



B.Sc. (Biochemistry) Sem. 6

Course Code	US06CBCH51	Title of the Course	Genetic Engineering
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<p>The objective of the course is to familiarize the students with the basic concepts in genetic engineering.</p> <ol style="list-style-type: none">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.
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Course Content		
Unit	Description	Weightage* (%)
1.	<p>Regulation of gene expression</p> <ol style="list-style-type: none">1. Principle of gene regulation2. Definition: constitutive enzyme, induced enzyme .inducible and induction, repressible and repression, activators and repressors3. Lac operon hypothesis<ol style="list-style-type: none">A. Negative control mechanismB. Positive control mechanism4. Tryptophan operon<ol style="list-style-type: none">A. Repressor mechanismB. Attenuation mechanism5. Regulation of gene expression in eukaryotes<ol style="list-style-type: none">A. Euchromatin and heterochromatinB. Many eukaryotic promoters are positively regulatedC. DNA binding activators and co activators	25%
2.	<p>Gene mutation and repair</p> <ol style="list-style-type: none">1. Definition : Mutation, Mutation hotspot ,mutagens ,Mutagenic agents2. Chemical mutagenic agents Causes Mutation:<ol style="list-style-type: none">a. Base analoguesb. Agents modifying nitrogen basec. Agents producing distortion in DNA3. The primary mutagenic effect of UV light<ol style="list-style-type: none">a. Thymine Dimer.4. DNA Repair mechanism<ol style="list-style-type: none">a. Mismatch Repairb. Base excision repair	25%





	<ul style="list-style-type: none">c. Nucleotide excision repaird. Direct repair	
3.	Recombinant DNA technology and genetic engineering <ul style="list-style-type: none">1. Introduction of Recombinant DNA technology and genetic engineering2. Purification of DNA<ul style="list-style-type: none">a. Preparation of total cell DNAb. Preparation of plasmid DNA3. Gene cloning vectors (brief)<ul style="list-style-type: none">a. Plasmidb. Lambda phagec. Cosmidd. Ti plasmide. pBR3224. Restriction endonuclease its types and function	25%
4.	Applied genetics <ul style="list-style-type: none">1. Detection of recombinant clone by following methods:<ul style="list-style-type: none">a. Southern blottingb. Northern blottingc. Western blotting2. Principle, method and application of :<ul style="list-style-type: none">a. PCRb. RFLPc. DNA finger printingd. Gene library3. Gene sequencing :<ul style="list-style-type: none">a. Sanger's methodb. 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.
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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
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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. Krebs, and Stephen T. Kilpatrick

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

On-line Resources





B.Sc. (Biochemistry) Sem. 6

Course Code	US06CBCH52	Title of the Course	Immunology
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<ol style="list-style-type: none">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. <p>...</p>
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Course Content		
Unit	Description	Weightage* (%)
1.	<p>Basic Concept of Immunology: Introduction & definition of immunity, Local immunity, Herd immunity, Infection, Pathogens, Saprophytes, Parasites</p> <p>Types of Immunity:</p> <p>A) Innate Immunity</p> <ol style="list-style-type: none">1. Levels of innate Immunity2. Factors influence levels of innate Immunity3. External defence (1st line of defence)4. Internal defence (2nd line of defence) <p>B) Acquired Immunity</p> <ol style="list-style-type: none">i) Types of Acquired Immunityii) Cells involved in Acquired Immunity(3rd line of defence) <p>lymphoid organs:</p> <ol style="list-style-type: none">a) Primary lymphoid organsb) Secondary lymphoid organs	25%
2.	<p>Fundamentals of immune components Introduction & definition of antigen, Haptens, antigenicity, Epitope, Antibody</p> <p>Antigens:</p> <ol style="list-style-type: none">a) General features of Antigenb) Types of antigens <p>Antibodies:</p> <ol style="list-style-type: none">a) General features of Antibodyb) Structure of Antibodyc) Classes of Antibody <p>Complements and MHC Complements: Functions & Pathway of Complement i) Classical, ii) Alternate MHC : Types & function of MHC</p>	?



