

Swami Ramanand Teerth Marathwada University, Nanded

Syllabus B.Sc. Biotechnology

CBCS (Choice Based Credit system) Pattern- June-2016

B. Sc. Biotechnology First Year (First Semester)

Course Code No.	Course Title	Periods/ Week	Total Period	Internal	External	Total Marks	Credits
AECCBT-1A	English and Science Communication Skills-I	3	45	10	40	50	2
CCBT-2A	Introduction to Biotechnology	3	45	35	40	75	3
CCBT-3A	Basics of Biosciences	3	45	35	40	75	3
CCBT-4A	Microbiology-I	3	45	35	40	75	3
CCBT-5A	Fundamentals of Chemistry	3	45	35	40	75	3
CCBTP-1A	Practical Based on CCBT-2A & 3A	03+03	20	20	80	100	4
CCBTP-2A	Practical Based on CCBT-4A & 5A	03+03	20	20	80	100	4
					Total	550	22

B. Sc. Biotechnology First Year (Second Semester)

Course Code No.	Course Title	Periods/ Week	Total Period	Internal	External	Total Marks	Credits
AECCBT-1B	English and Science Communication Skills-II	3	45	10	40	50	2
CCBT-2B	Principles of Genetics	3	45	35	40	75	3
CCBT-3B	Bioinstrumentation techniques	3	45	35	40	75	3
CCBT-4B	Microbiology-II	3	45	35	40	75	3
CCBT-5B	Biomolecules	3	45	35	40	75	3
CCBTP-1B	Practical Based on CCBT-2B & 3B	03+03	20	20	80	100	4
CCBTP-2B	Practical Based on CCBT-4B & 5B	03+03	20	20	80	100	4
					Total	550	22

Swami Ramanand Teerth Marathwada University, Nanded
Choice Base Credit System (CBCS) Course Structure (New Scheme)
B.Sc First Year (Semester I)
Biotechnology

AECCBT 1-A English & Science communication Skills –I
Maximum Marks: 50 Hours: 45 Credits:2

Objective: To improve the skills in correct English in writing and pronunciation

Unit I: Grammar

Word Classes (Open & Closed), Sentence – Kinds – Transformation, Phrase, Clause and its kinds,

Simple, Complex & Compound sentences, (Only definitions & Structure)

Tenses - Use of verbs in the Sentences

Unit II: Vocabulary

Morphology, Synonyms & Antonyms, One Word Substitution, Homophones & Homonyms

Unit III Communication Skills

Definition & its all Types, Communication Cycle & Barriers, Principles for Effective Communication,

Varieties in English (Indian, British & American).

Unit IV: Writing Skills

Letters (Formal & Informal), Report Writing (Scientific and Formal), Memorandum, Curriculum Vitae,

Personal Employment Interview, Group Discussion.

Phonetics: 44 sounds, consonants, vowels & Diphthongs, Transcription of words, Accent,

Syllable cluster and Intonation.

Reference Books:

1. Developing of Communication Skills -Krishna Mohan & Meera Banerji
2. A Practical English Grammar A.J. Thomson -Oxford
3. Mastering English Grammar – S.H.Burton
4. Technical Communication- Raman Sharma- Oxford
5. Written Communication in English – Sarah Freeman Orient Longman Pvt. Ltd.
6. A Course in Phonetics & Spoken English -J.Sethi & P.V.Dhamija
7. Radiance-Tengse

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B.Sc First Year (Semester I)

Semester Pattern effective from June 2016

Biotechnology

CCBT-2A Introduction to Biotechnology

Maximum Marks: 75

Hours: 45

Credits:3

Objective: To understand the basic concept of Biotechnology and its applied areas

Unit-I: Introduction: Definition, Historical overview of Biotechnology, Recent discoveries from Cell biology to Biotechnology.

Biotechnology in Agriculture: Plant tissue culture, Seed Technology, Plant Breeding, Transgenic plants with examples. Biofertilizers, Biopesticide, etc.

Unit II: Biotechnology in Health & Biopharmaceuticals: Diagnostics- Ag-Ab Interactions and other types of diagnosis. Concept of Stem Cells, Hybridoma Technology, Genetic Counseling. Transgenic Animals and their applications.

