – Determination of structure, Identification of functional groups spectral problems based on IR

1.2 NMR Spectroscopy.

- 1.2.1 Introduction
- 1.2.2. Proton magnetic resonance (^1H) spectroscopy (PMR).
- 1.2.3 Principles of PMR spectroscopy.
- 1.2.4 Magnetic and non-magnetic nuclei.
- 1.2.5. Theory of PMR spectroscopy - spinning nuclei, magnetic moment and magnetic field, precessional motion of nuclei without mathematical details, nuclear resonance.
- 1.2.6 NMR - Instrument. Schematic diagram.
- 1.2.7. Shielding and deshielding.
- 1.2.8. Chemical shift, measurement of chemical shift, by delta scale and tau scale.
- 1.2.9. TMS as reference. Advantages of TMS.
- 1.2.10. Peak area (integration)
- 1.2.11. Spin - spin splitting (n + 1 rule).
- 1.2.12. Definition of coupling constant (J value) of first order coupling.
- 1.2.13. PMR spectra of ethanol, ethyl bromide, acetaldehyde, 1, 1, 2 - tribromoethane, ethyl acetate, acetophenone, benzaldehyde, propanoic acid and benzoic acid
- 1.2.14. Problems pertaining to the structure elucidation of simple organic compounds using PMR spectroscopic data (supporting IR and UV data to be given).

1.3 Mass spectroscopy.

- 1.3.1 Introduction
- 1.3.2 Theory of mass spectroscopy
- 1.3.3 Mass spectrometer - schematic diagram
- 1.3.4 Formation of ions by ionization
- 1.3.5 Types of ions with at least one example.
- 1.3.6. Applications of mass spectroscopy.
 - i) Determination of molecular weight.
 - ii) Determination of molecular formula

2. Stereochemistry.**[07]**

2.1 Introduction.

2.2 Baeyer's strain theory.

2.3 Theory of strainless rings.

2.4 Conformation and stability of cyclohexane and monosubstituted cyclohexanes : cyclohexanol, bromocyclohexane and methyl cyclohexane.

2.5 Locking of conformation in t-butyl cyclohexane.

2.6 Stereoselective and stereospecific reactions :

i) Stereochemistry of addition of halogens to alkenes : syn and anti addition.

Example - Addition of bromine to 2-butene. (mechanism not expected)

ii) Stereochemistry of elimination reaction : syn and anti elimination Example - Dehydrohalogenation of 1-bromo -1, 2 - diphenylpropane. (Mechanism not expected)

3. Name reactions.**[10]**

Mechanism of following reactions :

3.1 Stobbe condensation.

3.2 Oppenauer oxidation.

3.3 Meerwein Ponndorf Verley reduction.

3.4 Reformatsky reaction

3.5 Wagner - Meerwein Rearrangement.

3.6 Hofmann rearrangement reaction.

3.7 Wittig reaction.

3.8 Related problems.

4. Organic synthesis via Enolates**[08]**

4.1 Introduction - Reactive methylene group.

4.2 Ethyl acetoacetate - synthesis by Claisen condensation, acidity of methylene hydrogen (salt formation), Keto-enol tautomerism, synthetic applications - Synthesis of alkyl and dialkyl derivatives, monobasic, dibasic and α - β - unsaturated acid, heterocyclic compound.4.3 Diethyl malonate - Synthesis, acidity of methylene hydrogen (salt formation). Synthetic applications - Synthesis of alkyl and dialkyl derivatives, monobasic , dibasic acid, α - β - unsaturated acid, α -amino acid and heterocyclic compound.**Recommended (Reference) Books :**

- 1) Organic Chemistry - Cram D. J. and Hammond G.S. McGraw Hill book Company New York.
- 2) Organic Chemistry - Finar I. L. The English Language Book Society, London.
- 3) A Guide Book to mechanism in Organic Chemistry - Peter Sykes Longman Green and Co. Ltd. London 6th Edition.
- 4) Organic Chemistry - R. T. Morrison and R. N. Boyd Prentice Hall of India private limited New Delhi. 6th Edition.
- 5) Text book of organic Chemistry - Furguson L. N. D. Van Nostrand Company Indian Edition, Affiliated East West press private Ltd. New Delhi.
- 6) Organic Chemistry Vol. I, II and III - S. M. Mukharji, S. P. Singh, R. P. Kapoor Wiley Estern, Limited, New Delhi.
- 7) A text book of organic Chemistry - K. S. Tewari, S. N. Mehrotra, N. K. Vishnoi Vikas Publishing House Private Ltd. New Delhi.
- 8) A text book of Organic Chemistry - Arun Bahl and B. S. Bahl S. Chand and Company Ltd. 6th Edition.
- 9) Heterocyclic Chemistry Synthesis, Reactions and Mechanism - Raj K. Bansal

Wiley Easter Ltd. New Delhi.

- 10) Reaction Mechanism and reagents in Organic Chemistry - G. R. Chatwal Himalaya Publishing House New Delhi.
- 11) Stereochemistry conformation and mechanism - P. S. Kalsi, New Age International Publishers 4th Edition.
- 12) Organic Chemistry Volume I and II - I. L. Finar ELBS with Longman 6th Edition.
- 13) Organic Chemistry Volume I and II - William Kemp ELBS with Macmillan 3rd Edition.
- 14) Advanced Organic Chemistry - Jerry March Wiley Eastern Ltd.
- 15) Spectroscopy of Organic compounds - P. S. Kalsi.
- 16) Organic Chemistry - Fieser and Fieser.
- 17) Principles of Organic Chemistry - English and Cassidy.
- 18) Elementary Organic Absorption Spectroscopy - Y. R. Sharma.
- 19) Spectroscopy - V. M. Parikh.
- 20) Stereochemistry of Carbon Chemistry - Eliel.
- 21) Principles of Organic Chemistry - M. K. Jain.
- 22) Organic Chemistry by Clayden, Greeves, Warren and Wothers Oxford press.
- 23) Organic Chemistry - A Comprehensive degree text and source book by Hanes Baeyers and Wolfgang Walter Albion Chemical Science Series.
- 24) Reactions, Rearrangements and reagents - S.N.Sanyal Bharati Bhawan publishers and Distributors Patna.

PAPER-XII ANALYTICAL AND INDUSTRIAL PHYSICAL CHEMISTRY

1. Colorimetry. [08]

1.1 Introduction

1.2 General discussion of theory of colorimetry : Lambert law, Beer's law (Derivation not expected), Terms used in Colorimetry, Application of Beer's law, Deviation from Beer's law.

1.3 Classification of methods of 'colour' measurement or comparison, Photoelectric photometer method - single cell photo-electric colorimeter.

2. Potentiometry [10]

2.1 Introduction.

2.2 Detail study of calomel, quinhydrone and glass electrodes and their use in determination of pH. .

2.3 Potentiometric titrations : Classical and analytical methods for locating end points,

i) Acid - Base titrations.

ii) Redox - titrations.

iii) Precipitation titrations.

2.4 Advantages of potentiometric titrations,

2.5 Basic circuit of direct reading potentiometer.

3 Electroplating [08]

3.1 Introduction.

3.2 Electrolysis, Faraday's laws, Cathode current efficiency.

3.3 Basic principles of electroplating, cleaning of articles.

3.4 Electroplating of Nickel and Chromium.

3.5 Anodising.

4 Flame photometry [09]

4.1 General principles.

4.2 Instrumentation : Block diagram, Burners: Total consumption burner, premix or laminar-flow burner, Lundergraph burner,

Mirrors, Slits, Monochromators, Filters and Detectors.

4.3 Applications in qualitative and quantitative analysis.

4.4 Limitations of flame photometry.

5. Conductometry: [10]

5.1 Measurement of conductance by Wheatstone bridge, Basic circuit of D.C. Wheatstone bridge, use of alternating current,

conductivity water, Different types of conductivity cells, cell constant and its determination.

Experimental determination of specific, equivalent and molecular conductance's.

5.2 Conductometric acid-base titrations

i. Strong acid against strong base

ii. Strong acid against weak base

iii. Weak acid against strong base.

iv. Weak acid against weak base.

5.3 Advantages of conductometric titrations

Recommended (Reference) Books :

1. Text book of Quantitative Inorganic Analysis - By A. I. Vogel (ELBS and Longman 3rd Edition).
2. Instrumental methods of Chemical analysis by Willard, Merit and Dean.
3. Instrumental methods of Chemical analysis by Chatwal and Anand (Himalaya Publication).
4. Principles of electroplating and eletroforming by Blum and Hogaboom, Mac Graw - Hill Book Co. 3rd Edn.
5. Vogel's text book of Quantitative Inorganic Analysis by Basssett and Denny etc. ELBS and Longman 4th Edition.
6. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Naginchand and Company, Jalandar.
7. Text Book of Physical Chemistry by S. Glasstone, Macmillan India Ltd.
8. Elements of Physical Chemistry by D. Lewis and S. Glasstone (Macmillan).
9. Principles of Physical Chemistry by Maron and Lando (Amerind).
10. An Introduction to Electrochemistry by S. Glasstone.
11. Physical Chemistry by W. J. Moore.
12. Essentials of Physical Chemistry, Bahl and Tuli (S. Chand).

SEMESTER-VI**PAPER- XIII PHYSICAL CHEMISTRY****1. Spectroscopy.****[10]**

1.1 Introduction

1.2 Electromagnetic radiation.

1.3 Electromagnetic spectrum, Energy level diagram.

1.4 Rotational spectra of diatomic molecules : Rigid rotor model; moment of inertia (derivation not expected); energy levels of rigid rotor, selection rule; spectral intensity; distribution using population distribution (Maxwell - Boltzman distribution), determination of bond length; isotope effect. Interaction of radiation with rotating molecule.

1.5 Vibrational spectra of diatomic molecules : Simple Harmonic oscillator model, Vibrational energies of diatomic molecules, Determination of force constant, overtones. Interaction of radiation with vibrating molecules.

1.6 Numerical problems.

2. Solutions.**[09]**

2.1 Introduction

2.2 Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal solutions of miscible liquids.

2.3 Vapour pressure and boiling point diagrams of miscible liquids.

Type I : Systems with intermediate total vapour pressure.

(i.e. System in which B.P. increases regularly - Zeotropic)

Type II : Systems with a maximum in the total vapour pressure.

(i.e. System with a B.P. minimum - Azeotropic)

Type III : Systems with a minimum in the total vapour pressure.

(i.e. System with a B.P. Maximum - Azeotropic)

Distillation of miscible liquid pairs.

2.4 Solubility of partially miscible liquids.

(i) Maximum solution temperature type : Phenol - water system.

(ii) Minimum solution temperature type : Triethyl amine - water system.

(iii) Maximum and minimum solution temperature type : Nicotine - water system.

3. Thermodynamics.**[13]**

3.1 Introduction

3.2 Free energy : Gibbs function (G) and Helmholtz function (A), Criteria for thermodynamic equilibrium and spontaneity.

3.3 Relation between ΔG and ΔH : Gibbs Helmholtz equation.

3.4 Phase equilibria : Clapeyron - Clausius equation.

3.5 Thermodynamic derivation of law of mass action, van't - Hoff isotherm and isochore.

3.6 Fugacity and activity concepts.

3.7 Numerical problems.

4. Chemical Kinetics**[13]**

4.1 Introduction, simultaneous reactions such as opposing reactions, side reactions, consecutive reactions and chain reactions

[Derivations of rate Equations for these reactions are not expected.]

4.2 Effect of temperature on the rate of reaction.

1. Temperature coefficient
2. Arrhenius equation
3. Energy of activation

4.3 Theories of reaction rate :

1. Collision theory and
2. Transition state theory

4.4 Third order reaction with equal concentration of all reactants, their characteristics and examples

4.5 Numerical problems.

Recommended (Reference) Books :

1. Principles of Physical Chemistry by Maron and Pruton 4th edition.
2. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Naginchand and Company, Jalandar.
3. Text Book of Physical Chemistry by S. Glasstone, Macmillan India Ltd.
4. Elements of Physical Chemistry by D. Lewis and S. Glasstone (Macmillan).
5. Principles of Physical Chemistry by Maron and Lando (Amerind).
6. Thermodynamics for chemists by S Glasstone.
7. Physical Chemistry by W. J. Moore.
8. Essentials of Physical Chemistry, Bahl and Tuli (S. Chand).
9. Basic Chemical Thermodynamics by V V Rao (Macmillan)
10. An introduction to chemical thermodynamics by R. R. Mishra and R. P. Rastogi.
11. Fundamentals of molecular spectroscopy by C. N. Banwell and McCash- Tata McGraw Hill

PAPER : XIV- INORGANIC CHEMISTRY

1) Study of F-block Elements

[11]

1.1 Lanthanides :-

- I) Introduction
- II) Electronic configuration
- III) Occurrence
- IV) Separation of Lanthanides

- i) Bulk separation methods
- ii) Individual separation of lanthanides- Mention names of methods only; In detail Ion exchange method.

