BIO-CHEMISTRY

Semester-V
Theory: BCT-501-Physiology, Clinical Biochemistry and Immunology

Unit I: Physiology
Digestion and absorption of carbohydrates, lipids and proteins. Composition of blood and coagulation of blood. Hemoglobin and transport of gases in blood (oxygen and CO₂).
Muscle- kinds of muscles and mechanism of muscle contraction.

Unit II: Endocrinology

Unit III: Nutritional Biochemistry

Unit IV: Clinical Biochemistry
Liver diseases-jaundice. Liver function tests- conjugated and total bilurubin in serum, albumin: globulin ratio, Serum enzymes in liver diseases- SGPT, GGT and alkaline phosphatase.
Kidneys-structure of nephron, urine formation, normal and abnormal constituents of urine. Biological buffers. Role of kidneys in maintaining acid-base and electrolyte balance in the body. Renal function test-creatinine.

Unit V: Immunology

Practical: BCP-501-Nutritional and Clinical Biochemistry

List of Experiments:
1. Estimation of calcium by titrimetry
2. Estimation of iron by Wong’s method.
3. Estimation of vitamin C by 2, 6 -dichlorophenol indophenol method.
4. Determination of iodine value of an oil.

45 hrs
(3 periods/week)
5. Estimation of hemoglobin in blood.
7. Determination of blood group and Rh typing.
8. Visualization of antigen antibody reactions (Ouchterlony technique).
9. Urine analysis for albumin, sugars and ketone bodies.

**Elective Theory BCT-502: Basic Microbiology**

60 hrs
(5 periods/weeks)

**Unit –I : History of Development of Microbiology**

12 hrs

**Unit-II: Diversity of Microbial world**
Binomial Nomenclature, Whittaker’s five kingdom and Carl Woese’s three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms. General characteristics of different groups: acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence and mode of reproduction.

12 hrs

**Unit-III : Viruses, Bacteria and Protozoa**
An introduction to viruses with special reference to the structure and replication of the following: Poxvirus and Poliovirus. Bacterial Diseases- Cholera and Typhoid. TMV and T4, Protozoan Diseases- Amebiasis and Malaria.

12 hrs

**Unit- IV: Algae**
History of phycology; General characteristics of algae: occurrence, thallus organization, algae cell ultra structure, pigments, flagella, eyespot food reserves and vegetative, asexual and sexual reproduction. Applications of Algae in agriculture, industry, environment and food.

12 hrs

**Unit- V: Fungi**
General characteristics of fungi - habitat, distribution, nutritional requirements, fungal cell ultra-structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasaexual mechanism. Economic Importance of Fungi in Agriculture, environment, Industry, medicine, food, biodeterioration, mycotoxins

45 hrs
(3 per/week)
List of Experiments:

1. Microbiology Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter)
3. Preparation and sterilization of culture media for bacterial cultivation
4. Study of different shapes of bacteria, fungi, algae, protozoa using permanent slides/pictographs
5. Staining of bacteria using Gram stain
6. Isolation of pure cultures of bacteria by streaking method.

SUGGESTED READINGS


Elective Theory BCT-503: Molecular Basis of Infectious Diseases

60hrs
(5 periods/week)

Unit-I: Classification of infectious agents

Unit-II: Overview of diseases caused by bacteria
Detailed study of tuberculosis: History, causative agent, molecular basis of host specificity, infection and pathogenicity, Diagnostics, Therapeutics, inhibitors and vaccines. Drug resistance and implications on public health. Other bacterial diseases including Typhoid, Diphtheria, Pertussis, Tetanus and Pneumonia.

Unit-III: Overview of diseases caused by Viruses
Detailed study of AIDS, history, causative agent, pathogenesis, Diagnostics, Drugs and inhibitors. Other viral diseases including hepatitis, influenza, rabies, chikungunya and polio.

Unit-IV: Overview of diseases caused by Parasites
Detailed study of Malaria, history, causative agents, Vectors, life cycle, Host parasite interactions, Diagnostics, Drugs and Inhibitors, Resistance, Vaccine development. Other diseases including leishmaniasis, amoebiasis.

Unit-V: Overview of diseases caused by other organisms
Fungal diseases, General characteristics. Medical importance of major groups, pathogenesis, treatment.