Unit-II: Biotechnology in Industry: Beverage-Winery, Distillery, Dairy, Food Processing and packaging, Enzymes, Paper & Pulp etc

Unit-IV: Biotechnology in Environment & Biodiversity: Waste Water Treatment, Biodegradation, Bioremediation, composting, Solid waste Management. Biofuel- Biodiesel, Biogas, Ethanol. Biodiversity: *in situ*, *ex situ* conservation of endangered species. Ethical, Legal (IPR, Patent) and Social impact of Biotechnology.

Reference Books & Text:

1. Introduction to Biotechnology- Brown, C Publications ampbell, Priest-Panima Publications
2. Biotechnology-U Satyanarayana- New Age Publications
3. Biotechnology - B.D. Singh, Kalyani Publications
4. Biotechnology: Expanding Horizon- B.D. Singh- Kalyani Publications
5. Elements of Biotechnology - P.K. Gupta, Rastogi Publications
6. A Text book of Biotechnology - R.C. Dubey- S. Chand
7. Advances in Biotechnology- S.N. Jogdand- Himalaya Publication
8. Concepts in Biotechnology-Balasubranian- University Press
9. Biotechnology - Purohit- Agrobios Publication
10. Modern concepts of Biotechnology, H.D. Kumar, Vikas Publications

Practicals

1. Students are expected to go on field study to reveal the applied areas of biotechnology, Biotech
2. Companies, Products and their impact on society.
3. Survey and report on commercial dairy products and packaged food products available in market.
4. Survey and report on bio pesticides, and bio control agents available in market
5. Survey and report on genetically modified/hybrid crops seeds and vegetables
6. Survey and report on vaccination programme in India and vaccines in market
7. Survey and report diagnostic kits, antibiotics, anti sera available in market
8. Survey and report on use of Biofuel (Biodiesel, biogas, ethanol, biomass, coal etc)
9. Visit and report on local drinking and waste water treatment, bio composting, biogas unit
10. Report on government agencies- DBT, CSIR, ICMR, ICAR, TIFR, ISSER, IIT, DRDO etc
11. Report on Top 10 Biotech companies in India and World
12. Visit and report on Biotech Research Institute, Forensic Laboratory and Biotech Industry

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Biotechnology

CCBT-3A Basics of Biosciences

Maximum Marks: 75

Hours: 45

Credits:3

Objective: To understand the basic concept of Life forms, Evolution and Biodiversity

Unit-I: Evolution in life

Prebiological chemical evolution, Diversity of living world, Whittaker's Five Kingdom System, Classification up to genus & species level, Brief account of Prokaryotic & eukaryotic cell.

Unit-II: Plant body organization

a) Structural Morphology of vegetative and reproductive organs of monocot & dicot plants

b) Functional - Flower- Parts and their functions. **Inflorescence-** Types, special types of inflorescence, **Physiology of flowering** –Photoperiodism, Vernalization and Dormancy **Fruit-** Types of fruit , Parthenocarpy. **Seed** – Development, structure, germination, control of seed germination,

Unit-III : Brief Introduction to types of Animals

Placentation in mammals, Gametogenesis, reproductive cycles, fertilization, gestation, Partuition & lactation and Introduction to Nuclear & Embryo transplantation.

A Brief Introduction to Apiculture, Sericulture, Aquaculture & Vermiculture.

Unit-IV: Fungi

General characters of Fungi, Ultra structure of typical fungal cell, cell wall composition, Nutrition, Reproduction, Types of spores, effect of environment on growth, prevention of fungal growth.

Reference Books:

1. Botany by –A.C. Dutta- Oxford
2. Botany for Degree Students- Vasitha- S. Chand Publication
3. College Botany- B.P. Pandey- S.Chand
4. An Introduction to Mycology- K.R.Aneja- New Age
5. Plant Physiology-Sundara Ranjan- Anmol Publication
6. Fundamentals of Plant Physiology- V.K. Jain- S. Chand
7. Fungi for Degree Students- Vashist- S.Chand
8. Zoology –Jordan & Verma-S. Chand
9. Chordate Embryology- Verma, Agarwal- S.Chand
10. Plant physiology, Biochemistry & Biotechnology- Verma & Verma- S Chand

Practicals:

1. Study of T S of Monocot & Dicot stem and root
2. Study of Flower, Inflorescence, fruits, Seeds
3. Study of TS of anther and ovule
4. Preparation of Potato dextrose agar and growth of any fungus
5. Study of embryo development (Chicken /Frog)
6. Study of extra embryonic membranes in chicks
7. Visit to a protected area of the state to understand and appreciate biodiversity
8. Observation of permanent slides of anther, ovule, embryo sac, embryo and endosperm etc
9. Study of eukaryotic and prokaryotic cell structures

