B.Sc. Biochemistry Semester -6

Course Code	**US06MABIC01**	Title of the Course	**Genetic Engineering**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	The objective of the course is to familiarize the students with the basic concepts in genetic engineering. 1. Process of inserting new genetic information into existing cells in order to modify a specific organism for the purpose of changing its characteristics. 2. To acquaint the students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology; and to appraise them about applications genetic engineering.

Course Content		
Unit	Description	Weightage* (%)
1.	**Regulation of gene expression** 1. Principle of gene regulation 2. Definition: constitutive enzyme, induced enzyme .inducible and induction, repressible and repression, activators and repressors 3. Lac operon hypothesis A. Negative control mechanism B. Positive control mechanism 4. Tryptophan operon A. Repressor mechanism B. Attenuation mechanism 5. Regulation of gene expression in eukaryotes A. Euchromatin and heterochromatin B. Many eukaryotic promoters are positively regulated C. DNA binding activators and co activators	**25%**
2.	**Gene mutation and repair** 1. Definition : Mutation, Mutation hotspot ,mutagens ,Mutagenic agents 2. Chemical mutagenic agents Causes Mutation: a. Base analogues b. Agents modifying nitrogen base c. Agents producing distortion in DNA	**25%**

	3. The primary mutagenic effect of UV light a. Thymine Dimer. 4. DNA Repair mechanism a. Mismatch Repair b. Base excision repair c. Nucleotide excision repair d. Direct repair	
3.	**Recombinant DNA technology and genetic engineering** 1. Introduction of Recombinant DNA technology and genetic engineering 2. Purification of DNA a. Preparation of total cell DNA b. Preparation of plasmid DNA 3. Gene cloning vectors (brief) a. Plasmid b. Lambda phase c. Cosmid d. Ti plasmid e. pBR322 4. Restriction endonuclease its types and function	**25%**
4.	**Applied genetics** 1. Detection of recombinant clone by following methods: a. Southern blotting b. Northern blotting c. Western blotting 2. Principle, method and application of : a. PCR b. RFLP c. DNA finger printing d. Gene library 3. Gene sequencing : a. Sanger's method b. Maxam and Gilbert's method	**25%**

Teaching-Learning Methodology	The course will be covered through lectures, with the help of new technologies Apart from discussions on topics covered in lectures, assignments will also be given.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	The student will gain a basic understanding on human genetics and hereditary.
2.	They learn about DNA, RNA and their replication, mutations, DNA repair mechanism.
3.	Students learn about transgenic animal, their application in pharmaceutical industry, cloning and its importance
…	

Suggested References:	
Sr. No.	References
1.	Freifelder's Essentials of Molecular Biology by George M. Malacinski
2.	Molecular Biology of the Gene 6th edition. By Watson J D, Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.,2008 Cold Spring Harbour Lab. Press, Pearson Pub.
3.	Gene Cloning & DNA Analysis: An introduction by T A Brown WILEY Blackwell 7th Edition
4.	Lewin's Gene XII by Elliot S Goldstein, Jocelyn E. Krebbs, and Stephen T. Kilpatrick
On-line resources to be used if available as reference material	
On-line Resources	

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B.Sc. Biochemistry Semester -6

Course Code	US06MABIC02	Title of the Course	Human Metabolism-II
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. To learn major catabolic and anabolic pathways by which human cell types metabolize protein and nucleotides. 2. To understand how energy is produced in the cell 3. To study of concepts in protein and carbohydrate 4. To understand the fundamentals of integration of various metabolic pathways 5. To aware about the changes in metabolic pathways during fasting and fed state

Course Content

Unit	Description	Weightage* (%)
1.	**RESPIRATORY CHAIN AND OXIDATIVE PHOSPHORYLATION** • Understanding of Respiratory chain and Oxidative Phosphorylation • Components of respiratory chain ▪ Nicotinamide nucleotides ▪ Coenzyme Q ▪ Flavin nucleotides ▪ Cytochromes ▪ Iron-Sulphur proteins • Organisation of Electron Transport Chain • Inhibitors of electron transport chain • Oxidative phosphorylation • Mechanism of oxidative phosphorylation (Hypothesis) • P:O Ratio • ATP synthase : structure and mechanism of ATP synthesis. • Inhibitors of oxidative phosphorylation • Uncouplers • Chemiosmotic theory	**25%**
2.	**PROTEIN METABOLISM** • Digestion and absorption of protein • Metabolic uses of Amino acid • Protein turnover • Amino acid pool	**25%**

