STUDY CENTRE FOR BIOCHEMISTRY

COURSE STRUCTURE

for

(M.Sc. Biochemistry)
Four Semesters (Two Year)

Programme

Based on

Choice Based Credit System (CBCS)
(As per Ordinance-14/2)

03/09/25

AWADHESH PRATAP SINGH UNIVERSITY, REWA (M.P.)

03-09-25

3.9.25

Semester Course of M.Sc. Biochemistry

Programme	:	**M.Sc. Biochemistry**
Programme Code	:	**508**
Duration	:	**4 Semester (Two Year)**
Eligibility	:	Graduation with Chemistry, Biotechnology, Microbiology and Biochemistry as a subject.
Age Limit	:	No age limit
Admission Procedure	:	The admission will be done as per merit of qualifying examinations

PROGRAMME OBJECTIVES & STRUCTURE

PO #	PROGRAMME OUTCOME
PO 1	**Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, check out the degree to which these assumptions are accurate and valid, and look at our ideas and decisions (intellectual, organizational, and personal) from different Perspectives.
PO 2	**Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and Technology.
PO 3	**Social Interaction**: Elicit views of others, mediated is agreements and help reach conclusions in group settings.
PO 4	**Effective Citizenship**: Demonstrate empathetic social concern and equity- centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5	**Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6	**Environment and Sustainability**: Understand the issues of environmental context: and sustainable development.
PO 7	**Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

3.9.25

ROGRAMME SPECIFIC OUTCOME

PSO #	PROGRAMME SPECIFIC OUTCOME
PSO 1	To gain essential knowledge and skills to pursue a career in research, industry and in academic set up.
PSO 2	To integrate and apply the techniques in Analytical biochemistry, Clinical biochemistry, Microbiology, Molecular biology and Bioinformatics.
PSO 3	To understand the depth of scientific knowledge in the broad range of fields including Cell biology, Metabolism, Pharmaceutical Biochemistry, Genetics, Nutritional Biochemistry, Immunology and Enzymology.
PSO 4	Provide the biochemical basis of human diseases, protein structure and conformation, non-invasive diagnostics, biochemical pathway regulation and drug development and synthesize this knowledge and apply the same for multitude of laboratory applications.

Course Outcome (COs)

S.No.	Course Name	Course Code
Semester-I		
101	**Biochemistry & Cell Biology**	**BCH-101**
	Course Outcome	
CO1	Understand occurrence and classification of carbohydrate, lipids, proteins	
CO2	Understand the structures and basic components of cell	
CO3	Discuss Bio-membrane transport and cell cycle	
CO4	Discuss molecular organization and nucleus and its elements	
CO5	Explain biogenesis, molecular organization and functions of mitochondria	
102	**Practical: Biochemistry & Cell Biology**	**BCH-102**
	Course Outcome	
CO1	Screening of Biomolecules by various qualitative techniques	
CO2	Learn microscopic observations of cell, cell organelles and its compartments	
CO3	Understand the identification of cells and its characters	
CO4	Demonstrating the isolation of cell organelles	
CO5	Understand animal and plant proteins and their role in life	

3.9.25

103	Human Anatomy and Physiology	BCH-103

	Course Outcome	
CO1	Understand composition of blood and blood coagulation	
CO2	Understand human nervous system and its parts with functioning	
CO3	Understand excretory system and its working with its parts	
CO4	Understand structure of skeletal muscles and its functions	
CO5	Understand the structure, organization and functions of human system	
104	**Practical: Human Anatomy and Physiology**	**BCH-104**
	Course Outcome	
CO1	Determination of Hb%, Bleeding and clotting time	
CO2	Learn microscopic observations of various living samples	
CO3	Understand blood film preparation and identification of cells	
CO4	Explain isolation of cell organelles with the help of various techniques	
CO5	Estimation of proteins from animal and plant cell material	

Semester-II

201	Biochemical Analytical Techniques	BCH-201
	Course Outcome	
CO1	Understand both qualitative and quantitative analysis	
CO2	Discuss the cell fractionation by the use of centrifugation	
CO3	Understand colorimetric and spectrophotometric analysis	
CO4	Understand the principle and types of chromatography with its applications	
CO5	Understand the principle and types of electrophoresis with its applications	

202	Practical : Biochemical Analytical Techniques	BCH-202
	Course Outcome	
CO1	Fractionation of various cell components by appropriate techniques	
CO2	Isolation and identification of various cell samples.	
CO3	Understand the working of spectrophotometer with different samples.	
CO4	Demonstration of chromatography and its applications	
CO5	Demonstration of electrophoresis and its applications	
203	**Nutritional And Clinical Biochemistry**	**BCH-203**
	Course Outcome	

CO1	Understand the concept of balanced diet and its components	
CO2	Making of diet charts for various categories of human beings	
CO3	Understanding of importance of food, Food additives, artificial food additives and their biochemistry	
CO4	Learn to diagnose various diseases on the basis of biochemical parameters	
CO5	Learn and understand clinical enzymes marking the diseases	
204	**Practical : Nutritional And Clinical Biochemistry**	**BCH-204**
	Course Outcome	
CO1	Determination of food additives in samples	
CO2	Understand Food processing and fortification test	
CO3	Understand BMR calculation, RQ, SDA	
CO4	Understand Biochemical aspects of Hematology	
CO5	Understand LFT and KFT	