1.2 Actinides :-

- I) Introduction
- II) Electronic configuration
- III) General Methods of preparation –

- a. Neutron-capture followed by β -decay
- b. Accelerated projectile bombardment method
- c. Heavy-Ion Bombardment method

1.3 IUPAC Nomenclature of the super Heavy Elements with atomic numbers (Z) greater than 100.

2) Metals and Semiconductors.

[11]

2.1 Introduction.

2.2 Properties of metallic solids.

2.3 Theories of bonding in metal.

- a) Free electron theory.
- b) Molecular orbital theory (Band theory).

2.4 Classification of solids as conductor, insulators and semiconductors on the basis of band theory.

2.5 Semiconductors:

- a) Types of semiconductors - intrinsic and extrinsic semiconductors.
- b) Applications of semiconductors.

2.6 Superconductors :

- a) Ceramic superconductors - Preparation and structures of mixed oxide $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$
- b) Applications of superconductors.

3) Structural Chemistry.

[11]

3.1 Structural study of following compounds.

- i) Diborane.
- ii) Borazine.
- iii) Xenon compounds $\rightarrow \text{XeF}_2, \text{XeF}_6, \text{XeO}_4$ (w.r.t. VBT only.)

3.2 Structural study of Oxides Of Sulphur and Phosphorous:

- I Oxides of Sulphur : SO_2 , and SO_3 ;
- II Oxides of Phosphorous : P_4O_6 and P_4O_{10}

4) Corrosion and Passivity.

[07]

4.1 Corrosion :-

- A) Introduction, with types of corrosion.
- B) Electrochemical theory of corrosion.
- C) Factors affecting the corrosion.

- i) Position of metal in emf series.
- ii) Purity of metal.
- iii) Effect of moisture.
- iv) Effect of oxygen.
- v) Hydrogen over voltage.

D) Methods of protection of metals from corrosion.

4.2 Passivity :-

- A) Definition.
- B) Types of passivity.
- C) Oxide film theory.
- D) Application of passivity.

5. Organometallic Chemistry.

[05]

5.1 Introduction - Definition,

5.2 Nomenclature of organometallic compounds.

5.3 Synthesis and structural study of alkyl and aryl compounds of Li, Be and Al.

5.4 Mononuclear carbonyl and nature of bonding in simple metal carbonyls.

Recommended(Reference) Books :

1. Concise Inorganic Chemistry (ELBS, 5th Edition) - J. D. Lee.
2. Inorganic Chemistry (ELBS, 3rd Edition) D. F. Shriver, P. W. Atkins, C. H. Lang Ford, Oxford University Press, 2nd Edition.
3. Inorganic Chemistry (Harper International, 3rd edition) J. E. Huheey Harper and Row.
4. Basic Inorganic Chemistry : Cotton and Wilkinson.
5. Advanced Inorganic Chemistry (4th Edn.) Cotton and Wilkinson.
6. Concepts and Models of Inorganic Chemistry : Douglas and Mc. Daniel. 3rd Edition. John Wiley publication.
7. Fundamental concepts of Inorganic Chemistry by E. S. Gilreath.
8. Structural principles in inorganic compounds. W. E. Addison.
9. T. B. of Inorganic analysis - A. I. Vogel.
10. Theoretical principles of Inorganic Chemistry - G. S. Manku.
11. Theoretical Inorganic Chemistry by Day and Selbine.
12. Co-ordination compounds S F A Kettle.
13. Modern Aspects of Inorganic Chemistry. E. Sharpe.
14. New guide to Modern Valence Theory by G. I. Brown.
15. Essentials of Nuclear Chemistry by H. J. Arnikar.
16. Organometallic Chemistry by R. C. Mahrotra A. Sing, Wiley Eastern Ltd. New Delhi.
17. Inorganic Chemistry by A. G. Sharpe, Addison - Wisley Longman - Inc.
18. Principles of Inorganic Chemistry by Puri, Sharma and Kalia, Vallabh Publication. Pitampur Delhi.
19. Text book of Inorganic Chemistry by K. N. Upadhyaya Vikas Publishing House – New Delhi.
20. Progress in inorganic polymer by Laport and Leigh.
21. Co-ordination compounds by Baselo and Pearson.
22. Organometallic Chemistry by P. L. Pauson.
23. Advanced inorganic chemistry, Vol. I and II Satyaprakash, G. D. Tuli, S. K. Basu and Madan
24. Selected Topics in inorganic chemistry by W U Malic, G. D. Tuli, R. D. Madan. (S. Chand)
25. Industial chemistry part I and II by A. K. De
26. Industrial chemistry by B. K. Sharma

Paper : XV - Organic Chemistry

1 Heterocyclic compounds

[09]

1.1 Introduction and classification.

1.2 Pyrrole.

1.2.1 Methods of synthesis :

i) From acetylene.

ii) From furan.

iii) From succinamide.

1.2.2 Physical properties.

1.2.3 Reactivity of pyrrole :

i) Basic character.

ii) Acidic character.

iii) Electrophilic substitution with general mechanism.

1.2.4 Chemical reactions :

i) Reduction.

ii) Oxidation.

iii) Nitration, sulphonation and halogenation.

iv) Friedel Craft's reaction.

v) Coupling reaction.

1.3 Pyridine.

1.3.1 Methods of synthesis.

i) From acetylene and hydrogen cyanide.

ii) From piperidine.

1.3.2 Physical properties.

1.3.3 Chemical reactions

i) Basic character

ii) Electrophilic substitution(nitration, sulphonation abd bromination) reactions

iii) Nucleophilic substitution - General mechanism, Reactions with sodamide, sodium hydroxide and n-Butyl lithium.

1.4 Quinoline

1.4.1 Synthesis - Skraup's synthesis

1.4.2 Physical properties.

1.4.3 Reactions of quinoline :

i) Electrophilic substitution reactions - Nitration and sulphonation.

ii) Nucleophilic substitution reactions - Reactions with sodamide, alkylation and arylation.

iii) Reduction.

2. Carbohydrates

[11]

2.1 Introduction.

2.2 Classification and nomenclature.

2.3 Monosaccharide D-glucose - Open chain structure.

2.4 Chain lengthening of Aldoses - Kiliani synthesis.

2.5 Chain shortening of Aldoses - Weerman's reaction.

2.6 Interconversion of glucose and fructose.

2.7 Configuration of D-glucose from D-arabinose.

2.8 Objections against open chain structure of D-glucose.

2.9 Muta-rotation with mechanism.

2.10 Ring structure of D-glucose - Determination of size of ring by,

i) Methylation method.

ii) Periodic acid treatment method.

iv) X - ray analysis.

2.11 Disaccharides - Introduction, maltose, sucrose and lactose - Sources, structural formulae and uses.

2.12 Polysaccharides - Introduction starch, cellulose - Sources, structural formulae and uses.

3. Vitamins and Hormones

[07]

3.1 General idea of vitamins, structure and synthesis of vitamin A

3.2 General idea of hormones, structure and synthesis of Adrenaline and Thyroxin

4. Pharmaceuticals

[07]

4.1 Introduction.

4.2 Qualities of ideal drug.

4.3 Methods of classification of drugs - Classification based on the therapeutical action.

4.4 Brief idea of penicillin-G (constitution, synthesis not expected)

4.5 Synthesis and uses of the following drugs :

i) Antimalerials - Paludrin.

ii) Antituberculars - Isoniazide and Ethambutol.

iii) C. N. S. drugs - Phenobarbitone.

iv) Antidiabetics - Tolbutamide.

v) Antiinflammatory drugs - Ibuprofen.

vi) Antibiotic - Chloromycetin.

5 Synthetic dyes.

[07]

5.1 Introduction, Qualities of good dye.

5.2. Classification based on constitution and methods of applications.

5.3 Witt's theory - Colour and constitution.

5.4 Synthesis of Orange IV, Malechite green, phenolphthalein.

6 Agrochemicals.

[04]

6.1 General idea of agrochemicals including pyrethroides.

6.2 Synthesis and uses of the following agrochemicals :

i) Indole-3-acetic acid.

ii) Monocrotophos.

iii) Methoxychlor.

iv) Ethophan.

v) Carbaryl.

Recommended (Reference) Books :

- 1) Organic Chemistry - Cram D. J. and Hammond G.S. McGraw Hill book Company New York.
- 2) Organic Chemistry - Finar I. L. The English Language Book Society, London.
- 3) A Guide Book to mechanism in Organic Chemistry - Peter Sykes Longman Green and Co. Ltd. London 6th Edition.
- 4) Organic Chemistry - R. T. Morrison and R. N. Boyd Prentice Hall of India private limited New Delhi. 6th Edition.
- 5) Text book of organic Chemistry - Furguson L. N. D. Van Nostrand Company Indian Edition, Affiliated East West press private Ltd. New Delhi.
- 6) Organic Chemistry Vol. I, II and III - S. M. Mukharji, S. P. Singh, R. P. Kapoor Wiley Estern, Limited, New Delhi.
- 7) A text book of organic Chemistry - K. S. Tewari, S. N. Mehrotra, N. K. Vishnoi Vikas Publishing House Private Ltd. New Delhi.
- 8) A text book of Organic Chemistry - Arun Bahl and B. S. Bahl S. Chand and Company Ltd. 6th Edition.
- 9) Heterocyclic Chemistry Synthesis, Reactions and Mechanism - Raj K. Bansal Wiley Easter Ltd. New Delhi.
- 10) Reaction Mechanism and reagents in Organic Chemistry - G. R. Chatwal Himalaya Publishing House New Delhi.
- 11) Organic Chemistry Volume I and II - I. L. Finar ELBS with Longman 6th Edition.
- 12) Organic Chemistry Volume I and II - William Kemp ELBS with Macmillion 3rd Edition.
- 13) Advanced Organic Chemistry - Jerry March Wiley Eastern Ltd.
- 14) Spectroscopy of Organic compounds - P. S. Kalsi.
- 15) Organic Chemistry - Fieser and Fieser.
- 16) Principles of Organic Chemistry - English and Cassidy.
- 17) Chemicals for crop improvement and pest management - Green, Hartly and West.
- 18) Chemistry of pesticides - K. H. Buchel (T. W.).
- 19) Medical Chemistry - Burger.
- 20) Principles of Organic Chemistry - M. K. Jain.
- 21) Organic Chemistry by Clayden, Greeves, Warren and Wothers Oxford press.
- 22) Organic Chemistry - A Comprehensive degree text and source book by Hanes Baeyers and Wolfgang Walter Albion Chemical Science Series.
- 23) Reactions, Rearrangements and reagents - S.N.Sanyl Bharati Bhawan publishers and Distributors Patna.
- 24) Synthetic Organic Chemistry-Kamlesh Bansal.
- 25) Synthetic Organic Chemistry-Gurudeep Chatwal.

Paper – XVI Analytical and Industrial Organic Chemistry

1. Soaps and Detergents.

[08]

1.1 Soap

- i) Raw materials.
- ii) Types of soaps.
- iii) Manufacture of soap - Hot process.
- iv) Cleansing action of soaps.

1.2 Detergents

- i) Raw materials.
- ii) Types of detergents - Cationic, anionic, amphoteric, neutral detergents.
- iii) Preparation of teepol and deriphat.

1.3 Comparison between soaps and detergents.

2. Synthetic polymers.

[08]

2.1 Introduction.

2.2 Classification :

- i) According to origin, composition, method of preparation and general physical properties.
 - ii) Classification based upon structure.
- 2.3 Process of addition polymerisation - free radical polymerisation of alkenes and Dienes.
- 2.4 Ionic polymerisation.
- 2.5 Ziegler - Natta polymerisation.
- 2.6 Methods of preparation and uses of :
- i) Polythene. ii) Polystyrene
 - iii) PVC. iv) Phenol formaldehyde resin.
 - v) Urea formaldehyde resin vi) Poly urethane
- 2.7 Natural rubber : General idea and vulcanisation.
- 2.8 Synthetic rubbers : Synthesis and uses of -
- i) Polychloroprene, ii) Buna rubber - Buna N and Buna S.

3. Sugar and Alcohol Industry

[09]

3.1 Manufacture of raw cane sugar.

3.2 Refining of raw sugar.

3.3 White sugar.

3.4 By-products of sugar industry.

3.4.1 Manufacture of ethyl alcohol from molasses

3.4.2 Rectified spirit, Denatured spirit absolute alcohol and power alcohol.

3.4.3 By-products of alcohol industry.

4. Textile chemistry

[07]

4.1 Introduction, classification of fibers.

4.2 Sizing: object of sizing, sizing ingredients and their functions.

4.3 General idea of processes like singeing, desizing, scouring.

4.4 Bleaching: i) Brief study of the outline of the process of bleaching cotton and synthetic material.

4.5 Dyeing : Study of dyeing of cellulosic material and synthetic fibers with dyes like direct, vat, reactive and disperse dyes.