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B.Sc First Year (Semester II)
Semester Pattern effective from June 2016

Biotechnology
CCBT-4A Microbiology- I

Maximum Marks: 75

Hours: 45

Credits:3

Objective: To understand basic concepts in Microbiology

Unit –I: Introduction to Microbiology

History of Microbiology: Discovery of microscope and Microbial world: Micrographia of Anton von Leeuwenhoek and Robert Hooke. Controversy over Abiogenesis: Aristotle's notion about spontaneous generation, Redi's experiment, Louis Pasteur's & Tyndall's experiment. Theory of fermentation, Discovery of anaerobic life & physiological significance of fermentation. Surgical antiseptics, Germ theory of disease – Koch's postulates & River's postulates.

Unit –II. Basic and applied areas: Medical Microbiology, Space microbiology, Soil and Agricultural Microbiology, Food and Dairy Microbiology, Geomicrobiology. Concept of Systematic and Classical taxonomy including Bergey's Manual of Bacteriology.

Unit-III: Morphology and Fine Structure of Bacteria

Morphology of Bacteria, Size and shape, Arrangements.

Ultra structure of Bacteria Structure, function and chemical composition of Capsule, Flagella, Pili and Fimbriae, Cell Wall (Gram positive & Gram negative), Cell membrane, Mesosome, Cytoplasm, Nucleoid and ribosome's.

Unit –IV. Cytoplasmic inclusion – PHB granules, glycogen, carbohydrates, Magnetosome, Gas vesicles, chlorosome, sulphur, granules.

Spore and Cyst- Endospore and Exospores, Germination and Sporulation of endospore.

Text & References:

1. General Microbiology-Powar and Dagainawala- Himalya Publication
2. Fundamental Principles of Bacteriology- A.J.Salle- TATA-McGraw Hill
3. General Microbiology-Pelczar- Tata McGraw Hill
4. Text-book of Microbiology- Anantnarayan, C.K. Jayram, Panikar, Orient Longman.
5. General Microbiology- Stanier R.-. Macmillan Press Ltd.
6. Text Book of Microbiology- R.C. Dubey- S.Chand

Practicals:

- 1.General Rules and Safety in Microbiology Laboratory.
- 2.Study of basic requirements in Microbiology Laboratory- Autoclave,Hot air oven & Incubator
- 3.Isolation of microorganisms from soil, water and air.
- 4.Detection of number of bacteria from milk by SPC
- 5.Microbiological examination of food
- 6.Simple staining
- 7.Gram staining
8. Measurement of size of microorganism by Micrometry method
- 9.Study of motility of Microorganisms by hanging drop method
- 10.Alcoholic fermentation

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B.Sc First Year (Semester I)

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Biotechnology

CCBT-5A Fundamentals of Chemistry

Maximum Marks: 75

Hours: 45

Credits:3

Objective: To focus on the basic concepts of Chemistry, atomic and molecular nature and interactions

Unit-I: Atomic Structure and Periodicity

Quantum Chemistry, Bohr's Atomic Model, Rutherford's Atomic Model, Planks quantum theory, Quantum Mechanical Model of Hydrogen atom, Electronic Configuration of atoms, Periodic Trends, Ionization energy, Electro negativity, Atomic Size.

Unit-II: Structure and Bonding

Types of Chemical Bond: Ionic, Covalent & coordinate bonding, VSEPR theory, shape of molecule, hybridization, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding, van-der Waals interactions, lattice energy (Born-Haber cycle)

Unit-III: Chemical Equilibrium

Colligative properties of solutions, Concept and Theories of Acid and Base. Ionic equilibrium in solution, solubility product, Common Ion Effect, pH, buffer and their application .

Unit-IV: Reaction Kinetics & Thermodynamics

Rate Constant, Order of Reaction, Molecularity, Activation energy, Zero, First and Second order kinetics.

Thermodynamics: First law, reversible and irreversible processes, internal energy, enthalpy, Kirchhoff's equation. Heat of reaction Hess law, Heat of formation, Second law, entropy, free energy and Gibbs-Helmholtz equation. Clausius clapeyron equation, free energy change and equilibrium constant.

