

**DEPARTMENT OF BIOCHEMISTRY
UNIVERSITY OF KASHMIR**



**Choice based Credit System Syllabus for M. Sc. Biochemistry, Session/year
2018 Nov. onwards**

Session/Year 2018 Nov. (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-18101CR	Biomolecules	Core	4	0	0	4	RH/AM/TA	80	20
BCH-18102CR	Cell Biology - I	Core	4	0	0	4	NAD/ TA	80	20
BCH-18103CR	Plant Biochemistry	Core	3	2	0	3+1= 4	SAG/ TA	80	20
BCH-18104CR	Lab Course - I	Core	0	0	8	4	AM/RH/SA/NAD/SAA/AD	80	20
BCH-18101DCE	Cell Biology - II	DCE	3	2	0	3+1= 4	NAD/SAA	80	20
BCH-18102DCE	Biochemical Techniques	DCE	3	2	0	3+1=4	AD/SAA/TA	80	20
BCH-18001GE/OE	Fundamentals of Biochemistry	GE/OE	2	0	0	2	AM/AD	40	10
26 credits, 33 contact hrs.			19	6	8	26			

Semester 2

Course Code	Course Name	Category	Hrs./Wk.			Credits	Names of Instructors	Max. Marks	
			L	T	P			Ext	Int
BCH-18201CR	Metabolism - I	Core	4	0	0	4	AM/RH/TA	80	20
BCH-18202CR	Molecular Biology	Core	4	0	0	4	NAD/SAA/TA	80	20
BCH-18203CR	Advanced Techniques	Core	2	0	0	2	AD/TA	40	10
BCH-18204CR	Laboratory course - II	Core	0	0	8	4	AM/RH/SA/NAD/SAA/AD	80	20
BCH-18201DCE	Enzymology	DCE	3	2	0	3+1= 4	SA/AD/TA	80	20
BCH-18202DCE	Metabolism II	DCE	3	2	0	3+1=4	RH/TA	80	20
BCH-18002GE/OE	Protein Biochemistry	GE/OE	1	2	0	1+1= 2	SA/NAD	40	10
BCH-	Chronic	GE/OE	2	0	0	1+1=2	AD/SAA	40	10

180003GE/ OE	diseases – Cancer and Diabetes								
26 Hours; 34 credits			20	8	8	26			

SEMESTER 3

Course Code	Course Name	Category	Hrs./Wk			Credits	Names of Instructors	Max Marks	
			L	T	P			Ext	Int
BCH-18301CR	Immunology	Core	4	0	0	4	NAD/SAG	80	20
BCH-18302CR	Biotechnology	core	3	2	0	3+1=4	SAA/AD/TA	80	20
BCH-18303CR	Enzyme Immobilization	core	2	0	0	2	AM/TA	40	10
BCH-18304CR	Lab course - III	Core	0	0	8	4	AM/RH/SA/NAD/SA A/AD	80	20
BCH-18301DCE	Nutritional Biochemistry	DCE	3	2	0	3+1=4	AM/RH/ TA	80	20
BCH-18302DCE	Physiology and Clinical Biochemistry	DCE	4	0	0	4	SA/RH	80	20
BCH-18004GE/ OE	Metabolic Disorders	General Elective (GE)	1	2	0	1+1=2	RH/TA	40	10

Semester 4

Course Code	Course Name	Category	Hrs./Wk.			Credits	Name of Instructors	Max. Marks	
			L	T	P			Ext.	Int.
BCH-18401CR	Designing and Drafting a Research Project	Core	4	0	0	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-18402CR	Journal Club	Core	4	0	0	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-18403CR	Lab course - IV	Core	0	0	8	4	AM/RH/SA/ NAD/SAA/AD	80	20
BCH-	Endocrinology	DCE	1	2	0	1+1=4	SAG/RH/AD	40	10

18401DCE									
BCH-18402DCE	Microbiology	DCE	3	2	0	3+1=4	SA/NAD/TA	80	20
BCH-18403DCE	Basics of Biostatistics	DCE	2	0	0	2		40	10
BCH-18005GE/OE	Signal Transduction	GE/OE	1	2	0	1+1=2	SAA/TA	40	10
BCH-18006GE/OE	Biochemical Laboratory tests and Interpretations	GE/OE	1	2	0	1+1=2	AD/SAA	40	10
28 credits = 38 contact hrs			18	12	8	24			

Instructors:

AM: Akbar Masood

SA: Shajrul Amin

RH: Rabia Hamid

NAD: Nazir Ahmad Dar

SAA: Shaida Ahmad Andrabi

SAG: Showkat Ahmad Ganie

AD: Mohd Ashraf Dar

TA.: Teaching Assistant

Abbreviations

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 - 18101CR: 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 physiochemical 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 – 18102CR: 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-18103CR: 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 – 18104CR: 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 -18101DCE: 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 -18102DCE: 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

Northern, Southern

Polymerase chain reaction,

Overlap extension PCR,

Multiplex, Gradient and Nested PCR,

RT-PCR

Principles of - RFLP, RAPD and AFLP techniques

Single strand conformation polymorphism and heteroduplex analysis

Mutagenesis

Preparation and analysis of RNA and DNA probes and tags

Unit-IV

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

Methods for analysis of gene expression at RNA level and protein level, qPCR, large-scale expression analysis using micro array analysis.