5. Green Chemistry.**[04]**

- 5.1 Introduction - Twelve principles of green chemistry.
- 5.2 Zeolites - Friedel Craft's alkylation and acylation, oxidation of benzene to phenol and benzoquinone, Reduction of benzoquinone to hydroquinone.
- 5.3 Biocatalytic reaction - Hydroxylation and oxidation using enzymes.
- 5.4 Introduction to microwave assisted reactions.

6 Chromatography.**[09]**

- 6.1 Introduction.
- 6.2 General principles.
- 6.3 Classification.
- 6.4 Study of following chromatographic techniques with reference to principle, methodology and applications.
 - i) Paper chromatography.
 - ii) Column chromatography.
 - iii) Thin layer chromatography.
 - iv) Gas chromatography

Recommended (Reference) Books :

1. Basic Concepts of Analytical Chemistry - S. M. Khopkar, Wiley Eastern Ltd., Bombay.
2. Industrial Chemistry - R. K. Das, Asia Publishing, Mumbai.
3. Text Book of Quantitative Organic Analysis - A. I. Vogel, Pearson Edn. Delhi.
4. Quantitative Organic Chemistry - A. I. Vogel, Pearson Edn. Delhi.
5. Hand Book of Organic Analysis - H. T. Clarke, Arnold Heinemann Pub. Delhi.
6. Advanced Organic Chemistry - B. S. Bahl and Arun Bahl, S. Chand Comp. Delhi.
7. Riegel's Handbook of Industrial Chemistry - J. A. Kent, Van. Nostrand, London.
8. Chemical Process Industries - Shreve and Brinic - Ostin, Magraw Hill, New York.
9. Analytical Chemistry- Walton.
10. Biotechnology and Applied Microbiology - Alani and Moo-Young.
11. Immobilize Biocatalysis - Joy Wleser.
12. Introduction to Polymer Chemistry - Raymond B. Seymour.
13. Polymer Science - V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar Willey Eastern Limited.
14. Advances in Green Chemistry : Chemical synthesis using MW-irradiation by R. S. Varma.
15. Green Chemistry : Environment Friendly alternatives - Rashmi Sanghi and M. M. Srivastava (Eds) (c) 2003 Narosa Publishing House, New Delhi, India.
16. Textile science - J. T. Marsh
17. A book of textile chemistry - A. J Hall, (Butterworths group)
18. Sizing - D..B. Ajagaonkar
19. Bleaching - Dr. V. A. Shenai
20. Dyeing - Dr. V. A. Shenai

Practicals

- N. B. i. Use of Analytical / Chainometric / Electronic / Single pan balance is allowed.
- ii. Use of Scientific calculator is allowed.

Physical Chemistry

I) Non instrumental Experiments(Any Five) :

1. To determine the equilibrium constant of the reaction, $\text{KI} + \text{I}_2 = \text{KI}_3$ by the distribution method.
2. To determine the partition coefficient of CH_3COOH between H_2O and CCl_4 .
3. Critical Solution Temperature.
To determine the CST for phenol – water system.
4. The study of energy of activation of first order reaction i.e. hydrolysis of methyl acetate in presence of 0.5 N HCl.
5. The study of energy of activation of first order reaction i.e. hydrolysis of methyl acetate in presence of 0.5 N H_2SO_4 .
6. The study of energy of activation of second order reaction i.e. reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI (Equal concentrations).
7. The study of energy of activation of second order reaction i.e. reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI (Unequal concentrations).
8. To study the hydrolysis of methyl acetate by using its two concentrations in presence of 0.5 N HCl and hence find velocity constant of the reaction.
9. To study the effect of addition of electrolyte (KCl) on the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI (Equal concentrations).

II. Instrumental experiments

A. Potentiometry (Any Three).

1. Titration of strong acid with strong alkali.
2. Preparation of buffer solution and determination of their pH (Any five buffer solutions), - Theoretical calculation of pH values by using Henderson's equation.
3. Determination of standard electrode potential of Zn/Zn^{++} , Cu/Cu^{++} , Ag/Ag^+ (Any two).
4. Determination of solubility and solubility product of AgCl.
5. Titration of ferrous ammonium sulphate using $\text{K}_2\text{Cr}_2\text{O}_7$ solution and to calculate redox potential of Fe^{++} , Fe^{+++} system

B. Conductometry (any three).

1. Titration of weak acid with strong alkali.
2. Titration of a mixture of weak acid and strong acid with strong alkali.
3. To study the effect of substituent on dissociation constant of weak acid with respect to acetic acid and monochloroacetic acid (cell constant to be given).
4. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by conductometric method.

C. Refractometry.

1. To determine the percentage composition of unknown mixture by (i) graphical method and (ii) by composition law (Densities of pure liquids A & B be given).
2. To determine the molar refractivity of methyl acetate, ethyl acetate, n-hexane and carbon tetrachloride and calculate the refraction equivalents of C, H and Cl atoms.

D. Colorimetry (Any Two).

1. To verify Lambert - Beer's law using CuSO_4 solution.
2. To estimate of Fe^{+++} ions by thiocyanate method.
3. To estimate Fe^{+++} ions using salicylic acid by colorimetric titration.

E. pH - metry (Any One).

1. To determine the dissociation constant of monobasic acid (Acetic acid).
2. To determine the dissociation constant of dibasic acid (Malonic acid).

Recommended (Reference) Books :

1. Findlay's Practical Physical Chemistry (Longman)
2. Advanced Practical Physical Chemistry by J. B. Yadav, Goel publishing house.
3. Practical Physical Chemistry by B. D. Khosla, V. C. Garg (R. Chand and Co.)
4. Systematic experimental Physical Chemistry by Rajbhoj, Chandekar (Anjali Publicaiton)
5. Practical Physical Chemistry : Nandkumari, Kothari and Lavande.
6. Practical Physical Chemistry by Gurtu (S. Chand).

PRACTICALS**Inorganic Chemistry****I. Gravimetric Estimations (G).**

N. B. : Any two experiments from G1 to G3 and any two experiments from G4 to G7

G1. Gravimetric estimation of iron as ferric oxide from the given solution containing ferrous ammonium sulphate, copper sulphate and free sulphuric acid.

G2. Gravimetric estimation of zinc as zinc pyrophosphate from the given solution containing zinc sulphate, ferrous ammonium sulphate and free sulphuric acid.

G3. Gravimetric estimation of barium as barium sulphate from the given solution containing barium chloride, ferric chloride and free hydrochloric acid.

G4. Gravimetric estimation of manganese as manganese ammonium phosphate from the given solution containing manganese sulphate, copper sulphate and free sulphuric acid.

G5. Gravimetric estimation of barium as barium chromate from the given solution containing barium chloride, ferric chloride and free hydrochloride acid.

G6. Gravimetric estimation of Aluminium as Aluminium oxinate i.e.

tris (8-hydroxyquinolino) aluminate (III) from a given solution containing potash alum, copper sulphate and free sulphuric acid.

G7. Gravimetric estimation of nickel as bis (dimethylglyoximato) nickel (II) from the given solution containing nickel sulphate, ferrous ammonium sulphate and free sulphuric acid.

[For the gravimetric experiments, stock solution should be given in the range of 10 to 15 cm and asked to dilute to 100 cm (or the stock solution should be given in the range of 20 to 30 cm and asked to dilute to 250 cm). Use 50 cm of this diluted solution for estimation.]

II. Inorganic Preparations (P) : (any five).

N. B. - Calculations of % yield is expected.

P1. Preparation of sodium cuprous thiosulphate.

P2. Preparation of potassium trioxalatoferrate (III).

P3. Preparation of potassium trioxalatoaluminate (III).

P4. Preparation of tris (ethylene diamine)nickel (II) thiosulphate.

P5. Preparation of sodium hexanitrocobaltate (III).

P6. Preparation of ammonium diamminetetraethiocyanochromate(III) (Reineck's salt).

P7. Preparation of chloropentaamminecobalt (III) chloride.

P8. Preparation of hexamminenickel (II) chloride.

P9. Preparation of tris(thiourea)cuprous(I) sulphate.

III) Titrimetric Estimations :**A) Percentage Purity (any three)**

V1. Determination of percentage purity of ferrous ammonium sulphate.

V2. Determination of percentage purity of tetramminecopper (II) sulphate.

V3. Determination of percentage purity of potassium trioxalatoaluminate(III).

V4. Determination of percentage purity of potassium trioxalatoferrate (III).

B) Analysis of Commercial Sample (any three).

V5. Determination of percentage of magnesium in the given sample of talcum powder.

V6. Determination of amount of aluminium in the given solution of potash alum.

V7. Determination of titrable acidity in the given sample of milk or lassi.

V8. Determination of Chemical Oxygen Demand of the given sample of industrial effluent by dichromate method.

V9. Determination of percentage purity of boric acid using supplied sodium hydroxide (Standard succinic or oxalic acid solution to be prepared to standardise the given sodium hydroxide solution.)

C) Ion exchange method (any two).

V10. Determination of amount of sodium present in the given solution of common salt using cation exchange resin (By Acid Base titration).

V11. Determination of amount of magnesium in the given solution containing (Mg^{++} and Zn^{++}) using anion exchange resin and standard solution of EDTA.

V12. Determination of amount of zinc in the given solution containing (Mg^{++} and Zn^{++}) using anion exchange resin and standard solution of EDTA.

Recommended (Reference) Books:

1. A text book of quantitative Inorganic Analysis - A. I. Vogel.
2. Text book of Quantitative Inorganic Analysis - Kolthoff and Sandell.
3. Experimental Inorganic Chemistry - Palmer W. G.
4. Advanced Practical Inorganic Chemistry - Adams and Raynor.
5. Handbook of Preparation Inorganic Chemistry. Vol. 1 and 11 - Brauer.
6. Manual in Dairy Chemistry - I.C.A.R. Sub-Committee on Dairy Education.
7. Chemical methods for environmental analysis - R. Ramesh and M. Anbu.

Practicals**Organic Chemistry****I) Qualitative analysis**

Separation of binary mixture and Identification of its components. 5g of mixture is to be given for separation.

At least **08 mixtures** are to be separated.

Nature 1) Solid - Solid : 4 mixtures

2) Solid - Liquid : 2 mixtures

3) Liquid - Liquid : 2 mixtures

1) Solid - Solid Mixtures :

One mixture from each the following types should be given :

i) Acid + Phenol ii) Acid + Base

iii) Acid + Neutral iv) Phenol + Base

v) Phenol + Neutral vi) Base + Neutral

2) Solid - Liquid Mixtures

One mixtures of type Neutral + Neutral and One mixture of type Acid + Neutral should be given.

3) Liquid - Liquid Mixtures

One mixture of type Neutral + Neutral and One mixture of type Base + Neutral should be given.

Following compounds should be used for preparation of mixtures:

Acids : Benzoic acid, Phthalic acid, Salicylic acid, Cinnamic acid,

Aspirin, Oxalic acid.

Phenols: α -naphthol, β -naphthol

Bases : o -nitroaniline, m-nitroaniline, p-nitroaniline, aniline, o-toluidine and N, N-dimethyl aniline.

Neutrals : Naphthalene, acetanilide, m-dinitrobenzene, chloroform, carbon tetrachloride, acetone, nitrobenzene, ethyl acetate, ethyl benzoate, acetophenone, bromobenzene, urea and thiourea.

II) Quantitative analysis : (Any four)

Organic estimations :

- 1) Estimation of sucrose
- 2) Estimation of nitro group
- 3) Saponification value of oil.
- 4) Estimation of formaldehyde from given formalin solution.
- 5) Estimation of acid and ester present in the given mixture of acid and ester.
- 6) Estimation of acid and amide from the mixture of acid and amide.

III) Organic Preparations : with following – (any four)

N.B.: a) Calculation of percentage practical yield.

b) Recrystallisation of crude product and its melting point.

c) The purity of the product may be confirmed by TLC.

- 1) Preparation of m-nitroaniline from m-dinitrobenzene.
- 2) Preparation of aspirin from salicylic acid .
- 3) Preparation of nerolin from β -naphthol
- 4) Preparation of p-iodonitrobenzene from p-nitroaniline.
- 5) Preparation of benzene azo - β - naphthol.
- 6) Preparation of benzoic acid from cinnamic acid.

IV Preparation of Derivatives :

N.B.: During practical course, name of the organic compound should not to be given.

