### BIOTECHNOLOGY

**SEE: Semester End Examination** -

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Title of course</th>
<th>Number of Credits</th>
<th>Number of teaching hrs</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BT 101</td>
<td>Microbiology and cell biology</td>
<td>4</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
ACHARYA NAGARJUNA UNIVERSITY :: NAGARJUNANAGAR-522 510

BIOTECHNOLOGY
B. Sc. Semester Syllabus
Semester based credit system(CBCS)
B. Sc. Part II – Semester I
BIOTECHNOLOGY
(With effect from academic session 2015-16)

1) The examination shall comprise one theory paper, an Internal assessment and a practical, in each semester up to fourth semester. Each theory paper shall be of three hours duration and carry 100 marks. The practical shall be of 6 hours duration and carry 100 marks. Internal assessment shall carry 25 marks.

<table>
<thead>
<tr>
<th>Theory Paper (Semester end examination, SEE)</th>
<th>75 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (Semester end examination, SEE)</td>
<td>75 marks</td>
</tr>
<tr>
<td>Internal Assessment theory</td>
<td>25 marks</td>
</tr>
<tr>
<td>Internal Assessment practical</td>
<td>25 marks</td>
</tr>
</tbody>
</table>

-----------------------------------------------
Total - 200 marks per seven credits
Or 300 marks per 11 credits

2) The distribution of marks in practical shall be as follows.

[A] Experiments (SEE)                              75 marks
[B] Practical record                              10 marks
[C] Viva                                          05 marks
[D] Internal experiments                           10 marks

-----------------------------------------------
Total - 100 marks

3) The syllabus is based on four theory periods and three practical periods per week. Candidates are required to pass separately in theory, internal assessment and practical examination.

4) Students are expected to perform all the practicals mentioned in the syllabus.

5) Internal assessment: There shall be two internal assessments based on theory paper for 25 Marks each. The average of the two tests shall made to average of 25 marks. The Internal assessment shall be conducted by the University approved teachers in the relevant subjects. The internal assessment shall be done by the respective college one month prior to the final exam of each semester. The Marks shall be sent to the university immediately after the internal assessment is over.

6) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method teacher / department / college propose to adopt a scheme of marking for internal assessment.

7) The internal assessment marks assigned to each theory paper shall be awarded on the basis of attendance / home assignment / class test / Project assignment / seminar / any other innovative practice / activity.

8) The concerned teacher / department / college shall have to keep the record of all the above activities till six months after the declaration of result of that semester.

9) In the fifth and sixth semesters two theory courses and one practical course shall be opted by the students. The practical course shall consist of experiment of two theory courses.

* * * * * *
UNIT I
History, Development and Microscopy

UNIT II
A. Bacteria:
Bacterial morphology and subcellular structures, general morphology of bacteria, shapes and sizes, generalized diagram of typical bacterial cell. Slime layer and capsule, difference between the structure, function and the position of the two structures. Cell wall of gram +ve and Gram -ve cells, Prokaryotic classification. General account of flagella and fimbriae. Chromatin material, plasmids; definition and kind of plasmids (conjugative and non-conjugative) F, R, and Col plasmids.

A brief idea Bergey’s manual. Morphology of archaea, archaecal cell membrane (differences between bacterial and archaecal cell membrane), other cell structures, concept of the three distinct archaea groups.

B. Viruses: General characteristics of viruses, difference between virus and typical microbial cell, structure, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, phage and animal cell viruses, example of each and their importance. Brief idea of lytic cycle and lysogeny.

UNIT III
Microbial Nutrition: Basic nutritional requirements: Basic idea of such nutrients as water, carbon, nitrogen, sulfur and vitamins etc., natural and synthetic media, nutritional classification of bacteria. Selective and Differential media, Enriched media, Enrichment media.

UNIT IV: Microbial growth and control:
Growth: Growth rate and generation time, details of growth curve and its various phases. Concept of synchronous cultures, continuous and batch cultures (chemostat and turbidostat). Measurement of growth. Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), pH etc. Pure cultures and cultural characteristics. Maintenance of pure culture.

Microbial Control: Terminologies - Sterilization, disinfection, antiseptic, sanitization, germicide, microbiostasis, preservative and antimicrobial agents. Mechanism of cell injury: Damage to cell wall, cell membrane, denaturation of proteins, inhibition of protein synthesis, transcription, replication, other metabolic reactions and change in supercoiling of DNA. Physical control: Temperature (moist heat, autoclave, dry heat, hot air oven and incinerators), dessication, surface tension, osmotic pressure, radiation, UV light, electricity, ultrasonic sound waves, filtration. Chemical control: Antiseptics and disinfectants (halogens, alcohol, gaseous sterilization. Concept of biological control.

UNIT V Cell Biology
Eukaryotic Cell - Structure and function of the following: nucleus, nuclear membrane, nucleoplasm, nucleolus, golgi complex, Mitochondria, Chloroplast, endoplasmic reticulum, lysosomes, peroxisomes, glyoxisomes and vacuoles.

Plant cell wall.

Cytoskeleton (Micro and Macro filaments, microtubules) and cell locomotion. Mitosis and meiosis. Brief idea of cell cycle.

Muscle and nerve cell structure, synaptic transmission and neuromuscular junctions.

ACHARYA NAGARJUNA UNIVERSITY :: NAGARJUNANAGAR-522 510

I B.Sc.
SEMESTER PRACTICALS
Biotechnology
102 Microbiology & Cell Biology

1. Demonstration, use and care of microbiological equipments.
2. Preparation of media, sterilization and isolation of bacteria.
3. Isolation of Bacteriophage from sewage / other sources.
4. Demonstration of motility of Bacteria.
5. Simple staining of bacteria
6. Gram staining of Bacteria
7. Acid fast staining of Bacteria
8. Endospore staining.
9. Demonstration of starch hydrolysis by bacterial cultures
10. Growth of fecal coliforms on selective media.
11. Isolation of pure culture by pour plate method
12. Isolation of pure culture by streak plate method.
17. To study germicidal effect of UV light on bacterial growth.

Note: - Mandatory to perform at least ten practical.

* * * * *
B.Sc., Biotechnology: Choice based Credit System

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Title of course</th>
<th>Number of Credits</th>
<th>Number of teaching hrs</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BTT- 201</td>
<td>Macromolecules and metabolism</td>
<td>3</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>BTP- 202</td>
<td>Macromolecules and enzymology lab</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>BTT-301</td>
<td>Biophysical Techniques</td>
<td>3</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>BTP-302</td>
<td>Metabolism and Biophysical Techniques lab</td>
<td>2</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BTT- 401</td>
<td>Immunology</td>
<td>3</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>BTP- 402</td>
<td>Immunology lab</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

B. Sc. SEMESTER II
BTT- 201 MACROMOLEULES, ENZYMOLGY 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

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 Porphyryines, Heme, Cytochromes, and Chlorophylls

UNIT IV
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 & ENZYMEOLOGY**

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
7. Estimation of glucose by Benedict’s quantitative 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
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:**

**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.
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
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).

**Note:** - Mandatory to perform atleast 10 practicals

* * * * * * *

**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 Antigenecity (factors affecting antigenecity). 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