

Swami Ramanand Teerth Marathwada University, Nanded
B.Sc. Biochemistry First Year
(w.e.f. June - 2013)
First Year (Semester – I)

Sr.No.	Course No.	Course Title	Periods /Week	Total Periods	Marks
		Compulsory English	3	45	50
		Second Language Hindi	3	45	50
I	BCH-101	Principles of Chemistry	03	45	50
II	BCH-102	Organic & Inorganic chemistry	03	45	50
III	BCH-103	Basic Microbiology	03	45	50
IV	BCH-104	Basic Biotechnology	03	45	50
V	BCH-105	Bio Molecules - I	03	45	50
VI	BCH-106	Bio physical & Bio chemical Technique - I	03	45	50
LC-1	BCH-107	Laboratory Course Chemistry - I	04	60	50
LC-2	BCH-108	Laboratory Course Micro Biology & Biotechnology	04	60	50
LC-3	BCH-109	Laboratory Course Bio chemistry - I	04	60	50

B.Sc. Biochemistry
First Year Semester – II

Sr.No.	Course No.	Course Title	Periods /Week	Total Periods	Marks
		Compulsory English	3	45	50
		Second Language Hindi	3	45	50
VII	BCH-110	Inorganic & Physical Chemistry-I	03	45	50
VIII	BCH-111	Stereochemistry	03	45	50
IX	BCH-112	Applied Microbiology	03	45	50
X	BCH-113	Microbial technology	03	45	50
XI	BCH-114	Intermediary metabolism	03	45	50
XII	BCH-115	Bio Physical & bio chemical Technique – II	03	45	50
LC-4	BCH-116	Laboratory Course Chemistry-II	04	60	50
LC-5	BCH-117	Laboratory Course Micro biology & Biotechnology – II	04	60	50
LC-6	BCH-118	Laboratory Course Biochemistry - II	04	60	50

B.Sc. Biochemistry
First Year Semester – I
Principles of Chemistry
(BCH-101)

Periods: 45

1. Chemical Bonding : **10 P**

Definition, Types of chemical bonding Ionic bond, covalent bond, Co-ordinate bond, Metallic bond, Vander wall's bond, Hydrogen bond. Theories of bonding – Valence bond Theory, Molecular orbital Theory. Concept of Hybridization, Types of Hybridization – SP , SP^2 , SP^3 , dSP^2 , dSP^3 , d^2SP^3 hybridization with suitable examples.

2. Study of Organic Compounds :- **10 P**

Empirical, structural & Molecular formula, Nomenclature & classification of organic compounds, Determination & estimation of C, H, N & Halogens.

3. Mechanism of organic Reactions : **12 P**

- Types of reagents – Electrophiles, Nucleophiles
- Electron Mobility : Inductive effect, Resonance, Hyper conjugation (With one example each)
- Reactive intermediates – carbocation, carbanion, free radicals, carbenes, Arynes & nitrenes.
- Aromaticity & Huckel Rule.
- Types of Reactions: Substitution, Addition, Elimination, Rearrangement, Redox Reaction.

4. Solid State : **13 P**

- Definitions of unit cell, space lattice
- Laws of crystallography – Law of constancy of interfacial angles, Law of Rational indices, Law of symmetry.
- Symmetry elements in crystal, Determination of miller indices study of crystal structure – NaCl, KCl, CsCl.
- X-ray crystallography, Derivation of Bragg's equation.

Reference Books:-

1. Text book of Inorganic chemistry - Puri & Sharma.
2. Concise inorganic chemistry - J.D.Lee
3. Text book of inorganic chemistry - Guradeep Raj & Chatwal
4. Advanced organic chemistry - Bhal & Bhal
5. Physical chemistry - Bhal & Tuli
6. Advanced organic chemistry - P.L.Soni
7. Fundamentals of chemistry - Farooqui, Kuberkar & Wangikar,
Renuka Prakashan, "Saikrupa"
Aurangapura,
Aurangabad – 431 001.