- 1) Bromo derivative of aniline and cinnamic acid.
- 2) Nitro derivative of salicylic acid and nitrobenzene.
- 3) Benzoyl derivative of β -naphthol and aniline.
- 4) Picrate derivative of anthracene and β -naphthol.
- 5) Oxalate and nitro derivatives of urea.
- 6) Anhydride derivative of phthalic acid.
- 7) Oxime derivatives of Ketones : Acetone and acetophenone.
- 8) 2 : 4 DNP of acetophenone.

Recommended (Reference) Books :

1. Practical Organic Chemistry by A. I. Vogel.
2. Hand book of Organic qualitative analysis by H. T. Clarke.
3. A laboratory Hand Book of Organic qualitative analysis and separation by V. S. Kulkarni. Dastane Ramchandra & Co.
4. Practical Organic Chemistry by F. G. Mann and B. C. Saunders. Low - priced Text Book. ELBS. Longman.
5. Experiments in General Chemistry by C. N. R. Rao. Affiliated East-West Press Pvt. Ltd. Delhi.
6. Advanced Practical Organic Chemistry by N. K. Vishnoi. Vikas Publishing House Private Limited.
7. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwalia, Sunita

- Dhingra. University Press. Distributor - Orient Longman Ltd.
8. Comprehensive Practical Organic Chemistry Preparation and Quantitative Analysis
by V.K.Ahluwalia, Renu Aggarwal. University Press.Distributor-Orient Longmann Ltd.
 9. Practical Chemistry - Physical - Inorganic - Organic and Viva - voce by Balwant Rai Satija.
Allied Publishers Private Limited.30
 10. College Practical Chemistry by H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S. P.
Turakhia. Himalaya Publishing House, Mumbai.
 11. College Practical Chemistry by Patel, Jakali, Mohandas, Israney Turakhia. Himalaya
Publishing House, Mumbai.
 12. Practice of thin layer chromatography by Joseph C. Touchstone, Murrell F. Dobbins. A
Wiley - Interscience Publication John-Wiley & Sons.

Solapur University, Solapur.
Syllabus for B.Sc.-III(MATHEMATICS) Semesterwise
New Syllabus w.e.f. June 2015

Structure of the revised course:

SEMESTER-V

(I) Theory Papers

Paper	Title of the Paper	Marks
IX	Algebra-II	50
X	Complex Analysis	50
XI	Integral Calculus	50
XII	Partial Differential Equations	50

SEMESTER-VI

(I) Theory Papers

Paper	Title of the Paper	Marks
XIII	Metric Spaces	50
XIV	Numerical Analysis	50
XV	Integral Transform	50
XVI	Programming in C	50

(II) Numerical Technique Laboratory[NTL]

NTL No.	Topic	Marks
NTL-III(A)	S-I:Algebra-II[6] S-II : Metric Space [6]+Seminar	50
NTL-III(B)	S-I :Complex Analysis[6] S-II: Numerical Analysis[6] +Project	50
NTL-III(C)	S-I :Integral Calculus [6] S-II: Integral Transform[6]+Study Tour	50
NTL-III(D)	S-I: Partial Differential Equation[6] S-II: Programming in C [6]+Viva Vocae	50

Note : [] Number inside bracket indicates **number of assignments**.

In Numerical Technique Laboratory: NTL -III(A) – III(D) [Project/ Seminar / Study Tour/Viva Vocae]

Project : Biography of One Mathematician or One Mathematics Topic (which is not included in the syllabus upto B.Sc. -III Mathematics) about Five Pages. **05 Marks**

Seminar: Any topic in mathematics. **05 Marks**

A book Review/ Study Tour: Visit to any Industry / Research Institution / Educational Institution. **05 Marks**

Viva Voce : Viva voce on Project, Seminar and Study Tour. **05 Marks**

(Free internet should be availed for collection of Material for Project, Seminar.)

Instructions:

1. Each Theory Paper is allotted 45 periods per semester.
2. All **Numerical Technique Laboratory [NTL]** (similar to Practicals) will be conducted in the batch as a whole Class.
3. Total evaluation of B.Sc. III (**600 Marks**). [Theory papers (**400 Marks**) + **NT L- III(A) to NTL - III(D)** (Similar to Practicals) (**200 Marks**)]
4. The annual **Numerical Technique Laboratory [NLT - III(A) to NLT - III(D)]** will carry **50 Marks** each.
5. **Department of Mathematics should provide FIVE computers per batch of TEN students.**

Nature of question Paper

Semester –V Theory Papers IX, X, XI and XII and

Semester –VI Theory Papers XIII, XIV, XV and XVI

Theory Paper

[Marks 50]

- | | |
|--|----------|
| Q. 1: Multiple Choice Questions (Ten) | Marks 10 |
| Q. 2 : Attempt any FIVE out of SIX (each of 2 Marks) | Marks 10 |
| Q. 3:(A) Attempt any TWO out of Four (each of 3 Marks) | |
| (B) Compulsory (Mark 4) | Marks 10 |
| Q. 4: Attempt any TWO out of THREE (each of 05 Marks) | Marks 10 |
| Q. 5: Attempt any TWO out of THREE (each of 05 Marks) | |
| OR | |
| Attempt any ONE out of TWO (each of 10 Marks) | Marks 10 |

Nature of paper for Numerical Technique Laboratory) (For NLT- III(A) to NLT- III(D))

Section-I

- | | |
|---|----------|
| I) Attempt TWO out of FOUR (each of 10 marks) | Marks 20 |
| OR Attempt FOUR out of SIX (each of 05 Marks) | |

Section-II

- | | |
|---|----------|
| II) Attempt TWO out of FOUR (each of 10) marks) | Marks 20 |
| OR Attempt FOUR out of SIX (each of 05 Marks) | |
| III) Seminar/Project/Study Tour/Viva-vocae | Marks 05 |
| III) Journal | Marks 05 |

Total Marks 50

SEMESTER-V
Paper-IX :Algebra - II

Unit -1 : Introduction to Rings [10]

- 1.1. Definitions and Examples
- 1.2. Integral Domains. Subrings
- 1.3. Fields
- 1.4. Isomorphism. Characteristic

Unit –2 : Quotient Rings [05]

- 4.1. Homomorphisms of Rings. Ideals
- 4.2. Quotient Rings

Unit–3: Vector spaces [10]

Vector spaces, Subspaces, Linear combination and system of linear equation, Linear dependence and independence, Basis and dimensions

Unit-4 : Linear transformation and matrices [15]

Linear transformation, Null spaces and ranges, Matrix representation of linear transformation, Composition of linear transformation and Matrix multiplication, Invertibility and isomorphism.

Unit- 5 : Inner product space [05]

Inner products and Norms

Recommended books (Scope of Syllabus):

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

Unit – 1 : Chapter-VI: Art. 24,25,26,27

Unit – 2 : Chapter-IX:Art.38, 39

Linear Algebra Fourth Edition by Stephen H. Friedberg, Arnold J. Insel Lawrence E. Spence Prentice Hall of India New Delhi (EEE)

Unit-3: Chapter-I (Vector spaces): Art. 1.2 to 1.6

Unit-4 :Chapter-II (Linear transformation and matrices): Art. 2.1to 2.5

Unit-5:Chapter-VI (Inner product space) Art. 6.1, 6.2

Reference Books:

1. A First Course In Abstract Algebra J. B. Fraleigh Pearson Education 7th edition
2. University Algebra N.S. Gopalkrishnan
3. Algebra M. Artin Prentice Hall of India
4. Abstract Algebra David S. Dummit & Richard M. Foote Wiley & Sons, Inc.

5. Fundamentals of Abstract Algebra D. S. Malik & N. Mordeson & M. K. Sen Mc. Graw Hill International Edition.
6. Linear Algebra by Vivek Sahai & Vikas Bist Narosa Publishing House
7. Linear Algebra And Its Application Gilbert Strang International Student Edition
8. Topics In Algebra John Wiley & Sons by I. N. Herstein

Paper-X Complex Analysis

Unit -1 : Analytic Functions **[15]**

Complex Differentiation, Limits and Continuity, Differentiability, Necessary and Sufficient condition of analytic function, Method of constructing a regular function and analytic function, Polar form of Cauchy-Riemann Equations.

Unit -2 : Complex Integration **[15]**

Introduction, Some basic definitions, Complex line integral, Reduction of complex integrals to real integrals, Some properties of complex Integrals, An Estimation of a complex integral, Line integrals as functions of arcs, Cauchy's Fundamental Theorem, Cauchy Goursat Theorem[Statement Only], Expansions of Analytic functions as power series, Taylor's and Laurent's Series [Statement only]

Unit -3: Calculus of Residues **[15]**

Residue at simple pole, Residue at a Pole of order greater than unity, Residue at infinity, Cauchy's Residue Theorem. Evaluation of Definite integrals, Integration round the unit circle.

Evaluation of $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$.

Recommended Book (Scope of Syllabus):

- 1. Functions of Complex Variable by J. N. Sharma Revised by Dr. Shanti Swarup, (38 Edition) Krishna Prakashan Media Ltd., Meerut.**

Chapter -2 (Analytic Functions): 1 to 11

Chapter-6 (Complex Integration): 1 to 8, 9(Statement Only), 19, 20, 21,22
[Theorems I to IV only] .

Chapter -7 (Calculus of Residues): 1 to 7,10.

Paper –XI: Integral Calculus

Unit 1: Improper Integrals :

Convergence of Improper integrals of the first kind, Test of convergence of a (Positive integrand), Necessary and sufficient condition for the convergence of improper integrals, Comparison of two integrals, A practical comparison test, Useful comparison integrals, Two useful tests, $f(x)$ not necessarily positive General test for convergence, Absolute and conditionally convergence, Convergence of improper integrals of the second kind, Convergence at infinity(Integrand being positive),Comparison of two integrals, A useful comparison integrals, General test(for convergence at infinity and $f(x)$ may be positive or negative), Cauchy's test for convergence, Absolute and conditionally convergence of improper integrals of second kind, Test for the absolute convergence of the integral of a product, Abel's test, Dirchilet's test.. (20)

Unit 2 .Beta and Gamma function :

Definition, Properties, Transformations of Gamma function and Beta function and relation between them, Some Important deductions, Duplication Formula. (15)

Unit 3. Multiple integrals :

Double Integrals, Cartesian and polar, Applications of Double Integration (Area of region and Volume of a Solid only),Change of order of integration, Change of Variables. (10)

Recommended Book

Paper-VII (Integral Calculus)

Elements of Real Analysis by Shantinayakan, M.D. Raisinghanian by S. Chand(8 th Edition)

Unit 1 : 16.1 to 16.18.

**Integral Calculas by Shanti Narayan and P.K.Mittal S.Chand
Publication Revised Edition 2005.**

Unit 2 : 7.1,7.2,7.3,7.4, 7.5.

Unit 3: 12.2,12.3,12.4,12.5.

Reference books:-

1. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow
2. P. N. Wartikar and J. N. Wartikar, A Text Book of Applied Mathematics, Vol. I, Poona Vidyarthi Griha Prakashan, Poona 30.
3. Tom M. Apostol, Calculus Vol I and II, Wiley Publication.
4. Mathematical Analysis by S. C. Malik and Savita Arora.

Paper-XII : Partial Differential Equations

Unit-1: Linear partial differential equation of order one [15]

- 1.1 Derivation of partial differential equation of arbitrary constants
- 1.2 Derivation of partial differential equation of arbitrary functions.
- 1.3 Lagrange's Method of solving linear partial differential equation of order one. Namely $Pp + Qq = R$ Working rule for solving $Pp + Qq = R$ by Lagrange's Method.
- 1.4 Integral surface passing through a given curve

Unit-2: Non Linear partial differential equation of order one [15]

- 2.1 Solution of first order partial differential equation Charpit's Method.
- 2.2 Special methods of solution applicable to certain Standard form I, II, III, IV.

Unit-3: Linear partial differential equation with constant Coefficient [10]

- 3.1 Homogeneous and Non Homogeneous linear partial differential equation with constant Coefficient working rule for finding C.F. method of finding particular integral (P.I).
- 3.2 Short method when $f(x, y)$ is $\emptyset (ax + by)$ and $x^m y^m$,

Recommended Book (Scope of syllabus) :

1. Ordinary and partial differential equation by M. D.Raisinghania, S. Chand Co. [PART – III]

Unit – 1 :Chapter-1 : 1.1, 1.2, 1.2a, 1.2b, 1.3, 1.4, 1.5, 1.5a, 1.5b, 1.5c, 1.5d, 1.6

Unit – 2 :Chapter-2 : 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10,

Unit – 3 :Chapter-3: 3.1, 3.2, 3.3, 3.4, 3.4A, 3.4B, 3.5, 3.6, 3.6A, 3.6B, 3.7, 3.8, 3.9,3.10

Reference Books :

- 1. Elements of partial differential equation IAN Sneddon (International students edition by Mc Graw Hill Book)
- 2. Differential equation
Sharma & Gupta (Krishna Prakashan Media (P)Ltd. Meerut)
- 3. Partial differential equation J. M. Kar.

