

DEPARTMENT OF BIOCHEMISTRY UNIVERSITY OF KASHMIR



Choice based Credit System Syllabus for M. Sc. Biochemistry, Session/year 2017 onwards

Session/Year 2017 (Onwards)

PAPERS, CREDITS AND MARKS DETAILS

Semester 1

Course Code	Course Name	Category	Hrs./Wk.			Credits	Names of Instructors	Max. Marks	
			L	T	P			Ext	Int
BCH-01-CR	Biomolecules	Core	4	0	0	4	RH/AM	80	20
BCH-02-CR	Cell Biology - I	Core	4	0	0	4	SAA/NAD	80	20
BCH-03-CR	Lab Course - I	Core	0	0	8	4	AM/RH/SA/NAD/SAA/AD	80	20
BCH-04-DCE	Plant Biochemistry	Discipline Centric Elective (DCE)	3	2	0	3+1=4	SA/SAG	80	20
BCH-05-DCE	Biochemical Techniques	Discipline Centric Elective (DCE)	3	2	0	3+1=4	SAA/AD	80	20
BCH-06-GE	Nutritional Biochemistry	General Elective (GE)	1	2	0	2	AM/RH	40	10
BCH-07-GE	Biochemical Calculations	General Elective (GE)	1	2	0	1+1=2	SA/NAD	40	10
BCH-08-OE	Fundamentals of Biochemistry	Open Elective (OE)	2	0	0	2	AM/AD	40	10
26 credits = 34 contact hrs			18	8	8	26			

Semester 2

Course Code	Course Name	Category	Hrs./Wk.			Credits	Names of Instructors	Max. Marks	
			L	T	P			Ext	Int
BCH-09-CR	Metabolism - I	Core	4	0	0	4	AM/RH/CL	80	20
BCH-10-CR	Molecular biology	Core	4	0	0	4	NAD/SAA/CL	80	20
BCH-11-CR	Laboratory course - II	Core	0	0	8	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-12-DCE	Enzymology	Discipline Centric Elective (DCE)	3	2	0	3+1= 4	SA/AD/CL	80	20
BCH-13-DCE	Cell Biology - II	Discipline Centric Elective (DCE)	3	2	0	3+1= 4	NAD/SAA/CL	80	20
BCH-14-GE	Protein Biochemistry	General Elective (GE)	1	2	0	1+1= 2	SA/AD/CL	40	10
BCH-15-GE	Enzyme Immobilization	General Elective (GE)	1	2	0	1+1= 2	AM/RH/CL	40	10
BCH-16-OE	Chronic diseases – Cancer and Diabetes	Open Elective (OE)	2	0	0	1+1=2	AD/CL	40	10
26 credits = 34			18	8	8	26			

SEMESTER 3

Course Code	Course Name	Category	Hrs./Wk.			Credits	Names of Instructors	Max Marks	
			L	T	P			Ext	Int
BCH-17-CR	Physiology and Clinical Biochemistry	Core	4	0	0	4	SA/RH/CL	80	20
BCH-18-CR	Immunology	Core	4	0	0	4	NAD/SAG/CL	80	20
BCH-19-CR	Lab course - III	Core	0	0	8	4	AM/RH/SA/NAD/SAA/AD	80	20
BCH – 20-DCE	Biotechnology	Discipline Centric Elective (DCE)	3	2	0	3+1=4	SAA/AD/CL	80	20
BCH-21-DCE	Metabolism II	Discipline Centric Elective (DCE)	3	2	0	3+1=4	RH/AM/CL	80	20
BCH-22-GE	Metabolic Disorders	General Elective (GE)	1	2	0	1+1=2	SAA/CL	40	10
BCH-23-GE	Enzyme Regulation	General Elective (GE)	1	2	0	1+1=2	SA/AD/CL	40	10
BCH-24-OE	Diet, Physical Activity and health	Open Elective (OE)	2		0	2	AM/NAD/CL	40	10
26 credits = 34 contact hrs			18	8	8	26			