B.Sc. Biochemistry
First Year (Semester – I)
Organic & Inorganic Chemistry
(BCH -102)

Marks: 50

Periods: 45

1. Substituted Carboxylic Acids

10 P

Hydroxy Acids:

A. Hydroxyethanoic acid

- (i) Methods of Formations:-
 - a) From chloroacetic acid
 - b) From glycine
 - c) From Pyruvic acid
- (ii) Physical Properties
- (iii) Chemical Properties
 - a) Oxidation
 - b) Reduction
 - c) Action of heat

B. Malic Acid

- (i) Methods of Formations :
 - a) From Malic acid
 - b) From α - bromosuccinic acid
- (ii) Chemical reaction:
 - c) Oxidation
 - d) Action of HI
 - e) Action of Heat

C. Citric acid

- (i) Methods of formations:-
 - a) From glycerol
 - b) From oxaloacetic acid
- (ii) Chemical Reactions:-
 - a) Dehydration
 - b) Action of Heat

D. Unsaturated Monocarboxylic acids

Introduction and nomenclature

Methods of formations of Propenoic acid

- a) From α , β - unsaturated aldehydes.
- b) From β - hydroxy acids
- c) From acetylene :

Chemical Reactions:

- a) Addition of HBr
- b) Addition of H₂O

2. Substituted carboxylic acid derivatives :

10 P

Relative stability of acyl derivatives.

Acid chlorides:-

Introduction, nomenclature of ethanoyl chloride.

Methods of formations:

- a. By the action of thionyl chloride on acetic acid
- b. By the action of phosphorous Pentachloride on acetic acid.

General Reaction:

- i. Hydrolysis
- ii. Action with alcohol
- iii. Action with amines
- iv. Action with sodium acetate.

Acid Anhydride:

Introduction, nomenclature.

Methods of formations:

- a. By reaction of acid halide & carboxylic acid.
- b. By distilling a mixture of sodium acetate and acyl chloride.

General Reaction:

- i. Hydrolysis.
- ii. Action with alcohol
- iii. Action with amines.
- iv. Action with benzene.

Ester:-

Methods of Formations:-

- a. From ethyl alcohol and acetic acid.
- b. From ethyl alcohol and acetyl chloride.

General Reaction:

- i. Hydrolysis
- ii. Alkaline hydrolysis
- iii. Action with amines.
- iv. Reduction.

Amides:-

Methods of Formations:

- a. By the action of ammonia on acid chloride.
- b. By the actions of ammonia on acetic anhydride.

General Reaction:

- i. Hydrolysis
- ii. Action of nitrous acid
- iii. Reduction
- iv. Action of Br_2 and NaOH .

3. Organometallic Compounds :

08 P

1. Organomagnesium compounds :

- a. Preparation of methylmagnesium bromide.
- b. Reaction of methyl magnesium bromide ($\text{CH}_3\text{-Mg-Br}$) to gives :
Ethanol, 2-Propanol, 2-methyl-2-Propanol,
Acetaldehyde and acetone, Acetic acid, Methylamine, Acetonitrile, Ethyl acetate.

2. Organolithium compounds :

- a. Preparation of Methyl lithium from methyl iodide.
- b. Reactions of methyl lithium to give :
1. Methane 2. Ethanol 3. I-Propanol 4.ii-Propanol.

4. Metallurgy:

10 P

1. Occurrence of metals, General Principles of metallurgy, concentration of ore by hand picking, Gravity. Separation, Magnetic separation, Roasting, Reduction of metals by displacement. Thermal, carbon, Aluminum (Goldschmidt Process), refining of metal by thermal decomposition, Electro refining, Zone refining.
2. Metallurgy of Iron :
Occurrence types of iron, Extraction of cast – Iron From hematite ore physical and chemical properties, Uses.
3. Metallurgy of Aluminum: Occurrence, extraction, refining, Properties and study of alloys.

5) Oxidation and Reduction :

06 P

1. Definition of oxidation, Reduction, oxidizing agent and reducing agents according to electron concept..
2. Definition of oxidation, Reductions, oxidizing agent and reducing agent according to oxidation number concept. Rules of assigning oxidation number.
3. Balancing of redox reaction by 1) Ion – electron method and (2) Oxidation number method.
4. Redox Potential and its applications.