SEMESTER-VI

Paper – XIII :Metric Spaces

Unit – 1 :Limits and metric Spaces [15]

- 2.1 The class l^2 (Schwartz, Minkowski inequality)
- 2.2 Limit of a function on the real line
- 2.3 Metric spaces
- 2.4 Limits in metric spaces

Unit-2 : Continuous functions on metric spaces [15]

- 3.1 Functions continuous at a point on the real line
- 3.2 Reformulation
- 3.3 Functions continuous on a metric space
- 3.4 Open sets
- 3.5 Closed sets

Unit-3 : Completeness and Compactness [15]

- 4.1 More about open sets
- 4.2 Connected sets
- 4.3 Bounded sets and totally bounded sets
- 4.4 Complete metric spaces
- 4.5 Compact metric spaces
- 4.6 Continuous functions on compact metric spaces

Recommended Book (Scope of Syllabus):

Scope :

Methods of real analysis by R.R. Goldberg John Wiley & Sons 1976.

Metric Spaces

Unit – 1: Limits and metric spaces Art: 3.10, 4.1 to 4.3

Unit -2: Continuous functions on metric spaces Art: 5.1 to 5.5

Unit -3 : Completeness and Compactness Art: 6.1 to 6.6

Reference books

1. A first course in mathematical analysis by D. Somasundaram & B. Choudhary Narosa Publishing House.
2. Mathematical Analysis second edition by S. C. Malik & Savita Arora.
3. Principles of Mathematical analysis by Rudin W. McGraw-Hill, New York.
4. A Course of Mathematical Analysis by Shanti Narayan S. Chand & Company New Delhi.

Paper –XIV: Numerical Analysis

Unit- 1 : Finite Differences [10]

- 1.1.Introduction
- 1.2. Finite differences,
- 1.3.Differences of a Polynomial
- 1.4. Relation between the operators

Unit-2 : Interpolation [15]

- 2.1.Introduction
- 2.2. Newton's forward interpolation formula
- 2.3. Newton's backward interpolation formula
- 2.4. Gauss's forward interpolation formula
- 2.5. Gauss's backward interpolation formula
- 2.6. Interpolation with unequal Intervals(Lagrange's Interpolation Formula only)

Unit- 3 : Numerical Differentiation and Integration [10]

- 3.1.Numerical differentiation
- 3.2. Formula for derivatives
- 3.3. Maxima and minima of a tabulated function
- 3.4. Numerical Integration
- 3.5. Quadrature formulae(Trapezoidal rule, Simpson's 1/3 Rule and Simpson's 3/8 th rule only)

Unit- 4 : Difference Equations [10]

- 4.1.Introduction
- 4.2. Definitions
- 4.3. Formation of difference equations
- 4.4. Linear difference equation
- 4.5. Rules for finding the Complementary function
- 4.6. Rules for finding the Particular Integral
- 4.7. Difference equations reducible to linear form

Recommended book (Scope of Syllabus):

Numerical Methods in Engineering & Science with Programs in C and C++ Ninth Edition by B. S. Grewal Khanna Publishers New Delhi

Chapter-6. (Finite differences): Art. 1,2,3,7

Chapter-7 (Interpolation): Art. 1,2,3,5, 6, 11,12

Chapter-8 (Numerical Differentiation and Integration) Art.1,2,3,4,5(except IV and V)

Chapter-9 (Difference Equations)Art. 1 to 7

Reference books:-

- 1 .Numerical Analysis and Programming in C by Pundir and Pundir(Pragati Prakashan)
2. Linear Algebra And Its Application Gilbert Strang International Student Edition
3. Topics In Algebra John Wiley & Sons by I. N. Herstein
4. Hoffman & Kunj
5. K. B.Datta Matrix & Linear Algebra Prentice Hall of India Pvt. Ltd.New Delhi 2000

Paper –XV : Laplace Transforms

Unit 1: Laplace Transform. [15]

Integral Transform (Definition) ,Laplace Transform (Definition), Linearity property of Laplace Transform ,Piecewise continuous functions ,Existence of Laplace Transform, Functions of exponential order ,function of class A ,First Translation or Shifting Theorem,Second Translation or Shifting Theorem,Change of Scale Property ,Laplace Transform of the derivatives of $F(t)$, Laplace Transform of the n^{th} order derivatives of $F(t)$,Initial value theorem, Final value theorem, Laplace Transform of Integrals,Multiplication by t , Multiplication by t^n , Division by t , Evaluation of Integrals ,periodic functions.

Unit 2: The Inverse Laplace Transform. [15]

Inverse Laplace Transform, Null Function, Linearity property, Table of Inverse Laplace Transform, First Translation or Shifting Theorem, Second Translation or Shifting Theorem,Change of Scale Property, Use of partial fraction ,Inverse Laplace Transform of the derivatives , Inverse Laplace Transform of Integrals, Multiplication by powers of p , Division by powers of p , Convolution(definition), Convolution theorem, Heaviside's expansion formula, Beta function.

Unit 3: Applications of Laplace Transforms. [15]

Ordinary Differential equations with constant coefficients, Ordinary Differential equations with variable coefficients, Simultaneous ordinary differential equations, Partial differential equations..

Recommended Book for Paper –VIII (Integral Transform) :

Integral Transform by Vasistha A.R., Gupta R.K., Krishna Prakashan Media Pvt.Ltd.11 , Shivaji Road, Meerut India.

Unit 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, 1.19, 1.20, 1.21.

Unit 2: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17.

Unit 3 : 3.1, 3.2, 3.3, 3.4

Reference Books:

1. Rainville E.D. *The Laplace Transform*
2. Dr.J.R.Goyel and K.P.Gupta *Integral Transform Pragati prakashan Meerut.*
3. Sharma and Gupta, *Differential equation , Krishna Prakashan Media co., Meerut*

Paper-XVI : Programming in C

Unit – 1 : Overview of C [4]

- 1.1 Introduction
- 1.2 Importance of C
- 1.3 Sample C programs
- 1.4 Basic structure of C programs
- 1.5 Programming style
- 1.6 Executing a C program
- 1.7 Points to remember

Unit – 2 : Constants, Variables and Data Types [6]

- 2.1 Introduction
- 2.2 Character set
- 2.3 C Token
- 2.4 Constants
- 2.5 Keywords and Identifiers
- 2.6 Variables
- 2.7 Data Types
- 2.8 Declaration of variables

2.9 Assigning values to variables

2.10 Defining symbolic constants

Unit – 3 : Operators and Expressions

[9]

3.1 Introduction

3.2 Arithmetic operators

3.3 Relational operators

3.4 Logical operators

3.5 Assignment Operators

3.6 Increments and decrement operators

3.7 Conditional operators

3.8 Bit-wise operators

3.9 Special operators

3.10 Arithmetic expressions

3.11 Evaluation of expressions

3.12 Precedence of arithmetic operators

3.13 Some computational problems

3.14 Type conversions in expressions

3.15 Operators precedence and associativity

3.16 Mathematical functions

Unit –4: Managing Input and Output Operators

[4]

4.1 Introduction

4.2 Reading a character

4.3 Writing a character

4.4 Formatted input

4.5 Formatted output

Unit -5: Decision Making and Branching

[6]

5.1 Introduction

5.2 Decision making with IF statement

5.3 Simple IF statement

5.4 The IF...ELSE Statement

5.5 Nesting of IF...ELSE Statement

5.6 The ELSE...IF ladder

5.7 The SWITCH statement

5.8 The ?: operator

5.9 The GOTO statement

Unit -6 Decision Making and Looping [4]

- 6.1 Introduction
- 6.2 The WHILE statement
- 6.3 The DO statement
- 6.4 The FOR statement
- 6.5 Jumps in loops

Unit – 7 : Arrays [3]

- 7.1 Introduction
- 7.2 One dimensional arrays
- 7.3 Two dimensional arrays
- 7.4 Initialising two dimensional arrays
- 7.5 Multidimensional arrays

Unit – 8 : User-defined Functions [4]

- 8.1 Introduction
- 8.2 Need for user-defined functions
- 8.3 A multifunction program
- 8.4 The form of C Functions
- 8.5 Return values and their types

Recommended Book (Scope of Syllabus):

[I] Programs in C by E. Balgurusamy, McGraw Hill, New-Delhi

Unit- 1 : 1.1-1.7 Unit- 2 : 2.1 -2.10 Unit- 3 : 3.1-3.16 Unit- 4 :4.1-4.5

Unit- 5 : 5.1 - 5.9 Unit- 6 :6.1-6.5 Unit- 7 : 7.1 - 7.5 Unit- 8 :9.1- 9.5

Reference books:

1. Numerical Methods in Engineering & Science with Programs in C and C++ Ninth Edition by B. S. Grewal Khanna Publishers New Delhi.
2. Numerical Analysis and Programming in C by Pundir and Pundir(Pragati Prakashan)
3. A Book on C, Macmillan, by Berry, R.E. and Meekings.
4. C Programming Language: An applied perspective, John Wiley & Sons
5. The C Programming Tutor, Prentice-Hall, by Wortman, L.A. and Sidebottom.
6. C made Easy, Osbone McGraw-Hill by Schildt, H. C.
7. Let us C by Yeshwant Kanetkar BPB Publications, New-Delhi.
8. Programming in C by Schaum's Outline Series, Tata McGraw Hill, EEE.

Numerical Technique Laboratory [NTL –III(A) to III(D)]

Note: Each assignment is of 1.5 periods [50+25 = 75 minutes]

(Problems on following topics)

NTL-III(A)(Algebra - II +Metric Spaces)

(Problems on the following topics)

Section - I : Algebra - II

Assignment-1 : Rings and subrings ,Integral domains and Fields

Assignment-2 : Isomorphism and Characteristic,Ordered Integral domains, Ordered fields ,Field of quotients, Field of Complex numbers

Assignment-3 : Properties of polynomials and its division algorithm, Homomorphisms of Rings. Ideals , Quotient Rings

Assignment-4 : Subspaces, Linear dependence, independence and basis

Assignment-5 : Linear transformation and matrices, Kernel and range

Assignment-6 : Inverse and Composite, Orthonormal basis

Section – II :Metric Spaces

Assignment-7 : Metric Space-I(Examples on Metric spaces, open set, closed set, boundary set in Metric spaces)

Assignment-8 : Metric Space-II(Examples on bounded set, Totally bounded set and Diameter of set in Metric spaces)

Assignment-9 : Metric Space-III(Examples on Limit of metric space, Cauchy sequence in Metric spaces)

Assignment- 10 : Metric Space-IV(Examples on bounded set, Totally bounded set and Diameter of set in Metric spaces, contraction, Isometry, homeomorphism in Metric spaces)

Assignment- 11: Metric Space-V(Examples on cover, open cover, Dense in Metric spaces)

Assignment- 12: Metric Space-VI(Examples on completeness and compactness in Metric spaces)

NTL -III(B) (Complex Analysis+ Numerical Analysis)
(Problems on the following topics)

Section - I :Complex Analysis

Assignment-1 : Find the regular (analytic) function of which function (Real , Imaginary , $u+v$, $u-v$ type).

Assignment-2 : Solving the complex integration Circle , Line and Parabola.

Assignment-3 : Obtain the Taylor's and Laurent's series.

Assignment-4 : Calculus of residue.

Assignment-5 : Integration round the unit circle.

Assignment-6 : Evaluation of integral $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$.

Section – II :Numerical Analysis

Assignment No.7: Finite Differences

Examples on Forward, Backward and Central difference formulae,
Differences of a Polynomial, Relation between operators

Assignment No.8: Interpolation-I

Examples on Newton's forward and backward difference formulae.

Assignment No.9: Interpolation – II

Examples on Gauss's forward and backward difference formulae. Lagrange's interpolation formula

Assignment No. 10: Numerical Differentiation

Examples on Numerical differentiation, formula for derivatives and maxima and minima of tabulated function

Assignment No. 11: Numerical Integration

Examples on Numerical integration, Trapezoidal rule, Simpson's 1/3 Rule and Simpson's 3/8 th rule only

Assignment No. 12: Difference Equations

Examples on Formation of difference equations, Linear difference equation, finding the Complementary function, finding the Particular Integral, Difference equations reducible to linear form

NTL -III(C) (Integral Calculus + Integral Transforms)

Section - I : Integral Calculus

Assignment-1 : Improper Integral - I

Assignment-2 : Improper Integral - I

Assignment-3 : Beta and Gamma function - I

Assignment-4 : Beta and Gamma function -II

Assignment-5: Multiple integrals - I

Assignment-6: Multiple integrals - II

Section – II : Integral Transform

Assignment-7 : Laplace Transforms (Numerical examples)

Assignment-8 : Inverse Laplace Transform(Numerical Examples)

Assignment-9 :Applications of Laplace Transform Ordinary Differential equations with constant coefficients,

Assignment-10 : Applications of Laplace Transform Ordinary Differential equations with variable coefficients.