Semester 4

Course Code	Course Name	Category	Hrs./Wk.			Credits	Name of Instructors	Max. Marks	
			L	T	P			Ext.	Int.
BCH-25-CR	Designing and Drafting a Research Project	Core	4	0	0	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-26-CR	Journal Club	Core	4	0	0	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-27-CR	Lab course - IV	Core	0	0	8	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-28-GE	Microbiology	Discipline Centric Elective (DCE)	3	2	0	3+1=4	RH/SA/NAD	80	20
BCH-29-GE	Endocrinology	Discipline Centric Elective (DCE)	1	2	0	1+1=2	SA/SAG	40	10
BCH-30-DCE	Micro Nutrition	Discipline Centric Elective (DCE)	1	2	0	1+1=2	AD/CL	40	10
BCH-31-GE	Biochemistry of Chronic Diseases	General Elective (GE)	1	2	0	1+1=2	RH/AD	40	10
BCH-32-GE	Signal Transduction	General Elective (GE)	1	2	0	1+1=2	SAA/CL	40	10
BCH-33-OE	Biochemical Laboratory tests and Interpretations	Open Elective (OE)	1	2	0	1+1=2	NAD/SAA	40	10
28 credits = 38 contact hrs			18	12	8	28			

Instructors:

AM: Akbar Masood
RH: Rabia Hamid
SA: Shajrul Amin
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SAA: Shaida Ahmad Andrabi
SAG: Showkat Ahmad Ganie
AD: Mohd Ashraf Dar
CL.: Contractual Lecturer

Abbreviations (Scope)

CR- Core (For Department students)
DCE- Discipline Centric (For Department Students)
GE- General Elective (For with in Faculty students)
OE-Open Elective (For non-faculty students)

SEMESTER 1

BCH - 01 - CR, Biomolecules

Unit-I

Carbohydrates

Definition, classification, characterization and biological importance of mono- and disaccharides

Structure and conformation of sugars

Stereo- and optical isomerisms

Structure and function of homo- and heteropolysaccharides

Mucopolysaccharides and proteoglycans

Chemical reactions of functional groups present in carbohydrates

Unit-II

Lipids

Classification of lipids

Chemical composition and properties of triglycerides

Nomenclature and properties of saturated and unsaturated fatty acids

Properties and functions of phosphoglycerides and sphingolipids

Structure and functions of steroids (cholesterol and bile acids)

Prostanoids

Unit-III

Amino acids

Structure, classification and physicochemical properties

Essential and non-essential amino acids

Characteristics of a peptide bond

Oligo-peptides and polypeptides

Chemical synthesis of a peptide

Proteins

Levels of protein structure

Elucidation of primary structure

Forces stabilizing the tertiary structure

Protein denaturation and renaturation

Unit- IV

Nucleic Acids

Primary, secondary and tertiary structure of DNA

Various forms of DNA, structural polymorphism of DNA

Properties of DNA

Denaturation and annealing of DNA, Cot Curve

DNA as a genetic material

Primary, secondary and tertiary structure of RNA

Functions of various types of RNA

BCH – 02 - CR, Cell Biology- I

Unit-I

Basic properties of cells

Structural organization of prokaryotic and eukaryotic cells

Introduction of viruses

Cell membrane

- Chemical composition

- Structure and function of membrane proteins

- Membrane lipids and membrane fluidity

- Dynamic nature of plasma membrane

- Movement of substance across cell membrane

- Membrane potentials

Mitochondria

- Structure and function

- Oxidative metabolism in mitochondria

- Role of mitochondria in ATP formation

- Translocation of protons and establishment of a proton motive force

Unit-II

Introduction to endomembrane system

Approaches to study endomembrane

Endoplasmic reticulum, structure, functions

Golgi complex

Types of vesicle transport and their types

Lysosomes and plant vacuoles, peroxisomes

Moving membranes and materials into the cell interior

Posttranslational uptake of proteins by peroxisome, mitochondria and chloroplasts