Reference Books:

1. Organic chemistry : Marrison and Boyd.
2. Organic chemistry : Vol. I & II by I.I.Finar
3. Textbook of organic chemistry : P.L.Soni
4. Principle of Inorganic chemistry by : Puri, Sharma & Kalia.
5. Advanced Inorganic chemistry by : Gurudeep Raj & Chatwal Anand.
6. Concepts of chemistry : Farooqui, Kuberkar & Wangikar Renuka Prakashan, “Saikrupa” Aurangpura. Aurangabad- 431001

B.Sc. Biochemistry

First Year (Semester – I) Basic Microbiology BCH – 103

Periods: 45

- Unit – I. History and scope of Microbiology: - 07 P**
- Important contribution of: Antony van Leuwenhoek, Robert Hook, Louis Pasteur, Alexander Fleming, John Tyndall, Robert Koch, Edward Jenner, J.D.Waston and F.H.C.Crick.
 - Scope of microbiology, Introduction to applied branches of microbiology – Environmental (Air, water, sewage, soil) Dairy, food, Medical, Industrial, Biotechnology, Geomicrobiology.
 - Major microbiological Institutions in India.
- Unit – II. General characteristics of microorganism: - 13 P**
- Difference between prokaryote and Eucaryatic cell
 - Morphology of Bacteria – size, shape, Arrangements.
 - Cytology of Bacteria
 - Structure of typical Bacterial cell.
 - Structure and functions of: cell wall, cell membrane, capsule, slime layer Flagella, Pilli, Nuclear material, Misosome, Ribosome.
 - General characteristics of: Archaeobacteria, Actinomycetes, Rickettsia, Mycoplasma, Chlamydia, Viruses.
- Unit-III. Bacterial taxonomy:- 08 P**
- General principle of Nomenclature and Classification
 - General principle of Bacterial Nomenclature
 - Criteria for bacterial classification: Morphological, Cultural, Biochemical characteristics.
 - Approaches to Bacterial classification: Classical, Numerical Taxonomy, Genetic relatedness.

Unit – IV. Microscopy: - **09 P**

- General Principle of Microscopy: Image formation, Magnification, Numerical aperture, Resolving power, working distance, Focal length, Focal point.
- Principle, Construction, Working and Uses of compound microscope.
- Special features of: Contrast, Fluorescence, Dark field and Electron Microscope.

Unit – V. Stain and Staining Procedure: - **08 P**

- Definition of dye and stain.
- Classification of Stains : Acidic, Basic, Neutral
- Principle, Procedure, Mechanism of: Simple staining, Negative staining, Gram's staining, Acid fast staining, Cell wall, Capsule staining.

Reference Books:-

- 1) Introduction to Microbiology : Anderson D.A.
- 2) Textbook of Microbiology : Anantnarayan R. & C.KJ.
Panikar
- 3) Industrial Microbiology : Casida
- 4) Microbiology 5th edition : Pelzar M.J., E.C.S. Chan,
Krieg N.R.
- 5) General Microbiology 5th edition : Stainer R.Y., Ingraham J.L. &
Painter P.R.
- 6) Handbook of research : Institution in India edited by
I.B.C Staff Publication Indian
Bibliography centre
Varanasi, year – 1995.
- 7) Practical Microbiology : Dr.R.C.Dubey,
Dr.D.K.Maheshwari.

B.Sc.Biochemistry
First Year(Semester- I)
Basic Biotechnology
(BCH-104)

Periods:45

1.Introduction: (08P)

Definitions of Biotechnology, Historical account of traditional biotechnology, brewing, cheese making & silage production.

Recent discoveries from cell biology to biotechnology including the use of r-DNA technology & hybridoma.

2. Fundamentals of Biotechnology: (17P)

a. Enzyme technology: Industrial enzymes, Immobilization of enzymes, Diagnostic enzymes, Enzyme analysers & electrode therapeutics.

b. Food & Beverages: Beer, wine, Distilled spirit, Baker's yeast, Milk products, Organic acids, SCP, SCO, Aminoacids, Vitamins & Flavonoids.

c. Fuel & chemicals: Fuel alcohol, Biogas, Enhanced oil recovery, Industrial chemicals.

d. Health care: Penicillin & other antibiotics, Vaccine & steroid hormone.

e. Agriculture: Transgenic plants & animals, Microbial control of insects, Products from animal & plant cell culture.

f. Waste water treatment & biodegradation: Treatment systems & Biodegradation of xenobiotics.

g. Ethical & social impact of Biotechnology

3. Membrane Biophysics: (10P)

a. Structure & chemical composition of membrane- lipids, proteins, carbohydrates. Functions of membrane.