Assignment-11 : Applications of Laplace Transform Simultaneous Ordinary Differential equations.

Assignment-12 : Applications of Laplace Transform Partial Differential equations.

NTL -III(D)(Partial Differential Equation +Programming in C)
(Problems on the following Topics)

Section – I : Partial Differential Equation

Assignment-1 : Solve Linear differential equation of first order by arbitrary constant and arbitrary function, Lagrange's method.

Assignment-2 : Non linear partial differential equation of order one by Charpit method.

Assignment-3 : Non linear partial differential equation of standard form I , II , III & IV.

Assignment-4 : Find C.F and P.I for Homogeneous linear partial differential equation with constant coefficient.

Assignment-5 : Find C.F and P.I for Non-Homogeneous linear partial differential equation with constant coefficient.

Assignment-6 : Find C.F and P.I for equation reducible to linear differential equation with constant coefficient.

Section – II :Programming in C

(Run and write following C programs only)

Assignment No.7: Sample Programms – I

Addition, subtraction, multiplication and division. Area, Volume of a sphere, Temperature Conversion, Simple Interest Calculation, Compound Interest Calculation, Salary Calculation, Bonus and Commission

Assignment No.8: Sample Programms – II

Star pattern, Reverse of a given number, Fibonacci sequence, Factorial, nC_r , nP_r , Roots of the quadratic equation

Assignment No.9: Sample Programms – III

Maximum and Minimum, Sum of the series $1+2+3+\dots+n$, $1^2+2^2+3^2+\dots+n^2$, $1^3+2^3+3^3+\dots+n^3$, $1^2+3^2+\dots+(n-1)^2$, $2^2+4^2+6^2+\dots+(2n)^2$

Assignment No.10: Sample Programms – IV

Sine, Cosine, Exponential series

Assignment No.11: Sample Programs – V

Ascending and descending data. Matrix addition/Subtraction, Matrix multiplication.

Assignment No.12: Sample Programs – VI

Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 th Rule.



Solapur University, Solapur

B. Sc. Zoology Part – III Final Syllabus

Semester V & VI

w.e.f. - 2015-16

SOLAPUR UNIVERSITY, SOLAPUR

SYLLABUS FOR B.Sc. PART III (ZOOLOGY) Semester V & VI

(w. e. f. JUNE 2015)

Eligibility:

A student, who has been declared to have passed B.Sc. Part II Zoology successfully or is declared to be A.T.K.T. at B.Sc. Zoology and has cleared B.Sc. Part I, is eligible to take admission to B.Sc. Part III.

Course structure:

- The B. Sc. Part III (Zoology) will have two semesters viz... **Sem V and Sem VI.**
- Each semester shall comprise of four theory papers.
- Each paper has the weightage of 50 marks
- The course also includes a paper on English (Compulsory) as per B.Sc. III structure of Science faculty in each semester.
- The course also includes four practical courses with annual pattern of 50 marks each.
- The university practical examination will be conducted at the end of sixth semester.

SOLAPUR UNIVERSITY, SOLAPUR

Syllabus for B.Sc. III Zoology

(w.e.f. June 2015 onwards)

Theory Course

Semester V

Paper No.	Title of Paper	Marks	Lecture/ Periods
	Compulsory English	50	45
Paper- IX	Non-chordates	50	45
Paper- X	Biostatistics, Bioinformatics, Medical Zoology and Evolutionary Genetics	50	45
Paper- XI	Comparative Anatomy of Chordates	50	45
Paper -XII	Developmental Biology	50	45

Semester VI

Paper No.	Title of Paper	Marks	Lecture/ Periods
	Compulsory English	50	45
Paper XIII	Physiology	50	45
Paper- XIV	Endocrinology, Environmental Biology and Toxicology	50	45
Paper – XV	Molecular Biology and Biotechnology	50	45
Paper – XVI	Biotechniques and Applied Zoology	50	45

Practical Course

Practical No.	Title of Practical course	Marks
I	Non-chordates, Biostatistics, Bioinformatics, Medical Zoology and Evolutionary Genetics	50
II	Comparative Anatomy of Chordates and Developmental Biology	50
III	Physiology, Endocrinology, Environmental Biology and Toxicology	50
IV	Molecular Biology and Biotechnology and Applied Zoology	50

SOLAPUR UNIVERSITY, SOLAPUR
Semester Pattern Syllabus
B.Sc. III Zoology (Semester – V)
w. e. f. June 2015
Paper- IX: Non-chordates

UNIT - I. Protozoa –	(4)
1. Nutrition in Protozoa. -	
2. Reproduction in Protozoa. -	
UNIT -II. Porifera –	
1. Types of Canal Systems. -	(2)
UNIT -III A) Coelenterata –	(4)
1. Polymorphism. -	
2. Corals and Coral reef. -	
B) Salient features and affinities of Ctenophora. -	(2)
UNIT -IV. Annelida –Type study - Leech : -	(10)
1. Systematic position, Habits and habitat.	
2. Morphology, body wall, & Locomotion.	
3. Food, feeding and digestive system.	
4. Haemo-coelomic system.	
5. Excretory system.	
6. Nervous system and Sense organs.	
7. Reproductive system, copulation and cocoon formation.	
8. Parasitic adaptations and economic importance.	
UNIT -V Arthropoda –	(8)
1. Significance of Peripatus and Limulus	
2. Study of Crustacean larvae. -	
3. Types of Insect larvae. -	
4. Insect metamorphosis & its hormonal control.	
UNIT –VI Mollusca –	
1. Torsion and Detorsion. -	(2)
UNIT - VII Echinodermata –	
A) Type study –Sea star	(9)
a) Systematic position, Habit and habitat.	
c) Morphology and body wall.	
d) Food, feeding and digestive system.	
e) Water vascular system and locomotion.	
f) Reproductive system.	
g) Nervous system and sense organs.	
h) Haemal and perihemal system.	
B). Echinoderm larvae -	(2)
C). Minor phyla - Salient features and affinities of- Lingula	(2)

Total periods - (45)

Paper- X
Biostatistics, Bioinformatics, Medical Zoology
and Evolutionary Genetics

I. Biostatistics:

- UNIT -I.** A) Classification and Tabulation. - (3)
B) Frequency distribution & Graphical representation. - (2)
- UNIT -II** A) Measures of Central Tendency - Mean, Median and Mode. (4)
B) Dispersion – Mean Deviation, Standard Deviation & Standard Error, Student-T-test - (4)
- UNIT -III** Correlation –
a) Scatter diagram, - (3)
b) Types of correlation & Correlation coefficient.
i) Spearman's Rank Correlation Coefficient.
ii) Karl Pearson's Correlation Coefficient.
- UNIT - IV Bioinformatics : - (7)**
1. Introduction and applications of Bioinformatics
2. Introduction to proteomics and genomics
3. Applications of search Engine: Entrez, BLAST.
- UNIT - V Medical Zoology:**
- Study of following diseases with respect to their pathogenecity and treatment (7)
- a) Polio
b) Rabies
c) Ebola
d) Tuberculosis
- UNIT -VI**
- Study of following diseases with respect to their pathogenecity and treatment (7)
- a) Malaria
b)Fasciolasis
c) Elephantiasis
- UNIT –VII Evolutionary Genetics:**
1. Hardy-Weinberg Law of genetic equilibrium. (08)
2. Destabilizing forces of Natural selection with reference to:
a) Genetic drift and
b) Migration

Total Periods- (45)

Reference Books- (for Paper IX and X)

- There are few websites providing free downloadable books.

- Website of NCBI provides more than thirty books on microbiology, molecular biology, genetics and Biotechnology
- Website named Books4Doctor gives books on histology, physiology, molecular biology and Human genetics.

The books can be searched alphabetically.

1. Invertebrate Zoology- (W.B. Saunders Co.) – Barnes R.D.
2. Treatise in Zoology Sedgwick Vol III
3. Modern Text Book of Zoology, Invertebrates – R.L.Kotpal.
4. life of Invertebrates – S.N. Prasad, Vikas publishing House, New Delhi.
5. A Life of Invertebrates- Russell & Hunter.
6. Practical Zoology, Invertebrates- S.S. Lal.
7. Info technology- S. Chand and Co.
8. Bioinformatics- Murti, Himalaya Publications.
9. Introduction to Bioinformatics Attwood Pearson Education Delhi
10. General Parasitology- Cheng, T.C. Academic Press.
11. Parasitology-Chandler, Allied Agency, Kolkata.
12. Essentials of Parasitology – Gerald D. Smidth.
13. Introduction to Biostatistics Pranab Kumar Banerjee S. Chand and Company. New Delhi
14. Wikipedia : Free encyclopedia Major topics in Population genetics and related examples can be searched.
15. Evolution : Mark Ridley Blackwell Publishing In India marketed by John Wiley and Sons.
16. Textbook of medical Parasitology: K.D.Chatterjee

Paper- XI

Comparative Anatomy of Chordates

UNIT - I. a)Integument and its derivatives -	(7)
b) Endoskeleton - Appendicular skeleton.	(5)
UNIT - II. Digestive system – Alimentary canal and associated glands. -	(6)
UNIT - III. Respiratory system – Cutaneous respiration, Gills and lungs, Air sacs in birds. -	(5)
UNIT - IV. Circulatory system – Evolution of heart and Aortic arches, Portal systems. -	(7)
UNIT - V. Excretory system – Evolution of kidney and its ducts -	(4)
UNIT - VI. Nervous system – Comparative anatomy of Vertebrate brain -	(6)
UNIT - VII. Sense organs – Comparative anatomy of ear and eye. -	(5)

Total periods - (45)

Paper- XII
Developmental Biology

UNIT - I	Gametogenesis- Spermatogenesis and Oogenesis	(3)
UNIT - II	Process of fertilization -	(3)
UNIT - III	Types of eggs and cleavages -	(5)
UNIT - IV	Development of Amphioxus - a. Structure of Egg and Sperm b. Fertilization and cleavage c. Blastula and its fate map d. Gastrulation e. Primary organ formation: Nerve cord, Notochord, Mesoderm , Coelom and Gut	(11)
UNIT - V	Development of Chick a. Structure of Egg and Sperm b. Fertilization and cleavage c. Blastula and its fate map d. Gastrulation e. Structure of 24 Hr. Chick embryo. f. Development of nervous, digestive and circulatory systems in second day of incubation (Structure of 48 Hr. Chick embryo) g. Development of nervous, digestive and circulatory systems in Third day of incubation (Structure of 72 Hr. Chick embryo)	(18)
UNIT - VI	Foetal membranes (amnion ,chorion, allantois and yolk sac) & their significance in chick.	(2)
UNIT - VII	Placentae –Types and significance. -	(3)

Total Periods- (45)

Reference Books – (for Paper XI and XII):

1. An Introduction to Embryology 2003, Balinsky B.L., Saunders College, Philadelphia.
2. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.
3. Developmental Biology, 2004 , 3rd Edition, Gilbert S.F. Saunder Associates Inc. U.S.A.
4. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. & Williams, R.J. Saunders College, Publications, London.
5. A Text Book of Embryology, Dr. Puranik P. G. , S. Chand & Co.
6. Developmental Biology, 1984, Browder L.W. , Saunders College Publications, U.S.A.
7. Development of Chick embryo, 1972, Lillie.
8. Outlines of comparative Anatomy, Romer & Parsons, Central Book Depot, The Vertebrate Body (Saunders).
9. Biology of Vertebrates Walter & Sayles; (McMillan).
10. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications, Meerut.

11. The Life of Vertebrates, 3rd Edition, 1993, J. Z. Young E. L. B.S. Oxford.
12. Chordate Zoology – E.L. Jordan, S. Chand & Co., New Delhi.
13. The Phylum Chordata – 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra.
14. Comparative Anatomy of the Vertebrates G. C. Kent.