	• Transamination & Deamination • Ammonia transport and metabolism • Removal of ammonia • Metabolism of individual amino acid (In brief) • Urea cycle and its regulation • Interaction between urea cycle and Kreb's cycle	
3.	**NUCLEIC ACID METABOLISM** • Biosynthesis of Purine Nucleotides • De Novo synthesis • Synthesis of AMP and GMP from IMP • Formation of Purine Nucleotide Diphosphates and Triphosphates • Salvage pathways • Synthesis of Deoxyribonucleotides • Degradation of Purine Nucleotides • Uric acid metabolism • Gout • Pyrimidine metabolism : De Novo synthesis, Degradation of pyrimidine nucleotides	**25%**
4.	**INTEGRATION OF METABOLISM** • Energy demand and supply • Integration of metabolic pathways (carbohydrate, lipid and amino acid metabolic pathways) • Tissue specific metabolism (brain, muscle, adipose tissue and liver). • Fast – feed cycle The Fed state The Fasting state The Re-fed state • Glucose Homeostasis andstarvation	**25%**
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Teaching-Learning Methodology	This course will be taught by a mixture of discussion, lecture, readings, smart -board technology, on-line quizzes and student presentation modalities.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the structure and metabolism of macromolecules and understand the regulation and disorders of metabolic pathways.
2.	Acquire knowledge about how respiration chain operates and generates energy inside the cells.
3.	Nucleic acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism, monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes in the regulation of the pathways
…	

Suggested References:	
Sr. No.	References
1.	Lehninger Principles of Biochemistry by David L. Nelson, Michael Cox Publisher:WH Freeman
2.	Biochemistry by Donald Voet, Judith G. Voet Publisher: Wiley
3.	Textbook of biochemistry by Rafi MD Publisher: Universities Press (India) Pvt. Ltd.
4.	Biochemistry – By U Satyanarayana and U Chakrapani Publishers: Elsevier
5.	Biochemistry by Jeremy M. Berg (Editor), John L. Tymoczko (Editor), LubertStryer (Editor)
On-line resources to be used if available as reference material	
On-line Resources	

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B.Sc. Biochemistry Semester -6

Course Code	**US06MABIC03**	**Title of the Course**	**Biochemistry Practical**
Total Credits Of the Course	**4**	**Hours per Week**	**8**

Course Objectives:	Student should be able to: 1. To understand the fundamentals of instrumentation techniques such as Polyacrylamide gel electrophoresis. 2. To develop understanding of DNA isolation from different sources 3. To estimate compounds like proteins, phenols and carbohydrate 4. To learn the chromatographic technique for isolation of various compounds. 5. To learn different techniques for precipitation of proteins.

Unit	Description
	Section-I
1.	Isolation of chromosomal DNA from plant cells
2.	Agarose Gel Electrophoresis of plant DNA
3.	Isolation of Plasmid DNA by alkaline lysis method
4.	Demonstration of DNA Microarray
5.	Effect of substrate concentration on arginase enzyme.
6.	Estimation of total phenol
7.	Determination of saponification value of an oil
8.	Isoelectric precipitation of proteins.

	Section-II
1.	Extraction and Characterization of Starch.
2.	Separation of lipids by TLC.
3.	Estimation of vitamin C by DNPH method.
4.	Estimation of citric acid by titrametric method
5.	Determination of free fatty acid value of an oil
6.	Case studies on nutritional disorders
7.	Demonstration of Polyacrylamide gel electrophoresis of serum proteins
8.	Estimation of protein by Pattern Huston method

Teaching-Learning Methodology	Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitablyequippedlaboratoryeitherindividuallyoringroupsdependingon the nature of exercise as well as availability of infrastructure. Practical materials will be provided from primary and secondary sources of information.

EvaluationPattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written/Practical Examination (AsperCBCSR.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical,Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Students will be able to demonstrate an understanding of fundamental biochemical principles.
2.	They will gain the hands on knowledge of various techniques useful in biochemistry which can help them to stand with a skilful job at various industries and research labs
3.	Students will able to learn quantitative estimation of various parameters.
4.	They will develop understanding of DNA isolation from different sources

Suggested References:	
Sr. No.	References
1.	Standard methods of biochemical analysis–S.R.Thimmaiah
2.	Practical clinical biochemistry methods &interpretations–Ranjana Chawla
3.	Practical biochemistry by Harold Varley.

B.Sc. Biochemistry Semester -6

Course Code	US06MIBIC01	Title of the Course	Immunology
Total Credits of the Course	02	Hours per Week	02
Course Objectives:	1. The students will be introduced to the basic concepts of immunology as it relates to human and animal health. 2. The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease. 3. The students will be able to transfer knowledge of immunology into clinical decision-making through case studies presented in class.		

Course Content

Unit	Description	Weightage* (%)
1.	Serological reaction (A) Precipitation reaction:- Mechanism and application of precipitation reaction . (B) Agglutination reaction:- Mechanism and application of Agglutination reaction . (C) Immunological techniques 1. Immunofluorescence 2. Complement Fixation test 3. Radio immuno Assay 4. Enzyme linked immunosorbent Assay (D) Immunology of transplantation 1.Classification of Transplantation 2. Mechanism of Allograft Acception 3. Mechanism of Allograft rejection	**25%**
2.	Hypersensitivity and vaccination (A) Hypersensitivity reaction:- 1.Type I Hypersensitivity (Anaphyloetic Hypersensitivity) 2. Type II hypersensitivity (Cytotoxic) 3. Type III hypersensitivity (Immune complex) 4. Type IV hypersensitivity (cell mediated) (B) Autoimmune disease 1. Rheumatoid arthritis (C) Vaccine and Vaccination 1. Types of vaccine 2. Route and administration of vaccination	**25%**

Teaching-Learning Methodology	This course will be taught by a mixture of discussion, lecture, readings, smart -board technology, on-line quizzes and student presentation modalities.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Apply basic techniques for identifying antigen antibody interactions
2.	Exemplify the adverse effect of immune system including Allergy, hypersensitivity and autoimmunity
3.	Elucidate the reasons for immunization and aware of different vaccination
…	

Suggested References:	
Sr. No.	References
1.	Textbook of Immunology- Chakkaravarthy, Tata McGraw Hill publishing Company, Ltd (2004)
2.	Essentials of Immunology- I. Roitt, Blackwell Science
3.	Immunology Textbook by Janis Kuby
4.	Textbook of Microbiology by R. Ananthanarayan

On-line resources to be used if available as reference material
On-line Resources

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B.Sc. Biochemistry Semester -6

Course Code	US06MIBIC02	Title of the Course	Biochemistry Practical
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	1. To learn the diagnostic technique for detection of different antigens 2. To learn the technique of immune electrophoresis and immune diffusion. 3. To understand the basics principle of blood grouping and cross matching.

Sr No	Name of the Practical
1	Diagnosis of antigen by Widal test (Slide test)
2	To learn the technique of immune electrophoresis(Rocket Immuno electrophoresis)
3	Determination of Rheumatoid Arthritis(RA)factor
4	Case study of different diseases
5	Diagnosis of antigen by Widal test (Tube test)
6	Determination of human blood group and Rh factor
7	Cross matching
8	To learn the technique of immune diffusion

Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping

Course Outcomes: On the successful completion of the course, the students will be able to understand
By learning this course students will learn the diagnostic technique for detection of different antigens.
Students will learn the technique of immune electrophoresis and immune diffusion.
Students will understand the basics principle of blood grouping and cross matching.

Suggested References:

Sr. No.	References
1.	Standard Methods of Biochemical Analysis S.K. Thimmaiah Publishers: Kalyani
2.	Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
3.	An Introduction to Practical Biochemistry by David T. Plummer
4.	Textbook of Medical Laboratory Technology by Praful B. Godkar; Darshan P. Godkar

On-line resources to be used if available as reference material
On-line Resources:
https://vlab.amrita.edu/?sub=3&brch=63
https://vlab.amrita.edu/?sub=3&brch=64
https://biotech01.vlabs.ac.in/
https://www.nature.com/subjects/biochemistry
https://sbcihq.in/
https://iubmb.org/resources/biochemistry-education-movies/

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