Evidences from model systems & biomembrane, early models, Fluid mosaic model.

b. Electron microscope & X-ray analysis of membrane proteins, Membrane asymmetry, Fluidity, Membrane permeability, Membrane fusion, Hydropathy plot.

c. Application of liposome in biology & medicine.

4. Membrane Transport: (10P)

a. Passive transport: Osmosis, simple diffusion, Facillated diffusion

b. Active transport: Primary & secondary active transport, Na⁺-k⁺-ATPase pump, Calcium pump, Proton pump.

c. Bulk transport: Exocytosis, Phagocytosis, Endocytosis.

d. Transport by phosphotransferase system.

Reference Books:

1. Basic Biotechnology: Bullol&Bullok

2. Basic Biotechnology: S. Ignacimuthu

3. Introduction of Biotechnology: Brown, Camball&Triest

4. Fundamentals of Biochemistry: A.C.Deb

B.Sc. Biochemistry
First Year (Semester – I)
Biomolecules – I
BCH - 105

Periods: 45

Chapter – I : Amino acids and protein. 12 P

Introduction to amino acid, structure, classification of protein based on polarity. Properties (physical, chemical) Titration of amino acid. Essential and non essential amino acid. Amino and sequencing (EDMan and Sangar method).

Protein

Introduction to protein, classification of protein based on solubility, shape, composition and Function.

Peptide bond – Structure of peptide bond.

Denaturation – renaturation of protein, properties of protein.

Introduction to lipoprotein, glycoprotein and nucleoprotein.

Biological function of protein (Protein structure)

Protein structure - Primary, secondary / tertiary and quaternary.

Ramchandran plot, β – turns and motif.

Chapter – 2 : Carbohydrates. 05 P

Introduction to carbohydrate, classification, properties of monosaccharide, osazone formation, mutarotation. Introduction to disaccharide (lactose, maltose, sucrose) and polysaccharide (Heparin, starch, and glycogen) biological function of carbohydrate.

Chapter - 3 : Lipid and Fatty acids. 05 P

Introduction to lipid, occurrence, properties, classification of lipid. Importance of phospholipids, sphingolipid and glycerolipid.

Biological function of lipid.

Fatty acid, - Introduction, Nomenclature and classification of fatty acid Essential and non essential fatty acids.

Chapter - 4 : Nucleic acids**12 P**

Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & RNA Structure of Nitrogen bases in DNA and RNA along with the nomenclature.

- DNA double helix (Watson and crick) model
- Intuduction of A, B, Z DNA.
- Gene, genome and chromosome.
- Types of RNA , structure of t – RNA (clover leaf model)

Chapter – 5 : Vitamins & Hormones**11 P**

- Vitamins: Chemistry, sources, daily allowances function & deficiene of water soluble & fat soluble vitamins.
- Hormones: Defination, classification, mode of action & target, sites, chemistry & function of hormones of pituitary, thyroid, parathyroid, adrenal, pancreas, gonads & corpus luteum.

Reference Books:

- Biochemistry : U. Satyanarayana
- Biochemistry : Lubest Stryer
- Fundamental of Biochemistry : A.C. Deb
- Textbook of Biochemistry : Jain & Jain

B.Sc. Biochemistry
First Year (Semester - I)
Biophysical and Biochemical Techniques I
(BCH 106)

Periods: 45

I: concept of Bioenergetics

13p

Principles of thermodynamics and their applications in biochemistry. Introduction to thermodynamic state functions, first and second laws of thermodynamics and combination of both the laws. Concept of free energy, standard free energy, enthalpy and entropy. Relation between standard free energy change and equilibrium constant.

Biological oxidation-reduction reaction, redox potential and relation between standard reduction potential and free energy change.

Introduction to high energy phosphate compounds, hydrolysis of ATP along with reason for high ΔG .

II: Hydrodynamic methods (Centrifugation)

09p

Determination of sedimentation velocity and sedimentation coefficient and factors affecting on it.

Basic principle of centrifugation and RCF.

Instrumentation: Desktop, High-speed and Ultracentrifugation (preparatory and analytical)

Determination of molecular wt by hydrodynamic methods.

III: Measurement of pH

09p

Principle of Glass and reference electrode and types of electrodes.