Unit-III

Cell wall

- Detailed structure and functions of Cell wall

- Microbodies

Chloroplast

- Structure, function

- Photosynthetic units and reaction centers

- Photophosphorylation

Unit IV

Extracellular matrix and cell interaction

- Extracellular space

- Interaction of cells with extracellular material

- Tight Junction- sealing the extracellular space

- Cell -cell adhesion

- Cell -cell communication

The cytoskeleton

- Microtubules

- Intermediate filaments

- Microfilaments

BCH – 03 - CR, Laboratory Course - I

Concept of pH and buffers

Qualitative estimations of carbohydrates and amino acids

Quantitative estimation of proteins by

Lowry's method

Bradford's methods

Spectrophotometric methods

Quantitative estimation of cholesterol by Zlatki's method

Quantitative estimation of glucose by

Nelson Somogy's method

Enzymatic method

Determination of iodine and saponification value of oils

Titrimetric estimation of vitamin C

Paper chromatography of simple sugars/amino acids

BCH – 04- DCE, Plant Biochemistry

Unit-I

Photosynthesis
Photosynthesis in higher plants – general concepts
Organization of the photosynthetic apparatus
Mechanism of electron transport in photosynthesis
Proton transport and ATP synthesis
Calvin cycle and its regulation
C4 and CAM pathways
Repair and regulation of photosynthetic machinery
Photorespiration and its significance

Unit-II

Assimilation of mineral nutrients
Nitrate and ammonia assimilation and their incorporation into amino acids
Biochemistry of nitrogen fixation, nitrogenase complex and its functions
Nitrogen fixation genes and their regulation
Sulfate reduction and assimilation
Sulfite oxidation

Unit-III

Special features of secondary plant metabolism
Secondary metabolites - phenolics, tannins, lignins, lignans, pigments, terpenes, alkaloids and surface waxes – their biosynthesis and physiological role
Plant defense against pathogens
Translocation of inorganic and organic substances
Pathways of translocation and mechanism of translocation in the phloem

Unit-IV

Plant growth regulators
Auxins
 Chemical nature, biosynthesis and metabolism
 Physiological and developmental effects,
 Molecular basis of its action
Gibberellins
 Chemical structure, biosynthesis, metabolism and mechanism of its molecular effects
Cytokinin
 Properties and biological role
 Cellular and molecular modes of cytokinin action
Abscisic acid
 Chemical structure, metabolism and transport
 Molecular effects in the regulation of growth and development

BCH - 05 – DCE, Biochemical Techniques

Unit-I

Centrifugation

- Basic principle of centrifugation
- Factors affecting sedimentation
- Types of centrifugation including differential, density gradient and ultracentrifugation
- Analytical and preparative centrifugation
- Applications of centrifugation

Chromatographic techniques

Basic principle and applications of chromatographic techniques:

- Gel filtration chromatography
- Affinity chromatography
- Gas chromatography
- Ion Exchange chromatography
- High-pressure liquid chromatography

Unit-II

Electrophoresis

- Types of electrophoresis
- Factors affecting electrophoretic mobility
- Uses of electrophoresis

Isoelectric focusing

Analysis of biomolecules using UV/visible, fluorescence spectroscopy

Use of radioisotopes in biology

Their detection, measurement and safety guidelines

Unit-III

Different blotting techniques

- Western, Northern, Southern

Microscopy

- Light, electron (scanning and transmission), phase contrast and fluorescence microscopy
- Freeze- fracture techniques

Polymerase chain reaction

Principles of - RFLP, RAPD and AFLP techniques

Single strand conformation polymorphism and heteroduplex analysis

Gel retardation assays

DNA Sequencing

Next generation sequencing

Sequencing while synthesizing

Unit-IV

Detection of molecules using ELISA, RIA, immunoprecipitation, flowcytometry

Detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.

Methods for analysis of gene expression at RNA and protein level, large-scale expression analysis, such as micro array based techniques

Coimmunoprecipitation and Chromatin immunoprecipitation

DNA profiling, DNA foot printing

Gene silencing

Micro RNA

RNA interference

BCH – 06 - GE, Nutritional Biochemistry

Unit-I

Energy content of foods

BMR and SDA and factors affecting them

Energy requirements of man and woman and factors affecting energy requirements

Protein nutrition

Essential amino acids for man and concept of protein quality

Cereal protein and their limiting amino acids

Protein energy malnutrition (PEM). Etiology, clinical features, metabolic disorders and management of marasmus and kwashiorkor

Carbohydrate nutrition

Dietary requirement and sources of carbohydrates

Protein sparing action

Physiological actions of dietary fibers

Unit-II

Micronutrition

Dietary sources, biochemical functions and deficiency diseases of:

Water soluble

Fat soluble vitamins

Lipid nutrition

Major classes of dietary lipids

Essential fatty acids and their physiological functions

BCH - 07-GE, Biochemical Calculations

Unit I

Concentrations based on volume and weight

- Molarity
- Normality
- Osmolarity
- Molality

Acids and bases and their various definition theories

Various definitions

Ionization of strong acids and bases.