Semester-III		
301	**Advanced Molecular Biology**	
CO1	Understand chemical nature of genetic materials	
CO2	Understand transcription mechanism	
CO3	Explain bacterial recombination	
CO4	Understand DNA binding properties	
CO5	Discuss Mutation types	
302	**Practicals : Advanced Molecular Biology**	
CO1	Demonstrate isolation and characterization of mammalian DNA	
CO2	Determine specific activity of enzymes active in replication	
CO3	Estimation of DNA by appropriate method	
CO4	Estimation of RNA and study of its types	
CO5	Understand electrophoresis of genomic DNA	
303	**Immunology**	**BCH-302**
	Course Outcome	
CO1	Explain introduction of immune system	
CO2	Understand effect or mechanism of immunity	
CO3	Understand antigen	
CO4	Understand transplantation immunology	
CO5	Understand immunity to infection and immunological techniques	
304	**Practicals : Immunology**	
CO1	Demonstrate antigen – antibody reaction and lymphoid organs	
CO2	Understand agglutination by various live antigens	
CO3	Understand single immune diffusion	
CO4	Understand blood grouping and its significance in transfusion	
CO5	Understand Sandwich ELISA	
Semester-IV		
401	**Genetic Engineering**	
	Course Outcome	
CO1	Understand laws of Mendels	
CO2	Understand Recombinant DNA Technology	
CO3	Explain Tissue Culture	
CO4	Discuss population genetics	

CO5	Understand Gene Techniques	
402	**Practicals : Genetic Engineering and**	
	Course Outcome	
CO1	Isolation of genomic DNA	
CO2	Understand Western Blotting	
CO3	Understand Hematology	
CO4	Discuss population genetics	
CO5	Understand Gene Techniques	
403	**Pharmacobiochemistry & Clinical Research**	
CO1	Understand nutrition toxicology and immune toxicology	
CO2	Explain pre clinical toxicology	
CO3	Discuss ethical clinical research	
CO4	Discuss biological testing and bioassays during clinical trials	
CO5	Understand bioavailability and bioequivalence studies	
404	**Pharmacobiochemistry & Clinical Research**	
CO1	Determination of metal content in samples	
CO2	Understand Food processing and food additives test	
CO3	Understand guidelines for drug administration and pharmacoethics	
CO4	Estimation of essential Minerals quantitatively	
CO5	Understand Enzymes related toxicity testing	

M.Sc. BIOCHEMISTRY (FOUR SEMESTER COURSE) SCHEME OF EXAMINATION

(NEP Based Syllabus) (Effective from 2025-26)

First Year

Semester	Course Level	Core Course	Practical Course	Internship	Total Credit
Semester -I	400	Biochemistry & Cell Biology (6)	Biochemistry & Cell Biology (4)	Internship/Apprentice-ship/Seminar (2)	22
	400	Human Anatomy and Physiology (6)	Human Anatomy and Physiology (4)		
Semester -II	400	Biochemical Analytical Techniques (6)	Biochemical Analytical Techniques (4)	Value Added Course (2)	22
	400	Nutritional And Clinical Biochemistry (6)	Nutritional And Clinical Biochemistry (4)		

Second Year

Semester	Course Level	Core Course	Practical Course	Internship	Total Credit
Semester -III	500	Advanced Molecular Biology (6)	Advanced Molecular Biology (4)	Internship/Apprentice-ship/Seminar (2)	22
	500	Immunology (6)	Immunology (4)		
Semester -IV	500	Genetic Engineering (6)	Genetic Engineering (4)	Value Added Course (2)	22
	500	Pharmacobiochemistry & Clinical Research	Pharmacobiochemistry & Clinical Research		

UNIT-V

Bio-membrane Transport- Physiochemical properties of cell membranes. Molecular constitution of membranes, Solute transport across membrane's- fick's law, simple diffusion, passive-facilitated Diffusion, active transport- primary and secondary group translocation, transport ATPases, Membrane transport in bacteria and animals Transport mechanism- mobile carriers and pores mechanisms. Transport by vesicle formation, endocytosis, exocytosis, cell respiration.

Books Suggested

1. Biochemistry by L. Stryer, W.H. Freeman and Co. 5th 2002.
2. Fundamentals of Biochemistry by Voet and Voet, John Wiley and sons NY (2002).
3. Lehninger's Principle of Biochemistry by David L. Nelson and Michael M. Cox. W. H. Freeman; 4th edition (2004).
4. Text Book of Biochemistry with clinical correlation by Thomas .M. Devlin, John Wiley-Liss, Hobokhen N. J. publishers (2006).
5. Biochemistry by Zubey, GL WCB Publishers.
6. Cell Biology Protocols by Harris, R., Graham, J. & Rickwood, D.
7. Color Atlas of Biochemistry by Koolman, J. & Roehm, K. H.
8. Molecular Biology of The Cell - Bruce Alberts.
9. Molecular cell Biology by Harvey Lodish. W. H. Freeman; Sol edition (2007).
10. Cell Biology Protocols by Harris, R., Graham, J. & Rickwood, D.