Elective Practical BCP-503: MOLECULAR BASIS OF INFECTIOUS DISEASES

45 hrs
3 periods/ Week
List of Experiments:
1. Permanent slides of pathogens. Mycobacterium tuberculosis, Leishmania, Plasmodium falciparum
2. WIDAL test
3. Gram staining
4. Acid fast staining
5. PCR based diagnosis
6. Dot Blot ELISA
7. Immunization Programme- Field visit.

SUGGESTED READINGS


3. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J.Ryan, C. George Ray, Publisher: McGraw-Hill

4. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences

Semester – VI

Theory: BCT-601-Microbiology and Molecular Biology

Unit- I : Microbiology

Unit II-Applied Biochemistry
Fermentation Technology: Batch, continuous culture techniques, principle types of fermentors. Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin), Enzyme Technology: Immobilization of enzymes and cells, different methods. Industrial applications. Production of transgenic plants and their applications. Introduction to Bioinformatics- definitions of proteomics and genomics. Gene bank, NCBI, DDBJ, Swissprot, PDB. Sequence alignments- BLAST and FASTA.

Unit- III : DNA Replication and Transcription
Unit- IV: Protein Synthesis and Regulation of Gene Expression  12 hours

Introduction to protein synthesis- Genetic code, deciphering of genetic code, Nirenberg’s and Khorana’s experiments, wobble hypothesis, degeneracy of genetic code.
Inhibitors of protein synthesis.
Regulation of prokaryotic gene expression- induction and repression. Lac operon.

Unit- V: Recombinant DNA technology  12 hours

Construction of c-DNA and genomic libraries. Isolation and sequencing of cloned genes- colony hybridization, nucleic acid hybridization.
Polymerase chain reaction- principle and applications. Outlines of blotting techniques-Southern, Northern and Western.
Applications of gene cloning- production of insulin and human growth hormone, production of Bt cotton and edible vaccines.

Practical: BCP-601: Microbiology and Molecular Biology  45 hrs
(3 periods/week)

List of Experiments:

1. Preparation of culture media and sterilization methods.
2. Isolation of pure cultures: (i) Streak plate method. (ii) Serial dilution method.
3. Gram staining.
5. Antibiotic sensitivity by paper disc method.
6. Isolation of DNA from onion/liver/coconut endosperm.
7. Estimation of DNA by diphenylamine method.
8. Estimation of RNA by orcinol method..
9. Sequence alignments of insulin/BSA with other proteins using BLAST and FASTA.
10. Examination of milk quality by MBRT method.

Elective Theory BCT-602: Biochemistry of Cell  60hrs
(5 periods/week)

Unit- I: Biomolecules in their cellular environment  No. of Hours : 12

Unit –II : Amino acids and Lipids  No. of Hours : 12
Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides. Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments.
Unit- III: 3 sugars and nucleic acids
Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role. Structures and chemistry, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides.

Unit- IV: Vitamins, coenzymes and metal ions
Occurrence and nutritional role of vitamins. Coenzymes and their role in metabolism. Metal ion containing biomolecules - heme, porphyrins and cyanocobalamin; their biological significance.

Unit- V: Signalling molecules
Second messengers - cAMP, cGMP, IP3, diacyl glycerol, Ca++, NO. Brief account of their importance and role in signalling and signal transduction.

Elective Practical – 602: Biochemistry of Cell 45 hrs
(3 periods/week)

2. Qualitative tests for biomolecules - carbohydrates, lipids, amino acids, proteins, bases and nucleic acids.
5. Estimation of ascorbic acid in fruit juices.

Suggested Readings

Elective Theory: BCT-603: Biochemical Correlations in Diseases 60 hrs
(5 periods/week)

Unit- I: Inborn errors of metabolism
Alkaptonuria, Phenylketonuria, Glycogen and Lipid storage diseases, SCID, Clotting disorders.

Unit- II: Nutritional Deficiency and Life style diseases

Unit- III: Hormonal Imbalances and Autoimmune diseases
Outline of hormone action and imbalances leading to disease - precocious puberty, hyper and hypopituitarism. Hyper and hypothyroidism. Concepts in immune recognition - self and non self
discrimination, organ specific autoimmune diseases – Hashimoto’s thyroiditis, Grave’s disease, myasthenia gravis; Systemic diseases - SLE, rheumatoid arthritis; Diabetes Mellitus-I.

**Unit- IV : Diseases caused due to misfolded proteins**
Alzheimer’s, Huntington’s disease, Kuru, Creutzfeldt-Jakob disease, Sickle cell anaemia, Thalassemia.