Ionization of H₂O, ionic product of water,

Weak acids and bases.

Unit II

Concept of pH and buffer

pH, pK and pI of solutions

Henderson – Hasselbalch equation

Preparation of buffers,

pH changes in buffers, buffer capacity

BCH- 08 – OE, Fundamentals of Biochemistry

Unit I

Water and its role in biological systems

Introduction and roles of biomolecules of life

- Proteins
- Carbohydrates
- Lipids
- Nucleic acids
- Micronutrients

Unit II

Cell as a basic unit of life

Cell components

Functions of the various components

Cell death and its causes

Cell division as the unit of propagation

Concepts of Mitosis and Meiosis

SEMESTER II

BCH – 09 - CR, Metabolism - I

Unit-I

Bioenergetics

Energy transformation by biological systems

Concept and significance of free energy

Phosphoryl transfer potential

Coupled reactions

ATP as energy currency

Metabolon concept

Unit-II

Carbohydrate metabolism

Glycolysis

Citric acid cycle, its function in energy generation and biosynthesis of energy rich-bonds

Pentose phosphate pathway and its regulation

Alternate pathways of carbohydrate metabolism

Gluconeogenesis

Biosynthesis of glycogen and starch

Unit-III

Lipid metabolism

Fatty acid oxidation- α , β , ω , oxidation and lipo-oxidation.

Fatty acid biosynthesis- Acetyl CoA carboxylase, Desaturase and elongase

Biosynthesis of triacylglycerols, Phosphoglycerides and sphingolipids

Biosynthetic pathways for terpenes, steroids and prostaglandins

Ketone bodies- Formation and utilization

Unit-IV

Regulation of carbohydrate and lipid metabolism -hormonal/enzymatic

Interactions between carbohydrate and lipid metabolism – role of insulin and adiponectin

Inborn errors of carbohydrate and lipid metabolism

BCH – 10 - CR, Molecular Biology

Unit-I

Replication

- Unit of replication,
- Replication Origin and Replication Fork
- Enzymes involved in replication,
- Initiation, Elongation and Termination of Replication
- Fidelity of Replication,

Unit-II

Transcription

- Transcription in prokaryotes and eukaryotes
- Transcriptional factors and their role
- RNA polymerases
- Formation of initiation complex
- Elongation and termination
- Inhibitors of transcription

RNA processing, splicing, polyadenylation, capping
Structure and function of different types of RNA's

Unit-III

Regulation of gene expression

- Prokaryotes
- Eukaryotes
- Viruses

Transcriptional activators and repressors
Role of chromatin in regulating gene expression and gene silencing
Epigenetics and its importance in regulation of gene expression

Unit- IV

Translation

Protein synthesis and genetic code

- General characteristics of genetic code
- Deciphering of genetic code

Ribosomes as the site of protein synthesis, polysomes
Activation of amino acids
Chain initiation, elongation and termination in prokaryotes and eukaryotes
Control of translation (Role of Guanine nucleotides).
Translational fidelity, Kinetic proof reading
Positive and negative regulation of translation
Inhibitors of protein synthesis

BCH – 11 - CR, Laboratory Course - II

Extraction and assay of enzymes.

Effect of temperature, pH, and time on enzyme activity.

Isolation and purification of proteins using ion- exchange and gel filtration columns

Polyacrylamide gel electrophoresis of purified proteins

Electrophoretic separation of serum proteins.

Molecular weight determination by gel filtration chromatography and SDS-PAGE.

Subcellular fractionation of organelles from liver cells and identification by the use of marker enzymes.

