



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

Six Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UBT-T300	CAREER ADVANCEMENT & SKILL DEVELOPMENT(BIO-COMPUTING II)	1	0	2	3
TIU-UBT-T314	PLANT BIOTECHNOLOGY	3	0	0	3
TIU-UBT-T316	MEDICAL BIOTECHNOLOGY	2	1	0	3
TIU-UBT-T318	REGULATION OF GENE EXPRESSION	3	0	0	3
TIU-UBT-T322	BIOMATERIALS AND TISSUE ENGINEERING	3	0	0	3
Practical					
TIU-UBT-L312	BIOPHYSICAL INSTRUMENTATION LABORATORY	0	0	3	3
TIU-UBT-L314	PLANT BIOLOGY LABORATORY	0	0	3	3
Sessional					
TIU-UBT-S398	INDUSTRIAL VISIT	0	0	3	3
TIU-UES-S398	ENTREPRENEURSHIP SKILL DEVELOPMENT	0	0	2	2
Total Credits					26



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WEST BENGAL

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PLANT BIOTECHNOLOGY

TIU-UBT-T314

L-T-P: 3-0-0

Credits: 3

Unit I: Plant tissue culture and somatic cell genetics: Introduction to plant tissue culture: Tissue culture

Media; Initiation and maintenance of callus and suspension cultures; single cell clones, micropropagation (production of pathogen free plants).

Unit II: Plant regeneration pathways—Organogenesis and Somatic embryogenesis; Endosperm culture and triploid production; Anther and pollen culture, and production of haploid and doubled haploid plants; Protoplast culture and fusion, Somatic hybrids; Organelle transfer and cybrids, hairy root culture and secondary metabolites, cryopreservation and production of synthetic seeds.

Unit III: Gene transfer (Agrobacterium and Ti plasmid and gene gun), Pseudomonas, and transgenic crop development. Marker assisted breeding: Introduction - molecular markers as new efficient tools in breeding, Molecular markers for genome mapping: Principles of genetic linkage, concept of genetic distance, development and choice of mapping populations, linkage map construction.

MEDICAL BIOTECHNOLOGY

TIU-UBT-T316

L-T-P: 3-0-0

Credits: 3

Unit I: An introduction to medical biotechnology: Biotechnology and health care; Basic human physiology; Definition of disease and its types: Genetic disease, Metabolic disease, Immune system malfunction and disease, Hormonal disease, Vitamin and minerals deficiency diseases.

Unit II: Biochemical and Molecular Diagnostics: Different biochemical test using protein and enzyme markers and their interpretation. e.g. Liver function test, kidney function test, blood sugar test, hormone assay etc. Molecular diagnostics: PCR based detection, Microarray, Protein profiling by HPLC, FACS, ELISA. Prenatal diagnosis - Invasive techniques - Amniocentesis, Fetoscopy, Chorionic Villi Sampling (CVS), Non-invasive techniques -Ultrasonography, X-ray, TIFA, maternal serum and fetal cells in maternal blood.



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Unit III: Molecular therapy: Gene therapy: DNA based vaccine, RNA based therapeutics, Antisense therapeutics; Enzyme therapy; Hormone therapy; Cytokine therapy; Monoclonal Antibody therapy. An introduction to stem cell therapy and regenerative medicine.

REGULATION OF GENE EXPRESSION

TIU-UBT-T318

L-T-P: 3-0-0

Credits: 3

Unit I: Regulation of Prokaryotic Transcription and Translation: Lessons from bacteria; lac, trp, and ara operons; control of lysis and lysogeny in lambda phage; gene regulation in yeast - gal operon.

Unit II: Epigenetic control mechanisms: Histone modifying enzymes and their functions, enhancers, silencers, MNase Digestion.

Unit III: Techniques: Gel retardation assays, reporter gene assays, primer extension, S1 nuclease mapping assays, DNA fingerprinting, qPCR/RT-PCR, Y-2-H, Phage Display, Co-IP, ChIP, Western Blotting, ELISA, Microarray, Flowcytometry, SAGE.