COURSE OUTCOMES

- To understand the concepts of preparation of biomolecules, living system, their characterization and functioning.
- The understanding of different types of chemical bonding, molecular machinery of living cells, principles that govern the structures of macromolecules and their participation in living system.
- To identify with the classification and structural properties of carbohydrates, proteins, nucleic acids and lipids, glycoproteins and glycolipids and their significance in biological systems.
- By the end of the course, the students will be able to demonstrate advanced knowledge and understanding of aspects basic knowledge of the structural and functional properties of cells, cell organization, cell cycle, cell death

Practicals

Semester I

BCH – 102 : Biochemistry and Cell Biology

1. Screening tests of Monosaccharides, Disaccharides and Polysaccharides.
2. Extraction of Starch from a vegetable sample potato.
3. Isolation and extraction of Casein protein from animal milk using Neuman's method
4. Extraction of protein lecithin from egg yolk by appropriate method.
5. Preparation of blood film by suitable method and identification of different blood cells under microscope.
6. Observation and writing characters of various cell organelles using microscopy.
7. Blood Film preparation and identification of cells.
8. Extraction and estimation of proteins from plant cell material.

9. Extraction and estimation of proteins from animal cell material.
10. Microscopic observation of various stages of cell division by the use of prepared slides.
11. To identify and characterized bacterial species by using gram staining technique.

M.Sc. BIOCHEMISTRY
Semester-I
Paper-II
BCH-103: Human Anatomy and Physiology

COURSE OBJECTIVES

- The course is designed to assist the students to learn and understand fundamental concepts and principles of respiratory, renal, digestive, cardiovascular, muscle and neuro physiology.
- To develop a vocabulary of appropriate terminology to effectively communicate information related to anatomy and physiology.
- To study the interrelationships within and between anatomical and physiological systems of the human body.
- To understand the basic mechanisms of homeostasis by integrating the functions of cells, tissues, organs, and organ systems.
- To study the roll and mechanism of endocrine system in metabolism, regulation of normal homeostatic condition of body and other physiological functions.

UNIT-I

Blood- Composition of blood, structure & functions of formed elements, plasma and its constituents & function of plasma proteins.
Blood coagulation- Mechanism & regulation, fibrinolysis, role of Hb in oxygen & carbon dioxide transports or 2,3 DPG, Bohr effect and chloride shift.

UNIT-II

Digestive system- Composition, function & regulation of digestive juices, Digestion, absorption of carbohydrate, proteins and fats, nucleic acids, minerals and vitamins.

UNIT-III

I. Excretory system-Structure of nephron, mechanism of urine formation, clearance values, composition of urine, Homeostasis & acid- base balance & imbalance.
II. Structure of neuron, conduction of impulses across the nerve fiber, saltatory conduction. Synaptic transmission, role of neurotransmitter.

UNIT-IV

Muscles- Types and Structure of skeletal muscles, Bio-chemical characterization of extra cellular matrix, plasma lemma, transverse tubular system, sarcoplasmic reticulum and myofibrils. Actin, myosin, tropomyosin, troponin, Z-disc and H-line components. The sliding filament mechanisms and other theories metabolic and chemical changes during muscle constriction.

UNIT-V

Hormones- Endocrine system, basic knowledge of endocrinology, Classification of endocrine system, structure, function and disorders of pituitary, anterior and posterior pituitary gland, thyroid and parathyroid, adrenal, pancreases and reproductive hormones in case of human and female.

Books Suggested

1. Human Physiology by Devis.
2. Harper's Biochemistry (Lange Medical Books) (Paperback)By Robert K. Murray,Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
3. Clinical Biochemistry By Richard Luxton. Scion Publishing Ltd.
4. Text book of Biochemistry and Human Biology -Talwar , G.P. and Srivastava. L.M., Printice Hall of india.
5. Human Physiology Chatterjee.C.C, Medical Allied Agency.
6. Textbook of Medical Biochemistry By MN Chatterjea and Rana Shinde, Jaypee Brothers. 1. Principles of Anatomy & Physiology by Tortora, G.J.
7. Textbook of Medical Physiology by Guyton and Hall.
8. Essentials of Medical Physiology by Sembulingam K.
9. Proteins: structure and function by Whitford, D.

COURSE OUTCOMES

- This course will provide a sound basis in human physiology to support in-depth understanding of physiological processes of all body systems in detail and on an appropriate level.
- Students will able to explain how the activities of organs are integrated for maximum efficiency.
- Students will be prepared to identify how changes in normal physiology lead to disease and it will support further study in health and medical sciences or related fields.