Reference Books:

1. Text book of Physical Chemistry- Puri Sharma- S. Chand
2. Text book of Physical Chemistry- Bhal & Tuli- S.Chand
3. Text book of Physical chemistry- K.L. Kapoor
4. Text book of Inorganic Chemistry- Puri Sharma & Kalia-
5. Advance Inorganic Chemistry-Gurdeep Raj- Goel
6. Concise Inorganic Chemistry- Lee-Blackwell Science
7. Text book of organic chemistry- Morrison and Boyd
8. Advance Organic Chemistry- Bhal & Bhal- S. Chand
9. Organic Chemistry- Ghosh- New Central Book
10. Understanding Chemistry-CNR RAO-University Press.

Practical

1. Rules and safety measures in Chemistry Laboratory,
2. Study and care of glassware, handling of instruments planning and recording of experiment
3. Introduction to measurements, balance, burette, pipette, Standard flasks etc
4. Study of principle and working of pH meter and Standard Buffers.
5. Study and preparation of Distilled water.
6. Determination of Normality and Strength of given Solution by volumetric analysis
7. Problems based on pH determination of buffers.
8. Study of buffering capacity of buffer solutions.
9. Distillation of ethanol water mixture using water condenser.
10. Study of kinetics of cooling of hot water.

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B.Sc. First Year (Semester-II)

Semester pattern effective from June 2016

Biotechnology

AECCBT I-B English Science Communication Skills- II

Maximum Marks : 50

Hours : 45

Credits : 2

Objective : To be able to have effective communication, soft skills and career skills

Unit I : Grammar : grammar in day - today use

- a) Common errors in the use of English.
- a) Noun b) Pronoun c) Verb d) Preposition.
- b) Tense sequences in the clauses.
- a) Simple Present - Simple Present
- b) Simple Past - Simple Past,
- c) Simple Present - Simple Future
- c) Clauses : a) Adjective Clause & its function
- b) Adverb Clause & its usage.
- c) Noun Clause & its usage.

Unit II : Vocabulary :

- a) Vocabulary building : Active & Passive vocabulary
- b) Idioms & Phrases
- c) Synonyms & Antonyms (Advanced level)

Unit III : Communication & soft skills

- a) Para-jumbles
- b) Reading Comprehension (RC)
- c) Telephonic Interview
- d) Seminars
- e) Meetings - Notice, Agenda : Do's and Don'ts of the participant

Unit IV : Writing Skills

- a) Resume building : Do's and Don'ts
- b) Email writing Etiquettes - Business Emails
- c) Essay writing Techniques - Writing Essays

Reference Books :

- 1) Developing of Communication Skills - Krishna Mohan & Meera Banerji
- 2) A Practical English Grammar- A.J. Thomson - Oxford
- 3) Soft skills - by K. Alex
- 4) English Grammar & Composition - Rajendra Pal & Suri
- 5) Macmillan foundation English - R.K. Dwivedi A. Kumar

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B.Sc First Year (Semester II)

Semester Pattern effective from June 2016

Biotechnology
CCBT-2B Principles of Genetics

Maximum Marks: 75

Hours: 45

Credits: 3

Objective: To focus on the principles of classical, modern & population genetics and principle of inheritance.

UNIT-I: Mendelian laws of Inheritance, & interaction of genes for monohybrid & dihybrid (incomplete dominance, co dominance, complementary & supplementary gene action, duplicate gene action, collaborator gene action, epistasis), Lethality & its types, Multiple alleles & isoalleles, scope & significance of genetics. Linkage & crossing over, its types, Mapping of genes, interference; coincidence.

UNIT-II: Sex determination in plants & animals. Sex Linkage, sex influenced & sex limited inheritance. Basic Microbial genetics: Conjugation, Transformation transduction Plasmid & its types. Transposable elements.

UNIT-III: Concept of Gene. Classical & modern gene concepts; Structure of Eukaryotic chromosome, Special types of chromosomes: Polytene & Lampbrush chromosome. Mutations-spontaneous & induced; chemical & Physical mutagens; induced mutation in plants, animals & microbes for economic benefit of man.

UNIT-IV: Structural & numerical aberrations involving chromosomes; evolution of wheat, cotton & rice; hereditary defects-Klinefelter Turner, Cri-du-Chat & Down syndromes. Extra chromosomal inheritance: Cytoplasm inheritance; mitochondrial & chloroplast genetic systems. Population genetics Hardy-Weinberg equilibrium, gene & genotypic frequencies.