SOLAPUR UNIVERSITY, SOLAPUR
New Syllabus for B.Sc. III Zoology
(Semester – VI)

Paper - XIII
Physiology

UNIT I. Nutrition And Metabolism –	(14)
<ul style="list-style-type: none"> a) Digestion and absorption. b) Vitamins- With reference to source, Physiological role and deficiency. Water soluble –B complex and C ; Fat soluble – A, D, E and K. c) Carbohydrate metabolism - Glycogenesis, Glycogenolysis, Glycolysis, Krebs cycle, and Gluconeogenesis. d) Protein metabolism: Transamination, Deamination and Ornithine cycle e) Lipid metabolism. β- oxidation hypothesis. 	
UNIT II Physiology of Respiration –	
<ul style="list-style-type: none"> 1. Transport of respiratory gases 2. Chemical and nervous regulation of Respiration 	(4)
UNIT III. Physiology of Circulation	
<ul style="list-style-type: none"> 1. Origin and conduction of heart beat, Cardiac cycle 2. ECG, Blood pressure 	(7)
UNIT IV. Excretion physiology	
<ul style="list-style-type: none"> 1. Structure of nephrons 2. Physiology of urine formation. 3. Dialysis. 	(4)
UNIT V Muscle physiology	
<ul style="list-style-type: none"> 1. Ultra structure striated muscle 2. Molecular mechanism of muscle Contraction. 	(6)
UNIT - VI Nerve physiology	
<ul style="list-style-type: none"> 1. Ultra structure of neuron 2. Origin and conduction of nerve impulse 3. Synapse and synaptic transmission 	(7)
UNIT - VII Stress physiology	
<ul style="list-style-type: none"> 1. Introduction to stress physiology 2. Managing stress by exercise, yoga and meditation 	(3)
Total Periods- (45)	

Paper- XIV
Endocrinology, Environmental Biology and
Toxicology

Endocrinology:

UNIT I Study of endocrine glands –

(12)

Anatomy, histology and hormones – Nature, role, regulation and disorders with reference to the following glands :

- a) Thyroid gland
- b) Parathyroid gland
- c) Adrenal gland
- b) Islets of Langerhans.

UNIT II Prostaglandins and Neurohormones - GnRH, CRH and TRH

(4)

Environmental Biology:

UNIT III 1. Concept of Biodiversity (3)
2. Conservation of endangered species with reference to Great Indian Bustard (*Ardeotis nigriceps*) (3)

UNIT IV

1. Characteristics and faunal adaptations with reference to following habitats
Fresh water, Marine water and Terrestrial (Grassland, desert ecosystem) (7)
2. Biological indicators of pollution. (2)

UNIT V

1. Solid waste management. - (2)
2. Water Management: Rain Water harvesting (2)
3. Animal Ethics- Introduction, prevention of cruelty to animals, need of virtual dissection (2)

Toxicology –

(4)

- UNIT VI**
1. Classification of toxicants.
 2. Toxic agents and their action – Pesticides
 3. Determination of LC₅₀ and LD₅₀ Values

UNIT VII 1 Bioaccumulation and biomagnification.
2. Applications of Toxicology

Total Periods -(45)

Reference Books (for Paper XIII and XIV)

1. General and Comparative Physiology – Hoar (Prentice Hall).
2. Animal Physiology – Nelson (Cambridge).
3. Comparative Animal Physiology – Prosser (Satish Book Enterprise).
4. Endocrinology – Hadley Pearson Education Delhi
5. General Endocrinology – Bagnara & Turner (W.B. Saunders)
6. Ecology – Odum (Amerind)
7. Limnology – Welch (McGraw Hill)
8. Introduction to Environmental Science – Y Anjaneyulu (B.S. Publications)
9. Animal Physiology – Adaptation and Environmental – Schiemdt Nielson (Cambridge)
10. Physiology : A regulatory systems approach – Strand F.L. (McMillon Publications Co.).
11. Environmental and Metabolic Animal Physiology – Prosser C.L. (Wiley –Liss Inc.)
12. Environment Physiology- Willmet P.G., Stone & Johnson (Blackwell Science, Oxford).
13. Physiological Animal Ecology – Loan G.N. (Longman Harlog, UK)
14. Principles and methods of Toxicology – Hayes (Edited A. Wallace, Hayes Publications, Raven Press, N.Y.)
15. Books4Doctors Website Downloadable book of Endocrinology Nussey

Paper – XV
Molecular Biology and Biotechnology

Molecular Biology:

UNIT I . Organization of DNA

(7)

- a) Evidences for DNA as a genetic material - Transformation
- b) Transduction
- c) Conjugation
- d) . Replication of DNA -
- e) DNA damage and repair mechanism. -

UNIT II Transcription -

(5)

- a) Process of transcription in prokaryotes and eukaryotes
- b) RNA polymerases.
- c) Post transcriptional modifications in RNA

UNIT III Translation –

(5)

- i. Activation of amino acids
- ii. Binding or transfer of amino acid to t RNA.
- iii. Initiation
- iv. Elongation
- v. Termination.

UNIT IV Genetic Code

(3)

- i. Properties of Genetic Code
- ii. Codon assignments.
- iii. Initiation codon
- iv. Termination codon
- v. Codon and anticodon pairing
- vi. Wobble hypothesis

Biotechnology:

UNIT V

- 1. Recombinant DNA technology (3)
 - a. Mechanism and role of restriction enzymes, DNA ligase and DNA polymerase
 - b. Cloning vectors- Plasmid and Cosmid

UNIT VI

Techniques in genetic engineering- (12)

- A) Polymerase chain reaction:
 - a. Introduction
 - b. Mechanism
 - c. Applications
- B) DNA probes:
 - a. Introduction
 - b. Mechanism of synthesis of probe
 - c. Application
- C) Blotting (Southern, Northern, Western blotting)
 - a. Introduction
 - b. Mechanism
 - c. Applications
- D) DNA fingerprinting:
 - a. Introduction
 - b. Mechanism
 - c. Applications

UNIT VII

- 1). Immunological techniques: (4)
 - a) Hybridoma & synthesis of monoclonal antibodies
 - b) Applications of monoclonal antibodies
- 2) ELISA: (4)
 - a) Introduction
 - b) Applications
- 3) Application of Biotechnology – Cloning and Medicine (2)

Total Periods -(45)

Paper – XVI
Biotechniques and Applied Zoology

Biotechniques:

- UNIT I** 1. Tools and Techniques (Basic principles and uses) (3)
pH meter, colorimeter, spectrophotometer and ultracentrifuge
2. Separation techniques (4)
i. Chromatography- TLC and Column chromatography.
ii. Gel Electrophoresis- Polyacrylamide Gel Electrophoresis and Agarose Gel Electrophoresis
- UNIT II** 3. Animal Cell Culture (6)
i. Introduction and principle, Requirements and applications
ii. Stem cells and their culture
iii. Tissue and organ culture
iv. Embryo culture
4. Cryopreservation of gametes and its application (2)

Applied Zoology

- UNIT III Fisheries :** (5)
1. Marine Capture fisheries
a) Coastal fishery – Sardine, Mackerel, Bombay duck
b) Off – shore fishery – Sole, Tuna, Pomphret
c) Crustacean fishery – Lobsters Crabs, Shrimps
2. Economic importance of Fish Products and byproducts- (2)
3. Pearl Culture (1)
- UNIT IV** 1. Fishing Crafts and Gears- (7)
a) Crafts
i. Rafts
ii. Trawler
iii. Shampan
iv. Canoe
v. Catamaran
- b) Gears.
i. Hooks and lines

- ii. Cast net
- iii. Gill net
- iv. Trap net
- v. Rampani net
- vi. Trawl net

UNIT V Agricultural Pest Management-

(6)

- a) Agricultural pests – Pyrilla, Tribolium (Jowar grain borer), Cotton Boll worm, Grass hopper and Rat.
- b) Biological control of crop pests.
- c) Integrated Pest Management (IPM)

UNIT VI Rearing Technology of Silk worm

(6)

- a. Principle of Silkworm rearing
- b. Varieties of silkworms & their rearing methods
- c. Government schemes for propagation of sericulture
- d. Types of rearing houses
- e. Rearing , Appliances and maintenance

UNIT VII Silkworm diseases :-

(3)

- a. Protozoon diseases
- b. Bacterial diseases
- d. Viral diseases
- e. Fungal diseases

Total Periods- (45)

Reference Books- (for Paper XV and XVI)

1. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr. EMF, Lippincott Williams and Wilkins, Philadelphia,'
2. Cell Biology, C.B. Powar, Himalaya Publication House.
3. Cell and Molecular Biology, E.J. Dupraw, Academic Press, NewYork.
4. Cell Structure and Function – A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A. N. Gallant, Saunder College, Philadelphia.
5. Molecular Biololgy of the Cell – 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts & James D. Watson, Garland Publishing, New York.
6. Elements of Biotechnology – P. K. Gupta, Rastogi Publications.
7. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.
8. Prawn and Prawn Fishery of India – Kurian.
9. Fish Culture – K. H. Alikuhni.
10. Fish Culture – Lagler.
11. Fishes of India. – Zingran
12. Manual of sericulture – Krishnaswami et. al.
13. Introduction to sericulture – Ganga and Shetty.

Practical - I
Non-chordates, Biostatistics, Bioinformatics and Medical Zoology,
and Evolutionary Genetics

1) Leech: Anatomical Observations and detailed explanation of Leech with the help of CD/Model/Chart of the following systems-

1. Digestive system.
2. Nervous system.
3. Reproductive system.

Study of Nephridium, Salivary glands and jaw of Leech with the help of CD/Model/Chart /Slides.

(During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

2) Sea Star: Anatomical Observations and detailed explanation of Sea star with the help of CD/Model/Chart of the following systems

1. Digestive system.
2. Water vascular System.
3. Study of tube foot of sea star with the help of CD/Model/Chart /Slides

(During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

3) *Lingula*: Study of Lophophore and Nephridium of *Lingula*- with the help of CD/Model/Chart/Slides/Museum Specimens

(During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

4) *Squilla*: Anatomical Observations and detailed explanation of Nervous System of *Squilla* with the help of CD/Model/Chart

(During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

5) Study of Zooids of *Porpita* and *Obelia* colony with the help of CD/Model/Chart/Permanent Slides and Museum Specimens

6) Study of locomotion in Protozoa– Amoeba, Paramecium and Euglena using Permanent slides/photographs / Permanent Slides and Museum Specimens

7) Study of Canal systems– T.S. and L.S of Sycon using Permanent slides/photographs / Permanent Slides and Museum Specimens

8) Study of Physalia and any four Corals using models / photographs / Museum specimens / Permanent Slides and Museum Specimens

9) Study of following using photographs / Permanent Slides or Museum Specimens

- | | |
|---------------------------|----------------------|
| 1. Crustacean larvae. | 2. Insect larvae. |
| 3. Peripatus and Limulus. | 4. Echinoderm larvae |

10) Examples on Biostatistics. (Any Ten Examples)

11) Preparation of Parasites from Fecal samples of the animals

12) Study of Pathogens: *Plasmodium*, *Fasciola hepatica*, *Wuchereria bancrofti* using slides/photographs

13) Bioinformatics –

a) Data search by ‘text and sequence based search engines’: Entrez and BLAST tool

b) Examples based on bioinformatics: Searching sequences of any five genes or proteins using NCBI and submission of sequences in FASTA format.

(During regular practical students are expected to use INTERNET and access the NCBI website and study the ‘home page menu of NCBI, Entrez and BLAST search engine/tool’ and ‘perform sequence search of any five proteins or genes using Entrez tool’. At the time of examination students are expected to perform searching of any one protein or gene using INTERNET and get target sequence and submit the print of the same **or** they may directly explain the **home page or sequence format** which they had already performed and obtained during regular practicals of any five genes or proteins. For eg. Hemoglobin, Insulin, Trypsin, Myoglobin, and Collagen or any suitable protein).

14) Graphical representation of data using MS-EXCEL (produce Bar, Line, Pie, and Histogram using suitable data).

15) Examples based on Hardy Weinberg Law (08 examples)

PRACTICAL –II

Comparative Anatomy of Chordates & Developmental Biology

1) Scoliodon: Anatomical Observations and detailed explanation of Cranial Nerves of Scoliodon with the help of CD/Model/Chart (During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

2) Scoliodon: Anatomical Observations and detailed explanation of **Membranous labyrinth of Scoliodon** with the help of CD/Model/Chart (During regular practical and while annual examination students should be provided with unlabelled figure of membranous labyrinth of scoliodon and are expected to **label and write** a brief account on location, structure and functions of various parts and submit the labeled figure and **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

3) Scoliodon: Anatomical Observations and detailed explanation of **Eye Muscles and nerve innervations of Scoliodon** with the help of CD/Model/Chart (During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

4) Rat: Anatomical observations and detailed explanation of Reproductive System of rat with the help of CD/Model/Chart (During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

5) Rat: Anatomical Observations and detailed explanation of **Neck Nerves of Rat** with the help of CD/Model/Chart (During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

6) Study of Scales– Placoid, Cycloid and Ctenoid/Ampulla of Lorenzini ,Weberian ossicle of Labeo with the help of CD/Model/Chart/ permanent slides (During regular practical and while annual examination students should be provided with unlabelled figures and are expected to **label and write** a brief account on location, structure and function of various parts and submit the labeled figure and a **viva-voce** on the same is expected for the thorough understanding of his/her knowledge).