Estimation of SGPT

Estimation of SGOT

Estimation of alkaline phosphatase

BCH - 12 – DCE, Enzymology

Unit-I

Enzyme classification and nomenclature

Methods of examining enzyme – substrate complexes

Enzyme kinetics

An introduction, factors influencing enzyme reaction velocity

Henri and Michealis Menten equation, Briggs-Haldane modification

Determination and significance of kinetic constants

Derivation of rate expression for Ping Pong and ordered Bi Bi reaction mechanism

Unit-II

Enzyme inhibition

Reversible inhibition, its types

Determination of inhibitor constants

Irreversible inhibition

Enzyme assays

Mechanism of catalysis of -

Serine proteases

Triose phosphate isomerases

Unit-III

Enzyme regulation

General mechanism of enzyme regulation

Allosteric enzymes

Sigmoidal kinetics and their physiological significance

Symmetric and sequential modes for action of allosteric enzymes and their significance

Feed back inhibition and feed forward stimulation

Reversible and irreversible covalent modifications of enzymes

Unit IV

Immobilization of enzymes

- Methods of enzyme immobilization
- Effects of partition on kinetics and performance with particular emphasis on changes in pH and hydrophobicity
- Applications of immobilized enzymes

BCH – 13- DCE, Cell Biology - II

Unit-I

Structure and function of:

Nucleus
Nucleolus

Chromosomes the physical carrier of the genes

Chromosome and chromatin structure

Structure and composition of gene

Histones and histone modifications

Concept of Epigenetics

Unit II

Cell cycle and its stages

Regulation of cell cycle

Mitosis

Prophase, prometaphase, metaphase, anaphase, telophase, cytokinesis

Motor proteins and their role in cell division

Cytokinesis Meiosis

The stages of meiosis

Genetic recombination during meiosis Gene as unit of inheritance

Unit III

Cell signaling

The basic elements of cell signaling

Signaling molecules and their receptors

Functions of G-protein- coupled receptors and their second messengers

Protein phosphorylation and its role in signal transduction

Cytokine receptors

Role of calcium and NO as an intracellular messenger

Detailed mechanism of signaling in the following pathways:

GPCR pathway

RAS MAPK pathway

PI3 Kinase Pathway

Unit-IV

Cancer Biology

Basic concepts of cancer biology

Causes of cancer

Genetic of cancer

Properties of cancer cell

Hallmarks of cancer

Self-sufficiency in growth signals

Insensitivity to antigrowth signals

Evading apoptosis

Sustained angiogenesis

Limitless replicative potential

Tissue invasion and metastasis

BCH – 14 - GE, Protein Biochemistry

Unit I

Amino acids, the building blocks of proteins
Protein – a molecule with myriad of functions
Primary structure of the protein and its determination
Secondary structure, types
Tertiary structure, forces stabilizing tertiary structures
Quaternary structures

Unit II

Quantitative estimation of proteins by
Lowry's method
Bradford's method
Spectrophotometric method
Polyacrylamide gel electrophoresis of purified proteins
Molecular weight determination by gel filtration chromatography and SDS-PAGE.

BCH – 15 - GE, Enzyme Immobilization

Unit1

Enzymes as proteins and catalysts

Factors that affect the enzyme activity

Characteristics of free vs. immobilized enzymes

Methods of enzyme immobilization,

Effect of immobilization on enzyme activity, partitioning/ diffusion limitations.

Enzyme conformational changes. Enzyme stability and zulu effect.

Enzyme activity dependence on pH, partitioning of protons and limitation of proton diffusion

Unit II

Immobilized enzymes-

Hydrolysis of proteins, cheese manufacture, conversion of corn-starch to dextrose, conversion of dextrose to fructose, hydrolysis of lactose in whey

Biomedical and Analytical applications.