Text & References:

1. Concepts of genetics (Sixth Edition), William S. Klug & Michael R, Cummings, Person
2. Genetics, M.W., Strickberger, Prentice Hall College Division.
3. Genetics, P.J. Russel, Benjamin/Cummings.
4. Principles of Genetics, E.J. Gardner, John W.H. Sons Inc.
5. Genetics - Verma Agarwal- S. Chand
6. Genetics –B.D. Singh –Himalaya Publication
7. Microbial Genetics- David Friefelder- Narosa Publications
8. Molecular Biology of Gene -J.D. Watson -Pearson.
9. Genetics, P.K. Gupta- Rastogi Publication.
10. General Microbiology- Powar & Dagainawala- Himalaya
11. Genetics-Arora-Himalaya Publications

Practicals:

1. Two examples each on Dihybrid & Monohybrid cross.
2. One example each on interaction of genes.
3. Two examples on Hardy Weinberg law.
4. Study of Karyotype.
5. Study of Human blood group.
6. Observe sex linked characters in tabulation from surroundings.
7. Study of Human Traits
8. Study of polytene chromosome.

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B.Sc First Year (Semester II)

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Biotechnology
CCBT-3B Bioinstrumentation Techniques

Maximum Marks: 75

Hours: 45

Credits: 3

Objective: To understand principle and working of instrumentation used in Biotechnology

UNIT-I: MICROSCOPY & SPECTROSCOPY:

Light Microscopy: Simple & Compound Microscope, Phase contract Microscope, Electron Microscope (TEM/SEM) (Principle, Theory, ray diagram, Image formation and applications).

Spectroscopy: General principle, Electromagnetic Spectrum, radiation energy & atomic structure, Types of Spectra & their biochemical usefulness. Basic law of absorption, Visible & Ultraviolet Spectroscopy, application in biology.

UNIT-II: CHROMATOGRAPHY

Adsorption chromatography, Partition chromatography: Paper Chromatography, TLC, Column Chromatography, Ion exchange chromatography, GC.

UNIT-III: CENTRIFUGATION

Centripetal Force, Centrifugal force, basic principle of centrifugation, centrifuge type, types of rotor density gradient centrifugation, Nature of density gradient, preparative centrifugation, Differentials centrifugation & applications.

UNIT-IV: ELECTROPHORETIC TECHNIQUES

General Principles, Low & High voltage electrophoresis, Agarose, PAGE & SDS PAGE. Isoelectric focusing (IEF), Pulse field gel electrophoresis. Factors affecting on Electrophoretic Mobility.

Text & References:

1. Biophysical Chemistry- Upadhyay, Upadhyay and Nath-Himalaya
2. Practical Biochemistry- Wilson & Walker -Cambridge
3. Practical Biochemistry- David Plummer- Tata McGraw Hill
4. Principles of Biochemistry- Lehninger –Kalyani Publications
5. Light Microscopy in Biology-A.J. Lacey.
6. Instrumental Methods of Chemical Analysis- Chatwal Anand- Himalaya
7. Instrumental Methods of Chemical Analysis –B.K. Sharma-Goel
8. Physical Biochemistry-D. Friefilder

Practicals:

1. Study and Care of Microscope, Observation of Microscopic samples
2. Study of Colorimeter and determination of Lambda Max.
3. Study of UV-Visible Spectrophotometer
4. Study of Paper Chromatography/ TLC.
5. Separation of Pigments/ Biomolecules by Chromatography.
6. Separation of pigments by column chromatography
7. Demonstration of GC/ HPLC/ HPTLC
8. Principles and working of different centrifuges.
9. UV Spectroscopic Analysis of DNA, RNA & Proteins
10. Study of Paper/PAGE/ SDS-PAGE/ Agarose Gel Electrophoresis

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B.Sc First Year (Semester II)
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Biotechnology
CCBT-4B Microbiology- II

Maximum Marks: 75

Hours: 45

Credits: 3

Objective: To understand basic concepts in Microbiology

UNIT-I: Microbial Nutrition, cultivation

Nutritional requirements – Major and Minor elements and growth factors. Nutritional types of microorganisms. Nutrient uptake mechanisms: Active and passive Diffusion, Osmosis. Types of Culture media with examples (Defined, Selective, natural, Differential, enrichment, Synthetic). Pure culture techniques (Streak, pour, Spread plate and roll tube method)

UNIT-II: Bacterial Growth: Growth Kinetics and growth curve; Generation time, Growth rate, specific growth rate. Methods of Enumeration -Microscopic methods, Plate counts, Biomass, Chemical methods, Optical density. Continuous culture – Chemo stat and Turbido stat models, Diauxic growth and Synchronous culture.