BIOMATERIALS AND TISSUE ENGINEERING

TIU-IBT-T322

L-T-P: 3-0-0

Credits: 3

Module I: History and fundamentals of tissue engineering: Complexity and organization of the vertebrate body, Cell source, Tissue dynamics & cell migration, Stem Cells & TE, Biomaterials for tissue engineering, Biodegradable materials, Tissue engineering examples: Bone & Cartilage Tissue Engineering

Definition of biomaterials – biologically derived materials or materials compatible with biology. Common biomaterials: some proteins, many carbohydrates and some specialized polymers. Collagen (protein in bone and connective tissues): Structure production and its use. Fibroin (protein in silk): Production and its use. Production of these proteins by conventional cloning methods.

Module II: Carbohydrates: Modified carbohydrates act as gas lubricants for biomedical applications; Polydextrose made from bacteria; Carbohydrates modified from enzymes; artificial wood.



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Module III: Biopolymers: Synthesis from a simple biological monomer (hyaluronate polymers); Dextrans (used in chromatography columns); Rubberlike materials produced by bacteria and fungi (Polyhydroxybutyrate PHB), Polycaprolactone (PCL); Production of a copolymer of PHB and PHV (polyhydrovaleric acid), sold as Biopol by fermentation on *Alcaligenes eutrophus*; Biodegradable polymers

BIOPHYSICAL INSTRUMENTATION LABORATORY

TIU-UBT-L312

L-T-P: 0-0-3

Credits: 3

Explanation of Principle, Parts and Demonstration of the following instruments

- Laminar Air Flow Cabinet: Horizontal and Vertical
- Microscope: Compound Microscope, Fluorescence Microscope, Electron Microscope
- Spectrophotometer: Single Beam, Double Beam, Fluorescence, AAS
- Chromatography: SEC, Affinity Chromatography, IEC, HPLC, HPTLC, GC
- PAGE: SDS-PAGE and Native PAGE and Western Blot
- Protein unfolding by tryptophan fluorescence

PLANT BIOLOGY LABORATORY

TIU-UBT-L314

L-T-P: 0-0-3

Credits: 3

- Explant selection, sterilization and inoculation
- Callus culture from meristematic tissue and induction of growth, suspension culture
- Anther and Pollen culture
- Estimation of biologically important plant products



BOOK LIST

REGULATION OF GENE EXPRESION

- 1. Cell and Molecular Biology (1996) Karp, G.**
- 2. Cell Biology (1993) Sadava D. E.**
- 3. Cell and Molecular Biology (1995) Kish
V. M. and Kleinsmith L.J.**
- 4. Cell and Molecular Biology :deRobertis
and deRobertis**

PLANT BIOTECHNOLOGY

- 1. Plant Tissue culture: Basic and applied (2006) T. Jha and B. Ghosh.**
- 2. Plant Biotechnology: Methods in tissue culture and gene transfer (2006). R.
Keshavachandra and K.V. Peter.**
- 3. Plant, cell, tissue and organ culture (2005) Gamborg and Phillips.**
- 4. Plant cell and Tissue culture.(2005). I Vasil and T. Thorpe.**
- 5. Plant tissue culture: Theory and practice- revised editions. Bhojwani
and MRajdan**
- 6. Plant cell & tissue culture. (1994). Vasil, I.K. & Thorpe, T.A.**

- 7. Plant tissue culture: Applications and limits. (1990). Bhojwani, S.S.**

MEDICAL BIOTECHNOLOGY

- 1. Diagnostic and Therapeutic Antibodies (Methods in Molecular Medicine by Andrew
J.T.George (Editor), Catherine E. Urch (Editor) Publisher: Humana Press;
edition (2000)**
- 2. Molecular Diagnosis of Infectious Diseases (Methods in Molecular Medicine) by
Jochen Decker, U. Reischl Amazon**
- 3. Human Molecular Genetics by T. Strachan, AndrewRead Amazon Sales Rank:**

TISSUE ENGINEERING

- 1. Ratledge C and Kristiansen B, Basic Biotechnology, Cambridge University Press,
2ndEdition, 2001**
- 2. Doi Y, Microbial Polyesters, VCH Weinheim, 1990**