



**4-Year Bachelor of Technology (B.Tech.) Curriculum and  
Syllabus for Biotechnology  
Third Semester**

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
<b>Theory</b>					
TIU-UEN-T201	CAREER ADVANCEMENT & SKILL DEVELOPMENT	1	0	2	3
TIU-UBT-T203	MICROBIOLOGY	3	0	0	3
TIU-UBT-T205	BIOCHEMISTRY	3	0	0	3
TIU-UBT-T207	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	3
TIU-UBT-T209	MOLECULAR BIOLOGY	3	0	0	3
TIU-UBT-T212	CELL BIOLOGY	3	0	0	3
<b>Practical</b>					
TIU-UBT-L203	MICROBIOLOGY LABORATORY	0	0	2	2
TIU-UBT-L205	BIOCHEMISTRY LABORATORY	0	0	2	2
TIU-UBT-L207	LABORATORY SAFETY AND MANAGEMENT	0	0	1	1
<b>Sessional</b>					
TIU-UBT-S299	INDUSTRIAL VISIT	0	0	1	1
TIU-UES-S299	ENTREPRENEURSHIP SKILL DEVELOPMENT	0	0	2	2
<b>Total Credits</b>					<b>26</b>



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## **MICROBIOLOGY**

**TIU-UBT-T203**

**L-T-P: 3-0-0**

**Credits 3**

**Module I:** Microbial taxonomy including modern approaches such as DNA homology and numerical taxonomy, staining and microscopy, classification of bacteria, introduction to virus, viroids, prion proteins.

**Module II:** Morphology and cell structure of prokaryotes and eukaryotes (bacteria, fungi, algae and viruses), bacterial growth and reproduction, bacterial genetics (transformation, conjugation and transduction), mutation, bacterial growth and reproduction, sporulation and cell differentiation, microbial metabolism: nutrition; media and methods; Antibiotics.

**Module III:** Nitrogen Sulphur and Phosphorus cycle. Air, water and soil microbiology. Common microbial diseases.

## **BIOCHEMISTRY**

**TIU-UBT-T205**

**L-T-P: 3-0-0**

**Credits: 3**

**Unit I: Introduction to biochemistry:** pH, buffer, classical thermodynamics, entropy, enthalpy, Gibbs free energy.

**Unit II: Structure function of biomolecules:** Composition, structure and function of biomolecules: nucleic acids (A, B, Z forms), amino acids, proteins (Ramachandran plot, folding secondary, tertiary and quaternary structure; domains; motif and folds (Myoglobin, Hemoglobin, Lysozyme, Ribonuclease A, Carboxypeptidase and Chymotrypsin), carbohydrates, lipids, hormones and vitamins.

**Unit III: Metabolism of biomolecules:** Metabolism: carbohydrates (glycolysis, citric acid cycle and oxidative phosphorylation, lipid, amino acid and nucleotide metabolism, photosynthesis.



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## **ENVIRONMENTAL BIOTECHNOLOGY**

**TIU-UBT-T207**

**L-T-P: 3-0-0**

**C**

**redits: 3**

**Module: Introduction:** Biodiversity and Conservation. Environment and environmental pollution from chemical process industries, characterization of emission and effluents, environmental laws and rules, standards for ambient air, noise, emission and effluents, use of GIS and remote sensing in environmental monitoring, environment and forestry

**Module II: Bioremediation:** Bioremediation: definition; types; notable examples; bioremediation of xenobiotics present in environment, biodegradation: biodegradation of pollutants by microorganisms, biotransformation reaction, bioremediation of hydrocarbons and heavy metals from environment

**Module III: Pollution control:**

**Air Pollution and its control:** Particulate emission control by mechanical separation and electrostatic precipitation, wet gas scrubbing, gaseous emission control by absorption and adsorption, design of cyclones, ESP, fabric filters and absorbers.

**Water Pollution and its Control:** Sources of water pollution waste water management by physical, chemical and biological methods, pre-treatment, solids removal by setting and sedimentation, filtration centrifugation, coagulation and flocculation; activated sludge and lagoons, trickling filter.

**Soil pollution and its control:** Application of different ex situ and in situ methods of remediation, solids waste disposal - composting, landfill, briquetting/gasification and incineration

## **MOLECULAR BIOLOGY**

**TIU-UBT-T209**

**L-T-P: 3-0-0**

**Credits: 3**

**Unit I: DNA replication, repair and recombination:** Hershey Chase Experiment, Messelson and Stahl Experiment, Unit of replication, enzymes involved, replication origin, replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms.



