



**5-Year Integrated Master of Technology (Integrated. M.Tech.) Curriculum and  
Syllabus for Biotechnology  
Fourth Semester**

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
<b>Theory</b>					
TIU-UEN-T200	CAREER ADVANCEMENT & SKILL DEVELOPMENT	1	0	2	3
TIU-UBT-T202	GENETIC ENGINEERING	3	0	0	3
TIU-UBT-T204	IMMUNOTECHNOLOGY	3	0	0	3
TIU-UBT-T206	BIOPROCESS ENGINEERING	3	0	0	3
TIU-UBT-T214	NANOTECHNOLOGY	3	0	0	3
<b>Practical</b>					
TIU-UBT-L202	GENETIC ENGINEERING LABORATORY	0	0	3	3
TIU-UBT-L204	IMMUNOTECHNOLOGY LABORATORY	0	0	3	3
<b>Sessional</b>					
TIU-UBT-S298	INDUSTRIAL VISIT	0	0	3	3
TIU-UES-S298	ENTREPRENEURSHIP SKILL DEVELOPMENT	0	0	2	2
<b>Total Credits</b>					<b>26</b>



**TECHNO INDIA UNIVERSITY**  
WEST BENGAL

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## **GENETIC ENGINEERING**

**TIU-UBT-T202**

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

**Credits: 3**

**Unit I:** Restriction and modification enzymes (types and mechanism of action), vectors and plasmids (bacteriophage, viral vectors, cosmids, Ti plasmid, YAC, BAC, mammalian and plant expression vectors), siRNA technology.

**Unit II: Polymerase chain reaction** and its types, random primers, cloning and expression, cDNA libraries, screening of cDNA and genomic libraries, synthesis and labeling of DNA and RNA probes, nick translation, end labeling, hybridization probe method, antibody screening, southern, western and northern hybridization.

**Unit III:** DNA sequencing-Maxam-Gilbert, Sanger's method and Deep sequencing, Site directed mutagenesis, genetic transformation, transgene silencing, RAPD, RFLP, AFLP.

**Unit IV:** Applications of genetic engineering: drug development, stability of enzymes (heat stability)

## **IMMUNOTECHNOLOGY**

**TIU-UBT-T204**

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

**Credits: 3**

**Unit I:** Introduction, innate and acquired immunity, active, passive and adoptive immunization, complement system, clonal selection theory, humoral and cellular Immunity, Regulation of Immune response, Cellular responses, primary and secondary lymphoid organs, activation and function of T and B cells, role of Major Histocompatibility Complex (MHC) in antigen processing and presentation.

**Unit II:** Infection and immunity, host defence against various classes of pathogen, mechanism by which pathogens evade immune responses, active and passive immunization.

**Unit III:** Transplantation, relationship between donor and recipient, role of MHC molecules in Allograft rejection, Autoimmunity, criteria and causes of autoimmune diseases-(Autoimmune



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hemolytic anemia, myasthenia gravis, systemic lupus erythematosus, multiple sclerosis, rheumatoid arthritis), hypersensitivity (Type I, II, III, IV), Immune Tolerance.

## **BIOPROCESS ENGINEERING**

**TIU-UBT-T206**

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

**Credits: 3**

**Unit I:** Basics on fermentation technology, different types of fermenters, Characteristics of fermentation broth and by-products, Optimization and modelling of fermentation process – single variable design, multivariate screening designs, critical factor analysis, optimization designs for two or more factor, singlet method; Metabolic and flux control analysis.

**Unit II:** Bioreactor design and operation: classification of reactors; Ideal mixed v/s plug flow reactor; designing parameters for reactors (stirred tank reactor, airlift reactor, plug flow reactor), rheology of fermentation broth, Bioreactor design and operation: gas-liquid mass transfer, heat transfer, analysis of dimensionless parameters and their application (aeration number, power number and Reynold's number; Scale-up of bioprocesses: parameters used in scale-up and problems associated with scale-up.