7) Study of Eggs of Insects, Amphioxus, Frog and Chick with the help of CD/Chart/Model/Permanent slides and museum specimens

8) Study of Cleavage, Blastula and Gastrula Amphioxus with the help of CD/Chart/Model/Permanent slides

9) Study of Whole mounts and T.S. of 18, 24, 33, 48, and 72 hrs Chick embryos with the help of CD/Chart/Model/Permanent slides

10) Study of 'procedure to understand embryological stages of chick up to 72hrs' by non invasive method' using CD/Model/Chart

(During regular practical students are expected to learn flow chart for the whole mount of chick embryo starting from incubation of egg - location of embryo - transferring of embryo on glass slide – fixation – dehydration – staining – identification – drawing - labeling and submission. **At the time examination** students will be provided an unlabelled figure of any one developmental stage of chick embryo which they are expected to identify, label and write the procedure for making a whole mount and defend viva-voce).

11) Study of placenta of Rat/ Human using CD/Chart/Model / museum specimens

12) Study of following using CD/Chart/Permanent Slides / Museum Specimens

- | | |
|---------------------------------------|--|
| 1. T.S. / V.S. of skin of vertebrates | 2. Scales- Fishes and Reptiles. |
| 3. Feathers | 4. Gills of Fishes and Lungs of Amphibian, Reptiles, Birds and Mammals |
| 5. Hearts of Vertebrates | 6. Brains of Vertebrates. |

13) Project work- Research project should be prepared in consultation with faculty either individually or in group as required. The research guide will support students in selecting and executing the entire topic and preparing the report for final submission during examination after approval of the guide in the following format

a) Research project should be based on an original research topic

b) Format of Report:

1. Title
2. Introduction
3. Review of literature
4. Objectives
5. Material and Methodology
6. Result and discussion
7. Conclusion
8. References

c) At the time of practical examination submit the final project report (hard copy) and present your research findings using powerpoint.

PRACTICAL –III

Physiology, Endocrinology, Environmental Biology and Toxicology

1) Demonstration of physiological practical with the help of CD/Virtual Dissection

- a) Demonstration of preparation of gastrocnemius muscle with sciatic nerve in frog;
- b) Study of Simple muscle twitch and obtaining the computer generated graph;
- c) Study of normal cardiogram and obtaining the computer generated graph;
- d) Study of effect of temperature, Adrenaline, Nicotine on normal heart and obtaining the computer generated graph;

(At the time of examination students are supposed to ‘Analyze the given graph and provide details of principle, procedure, result, inference and viva-voce based on the given practical)

- 2) Estimation of hemoglobin.
- 3) Total count of R.B.C., W.B.C and differential count of WBC
- 4) Measurement of blood pressure and heart beat under normal and stress condition.
- 5) To perform ‘Erythrocyte Sedimentation Rate (ESR)’ of the given blood sample.
- 6) Preparation of Haemin crystals
- 7) To determine blood clotting time using capillary method
- 8) To study effect of hypotonic, hypertonic and isotonic solution on RBC
- 9) Estimation of protein, carbohydrate and lipid by colorimetric method
- 10) Endocrine glands – Anatomy and Histology using slides/photographs

Testis, Ovary, Adrenal, Thyroid, Pancreas.

- 11) Estimation of dissolved O₂ and free CO₂
- 12) Testing of hardness of water.
- 13) Quantitative analysis of soil samples to assess N, P, and K.
- 14) **Study of animals in relation to their habitats using charts/videos**

1. Lotic – Guppies.
2. Lentic – Anabas/ Indian major Carp
3. Pelagic – Puffer fish/Mackerel, Sardine
4. Benthic – Lobster, Prawn
5. Grass land – Stick insect/Grasshopper
6. Desert – Phrynosoma, Uromastix.

15) **Study of ecological pyramid using charts**

Presentation of given data in the form of ecological pyramids. Data for the ecological pyramids.

1. Members of Grass land ecosystem –
Grasshopper, rat snake, grass, herbs, shrubs, weeds, trees, vulture, squirrel, earthworm, centipede, scorpion ,
rabbit and Indian bustard.

2. Members of Pond ecosystem –

Sponge, nepa, leech, planaria, hydra, lymnea, planorbis, heron, kingfisher, Cyclops, daphnia, tortoise , diatoms Vallisneria, hydrilla, chara and spirogyra.

3. Members of Forest ecosystem-

Monkey, tree snake, hyla, python, vulture, giant squirrel, gaur, tiger, leopard, deer, loris, millipede, king cobra, shrub herb, tree, jungle fowl, moss and fern.

4. Members of Desert ecosystem-

Opuntia, Aloe, sidewinder, wild ass, camel, ground spider, scorpion, Phrynosoma, Uromastix, vitis , blackbuck, Pencil tree, nerium.

16) Study of Diversity indices (Shannon/Simpson) using quadrat/line transect method

17) Excursion Tour (Any one- of duration 8-12 days)

- a) Visit to sea-shore
- b) Visit to Fishery Centers
- c) Visit to National Parks
- d) Wildlife Sanctuaries
- e) National Research Institutes
- f) Central Research Institutes
- g) Zoological Survey of India
- h) Fresh Water Ecosystem

Note:

1. Kindly note that during field visits students shall observe only animals and make record of the observations without disturbing natural habitat nor kill the animals. Students should be told about the importance of biodiversity and conservation;

2. Students are encouraged to prepare and submit a concise report of the excursion;

3. Report on multiple excursion tours may be clubbed for preparing and submitting report at the time of final examination will be allowed.

PRACTICAL – IV **Molecular Biology, Biotechnology and Applied Zoology**

1) Study of procedure to understand whole mounts of Protozoa, coelenterate colony, planktons, insect larvae, echinoderm larvae, crustacean larvae, fish scales, filoplume and down feather using CD/Chart

(During regular practical students are expected to learn protocol for whole mount starting from acquisition of material – fixation if required – dehydration as necessary – staining – mounting - identification – drawing – labeling. **At the time examination** students will be given an unlabelled figure which they need to identify, label and write the protocol for making the whole mount)

2) Study of Microtomy and its applications by using CD/Chart:

- a) Principle and applications of microtome machine
- b) Study of 'Types of stains'(vital, nuclear, cytoplasmic)
- c) Theoretical study of flow chart of microtechnique (Introduction to autopsy and biopsy – Fixation – washing if needed – dehydration – clearing – embedding – block making – trimming – fixing of trimmed block to block holder- Demonstration of working of microtome machine – sectioned ribbon – spreading on slide)
- d) Theoretical study of 'Principle, staining and application of HE method

At the time examination students will be asked to write principle, procedure and applications of microtomy along with the flowchart of the Microtomy and HE staining and defend viva-voce).

3) **Staining:** Histochemical Techniques

- a) Staining of chromatin using 'Feulgen Method' in human blood smear
- b) Staining of DNA and RNA using methyl green and pyronin method in human blood smear

4) **Molecular Biology and Biotechnology**

- a) Isolation of DNA: from any suitable material
- b) Estimation of DNA by Diphenyl Amine method (DPA)
- c) Estimation of RNA by Orcinol method
- d) Paper chromatography: separation of amino acids
- e) Thin Layer Chromatography (TLC): Separation of amino-acids using Thin Layer Chromatography (TLC)
- f) Electrophoresis: understanding of banding pattern of gel electrophoresis of DNA / protein and determination of molecular weight of an unknown sample within the band using photographs
- g) Theoretical study of animal cell and tissue culture using CD/Model/Chart
- h) Study of meiotic phases in onion bud
- i) Study of human Karyotype using photographs: Normal male and female (classification of chromosomes according to size and position of centromere)

5) To find out codon sequences for known polypeptide chain of ten amino acids or to find out amino acid sequence from given codons (chart will be provided)

6) Economic importance of Leech, Prawn, Lobster, Crab, Oyster, Sepia using CD/Model/Chart

7) Economic importance of Shark, Pomphret, Oil Sardine, Mackerel, Bombay duck, Eel, Ophiocephalus, Catala, Rohu, Mrugal and Cyprinus using CD/Model/Chart

8) Study of fish products- fish meal, fish glue, fish liver oil, fish body oil, fish manure, and shagreen using CD/Model/Chart

9) Study of different Fishing Crafts and Gears using CD/Model/Chart using CD/Model/Chart

10) Study of Crop pests – Pyrilla, Jawar grain borer, Cotton ball worm, Grass hopper using CD/Model/Chart

11) Excursion visits to study Sericulture, agriculture research center, yoga & meditation center and Pearl Culture

Note:

As per the guidelines of **UGC notification number F.14-6/2014(CPP-II) dated 1st August, 2014** it is now essential to make necessary modifications to stop dissection and promote and orient students towards the knowledge component rather than skill development. However, ITC based virtual dissections are promoted. Now, the responsibility to discontinue dissections and use of animals in experiments totally rests on concerned authorities of respective colleges/Institutes. As per the notification it is important to encourage the field trips and observations without disturbing the biodiversity.

Skeleton paper for practical examination

Practical – I

	Marks
Q.1: Biostatistics example	06
Q.2: Example based on Bioinformatics	06
Q.3: Example based on Hardy-Weinberg Law	06
Q.4: Graphical representation using MS-EXCEL	05
Q.5: Identification	10
Q.6: Analysis and explanation of anatomical parts of given figure/CD/Chart/Model of Leech/Sea star/Squilla as per practical syllabus	07
Q.7: Analysis and explanation of given permanent slide/CD/Chart (Lingula lopophore, nephridium; Porpita zooids; and Obelia colony)	05
Q.8: Practical Record Book	05

Total - 50

Practical – II:

Q.1: Analysis and explanation of anatomical parts of given figure/CD/Chart/Model of Scoliodon- cranial nerves and Rat- reproductive system as per practical syllabus	08
Q.2: Analysis and explanation of given Model/CD/Chart (Scoliodon- Internal Ear, Eye Muscles; Rat: Neck Nerves as per practical syllabus-	06
Q.3: Identification-	10
Q.4: Study of 'procedure to understand embryological stages of chick up to 72hrs' by non invasive method' using CD/Model/Chart-	06
Q.5: Submission, PowerPoint presentation and viva-voce of Project report-	15
Q.6: Practical record book-	05

Total - 50

Practical – III:

Q.1: Estimation of Dissolved O ₂ from given sample/Free CO ₂ from given sample/Hardness of water	06
Q.2: Hemoglobin percentage /Blood Cell counts/Blood Pressure/ESR/Haemin Crystal/Blood Clotting Time/ effect of hypotonic, hypertonic and isotonic solution on RBC	10
Q.3: Ecological pyramid/Diversity Indices/Analysis of N,P,K in soil sample	06

Q.4: Analysis of given graph of Frog- muscle twitch or cardiogram / Biochemical estimations	08
Q.5: Identification	05
Q.6: Submission of Excursion Tour report	10
Q.7: Practical record book	05
Total - 50	

Practical – IV:

Q.1: Cytological preparation- Meiosis/ Feulgen technique/Methyl-green & Pyronin – 08	
Q.2: Examples based on codon/Analysis of Karyotype	05
Q.3: Isolation of DNA/Estimation of DNA/RNA	06
Q.4: Chromatographic separation of amino acids/Electrophoresis	06
Q.5: Principle and applications of Microtomy/whole mount preparation	05
Q.6: Identification	10
Q.7: Excursion report	05
Q.8: Practical record book	05
Total – 50	

Chairman
B O S in ZOOLOGY

Solapur University, Solapur
B.A /B. Sc. Part–III
English (Compulsory)
Text Prescribed: Literary Quest
Semester V&VI
(Teaching Years: 2018-19, 2019-20, 2020-2021)
(CBCS Semester Pattern Syllabus w.e.f. June, 2018)

Preamble:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

The present course hopes to address some of these aspects through an interactive mode of teaching-learning processes and by focusing on various dimensions of communication skills. Some of these are: Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note-taking etc.

This textbook presents balanced treatment of both the theory and applications of communication. Content includes strong coverage of ethics, cross-cultural communication and the newest technological influences in communication. Unique prose and poems are provided. Coverage of listening skills, intercultural communication, developing PowerPoint presentations, and writing instructions has been extensively enhanced. This book captures the dynamics of communication. It presents the subject in a fascinating way, powerfully stimulating and motivating readers. This book will give the foundation for excellent, effective, and practical communication and will definitely satisfy the literary quest of students.

Objectives:

- To enhances the skills of reading, writing, speaking and listening
- To teach the students various skills in class and tests these skills for a constant monitoring of their proficiency
- To broadens the horizon of understanding with the help of prose and poems
- To enhances the creativity of the student.
- To gives them a composite view of good communication.

Course outcomes:

By the end of the course students will

- Be competent and proficient to communicate properly
- Understand the social commitment and value of good communication
- Be creative and will try his hands in writing from time to time
- Be a good communicator