Flow-cytometry

Microscopy

Light, electron (scanning and transmission), phase contrast and fluorescence microscopy

Freeze- fracture techniques

Confocal Microscopy

BCH– 18001GE/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 – 182101CR: 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 – 18202CR: 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-18203CR: Advanced Techniques**Unit I**

- Protein detection and protein-protein interaction Techniques

- Western blotting and its applications, Far western blotting, dot blotting,

- Immunoprecipitation, Co-Immunoprecipitation,

- Yeast Two Hybrid screening, FRET, FREP,

- Analysis of interacting proteins with SPR spectroscopy,

- Eastern Blotting,

- Mass spectrometry

- Protein-DNA interaction techniques

- Gel Retardation Assay, DNase I Foot Printing analysis, ChIP, ChIP-Seq, DNA pull down

- assays, Reporter assay (Leuciferase reporter assay), Microplate capture and detection

- assay

Unit II

RNA interference: siRNA, micro RNA and shRNA mediated gene silencing, Ribozyme mediated gene silencing; Cre-Lox recombination system in gene knockout approaches, CRISPR-Cas9 in gene silencing and knockout approaches.
Genome editing with: CRISPR-Cas9 technology, TALEN system, Zinc finger system

DNA Sequencing

Next generation sequencing

Sequencing while synthesizing, Ion Torrent/semiconductor etc
 Genome wide and Whole genome sequencing, GWAS,
 Transcriptome and Exome sequencing.

BCH – 18204CR: 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 - 18201DCE: 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-18202DCE: 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 – 18002GE/OE: 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 – 18003GE/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 – 18301CR; 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 – 18302CR: 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.

Concept of Plant Cell culture

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 – 18303CR: 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 – 18304CR: 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-18301DCE: Nutritional Biochemistry

Unit-I

Composition of human body

Energy content of foods Measurement of energy expenditure Direct & indirect calorimetry

BMR and SDA and factors affecting them

Energy requirements of man and woman and factors affecting energy requirements

Protein nutrition

Proteins reserves of human body

Nitrogen balance studies and factors influencing nitrogen balance

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

Basic concept of high protein low caloric weight reduction diets

Unit-II

Carbohydrate nutrition

Dietary requirement and sources of carbohydrates

Protein sparing action

Simple and complex carbohydrates Physiological actions of dietary fibers

Mineral nutrients

Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper

Unit-III

Lipid nutrition

Major classes of dietary lipids

Properties and composition of plasma lipoproteins

Dietary needs of lipids

Essential fatty acids and their physiological functions

Obesity

Definition and classification

Genetic and environment factors leading to obesity

Obesity related diseases and management of obesity Role of leptin in regulation of body mass

Unit-IV

Micronutrition

Dietary sources of vitamins

Biochemical functions and specific deficiency diseases associated with fat and water soluble vitamins

Hypervitaminosis symptoms of fat- soluble vitamins

BCH – 18302DCE: 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 – 19004GE/OE: 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.

SEMESTER IV

BCH – 184001CR: Designing and Drafting of Research the 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 – 18402CR: 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 – 18403CR: 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 – 18401DCE: 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 – 18402DCE: 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-18403 DCE: Basics of Biostatistics

Unit-I

Data – Data types, measurement scales
Measures of Central tendencies: Arithmetic mean, Geometric mean, Harmonic mean), Median and Mode.
Measures of Variation – Range, Quartile deviation, Percentile, Mean deviation and Standard deviation, Coefficient of variation.
Concept of Probability – Random experiment, outcome, trial and event, Exhaustive events, favourable events, Independent events, sample space, definition of probability, addition theorem of probability.
Concept of random variables.
Probability Distribution: Binomial, Poisson, Normal Distribution: Properties and Applications.

Unit II

Hypothesis Testing: Introduction,
 Types of Hypothesis, one and two tailed test,
 Types of errors, level of significance,
 Power of a test, p-value, Z-test for a population mean (Variance known).
 Z-test for two population means (variance known and unequal),
 t-test for a population mean . t-test for two population means (variance unknown and equal),
 t-test for paired data,
 chi square test for independence of attributes & fisher exact test tests.one way ANOVA.

BCH-18003GE/OE: 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 – 18006GE/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