Complications of pH measurement (dependence of pH on ionic

Strength, Electrode contamination and sodium error)

Use of pH paper

IV: Radio isotopic techniques

14p

Types of radioisotopes used in biochemistry, units of radioactivity measurement,

Techniques used to measure radioactivity (gas ionization and liquid scintillation counting)

Isotopes commonly used in biochemical studies (^{32}P , ^{35}S , ^{14}C , ^3H)

Autoradiography. Biological applications

Biological hazard of radiation and safety measures in handling radioisotopes.

Reference books:

- 1) Physical biochemistry- : Vanholde
- 2) Physical biochemistry- : D. Friefielder, W.H. Freeman
- 3) Outline of biochemistry- : Eric. E. conn, P.K.Stumpf&Ray
- 4) Principles and techniques- : Upadhyay. Upadhyay. Nath
in Biophysical Chemistry
- 5) Principles and techniques of - : Keith Wilson and John walker
Biochemistry and Molecular biology

B.Sc. Biochemistry
First Year (Semester - I)
Lab course – Chemistry-I
BCH-107

Periods: 60

1. Qualitative Analysis of organic compound, Preliminary tests, Nature, detection of elements, functional groups, M.P. and their derivatives: Salicylic acid / phthalic acid, Aniline / Nitrobenzene, 1 -Naphthol / 2 -naphthol, Naphthalene / Carbohydrates.
2. Estimation of glycine
3. Estimation of unsaturation.
4. Estimation of phenol.
5. Estimation of Amine.
6. Estimation of Acids.
7. Prepare standard Na_2CO_3 solution. Standardize the given Hcl solution and estimate the amount of NaOH in the given solution.

Reference Books:

1. Textbook of organic Qualitative Analysis :Hynes
2. Vogel's Textbook of practical organic chemistry.

B.Sc. Biochemistry
First Year (Semester – I)
Lab Course Microbiology & Biotechnology
BCH – 108
Periods: 60

1. Determination of equipments
 - a. Microscope
 - b. Hot air oven
 - c. Seitz filter
 - d. Autoclave
 - e. Incubator
 - f. P^H meter.
2. Hanging drop method for motility.
3. Micrometry measurement of size of bacteria.
4. Bacterial staining: Simple, Negative, Grams staining.
5. Preparation of media
 - a. Nutrient broth
 - b. Nutrient Agar
 - c. MacConkeys broth
 - d. MacConkeys Agar
 - e. Milk Agar
6. Isolation of micro-organism by
 - a. Streak plate method
 - b. Spread plate method
 - c. Pour plate method

B.Sc. Biochemistry
First Year (Semester – I)
Laboratory Course – 1
Biochemistry - I
BCH - 109

Periods: 60

- 1. Qualitative test for amino acid**
 - a. Xanthoproteic test for aromatic amino acid
 - b. Millions test
 - c. Sakaguchi test
 - d. Hopkins Cole test

- 2. Qualitative test for protein**
 - a. Precipitation with heavy metal 10 no.
 - b. Precipitation with organic solvent
 - c. Precipitation with TCA
 - d. Precipitation with Ammonias sulphate

- 3. Qualitative test for carbohydrate**
 - a. Molish test
 - b. Anthrone test
 - c. Iodine test
 - d. Benedicts test
 - e. Barfoeds test
 - f. Seliwanoff's test
 - g. Osazone formation

- 4. Qualitative test for Nucleic acid**
 - a. Orcinol test
 - b. Diphenyl amine test
 - c. Neumann's test

- 5. Qualitative test for lipid**

B.Sc. Biochemistry
First Year (Semester – II)
Inorganic & Physical Chemistry - I
(BCH-110)