Practicals

Semester-I

BCH-104: Human Anatomy and Physiology

1. To determine the hemoglobin gram percentage by Sahli's hemometer in various given blood samples.
2. To determine the hematocrit of a human blood sample by using appropriate clinical methodology.
3. Detection of the concentration of anti-coagulant substance heparin in the blood sample.
4. Determination of Prothrombin Time in blood samples.
5. To demonstrate the effect of diet and hormones on the glycogen content of rat liver.
6. Microscopic observation of Longitudinal Section and Transverse Section of Reproductive organs and related tissues.
7. Microscopic study of Longitudinal Section and Transverse Section of Skeletal muscles, cardiac muscles and Skin Muscles.

M.Sc. BIOCHEMISTRY

Semester-II

Paper-I

BCH-201: Biochemistry & Analytical Techniques

COURSE OBJECTIVE

- The objectives of this paper is to develop student's knowledge and capabilities in areas of analytical chemistry that are particularly relevant to the analysis of a range of sample types
- To understand the physical principles of a range of quantitative and quantitative analytical techniques.
- To study the range of spectroscopic technique to characterize the biomolecules.
- To understand the governing mechanisms and driving forces of various advanced separation processes.

UNIT-I

Water- Physical properties & Structure of water, hydrogen bonding, Ionization of water. pH scale, concept of acids-bases & buffers, behavior of amino acids as buffers, Henderson- Hasselbalch equation, Biological buffering system. Principle of osmosis- Electro endosmosis, Donan- membrane equilibrium & its biological applications.

UNIT-II

Centrifugation- Basic principle of sedimentation, centrifuge and its uses. Preparative & analytical centrifugation and their application in biochemistry.

Electrophoresis-General principle, factors affecting electrophoretic mobility, moving boundary & zonal electrophoresis, paper & gel electrophoresis, isoelectric focusing.

UNIT-III

Thermodynamics- Open, closed & isolated system, first & second laws of thermodynamics and their applications in living organisms. Molecular basis of entropy, Helmholtz & Gibbs free energy, equilibrium constant. Chemical potential, Phosphate group transfer potential coupled reactions.

UNIT-IV

Chromatography- General principle of partition, absorption, paper, column, thin layer, ion exchange & gas chromatography (GLC, GSC). Affinity & high performance liquid chromatography (HPLC) & Gel filtration chromatography.

UNIT – V

Spectroscopic techniques- Basic concepts of spectroscopy, General principle of NMR, ESR, UV, IR & Visible spectrophotometers Single beam and Double beam, Nanodrop spectrophotometer .

Books Suggested

1. Analytical Biochemistry by Holme, D. J. & Peck, H.
2. Biochemical calculation by Segel.

3. Introduction to Protein Architecture: The structural biology of proteins by Lesk, A. M.
4. Modern Experimental Biochemistry by Boyer, R.
5. Biochemistry by Todd, W. B., Mason, M., Bruggen, R. V. & Macmillan
6. Wilson.K.And Walker.J. Pub:Cambridge Press 2.PhysicalBiochemistry-Friefelder,Publisher D.W.H.FreemanPress.
7. Biophysical Chemistry:Principles and Techniques, 2nd edition by A.Upadhyay, K. Upadhyayand N.Nath. Himalaya Publishing House.

COURSE OUTCOMES

- To understand the concepts of preparation of buffers, molarity, normality, ionization, molality.
- The understanding of different types of chemical bonding, molecular machinery of living cells, principles that govern the structures of macromolecules and their participation in living system.
- To identify with the classification and structural properties of carbohydrates, proteins, nucleic acids and lipids, glycoproteins and glycolipids and their significance in biological systems.
- By the end of the course, the students will be able to demonstrate advanced knowledge and understanding of aspects of physical and chemical properties of aqueous solutions, concepts of free energy.

Practicals

Semester II

BCH-202: Biochemistry & Analytical Techniques

1. Absorption spectrum determination based on Beer Lambert's Law.
2. Estimation of serum glucose by glucose oxidase - peroxidase method.
3. Quantitative estimation of fructose by Seliwanoff's method.
4. Quantitative estimation of Proteins by Biuret method.
5. Estimation of various amino acid by applying Ninhydrin and other methods.
6. Separation of sugar & amino acid by paper chromatography.
7. Separation of colour substances by paper chromatography.
8. Detection of proteins specially their quantity by UV Spectroscopy.
9. Separation and fractionation of various samples by the use of centrifugation.
10. Demonstration of different separation techniques such as Electrophoresis, PAGE and others.

M.Sc. BIOCHEMISTRY
Semester- II
Paper-II
BCH-203: Nutrition & Clinical Biochemistry

COURSE OBJECTIVES

- To study the classification and functional properties of blood components.
- To understand the coagulation, anti-coagulation mechanism of blood and its disorders.
- To study the biochemical, clinical, pathological and diagnostic aspects of diseases.
- To study dietary types, requirements, utilization and functions of different class of diet.
- To study the nutrition deficiency disorders and balance diet.