**Unit III:** Engineering principle of bio processing- Upstream production and downstream; Bioprocess design and development from lab to industrial scale; Microbial, animal and plant cell culture platforms.

## **NANOTECHNOLOGY**

**TIU-UBT-T214**

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

**Credits: 3**

**Unit I:** Introduction to nanoscience and nanotechnology; Concept of 3D, 2D, 1D and 0D nano particles and their behaviour, Different important types of nanoparticles: Quantum Dot, Nanowire, Nanotube, Nanocage, Buckminster fullerene etc. Synthesis and characterization of nanoparticles and nano-structured machinery, Top Down and Bottom Up Approach, Scanning probe microscopy (SPM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM). Photoreceptors as single photon optical detector; manipulating redox systems application in nanotechnology.



**Unit II:** Introduction to Bio-nanotechnology, naturally found nanoparticles, Molecular motors: natural molecular motors like myosin, kinesin, dynein, flagella, ATP synthase, RNA and DNA helicases, topoisomerases etc. Ion channels as molecular switches.

**Unit III:** Introduction to Nanomedicine, Application of Nanomedicine; Biosensors; Biodegradable nanoparticles for drug and gene delivery to cells and tissues: liposome, dendrimer, gold nano particle, silver

nano particle. Smart Drugs, DNA based nano devices, Nanorobotics, Nanomedical Diagnosis and treatment. Improved Human Abilities; Chromosome Replacement Therapy.

## **GENETIC ENGINEERING LABORATORY**

**TIU-UBT-L202**

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

**Credits: 3**

- Isolation of genomic DNA from bacteria
- PCR amplification of GOI
- Miniprep isolation of plasmid DNA
- Restriction digestion of plasmid DNA and agarose gel electrophoresis of restriction digests and PCR products
- Cloning of PCR product into the isolated plasmid and transformation
- Identification and characterization of transformed colonies

## **IMMUNOTECHNOLOGY LABORATORY**

**TIU-UBT-L204**

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

**Credits: 3**

- Blood grouping
- Assessment of antigen similarity using Ouchterlony double diffusion test.
- DOT ELISA test
- Quantitative ELISA
- Immuno-electrophoresis
- Western Blotting



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## **BOOK LIST**

### **GENETIC ENGINEERING**

1. Principles of gene manipulations (1996) Old.R.W. & Primrose, S.B.
2. The basic principles of gene cloning (1996). Brown, T.A.
3. An introduction to Genetic engineering.(1994). Nicholl, D.S.T.
4. Recombinant DNA. (1992). Watson et al.
5. Genetic engineering fundamentals: An introduction to principles & applications. (1989). Kammermeyer, K. & Virginica, C.
6. From Genes to Clones: Introduction to Gene Technology. (1987). Winnacker, E.L.

### **IMMUNOTECHNOLOGY**

1. Essential Immunology (2005) Roitt I.M. and Delves P.J.
2. Immunology – Roitt I, Bostoff J. & Male D.
3. Immunology (2006) Luttman M, Bratke K, Kupper M & Myrtek D.
4. Immunology (2007) Goldsby R.A., Kindt T.J., Osbrne B.A. and Kubly J.

### **BIOPROCESS ENGINEERING**

1. Encyclopedia of bioprocess technology. Vol 1-5. (1999). Flickinger, M.C. & Drew, S.W.(Ed).
2. Fermentation technology. (1994). Cassida.
3. Bioprocess engineering: Down stream processing & recovery of bioproducts, safety in biotechnology and regulations. (1990). Behrens, D. & Kramer, P.(Ed)

### **NANOTECHNOLOGY**

1. A introduction to Nanoscience and Nanotechnology.(PHI). K.K.Chattopadhyay and A.N.Banerjee
2. Nanophysics And Nanotechnology An Introduction To Modern Concepts In Nanoscience Second Updated And Enlarged Edition Pb 2013 By Wolf L E. Wiley India books, WOLF L E books, Technology and Engineering Books online, buy Technology and Engineering Books, Technology and Engineering Books india, Technology and Engineering