Periods: 45

- 1. Essential trace elements & its toxicity system. 10 P**
Introduction of Trace elements, criteria for essential elements, Ultra trace metals & non- metals, toxicity & deficiency of trace elements.
- 2. Role of metals & nonmetals ion in biological system 10 P**
 - Role of metals in biological systems.
 - Function of Biomineral, Biomineralisation.
 - Role of Hydrolysis, oxido-reductases, Isomerases & synthetase enzymes.
 - Role of non-metals in biological system.
- 3. Thermodynamics - I 10 P**
Definition of thermodynamics, terms-system, surrounding etc. Types of systems, Intensive & extensive properties, state & path functions & their differentials. Thermodynamic process, concepts of Heat & work. First law of thermodynamics - statement, definition of internal energy & enthalpy Heat capacity, heat capacities at constant volume & pressure & their relationship, Joule's law, Joule Thomson effect, Joule Thomson coefficient & Inversion temperature.
- 4. Chemical Equilibrium & Phase Equilibrium 15 P**
Chemical Equilibrium: Equilibrium constant & free energy, thermodynamics derivation of law of mass action. Reaction isotherm & isochore. Clapeyron equation, Clausius Clapeyron equation, applications, Numericals on van't Hoff's isochore.
Phase Equilibrium:
Statement & meaning of the terms, phase component & degree of freedom in phase rule equation, phase equilibria of one component systems, water & sulphur systems. Application of phase rule to CO₂ system.
 - Solid solution: Compound formation of congruent melting point (Mn-Zn) system & incongruent melting point (NaCl – H₂O) system, freezing mixtures, acetone, and dry ice melting.
 - Liquid – Liquid mixtures – Ideal liquid mixtures, Raoult's & Henry's law Non-ideal systems, azeotropes HCl – H₂O system & ethanol – water.

Reference Book:

1. Principles of physical chemistry : Puri & Sharma
2. Elementals of physical chemistry : T.W.Atkin
3. Essentials of physical chemistry : Bhal & Tuli
4. Concepts of chemistry : Farooqui, Kuberkar & Naikwade
Renuka Prakashan "Saikrupa"
Aurangapura,
Aurangabad – 431 001.

B.Sc. Biochemistry
First Year (Semester – I)
Stereochemistry
(BCH – 111)

Periods: 45

1. Organic Stereochemistry **30 P**

Isomerism, Types of isomerism, representation of organic molecules, optical isomerism. Plane polarized light, optical activity. Working of polarimeter angle of rotation, specific rotation d-l. Cause of optical activity symmetry, elements and chirality, enantiomers and their properties. Chiral and achiral molecule with 1 and 2 stereogenic centers. Diastereoisomers. Threo and erythro diastereoisomers mesoforms. Relative and absolute configuration d-l rotation, Sequence Rule R & S nomenclature.

Geometrical isomerism cis and Trans isomerism and E and Z systems of nomenclature, conformational analysis of ethane, n-butane and cyclohexane.

2. Racemisation and Resolution : **07 P**
Methods of Racemisation Resolutions of Racemic mixture

3. Inorganic Stereochemistry : **08 P**
Types of coordination complexes, isomerism of different coordination complexes. Geometric isomerism. Optical Isomerism with multidentate ligands.

Reference Book:

1. Text book of Inorganic chemistry : Gurudeep Raj & Chatwal
2. Advanced Organic Chemistry : Bhal & Bhal
3. Advanced Organic Chemistry : P.L.Soni
4. Organic Chemistry : Marrison & Boyd.
5. Stereochemistry : P.S.Kalsi
6. Fundamentals of Chemistry : Farooqui, Kuberkar & Wangikar
Renuka Prakashan,
Aurangabad - 431 001.
7. A Text book of chemistry : Kuberkar, Rashmi Publication,
Nanded.

B.Sc. Biochemistry
First Year (Semester – II)
Applied Microbiology
(BCH-112)

Period:45

1. Air Microbiology **(10P)**

Definition of atmosphere, Composition of air, Techniques for microbiological examination of air:

1. Solid Impingement Method

2. Liquid Impingement Method

Air borne disease, Significance of air flora in human health, hospitals & industries, Air sanitation- U.V.Light, Gaseous agent, Laminar air flow, HEPA filter, Air pollution- Nature & Types of pollutant

2. Soil Microbiology **(20P)**

Soil structure & Type, soil as environment & soil culture medium, composition of soil, Microorganism & soil fertility.

Biogeochemical activities of microorganism in soil: 1. Carbon cycle: Carbon assimilation, Mineralization of following carbonaceous compound with respect to structure, Microflora & biochemistry of degradation cellulose, starch.