**Unit II: RNA synthesis and processing:** Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

**Unit III: Protein synthesis and processing:** Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA,

tRNA identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post-translational modification of protein.

## CELL BIOLOGY

TIU-UBT-T212

L-T-P: 3-0-0

Cred

its: 3

**Unit I:** Structure of cell: Cell wall and cell membrane, cellular organelles (nucleus, mitochondria, golgi apparatus, ER, lysosomes etc) and their structure and function.

**Unit II:** Cell cycle and check points, cell division, chromosomes and chromatin structure.

**Unit III:** Brief introduction to cancer and stem cells.

## MICROBIOLOGY LABORATORY

TIU-UBT-L203

L-T-P: 0-0-2

Credits: 2

- Preparation of media and slants for bacterial culture
- Isolation of pure culture in slant techniques and by streak plate techniques
- Dilution plating for viable count
- Simple staining and gram staining of bacteria
- Biochemical Characterization of Bacteria: Catalase, Oxidase and Urease Tests,
- Antibiotic Assay (Disc Diffusion Method)



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## **BIOCHEMISTRY LABORATORY**

**TIU-UBT-L205**

**L-T-P: 0-0-2 Credits: 2**

- Concept of Normality, Molarity, Molality, Percentage solutions and their inter-conversion
- Operation of pH meter and pH buffers
- Isoelectric point determination of amino acids
- Introduction to spectrophotometer, absorption maxima
- Estimation of nucleic acids, amino acids, proteins, carbohydrates and fats
- Separation of amino acids by Paper chromatography and TLC

## **LABORATORY SAFETY AND MANAGEMENT**

**TIU-UBT-L207**

**L-T-P: 0-0-1**

**Credits: 1**

- Chemical and Reagent Grouping
- Personal Safety
- Standard Operating Principles
- Chemical Safety
- Biological Safety

## **Book list**

### **Biochemistry**

- 1. Principles of Biochemistry (2008). Lehninger A.L. (ed.)**
- 2. Biochemistry. (2002). Stryer, L.**
- 3. Principles of Biochemistry. (1995). Zubay, G.L., Parson, W.W. & Vance, D.E.**
- 4. Harper's Biochemistry.(1990). Murray, R.K. et al**
- 5. Biochemistry. (2004). Voet, D. & Voet J.G.**
- 6. Biochemistry and Molecular Biology.(2005). Elliott, W.H. & Elliott, D.C.**
- 7. Fundamentals of Biochemistry. (1999). Voet, D., Voet, J.G & Pratt, C.W.**
- 8. Introduction to Protein Structure (1999). Branden C. & Tooze J.**



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## **Fundamentals of Microbiology**

- 1. Brock's Biology of microorganisms. (2007). Madigan, M., Martinko & Parker, J. Pearson Prentice Hal**
- 2. Microbiology: Fundamentals and Applications. (1989). Atlas, R.M.**
- 3. Microbiology (1996). M J Pelezar, Chan E C S and Krige**
- 4. Industrial Microbiology. (1987). G Reed, Prescott & Dunn, CBS Publishers.**
- 5. General Microbiology. (1987). Stanier, R.Y., Ingraham, Wheelis and Painter**

## **Environmental Biotechnology**

- 1. Environmental Biotechnology Theory and applications – Evans et al., 2000.**
- 2. Environmental Biotechnology – Gareth M. Evans et al., 2003**
- 3. Biotechnology, Recombinant DNA Technology, Environmental Biotechnology – S. Mahesh et al., 2003**

## **Molecular Biology**

- 1. Genes X (2010). Lewin, B.**
- 2. Essential Genes (2006) Lewin.**
- 3. Essential Genetics: A genome perspective. Hartl and Jones. (4th Edition)**
- 4. Principle of Genetics. Gardner, E.J., Simmons, M.J. & Snustad, D.P. (8th Edition)**
- 5. Genetics (2002). Strickberger, M**
- 6. Molecular Biology of the Cell (2002) Alberts. et al.**
- 7. Molecular Biology of the Gene (2008) Watson et al.**
- 8. Cell and Molecular Genetics (1987) Schlesf, R.**
- 9. Microbial Genetics (2006). S. Maloy, J. Cronan Jr and Friefelder, D**
- 10. Concept of Genetics (2002). Klug, W.S. & Michael, R & Cummins, M.R.**

## **CELL BIOLOGY**

- 1. Molecular Biology of the Cell (2002) Alberts. et al.**
- 2. Molecular Biology of the Gene (2008) Watson et al.**
- 3. Cell and Molecular Genetics (1987) Schlesf, R.**