UNIT-I

Concept of Balanced Diet and its components, Nutritional aspects of Carbohydrates, Proteins, Fats and Vitamins. WHO recommended diet allowances for various categories of human beings eg. children, adults and elderly, pregnant and lactating mothers. Fluid & electrolyte balance and imbalance in various diseases.

UNIT-II

Food processing and loss of nutrients during processing and cooking. Naturally occurring anti-nutrients. Disorders related to the nutrition - Protein energy malnutrition, Starvation, Obesity.
Pre-operation and post operational diet plans, Importance of food for existence of life. Benefits and sources of functional foods, Effects of food processing conditions and storage. Food spoilage and poisoning.

UNIT-III

Disorders of Blood: Complete blood count (CBC), Bleeding time, Clotting time, Hemoglobinopathies, Thalassemia's & anemias, Prothrombin Time.

Liver Function Tests: Van den Bergh test for bilirubin, urine and fecal urobilinogen, epinephrine test, Detoxification and excretion tests, Determination of blood ammonia.
Kidney Function Tests: Urea clearance test, Creatinine clearance test, renal plasma flow, Concentration and dilution test, Function tests of pancreases.

Unit -IV
Disorders of Carbohydrates Metabolism: Diabetes mellitus, HbA1c,, various types of glucose tolerance tests.
Disorders of Lipids: Hypoliproteinemia, Hyperlipoproteinemia, Atherosclerosis,
Diagnostic tests for HDL - cholesterol, LDL - cholesterol and triglycerides. Fatty liver, Ketone bodies.
Diagnostic Tests for Proteins: Total protein, albumin, globulin and fibrinogen
Disorders of Thyroid: Hyperthyroidism, Hypothyroidism. Thyroid function Tests: T3, T4, TSH, TRH

UNIT-V

Enzymes in different diagnosis of disease & their clinical significance: Serum Aspartate aminotransferase, alanine aminotransferase, creatine kinase, gamma glutamyl transpeptidase, alkaline phosphatase.

Books Suggested

1. Text book of Biochemistry and Human Biology –Talwar , G.P. and Srivastava. L.M., Printice Hall of india.
2. Human Physiology - Chatterjee. C.C, Medical Allied Agency.
3. Textbook of Medical Biochemistry By MN Chatterjea and Rana Shinde, Jaypee Brothers.

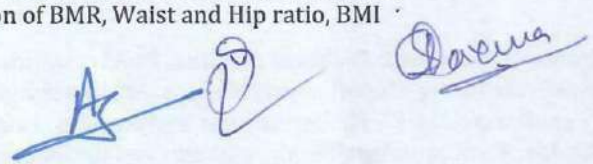
4. Lehninger Principles of Biochemistry 5th edition ByDavid L. Nelson and MichaelM. Cox,WH, Freeman and Company.
5. Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Edn By Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James, Shepherd. Publisher: Churchill Livingstone.
6. Harper's Biochemistry (Lange Medical Books) (Paperback)By Robert K. Murray.
7. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
8. Clinical Biochemistry By Richard Luxton. Scion Publishing Ltd.

COURSE OUTCOMES

- Gain detail understanding of Nutraceuticals; use of nutraceuticals in traditional health sciences from intestine in to blood it affect the body.
- Learn how to processing and loss of nutrients take place during processing and cooking.
- Recommended dietary allowances for different categories of human beings.
- Advanced understanding and knowledge of theoretical and practical aspects of blood biochemistry and its components.
- Connection of blood to entire organ system of body in single circulatory channel and consequences of environmental and genetic factors of blood disorders.
- Rationale and theoretical basis for methods and tools used in the diagnosis of common biochemical disorders.

Practicals
Semester II
BCH-204: Nutrition & Clinical Biochemistry

1. Determination of nutritional value for dietary products and other dietary substances.
2. Qualitative/ Quantitative estimation of carbohydrates, proteins, fatty acids and vitamins etc.
3. Identification of essential minerals according to source and their comparative dietary allowances.
4. Quantitative estimation test of various important minerals.
5. Calorimetric measurement for dietary substances.
6. Determination of BMR, Waist and Hip ratio, BMI



7. Estimation of Hemoglobin, Bleeding time & Clotting time
8. Total counting of Red Blood Cells & White Blood Cells by using appropriate stains and method.
9. Preparation of differential smear for differential blood cells count.
10. Identification of different blood groups & blood typing.
11. Determination of activity of SGOT and SGPT

M.Sc. BIOCHEMISTRY
Semester - III
Paper-I
BCH-301: Advanced Molecular Biology

COURSE OBJECTIVE

- Detailed understanding of prokaryotic and eukaryotic replication, types of DNA polymerases and inhibitors of DNA replication
- To gain detail on prokaryotic and eukaryotic transcription, translation and gene expression regulation
- To develop an understating of advanced technologies like RFLP, Sequencing, SSR, REMAP, SCAR and various types of PCR

UNIT I

Organization, Identification and chemical nature of genetic materials, Fine structure of Chromosome and gene, Concept of codon, prokaryotic and eukaryotic DNA replication, Types of replication, Enzymology of DNA replication.