2. Nitrogen cycle: Microbiology & Biochemistry of

a) Ammonification b) Nitrification c) Denitrification d) Dinitrogen fixation

3. Phosphorous cycle: a) Solubilization of inorganic phosphorous

b) Mineralization of organic phosphorous c) Immobilization

d) Oxidation & reduction of phosphorous

4. Sulfur cycle: a) Sulfur mineralization b) Oxidation & reduction of sulfur

3. Aquatic Microbiology

(05P)

Kinds of water, Definition of fresh water, Drinking water, sewage water, eusturie water, marine water, Microbiological flora of water- Normal & abnormal ,Factors affecting number & kinds

4. Industrial Microbiology

(10P)

General types of industrial process,

Industrial fermentation-

1. Ethanol fermentation
2. Steptomycin
3. Cheese production
4. Amylase production

Reference Books:

1. General Microbiology: R.Y. Stainer
2. General Microbiology vol II: H.F. Dagainawala & Powar
3. Text Book of Microbiology: M.B. Deshmukh, P.S. Wakte & others
4. Outlines of Microbiology: A.N. Deshmukh
5. Microbiology –Fundamentals & Application: S.S. Purohit

B.Sc. Biochemistry
First Year (semester – II)
Microbial Technology
BCH – 113

Periods : 45

- Unit – I - Ferment or, Screening, Stock culture and Inoculum: 11 P**
- Definition and Scope of Industrial Microbiology
 - Fermenter: Design and Role of different parts of Fermenter
 - Screening methods:- Primary and secondary screening
 - Stock cultures:- Primary stock, working stock, stock culture method
 - Inoculums preparation
- Unit – II - Fermentation media and Product recovery operation 16 P**
- Fermentation media: - Media composition, media sterilization and contamination.
Media economics, screening for Fermentation media
 - Fermentation process:- Batch, continuous, dual, solid state, surface Fermentation
 - Downstream processing (Fermentation product recovery):
Centrifugation, Flocculation, Filtration, dialysis, solvent extraction, adsorption and elution, distillation, precipitation, crystallization, counter – current distribution, chromatography, Ion exchange resin
 - Detection and assay of fermentation product: physical, chemical and biological assay (penicillin and vitamin B₁₂ bioassay in detail)
- Unit – III - Modern trends in microbial production of: 9 P**
- Bioinsecticides
 - Biofertilizers
 - Immobilized enzymes
 - Use of immobilized cell system in production of fine chemicals
- Unit – IV - Novel Technologies 9 P**
- Mushroom cultivation
 - Distilled Beverages and white Fermentation
 - Steroids and sterols transformation

Reference Books:-

- General Microbiology : R.Y. Stainer
- General Microbiology vol. I & II : H.F. Dagainawala & Powar
- Text book of microbiology : M.B. Deshmukh & P.S. Wakte
- Outline of Microbiology : A.N. Deshmukh
- Practical Microbiology : Dr. R.C.Dubey & Dr.D.K.Maheshwari

B.Sc. Biochemistry
First Year (Semester – II)
Intermediatory Metabolism
(BCH – 114)

Periods: 45

1. Introduction to Metabolism **06 P**

General features of metabolism, experimental approaches to study metabolism use of intact organism, bacterial mutants, tissue slices, stable and radioactive isotopes.

2. Carbohydrate Metabolism **12 P**

Reaction and energetic of glycolysis, Alcoholic & Lactic ACID, Fermentation. Entry of Fructose. Galactose Mannose, etc. Reaction and energetic of TCA cycle. Gluconeogenesis. Glycogenesis and glycogenolysis Reactions and Physiological significance of pentose phosphate pathway, Regulation of glycolysis and TCA cycle. Photosynthesis a brief review.

3. Electron Transport chain and Oxidative Phosphorylation **07 P**

Structure of Mitochondria, Sequence of electron carriers, site of ATP production, Inhibitors of electron transport chain. Hypothesis of mitochondrial oxidative phosphorylation (basic concepts). Inhibition and uncouplers of oxidative phosphorylation. Transport reducing potentials into mitochondria.

4. Lipid Metabolism **12 P**

Introduction hydrolysis of triacylglycerol transport of fatty acids into mitochondria, oxidation of saturated fatty acids. ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of ketone bodies oxidation of unsaturated and odd chain fatty acids. Biosynthesis of triglycerides and important phospholipids glycolipid, sphingolipids and cholesterol. Regulation of cholesterol metabolism.