3.	Serological reactions A. Precipitation reaction : Mechanism & Application of precipitation reaction B. Agglutination reaction: Mechanism & Application of Agglutination reaction C. Immunological technique: 1. Immunofluorescence 2. Complement fixation test 3. Radioimmuno Assay 4. Enzyme linked immunosorbent Assay D. Immunology of Transplantation: a) Classification of Transplantation b) The allograft reaction & mechanism of allograft rejection	25%
4.	Hypersensitivity & Vaccination: 1. Hypersensitivity Reaction :Type I, II, III and IV 2. Autoimmunity a) Mechanism of autoimmunization b) Rheumatoid arthritis in detail 3. Vaccines & Vaccination: a) Types of vaccine b) Routes of administration of Vaccination c)	25%
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Teaching- Learning Methodology	Lectures and colloquiums
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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.	Design a model of Immunoglobulin
4.	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



B.Sc. (Biochemistry) Sem. 6

Course Code	US06CBCH53	Title of the Course	Human Metabolism - II
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<ol style="list-style-type: none">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 cell3. To study of concepts in protein and carbohydrate4. To understand the fundamentals of integration of various metabolic pathways5. To aware about the changes in metabolic pathways during fasting and fed state
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Course Content		
Unit	Description	Weightage* (%)
1.	RESPIRATORY CHAIN AND OXIDATIVE PHOSPHORYLATION <ul style="list-style-type: none">• Understanding of Respiratory chain and Oxidative Phosphorylation• Components of respiratory chain<ul style="list-style-type: none">▪ 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 <ul style="list-style-type: none">• Digestion and absorption of protein• Cellular uptake of Amino acid• Metabolic uses of Amino acid• Protein turnover• Amino acid pool• Transamination & Deamination• Ammonia transport and metabolism• Ammonia toxicity• Removal of ammonia	25%





	<ul style="list-style-type: none">• Metabolism of individual amino acid (In brief)• Urea cycle and its regulation• Interaction between urea cycle and Kreb's cycle• Metabolic disorder of protein metabolism: Phenylketonuria, Albinism	
3.	NUCLEIC ACID METABOLISM <ul style="list-style-type: none">• Biosynthesis of Purine Nucleotides• De Novo synthesis• Synthesis of AMP and GMP from IMP• Formation of Purine Nucleotide Diphosphates and Triphosphates• Inhibitors of Purine synthesis• Regulation of Purine Nucleotide biosynthesis• Salvage pathways• Synthesis of Doxyribonucleotides• Degradation of Purine Nucleotides• Uric acid metabolism• Gout• Pyrimidine metabolism• De Novo synthesis , Regulation , Degradation of pyrimidine nucleotides	25%
4.	INTEGRATION OF METABOLISM <ul style="list-style-type: none">• 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 and starvation	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.
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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 thorough knowledge in biochemical human metabolism.
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
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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), Lubert Stryer (Editor)

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





B.Sc. (Biochemistry) Sem. 6

Course Code	US06CBCH54	Title of the Course	Clinical Biochemistry
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	Clinical Biochemistry is deals with the measurement of chemicals in blood and urine. These test results are useful for detecting health problems, determining prognosis and guiding the therapy of a patient. It also includes prevention of a particular disease state.
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Course Content		
Unit	Description	Weightage* (%)
1.	BLOOD 1) General composition of whole blood 2) Functions 3) Blood cells: Haematopoiesis <ul style="list-style-type: none">• Erythrocytes(RBC) :- functions , physical characteristics , composition, Formation & destruction of Erythrocytes• WBC:- functions, Classification• Platelets: - Role in Blood coagulation (brief).• Blood coagulation factors and pathways	25%
2.	PLASMA PROTEINS 1) Plasma protein : Classification ,types and major functions of plasma proteins 2) Separation of plasma protein 3) Chemistry , functions and clinical significance of <ul style="list-style-type: none">a) Albuminb) Alpha-1-antitripsinc) Lipoproteinsd) Haptoglobine) Ceruloplasminf) Transferrin	25%
3.	ORGAN FUNCTION TEST - 1) Liver function test : functions of liver, classification of liver function test (Detail: Test based on bile pigment formation and serum enzyme activities) <ul style="list-style-type: none">• Formation of bilirubin: Free bilirubin, conjugated bilirubin and unconjugated bilirubin• Jaundice : types – Hemolytic, Hepatic, Obstructive• Jaundice due to genetic defect: Neonatal Jaundice, Crigler-Najjar syndrome type 1 and II, Gilbert's disease 2) Renal function test : functions of kidney, classification of renal function test: examination of urine, blood analysis, test based on GFR (clearance test), test based on tubular function	25%