UNIT II

Transcription mechanism in prokaryotes and eukaryotes, transcription factors, Post transcription modification in eukaryotes, Translation, Post translation modification types and significance, anti- sense RNA, Regulation of gene expression in prokaryotes.

UNIT-III

Bacterial recombination, conjugation, transformation, transduction, transposons, transposable element in prokaryotes and eukaryotes, types and significance retrovirus. DNA damage and repair, SOS repair, Base excision repair, Mismatch repair etc. PAGE detection and extraction of DNA from gels.

UNIT IV

Satellite DNA, recombination of DNA, DNA binding properties, split genes, Overlapping genes, Pseudogene, Cryptic genes, centromere DNA, Promiscuous DNA. Rearrangement of DNA.

UNIT V

Mutations : Definition, Types, Classification and mechanism, Mutagens : types, structures, functions, Mutagenesis, site directed mutagenesis, suppressor mutation, mutations determination, Mutation rate.

Books Suggested

1. Genes VIII, by Benjamin Lewin.
2. Molecular Biology, by Turner et al.
3. Cell and Molecular Biology: Concept and Experiments, by Geraid Karp.
4. An Introduction to grnrtic Analysis by Griffiths et al.

5. The Biochemistry of Cell Signaling, Helmreich JM, Oxford Press.
6. Cell signaling – John T Hancock, Oxford University press.
7. Cell and Molecular biology. Second edition: Edited by C A Smith and E J Wood. Chapman & Hall publication.

COURSE OUTCOMES

- Students will choose appropriate experimental strategy for research in basic and molecular biology.

- To perform laboratory techniques in basic biology, molecular biology, and advanced techniques. Explanation and integration of biological principles, as applied to basic and molecular biology.
- Development of strong diversified background in modern biology, appropriate to the individual student goals. Develop critical-thinking, and problem based learning skills.
- This paper will open an understanding of current trends in molecular and genetic research, and critically appraise published work.

Practicals
Semester II
BCH-302: Advanced Molecular Biology

1. Estimation of DNA by diphenylamine method.
2. Estimation of RNA by Orcinol method.
3. Spectroscopic determination of melting temperature(Tm) of calf thymus DNA.
4. Demonstration of Amplification of desirable gene by Polymerase chain reaction.
5. Isolation, quantification and characterization (Spectrophotometric and agarose gel
6. Electrophoresis of total RNA, mRNA from plant and microbial sources.
7. Isolation, quantification and characterization (Spectrophotometric and agarose gel

8. Isolation of genomic DNA by Electrophoresis from bacteria (Escherichia. C*oli*).
9. Isolation, quantification and characterization (Spectrophotometric and agarose gel electrophoresis) of genomic DNA from plant.
10. Molecular Profiling of Blood sample for its characterization .
11. Molecular profiling of Animal tissues for its characterization.

M.Sc. BIOCHEMISTRY
Semester - III
Paper-II
BCH-303: Immunology

COURSE OBJECTIVE

- In-depth knowledge and understanding of major cellular and molecular mechanisms underlying immunological processes in health and diseases
- To acquire a knowledge of immunochemical techniques in qualitative and quantitative analysis of antibodies and antigens.
- An understanding of the factors that determine the effectiveness of immune responses to microorganisms (bacteria, viruses, parasites) and tumours and how protective immunity can be elicited by vaccination.

UNIT-I

Introduction of Immune system: Innate and acquired immunity, Active-passive immunity, Structure and functions of lymphoid organs, Cells involved in immune response, Phagocytic cells & their killing mechanisms.

UNIT-II

Mechanism of immunity : Cell mediated & humoral immune response. Macrophage activation, Cell mediated cytotoxicity, Hypersensitivity and its types, MHC genes organization, types, functions.

UNIT-III

Antigen: Types of antigen, Immunoglobulins- structure, occurrence & functions, Antigen-antibody reaction, Antigen binding sites, Hybridoma technology, Monoclonal antibodies production, principle of selection, characterization, application in diagnosis and therapy.

Antibody engineering: Chimeric and Humanized monoclonal antibodies, Phase display library for monoclonal antibody.

UNIT-IV

Transplantation immunology: immunologic basis of graft rejection & HLA tissue typing, Transplantation diseases, Complementation system – mode of activation, classical - alternative pathways, Biological functions of complement proteins.

Cancer immunology: Tumor antigen, immune response to tumos,, oncogene and induction, cancer immunotherapy.

UNIT-V

Immunity to infection: Immune tolerance, Immuno suppression, Immunodeficiency disorders, Autoimmunity, Vaccines- Active and Passive immunization whole organism vaccine, purified macromolecule as a vaccine, DNA vaccine, Recombinant vaccine and Subunit vaccine & diseases.

Immunological techniques: Immunoelectrophoresis, Radial & Double immunodifussion, RIA & ELISA, Western blotting and Immuno-histochemical technique.