Concept of Red Blood Cells as carrier of enzymes,

Practical demonstration of immobilization process using RBCs

BCH – 16 - OE, Chronic Diseases –Cancer and Diabetes

Unit I

Cancer - an Introduction
Various known causes of cancer
Cancers in Kashmir
Signs and symptoms
Cancer diagnosis
Management of cancer patients
Cancer prognosis
Responsibility of patients and attendants
Facilities of cancer care in developing world

Unit II

Glucose Metabolism
Organs and enzymes
What is diabetes?
Causes of diabetes
Diagnosis of diabetes
Incidence of diabetes in Kashmir
Treatment of diabetic patients
Diet control and physical exercise
Impact of diabetes on society
Preventive measures

SEMESTER III

BCH – 17 - CR, Physiology And Clinical Biochemistry

Unit-I

Hematology

Composition of blood

Mechanism and regulation of blood coagulation, fibrinolysis

Neuro-muscular system

Mechanism of conduction of nerve impulse along axon, neurotransmitters

Biochemistry of vision

Ultra structure and molecular mechanism of contraction of skeleton and smooth muscles and its regulation

Unit-II

Gastrointestinal physiology

Digestion and absorption

Gastrointestinal disorders

Excretory system

Formation of urine

Normal and abnormal constituents of urine

Unit – III

Introduction to clinical biochemistry

Water and electrolyte balance

Regulation of water and electrolyte balance, role of kidney and hormones

Acid base balance regulation by human body, concept of metabolic and respiratory acidosis and alkalosis

Unit – IV

Principles of diagnostic enzymology

Evaluation of organ function tests

Clinical presentation and diagnosis of renal, hepatic and pancreatic diseases

Cardiac function tests and Thyroid function tests

Diagnostic significance and interpretation of glucose tolerance test

Diagnostic tests for Apo lipoproteins, HDL cholesterol, LDL cholesterol and triglyceride disorders

BCH – 18 - CR, Immunology

Unit-I

Historical perspective, terms associated with immunology,
 Antigenicity, Features of Antigenicity, super antigens, adjuvants.
 Cells of immune system: Myeloid, Mononuclear cells, T-Lymphocytes, B-Lymphocytes, NK-Cells
 Primary and secondary lymphoid organs: Thymus, Bursa of fabricus, Peyers Patch, spleen, lymph nodes, mucosal associated and cutaneous associated lymphoid tissues.

Unit - II

Immunoglobulin, structure, classes and subclasses
 Multigene organization of Ig gene, variable region gene rearrangements, allelic exclusion, generation of diversity of Ig, Assembly and secretion of Ig, class switch, regulation of Ig transcription.
 Humoral and cell mediated immunity: B cell development and activation, BCR, T cell development and activation, TCR.
 Regulation of system: complement cascade, Biological function and its regulation. ,
 Complement fixation test.
 Introduction to cytokines.

Unit - III

Major histo-compatibility complex: different classes, organization and biological function.
 Transcription regulation of MHC
 Hypersensitivity: Type I, II, III, and IV
 Autoimmunity and autoimmune diseases
 Single organ and systemic autoimmune diseases
 Brief introduction to Primary and secondary immunodeficiencies, AIDS
 Mechanisms of transplantation. Examples of organ transplantation.
 Examples of immune response to Viruses, bacteria, protozoa, fungal and helminthic infection

Unit-IV

Immunoblotting and diagnosis of various important diseases, only infectious and few cancerous types
 Techniques – ELISA, RIA, fluorescent IA, agglutination of pathogenic bacteria,
 Haemagglutination and its inhibition. Affinity, avidity
 Immunoelectron microscopy
 Enumeration of total T-cell numbers by sRBC, resetting technique
 Determination of total number of B-lymphocytes by staining for surface IgG.
 Antigen – antibody interaction and its applications.
 Total hemolytic assay

BCH – 19 - CR, Laboratory Course - III

Isolation of DNA: Different Methods, Different sources
Quantification of DNA by Spectroscopy
Electrophoresis of Isolated DNA
Amplification of a DNA segment by PCR
Purification of PCR product
Restriction digestion of PCR product
Isolation of RNA from leukocytes
cDNA synthesis from mRNA

BCH – 20 - DCE , Biotechnology

Unit I

Recombinant DNA Technology:

Vectors: Plasmids, bacteriophages, phagemids, cosmids, YACs, and BACs

Methods of creating recombinant DNA molecule

Transformation and screening of recombinant vector

Confirmation of insert

Expression strategies in different hosts, vector and host engineering

Unit II:

Types of restriction endonucleases

Library construction

Types of libraries:

cDNA and genomic libraries

Primary, secondary and tertiary screening methods

Unit III:

Animal Cell Culture:

Primary and established cell lines

Types of various cell lines

Biology and characterization of the cultured cells.