Unit-III: Control of Microorganisms by physical methods.

Concept of Pasteurization, Tyndallization, Sterilization. Physical methods of Microbial Control: Heat: Moist & Dry, Low temperature, Filtration, High pressure, Desiccation, Osmotic pressure Radiations.

Unit-IV: Control of Microorganisms by chemical methods.

Chemical methods of Microbial Control: Phenolics, Biguanides- Chlorohexidine, Alcohols, Halogens, Heavy Metals, Quaternary ammonium compounds, Surface active agents, Aldehydes, Sterilizing gases, Peroxygens, chemotherapeutic agents.

Text & References:

1. General Microbiology-Powar and Dagainawala- Himalya Publication
2. Fundamental Principles of Bacteriology- A.J.Salle- TATA-McGraw Hill
3. General Microbiology-Pelczar- Tata McGraw Hill
4. Text-book of Microbiology- Anantnarayan, C.K. Jayram, Panikar, Orient Longman.
5. General Microbiology- Stanier R.-. Macmillan Press Ltd.
6. Text Book of Microbiology- R.C. Dubey- S.Chand

Practicals:

- 1) Study of basic requirements in Microbiology Laboratory
 - i) pH meter ii) Spectrophotometer iii) Laminar air flow
- 2) Preparation of solid and liquid media
- 3) Isolation of microorganisms by using selective media.
- 4) Isolation of bacteria by spread plate, streak plate and pour plate method.
- 5) Study of bacterial growth curve.
- 6) Detection of number of bacteria from milk by breed method.

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Biotechnology
CCBT-5B Biomolecules

Maximum Marks: 75

Hours: 45

Credits: 3

Objective: To focus on the basic concept of Biomolecules & their physiological role in life.

UNIT-I: Carbohydrate: Nomenclature, Classification (Monosaccharide's, oligosaccharides, polysaccharide), structure & functions, chemical properties and structural aspects of Monosaccharide's (Glucose), Disaccharides (Sucrose, Lactose) and polysaccharides (Starch, Glycogen).

UNIT-II: Amino Acid: Classification and Structure, Physical and Chemical properties.

Peptides- Nomenclature, Classification and examples.

Proteins- Classification (on the basis of solubility, molecular weight, shape, composition) Properties and Structure (Primary, Secondary, Tertiary and Quaternary) with examples. Role in biological system.

Enzyme- Nomenclature and Classification. Role of enzymes.

UNIT-III: Nucleic Acid: Structure of nucleic acid – Nitrogenous bases, pentose, nucleotides, nucleosides, nucleoside di and triphosphate. Basic structure of DNA & RNA, Forms of DNA, Types of RNA, physicochemical properties and biological function of nucleic acids.

UNIT-IV: Lipid- Classification (Saturated and Unsaturated fatty acid) structure and Biological role, Cholesterol.

Vitamin- Structure, Physiological role. Deficiency disorder of water soluble and fat soluble.

Text & References:

1. Biochemistry- U. Satyanarayana & Chakrapani- New Age
2. General Biochemistry- J.H. Weil- New Age
3. Fundamentals of Biochemistry- A.C. Deb- Central publication
4. Lehninger Biochemistry- Kalyani Publication
5. Principle of Biochemistry- Cohn and Stumpf.
6. Biochemistry- Powar & Chatawal- Himalaya
7. Biochemistry- J.L Jain- S.Chand
8. Biochemistry- Rastogi- Tata Mcgraw Hill
9. General Microbiology- Powar & Dagainawala- Himalaya Publication.

Practicals:

1. General and Safety Rules of Laboratory
2. Preparation of Standard solutions – Molar, Molal, Normal, Percent.
3. Identification of Bio molecules by Spot test.
4. Study of Lambert Beer's Law
5. Estimation of Carbohydrate by DNS Reagent.
6. Estimation of Protein by Biuret method.
7. Qualitative estimation of DNA by Diphenylamine method.
8. Determination of acid value of oil and fat.
9. Estimation of vitamin by DNPH/ Iodometric method.
10. Preparation of Buffers Solutions
11. Study of Enzymes.