Books Suggested

1. Kuby Immunology, Thomas J. Kindt, Richard A Goldsby, Publisher WH Freeman & Co.
2. Immunology- Ashort Course.
3. Immunology by Tizzard.
4. Fundamental of Immunology by William Paul.
5. Immunolgy by Abbas.
6. Roitt's Essential Immunology, Tenth Edition, Ivan Roitt, Peter Delves
7. Veterinary Immunology: Ian R. Tizard, I.R. Thomson press
8. The Immune System. By Peter Parham Publisher Garland publishing
9. Biochemistry - J. David Rawn – Neil Patterson publication, NC.

COURSE OUTCOMES

- To attain a working knowledge of current immunological principles as they relate to the cells and molecules of the immune system.
- Understanding of mechanism of interaction in defending the body against invading microorganisms.
- Students will get knowledge of development and acquisition of ability to recognize antigens and finally how they malfunction in autoimmune diseases.
- Students will extend and solidify their understanding of the presented principles through critical readings from the primary research literature.

Practicals

Semester III

BCH-304: Immunology

1. Demonstration of Single (Radial) Immuno diffusion technique of a given sample.
2. Demonstration of Double (Outcherlony) immuno diffusion technique in the mammalian sample.
3. To learn Immuno electrophoresis method using various type of samples.
4. Agglutination of various blood groups by using antigen – antibody reaction.
5. To learn Widal Test by application of different samples.
6. Immune diagnosis associated with Ag-Ab interaction concept.
7. Testing kit related diagnosis based on Ag-Ab reaction etc.
8. Demonstration step by step of Sandwich ELISA technique

9. Study Lymphoid organs and their microscopic organization.

M.Sc. BIOCHEMISTRY
Semester-IV
Paper-I
BCH-401: Genetic Engineering

COURSE OBJECTIVE

- To equip students with a basic knowledge of the structural and functional properties of cells.
- To examine properties of differentiated cell systems and tissues.
- Aspect of cell cycle and cell death.
- To introduce the fascinating mechanism of cell signaling along with brief overview on developmental biology.
- To provide thorough knowledge on classical genetics.

UNIT-I

Laws of Mendels-Applications and deviations, Monohybrid and dihybrid crosses, Alleles, Sex determination and Sex-linked inheritance, Sex differentiation, Blood group inheritance and determination, Maternal effects and cytoplasmic inheritance.

UNIT-II

Recombinant DNA Technology

Restriction enzymes- nomenculture, classification and mode of action. Cloning vectors- Plasmid, Bacteriophages, cosmid, phagemid and animal virus. Purification of DNA from living cells, Manipulation of purified DNA, Cloning in Pro & eukaryotic cells, DNA hybridization and blotting techniques. cDNA library. DNA probe, Nick translation, Genetic mapping.

UNIT-III

Tissue Culture

Micropropagation, somatic cell culture, Somatic cell hybridization. Protoplast isolation - fusion, Nif gene transfer. Transformation techniques, integration and analysis or conformation of transgene

integration. Transgenic plant and transgenic animals, Application of recombinant DNA technology in agriculture, medicine DNA vaccine and molecular diagnostics.

UNIT-IV

Population genetics- Gene pool and gene frequency, models of gene pool structure-Classical hypothesis, Balanced hypothesis, Hardy- Weinberg law and its application in calculating gene frequencies, deviations from Hardy-Weinberg equilibrium.

UNIT-V

Gene Techniques - DNA finger printing, DNA foot printing, RFLP, RAPDs, Molecular markers, PCR, Immuno-PCR, Antisense RNA technology, Biosensor development and applications, Microarray chips, types and their application, Human Genome project (HGP). Biosafety and ethical consideration for GMOs.

Book Suggested

1. Gene and Genome by Premrose.
2. Genetics by P. K. Gupta.
3. Cell Biology Protocols by Harris, R., Graham, J. & Rickwood, D.
4. Color Atlas of Biochemistry by Koolman, J. & Roehm, K. H.
5. Molecular Biology of The Cell - Bruce Alberts
6. Molecular Cell Biology by Lodish, H.
7. PrinciplesofGeneticsbyEldonJohnGardner,MichaelJ.Simmons,D.PeterSnustad;JohnWiley3.
8. Molecular Genetices of the gene by Watson.
9. Genes IX by Lewin, B.
10. Essential Molecular Biology by T. A. Brown
11. Biotechnology by B. D. Singh.

COURSE OUTCOMES

- To provide thorough knowledge on classical and population genetics along with evolutions.
- Understanding of app'ication of recombinant DNA technology or Genetics engineering in agriculture, medicine DNA vaccine and molecular diagnostic.
- Understanding of Biosafty and ethical consideration for genetic modified organism and crops developments.
- Understanding of modern gene techniques, operation and advantages in recovery and hilling of genetics involved disease.
- Understanding of Blood group, sex and other associated genetic inheritance process.