Introduction to balanced salt solutions and simple growth medium.

Role of CO₂, serum and supplements. Serum and serum free media, defined media and their applications, antibiotics

Immortalization and methods used to immortalize cells.

Viability and cytotoxicity assays: Trypan blue, MTT, TUNEL and ELISA based assays.

Unit- IV :

Immunobiotechnology

Development of Monoclonal Antibodies by:

Hybridoma Technology

Applications of MCA and Antibody Fragments.

Vaccination: Conventional and genetically engineered vaccines.

Lymphokines – production and applications

BCH - 21 – DCE, Metabolism - II

Unit-I

Amino acid metabolism
Specific aspects
Metabolic fates of amino groups
Pathways of amino acid catabolism
Inborn errors of amino acid metabolism

Unit II

Overview of Nitrogen Metabolism
Nitrogen excretion and urea cycle,
Biosynthesis of amino acids
Derivatives of Amino acids

Unit III

Nucleic Acid metabolism
Biosynthesis of purines and pyrimidines
Degradation of purines and pyrimidines
Structure and regulation of ribonucleotide reductase
Biosynthesis of ribonucleotides, deoxy ribonucleotides and polynucleotides
Inhibitors of nucleic acid biosynthesis

Unit-IV

Metabolite transport across mitochondrial membrane
Oxidative phosphorylation
Structural organization of respiratory chain
Electron flow in respiratory chain
Coupling of oxidation and phosphorylation
Structure and function of ATP-synthase complex
Short-circuiting of proton gradient
Regulation of rate of oxidative phosphorylation

BCH – 22 - GE, Metabolic Disorders

Unit I

Introduction to carbohydrates, lipids and their metabolism

Disorders of carbohydrate metabolism

Diabetes

Hereditary fructose intolerance

Lactose intolerance

Glycogen storage diseases

Disorders of Lipid Metabolism

Hypercholesterolemia,

Atherosclerosis,

Carnitine related diseases

Unit II

Introduction to amino acids, proteins and nucleic acids

Inherited disorders of amino acid metabolism- Phenylketonuria, Alkaptonuria, Maple syrup urine disease

Nonketotic hyperglycinemia, Propionic acidemia, Hyperprolinemia

Urea cycle disorders-

Hyperammonemia Argininemia,

Deficiency diseases related to Urea cycle enzymes

Disorders of nucleic acid metabolism

Purine and Pyrimidine metabolism related diseases,

Hypo and Hyperuricemia,

Gout, Lesch Nyhan Syndrome, Severe Combined Immunodeficiency Disease (SCID),

Xeroderma pigmentosum.

BCH-23-GE, Enzyme Regulation

Unit I

Enzyme regulation
General mechanism of enzyme regulation
Allosteric enzymes
Sigmoidal kinetics and their physiological significance
Symmetric and sequential modes for action of allosteric enzymes and their significance

Unit II

Feed back inhibition and feed forward stimulation
Zymogens, Isozymes
Enzyme repression, induction and degradation
Control of enzymatic activity by products and substrates
Reversible and irreversible covalent modifications of enzymes

BCH-24-OE, Diet, Physical Activity and health

Unit-I

Balanced diet
Components of diet
Diet requirement: young, old, men, women
Diseases due to diet deficiency
Diseases due to over eating
Diet as medicine

Unit-II

Body systems and energy for physical activity
Types of physical activity
Physical activity for health
Physical fitness
Nutrition and physical activity
Participating in physical activity with safety

SEMESTER IV

BCH – 25 - CR, Designing And Drafting Of Research Project

A student will have to pick up a problem in biological sciences and develop a grant application on the theme under mentorship of allotted supervisor. Grant application will have following components.

- Introduction
- National and international scenario
- Review of literature
- Objective
- Possible out come
- Significance of the study
- Material and methods
- Summary

BCH – 26 - CR, Journal Club

The recent and advanced scientific papers in high profile journals will be chosen by the students in consultation with mentor teachers and then presented by the student. The presenter is supposed to have all the relevant knowledge of the article. The audience will include faculty, research scholars and PG students.

