

B.Sc., Biotechnology: Choice based Credit System

| Semester | Course Code | Title of course | Number of Credits | Number of teaching hrs | Marks | | |
|----------|-------------|---|-------------------|------------------------|----------|-----|-------|
| | | | | | Internal | SEE | Total |
| II | BTT- 201 | Macromolecules and metabolism | 3 | 5 | 25 | 75 | 100 |
| II | BTP- 202 | Macromolecules and enzymology lab | 2 | 2 | 0 | 50 | 50 |
| III | BTT-301 | Biophysical Techniques | 3 | 5 | 25 | 75 | 100 |
| III | BTP-302 | Metabolism and Biophysical Techniques lab | 2 | 2 | 50 | 75 | 50 |
| IV | BTT- 401 | Immunology | 3 | 5 | 25 | 75 | 100 |
| IV | BTP- 402 | Immunology lab | 2 | 2 | 0 | 50 | 50 |

B. Sc. SEMESTER II

BTT- 201 MACROMOLECULES, ENZYMOLOGY AND BIOENERGETICS

UNIT I

Nucleic Acids and Chromosomes: Chemical structure and base composition of nucleic acids, Chargaff's rules, Watson Crick Model (B-DNA), deviations from Watson-Crick model, other forms of DNA (A- and Z-DNA), forces stabilizing nucleic acid structures, (hydrogen bonds and hydrophobic associations, base stacking).

UNIT II

Amino acids and Proteins: Structure of amino acids occurring in proteins, classification of amino acids (pH based, polarity based and nutrition based physico-chemical properties of amino acids. Primary, Secondary, Tertiary & Quaternary structure of proteins.

UNIT III:

Carbohydrates: Definition, classification, nomenclature of carbohydrates, structures of monosaccharides, disaccharides and polysaccharides. Concept and examples of heteropolysaccharides.

Lipid: Types of lipids, structures of saturated and unsaturated fatty acids, triglycerides, phospholipids, Concept of acid value, saponification value and iodine value. Chemistry of Porphyrines, Heme, Cytochromes, and Chlorophylls

UNIT IV

Enzymes: Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc. Classification and nomenclature of enzymes. Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity), lock and key and induced fit models.

Enzyme kinetics: Michaelis-Menten equation, effect of substrate concentration, effect of enzyme concentration, effect of pH and temperature, temperature. Enzyme inhibition kinetics (reversible inhibition types – competitive, uncompetitive and non-competitive), brief idea of irreversible inhibition.

UNIT V

Bioenergetics: Concept of free energy, Entropy, Enthalpy & Redox Potential. Concept of high energy bonds as related to the structure of ATP, Phosphoenolpyruvate, Creatine phosphate etc. Glycolysis (pathway, entry of other monosachharides and disaccharides, regulation, inhibitors) Gluconeogenesis: Bypass reactions. Structure of mitochondria.

PRACTICALS: BTP- 202 MACROMOLECULES & ENZYMOLOGY

1. Qualitative estimation of Carbohydrates
2. Qualitative estimation of Amino acids
3. Quantitative Estimation of proteins by Biuret method
4. Estimation of DNA by Diphenylamine method
5. Estimation of RNA by Orcinol method
6. Quantitative estimation of sugars (Dinitrosalicylic acid method).
7. Estimation of glucose by Benedict's quantitative method
8. Quantitative estimation of proteins by Lowry's method.

9. Determination of saponification value of Fats
 10. Determination of Acid Value of Fats
 11. Immobilization of enzymes / cells by entrapment in alginate gel 19. Effect of temperature / pH on enzyme activity
 12. Assay of protease activity.
 13. Assay of alkaline phosphatase
 14. Preparation of starch from Potato and its hydrolysis by salivary amylase
 15. Isolation of urease and demonstration of its activity
- * **Minimum of Ten practical's are mandatory**

B.Sc., SEMESTER III
BTT- 301: BIOPHYSICAL TECHNIQUES

UNIT – I:

Spectrophotometry: Spectrum of light, absorption of electromagnetic radiations, Beer's law - derivation and deviations, extinction coefficient. Instrumentation of UV and visible spectrophotometry, Double beam spectrometer; dual-wavelength spectrometer, Applications of UV and visible spectrophotometry. Spectrofluorometry: principle, instrumentation and applications. Absorption & emission flame photometry: principle, instrumentation and application.