4.	HEMOGLOBIN AND ANAEMIA <ul style="list-style-type: none">• HB: - Chemistry, Structure, Normal types of Hb.<ol style="list-style-type: none">1) Haemoglobinopathies2) Anaemia: Classification and Symptoms• Sickle – cell anemia- Molecular Basis of Hbs, Biochemical Basis of the diagnosis & management of Sickle cell Disease• Thalassemia (brief)• Nutritional anaemia (Iron deficiency anaemia, Vitamin B₁₂ deficiency anaemia and folate deficiency anaemia)	25%
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Teaching-Learning Methodology	The teaching methodology consists of lectures, discussion, new technologies.
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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.	Can understand the pathophysiology and molecular basis of the most prevalent diseases.
2.	Know the analytical methods commonly used in the clinical laboratory.
3.	Know the diagnosis and prevention for diseases.



Suggested References:

Sr. No.	References
1.	Principles of Anatomy and Physiology- Gerard .J. Tortora and Bryn Derrickson
2.	Textbook of Medical Physiology- Arthur. C .Guyton, John. E .Hall.
3.	Medical Physiology- Vol.1 and Vol.2-C.C.chatterjee
4.	Textbook of medical biochemistry by M. N. Chatterjea and Rana Shinde
5.	Textbook of biochemistry for medical students :D M Vasudevan

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

On-line Resources



B.Sc. (Biochemistry) Sem. 6

Course Code	US06CBCH55	Title of the Course	Biochemistry Practical
Total Credits of the Course	8	Hours per Week	12

Course Objectives:	<p>Student should be able to:</p> <ol style="list-style-type: none">1. To understand the significance of estimation of clinical parameters like SGPT, SGOT, A/G ratio, urea and creatinine2. To learn blood grouping and Rh factor3. To get knowledge about clinical diagnostic techniques such as Widal, RA and Rocket immunoelectrophoresis4. To understand significance of biochemical parameters in diagnosis such as LDL, HDL, triglycerides, bilirubin, cholesterol and differential count of WBC5. To understand the isolation and separation of plant DNA by agarose gel electrophoresis6. To learn separation of various proteins by SDS-PAGE7. To get knowledge for estimation of phytochemicals such as phenols, chlorophyll, IAA and other growth hormones.8. To develop exposure of entrepreneurship by learning plant tissue culture
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Unit	Description
	Section-I
1.	Estimation of Creatinine by Jaffe method
2.	Extraction and estimation of protein from green gram by Lowry method
3.	Estimation of SGOT and its clinical importance
4.	Estimation of SGPT and its clinical importance
5.	Determination of A/G ratio
6.	Estimation of Urea by DAMO Method
	Section-II
1.	Estimation of serum bilirubin
2.	Estimation of serum cholesterol
3.	Determination of human blood group and Rh factor
4.	Diagnosis of antigen by Widal test
5.	To learn the technique of immunoelectrophoresis (Rocket Immunoelectrophoresis)
6.	Determination of Rheumatoid Arthritis(RA) factor



Section-III	
1.	Estimation of DNA by UV spectroscopy
2.	Demonstration of Polyacrylamide gel electrophoresis of serum proteins
3.	Differential leucocyte count
4.	Isolation of chromosomal DNA from plant cells
5.	Agarose Gel Electrophoresis of plant DNA
6.	Estimation of LDL and HDL
7.	Estimation of TG
Section-IV	
1.	Estimation of chlorophyll
2.	To study the deficiency of micronutrients in plant through leaf morphology (Field study)
3.	Estimation of phenols
4.	Estimation of IAA
5.	Visit to plant tissue culture laboratory
6.	To study the effect of plant growth hormones
7.	To check the quality of oil extracted from plant seeds using Iodine value

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 suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Practical materials will be provided from primary and secondary sources of information.
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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%
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Course Outcomes: Having completed this course, the learner will be able to

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| 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 |

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.

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

On-line Resources

Related References Books