**Unit- V: Infectious diseases**
Viral infection (polio, measles, mumps, influenza, HIV); Bacterial infections (tetanus, diphtheria, tuberculosis, typhoid, cholera); Protozoan (*Plasmodium* and *Trypanosoma*) and parasitic infections. Vaccines against diseases. General strategies in the design and development of vaccines.

**Elective Practical BCP- 603: Biochemical Correlations in Diseases**
45 hrs
(3 per/week)

1. Glucose tolerance test.
2. Lipid profile: triglycerides and total cholesterol.
3. Obesity parameters.
4. RBC counting and haemoglobin estimation.
5. Blood pressure measurements.
6. Bone density measurements (visit to a nearby clinic).
8. Tridot Test/ Lateral flow test for viral diseases

**SUGGESTED READINGS**


**Recommended Books for UG Course -Biochemistry**

**General Biochemistry**


Enzymology


2. Understanding Enzymes – Palmer, T., Ellis Harwood.


Biochemical Techniques


Physiology, Nutrition and Clinical Biochemistry:


3. Human Physiology – Chatterjee.C.C, Medical Allied Agency


### Immunology:

1. **Immunology**. Tizard, I. R. Thomson Press.


### Microbiology:


### Molecular Biology and Biotechnology:


Bioinformatics

1. Instant Notes-Bioinformatics- Westhead et al., Viva Books (P), Ltd
2. Introduction to Bioinformatics- Attwood T K and Parry-Smith, D. J. Pearson Education.
3. Introduction to Bioinformatics- Lesk, A.M. Oxford University Press

Practical Biochemistry:

11. Practical Clinical Biochemistry –Methods and Interpretations –Ranjna Chawla- Jaypee

Practical Microbiology:

3. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom cultivation-Anjea, K. R - New Age International publishers.

Mathematical Problems in General Biochemistry:

Lab Reference Book:


MODEL QUESTION PAPER FOR END SEMESTER EXAM
B. Sc Degree Course (CBCS Semester pattern)
B. Sc Biochemistry

Time : 3 Hrs

Max marks : 75

(5 x 5 = 25 marks)

SECTION A
Attempt any five of the following

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 

(10 x 5 = 50 marks)

SECTION – B
Attempt all the questions

9. (OR) Unit I

10. 

11. (OR) Unit II

12. (OR) Unit III

13. (OR) Unit IV

14. 

15. (OR) Unit V

16. 

Distribution of Practical Exam Marks

Practical Exam Time: 3 Hrs

Max marks: 50

1. Major Experiment 20 (Principle -5M, Methodology-10M, Results-05)
2. Minor Experiment 10 (Principle -2M, Methodology-05M, Results-03)
3. Spotters 10 (5 nos. x 2 M)
4. Record 05
5. Viva-voce 05

MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS
B.Sc., Course Semester End Practical examination
B.Sc., Biochemistry

TIME: 3 hours Max. Marks: 50
1. Major experiment. 20 marks
2. Minor experiment 10 marks
3. Identify the given spotter and write a brief note on it- A, B, C,D,E, F (5x2M) 10 marks
4. Record marks
5. Viva-voce 05 marks

MID TERM EXAMINATIONS
(1st and IInd Internal Assessment Examinations)
Internal assessment; after completion of two Units one internal test will be conducted
No. of internal tests; Two
Average two internal tests will be taken
Total no. of Marks 25
Pattern; out of five short answers three questions have to be attempted each carries 5 Marks.
In essay questions out of two questions, one has to be attempted which carries 10 marks.

MID SEM EXAM MODEL QUESTION PAPER
1st INTERNAL ASSESSMENT EXAMINATION
B. Sc Degree Course (CBCS-Semester pattern)
B. Sc., Biochemistry

Time : 1 Hr Max marks : 25
(3 x 5 M= 15M)

SECTION -A
 Attempt any THREE short questions of the following
1. 
2. 
3. 
4. 
5.
MID SEM EXAM MODEL QUESTION PAPER
II Ind INTERNAL ASSESMENT EXAMINATION
B. Sc Degree Course (CBCS-Semester pattern)
B. Sc Biochemistry

Time : 1 Hr
Max marks : 25

SECTION - A
(3 x 5 M = 15M)
Attempt any THREE short questions of the following

SECTION – B
(1x 10M = 10 marks)
Attempt any ONE essay question of the following