BCH – 27 - CR, Laboratory Course - IV

- Bacterial culture methods
- Preparation of plasmid DNA by:
 - Manual
 - Kit
- Plasmid Transformation
- Cloning in plasmid
- Western blotting
- Simple staining
- Gram staining

BCH – 28 - DCE, Microbiology

Unit-I

Historical perspectives of microbiology
Importance of microbiology in agriculture, human and animal health industry and environment
Microbial classification
Types of microorganisms
General characteristics of main groups of microorganisms
Criteria used in the classification of microorganisms- cytology, genetics, host specialization, serology
Microbial growth
Different phases of microbial growth
Measurement of microbial growth
Effects of various environmental factors on microbial growth
Control of microbial growth, physical control, chemical control and antibiotics
Mechanism of drug resistance

Unit-II

Isolation, culture, identification and preservation of bacteria
Gram positive and gram negative organisms
Structure and functions of peptidoglycan in gram positive and gram negative organisms
Functions of polymeric components in outer membrane and acidic polymers in gram negative organisms
Special features of bacterial metabolism

Unit-III

Microbial nutrition
Nutritional types of microorganisms
Uptake of nutrients by the microbial cells
Nutritional requirement of bacteria
Resident flora
The human as a habitat
Pathogenicity and virulence factors
Bacterial toxigenicity (pathogenesis of infectious diseases)
Food spoilage, fermentation, food-borne infection
Biochemistry of nitrogen fixation and sulfur reduction

Unit-IV

Virus classification
Structure of virus
Viral proteins and methods of assay
Virus- host interaction
Microbial diseases
Respiratory diseases caused by viruses and bacteria – tuberculosis, small pox
Sexually transmitted diseases including AIDS

BCH – 29 - DCE, Endocrinology

Unit I

Introduction to endocrinology

Mechanism of action of hormones - hormone receptors, second messenger mechanisms for mediating intracellular hormone functions

Structure, biosynthesis, secretion, transport, mechanism of action and physiological role of Pancreatic and Thyroid hormones

Unit II

Pituitary hormones and their control by hypothalamus

Structure, biosynthesis, secretion, transport, mechanism of action and physiological role of Adrenal, Gastrointestinal, Sex hormones

BCH – 30 - DCE, Micro Nutrition

Unit I

Vitamins

Introduction to vitamins

Definition, classification

Nutritional sources, DRI recommendations and deficiency and health problems of :

- Vitamin A.
- Vitamin D.
- Vitamin C
- Vitamin E.
- Vitamin K

Role in human nutrition, recommendation, physiology and biochemistry of:

- Thiamine
- Riboflavin
- Niacin
- B6 vitamin
- B12 Vitamin
- Folic acid

Unit II

Minerals:

Nutritional sources, DRI recommendations and role in human nutrition of:

- Calcium
- Iron
- Zinc
- Iodine
- Selenium
- Fluoride
- Magnesium

BCH – 31 - GE, Biology of Chronic Diseases

Unit I

Diabetes: Types causes and prevention.

Diseases linked to functioning of Heart: Cardiomyopathy, Hypertension

Hepatitis

Unit II

Neurological disorders-

Alzheimer's disease

Parkinson's disease

Epilepsy

BCH-32-GE, Signal Transduction

Unit-I

Cell signaling:

Basic concepts of Signal Transduction
Components and general mechanism of Signal Transduction
Signaling motifs: SH2, SH3, PH and PDZ domains
Role of protein kinases in cell signaling: Serine/ Threonine and Tyrosine kinases

Unit-II

Pathways of intra cellular signal transduction:

GPCR pathway
RAS MAPK pathway
PI3 Kinase Pathway
Techniques to study Signal Transduction

BCH - 33- OE, Biochemical Laboratory Tests and Interpretation

Unit I

Concept of reference values

Observed values

Blood biochemistry

Electrolytes estimation and clinical significance

Blood gas analysis

Blood sugar and its clinical importance

Unit II

Cardiac function tests and clinical uses

Liver function tests: diagnostic importance

Kidney function test importance

Tumor markers – PSA, carbohydrate markers