5. Amino acid Metabolism

08 P

General reaction of amino acid metabolism transamination oxidative deamination and decarboxylation. Urea cycle, Glycogenic and ketogenic amino acids.

Reference Books:

- Fundamentals of Biochemistry : Donald Voet, J.g.Voet & Pran
- Biochemistry : Geoffrey L. Zubay
- Biochemistry : Lubert Stryer,
W.H.Freeman & Co.

B.Sc. Biochemistry
First Year (Semester - II)
Biophysical and Biochemical Techniques II
(BCH 115)

Periods: 45
14p

I: Chromatography

General principles and application of

- 1) Paper chromatography.
- 2) Thin layer chromatography.
- 3) Adsorption chromatography.
- 4) Ion-exchange chromatography.
- 5) Gas-liquid chromatography.
- 6) High performance liquid chromatography. (HPLC)
- 7) Molecular sieve chromatography.

II: Electrophoresis

09p

General principle and application of gel electrophoresis.

PAGE and SDS-PAGE, Isoelectric focusing.

Two dimensional electrophoresis and its applications.

III: Spectroscopic techniques

14p

Basic principle, laws of absorption (Lambert - Beers law).

Instrumentation for UV-Visible and IR Spectrophotometry and their applications.

Principle and applications of NMR, mass spectroscopy, Fluorescent and Emission spectroscopy.

IV: Immunological techniques

08p

Introduction, Radioimmunoassay, Immuno electrophoresis, Immunodiffusion, Immunofluorescence and ELISA.

Reference Books:

- 1) Fundamentals of biochemistry- : Donald Voet, J.G. Voet and Pratt.
- 2) Biochemistry- : Geoffrey L. Zubey.
- 3) Biochemistry- : Lubert Strayer and W.H. Freeman
- 4) Biophysical chemistry- : Upadhyay. Upadhyay. Nath.
- 5) Principles and techniques of - : Keith Wilson and John Walker.
biochemistry and molecular biology
- 6) Fundamentals of biochemistry- : J.L. Jain, Sanjay Jain, Nitin Jain.

B.Sc. Biochemistry
First Year (Semester – II)
Laboratory Course – 4
Chemistry - II
BCH – 116

Periods: 60

1. Qualitative Analysis of Inorganic radicals (Two acidic & two basic radicals).
2. To study kinetics of cooling of H₂O.
3. Determination of Viscosity of liquid by Ostwald's Viscometer.
4. To Determine Surface tension of a given liquid by stalagmometer method.
5. To study critical solution Temperature (CST) of phenol- water system.
6. Determination of Heat of Reaction of displacement of copper by Zinc.

Reference Book:

1. Textbook of Inorganic Qualitative Analysis : Vogel's.
2. Practical of physical chemistry : T.K.Choudhekar, Rajbhoj.
3. Practical of physical chemistry : Jahagirdar.

B.Sc. Biochemistry
First Year (Semester – II)
Lab Course – 5
Microbiology/ Biotechnology
BCH – 117

Periods: 60

1. Capsule staining (Hiss and Maneval's method)
2. Flagella staining.
3. Poly-beta hydroxyl butyrate granules staining.
4. Cultivation of anaerobes - (Candle Jar method)
5. Detection of primary metabolites produced by yeast and *lactobacillus* species.
6. Replica plate technique.
7. Effect of UV as mutagenic agent and photoreaction.
8. Isolation of the mutant of *E – coli*.
9. Alcohol production by *S.cerevisae*
10. Enumeration of air Microorganism by Solid & Liquid impingement method.

B.Sc. Biochemistry
First Year (Semester – I)
Biochemistry – II
Laboratory Course – 6
BCH – 118

- 1 Separation and identification of amino acids by paper chromatography.
- 2 Separation and identification of sugars by paper chromatography.
- 3 Separation of plant pigments on starch column.
- 4 Determination of λ_{max} of $COCl_2$ verification of Beer-Lambert's and determination of molar absorption coefficient.
- 5 Estimation of proteins by Biuret method.
- 6 Estimation of maltose by DNSA methods.
- 7 Separation of triglycerides (oils) on TLC.

Reference Books :-

- An Introduction to practical Biochemistry : David Plummer (TMH)
- Hawke's Physiological Chemistry :
- Laboratory Manual in Biochemistry : J.Jayaraman