PRACTICALS

Semester IV

BCH-402: Genetic Engineering

1. Identification of Restriction Digestive Enzymes used in prokaryotic as well as eukaryotic cells.
2. Demonstration of isolation of Plasmid DNA by suitable electrophoresis method.
3. Demonstration of genomic DNA Isolation from eukaryotic sample by using appropriate method.
4. Microscopic observation of Chromosome and their different elements and characters during the cell division of different phases.
5. Demonstration of separation and purification technique such as Gel Electrophoresis.
6. Isolation of DNA from human Blood by using different strategies.
7. Study of various steps of bacterial transformation.
8. Isolation of Plasmid DNA By Alkaline Lysis Method.
9. Extraction of DNA sample from Plant Tissue.
10. Demonstration of Nucleic Acid Purity Assessment Using A260/A280 Ratio.

M.Sc. BIOCHEMISTRY
Semester-IV
Paper-II
BCH-403: Pharmacobiochemistry & Clinical Research

COURSE OBJECTIVES

- To study the ICMR and Ethical Guidelines as per standardized toxicological values.
- To understand the in vitro-in vivo performed experimentation.
- To study the biological testing and bioassays during Clinical trials observation.
- To study about the Single dose and repeat dose toxicity studies.
- To study the Nutrition toxicology and Immunotoxicology.

UNIT-I

Source and nature of drugs, classification, nomenclature. principles of drug action, absorption, distribution and elimination of drugs, routes of drug administration. Drug-protein interactions. dose response curve - ED50 and LD50, Origin of drug from plants and animals, Uses of Pharmacokinetics In Drug Development Process, Concept of Prodrug and Soft Drug. Synergism and Antagonism, Acute and chronic exposures, factors influencing toxicity.

UNIT-II

Introduction, Concept of Receptor Agonists and Antagonists, Drug Receptors receptors, Enzymes, carrier proteins Interactions, Theories of Drug Activity Relationship, Forces involved in drug - receptor interaction, Receptor theories. Cholinergic and anticholinergic drugs, adrenergic and adrenergic blockers, General anesthetics, Local anesthetics. Adverse reactions to drugs and common drug receptor interactions,.Treatment of Diseases by Enzyme Stimulation, Elementary treatment of drug Receptor Interaction, Ld50, Ed50Membrane Active Drugs,. Mechanisms of drug effects, Drug delivery Systems,

UNIT-III

Clinical research: Types of clinical trials, single blinding, double blinding, open access, randomized trials and their examples, interventional study, ethics committee and its members, cross over design, Institution Ethics Committee/Independent Ethics Committee. Clinical research data management. Organ, genetic and reproductive toxicology, Toxic genomics.

UNIT-IV

Definition and aims of pharmacovigilance, Adverse drug reactions, Classification, mechanism, predisposing factors and causality assessment. Role of clinical pharmacist in reporting, evaluation, monitoring, prevention and management of ADR, drug induced diseases. Pharmaco epidemiology, Epidemiological approach, measurements epidemiology, (rates, ratios, and proportions), measurement of mortality, morbidity. Descriptive, analytical and experimental epidemiology.

UNIT-V

Ethics in Biological Research, Core ethical principles, Practical applications in Biological Research, Importance of ethics, Regulations and guidelines in research, Publication and research writing ethics, Research data and its open access, Information consent, Patient confidentiality and medical ethics Scientific Conduct and integrity.

Book Suggested

1. Pharmacology and Pharmacotherapeutics, 23 rd Edition, Popular Prakasham, Bombay.
2. Modern Pharmacology with clinical correlations, 6th Edn., Charles R. Creig, and Robert E. Stitzel, Lippincott Williams & Wilkins.
3. Foye's Principles of Medicinal Chemistry, Williams, D.A. 6th Edn. Lippincott Williams & Wilkins (2008).
4. Fundamentals of Experimental Pharmacology, Ghosh, M.N. 2nd Edn, Scientific Book Agency, Kolkatta (1984).
5. Wilson and Walker's Principles and Techniques in Biochemistry and Molecular biology; 8th Edn., Andreas Hofmann and Samuel Clokie; Eds. Cambridge University Press, New Delhi.
6. Applied Biopharmaceutics and Pharmacokinetics, Shar gel, L. 2012. McGraw- Hill Medical.

COURSE OUTCOMES

- Gain detail understanding of how drug and toxicant act inside the body an after absorption from intestine in to blood it affect the body.
- Understanding of factors that affect drug absorption, Bioavailability and Bioequivalence concept.

- Understanding of process of product registration and different guidelines which control the manufacturer to follow correct strategy for manufacturing of drug and Pre clinical toxicology studies.
- Learn how to write and file the patent; how to document clinical data of the concern to clinical research.
- Understanding of process biological testing and bioassays during Clinical trials of drug and toxicant.

PRACTICALS

Semester IV

BCH-404: Pharmacobiochemistry & Clinical Research

1. How to process the product registration following different guidelines which control the manufacturer to follow correct strategy for manufacturing of drug and Pre clinical toxicology studies.
2. To write and file the patent; how to document clinical data of the concern to clinical research.
3. To understand how drug and toxicant act inside the body an after absorption from intestine in to blood it affect the body.
4. Understanding the process of Biological testing and bioassays during Clinical trials of drug and toxicant.
5. To identify and practice on the factors that affect drug absorption, Bioavailability and Bioequivalence concept.