UNIT II:

Chromatography: Partition principle, partition coefficient, nature of partition forces, brief account of paper chromatography. Thin layer chromatography and column chromatography. Gel filtration: Concept of distribution coefficient, types of gels and glass beads, applications. Ion-exchange chromatography: Principle, types of resins, choice of buffers, applications including amino acid analyzer. Affinity chromatography: Principle, selection of ligand, brief idea of ligand attachment, specific and non-specific elution, applications. HPLC

UNIT III

Electrophoresis: Migration of ions in electric field, Factors affecting electrophoretic mobility. Paper electrophoresis, Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels Detection, Recovery & Estimation of macromolecules. SDS-PAGE Electrophoresis and applications. Isoelectric focusing, Pulsed-field gel electrophoresis.

UNIT – IV:

Isotopic tracer technique: Radioactive & stable isotopes, rate of radioactive decay. Units of radioactivity. Measurement of radioactivity: - Ionization chambers, proportional counters, Geiger- Muller counter, Solid and liquid scintillation counters (basic principle, instrumentation and technique), Cerenkov radiation. Measurement of Stable isotopes: Falling drop method for deuterium measurement, Mass spectrometry. Principles of tracer technique, advantages and limitations, applications of isotopes in biotechnology (distribution studies, metabolic studies, isotope dilution technique, metabolic studies, clinical applications, autoradiography).

UNIT V:

Centrifugation: Basic principles, concept of RCF, types of centrifuges (clinical, high speed and ultracentrifuges). Preparative centrifugation: Differential and density gradient centrifugation, applications (Isolation of cell components). Analytical centrifugation: Sedimentation

coefficient, determination of molecular weight by sedimentation velocity and sedimentation equilibrium methods.

Biostatistics Basic concepts of mean, median, mode, Standard deviation and Standard error.
Introduction to ANOVA

PRACTICALS : B T P : 3 0 2 - METABOLISM & BIOPHYSICAL TECHNIQUES

1. Spectrophotometric analysis of DNA denaturation.
2. Determination of absorption spectrum of oxy- and deoxyhemoglobin and methemoglobin.
3. Protein estimation by E280/E260 method.
4. Paper chromatography of amino acids/sugars.
5. TLC of sugars/amino acids.
6. Cellular fractionation and separation of cell organelles using centrifuge.
7. Isolation of mitochondria and assay of marker enzyme.
8. Estimation of Urea by diacetyl monoxime method.
9. Estimation of Sugars by Folin Wu method
10. Validity of Beer's law for colorimetric estimation of creatinine.
11. Absorption spectrum of NAD & NADH
12. Preparation of standard buffers and determination of pH of a solution
13. Titration of a mixture of strong & weak acid
14. Paper electrophoresis of proteins
15. Gel electrophoresis of proteins.
16. SDS-PAGE of an oligomeric protein.
17. Calculation of mean, median, and mode (manual/computer aided).
18. Calculation of standard deviation and standard error (manual/computer aided).
19. Biostatistical problem based on standard deviation.

Note: - Mandatory to perform atleast 10 practicals

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B. Sc. SEMESTER IV BTT-401: IMMUNOLOGY

UNIT I

Immune system: Organs and cells of immune system Immunity, innate immune mechanism, Acquired immune mechanism, Antigen, Humoral immunity, main pathways of complement system.

UNIT II

Antibody and Antigen: Antibody structure and classes, Antibody diversity, Types of Antigens Antigenicity (factors affecting antigenicity). Complement system .

UNIT III

Immunity: Cell mediated immunity: TC mediated immunity, NK cell mediated immunity, ADCC, brief description of cytokines and MHC (MHC types and diversity)

UNIT IV

Hypersensitivity and vaccination : General features of hypersensitivity, various types of hypersensitivity, Vaccination: Discovery, principles, significance, Types of Vaccines

UNIT V

Immunological Techniques:Antigen-antibody reactions: Precipitation, agglutination, complement fixation, immunodiffusion, ELISA. Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.

PRACTICALS: BT- 402 IMMUNOLOGY & BIOPHYSICAL TECHNIQUES

1. Antigen – antibody reaction – determination of Blood group , Cross reactivity
2. Pregnancy test
3. Widal test
4. Ouchterloney immunodiffusion
5. Radial immunodiffusion
6. ELISA
7. Isolation of casein by isoelectric precipitation
8. Production of antibodies and their titration

Note: - Mandatory to perform atleast 6 practicals