PROGRAMME : B.E. Bio-Technology, VII Semester

Course: BT-701

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Inter Disciplinary DID-6	Animal Tissue Culture	BT-701	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 1

Course: Animal Tissue Culture

UNIT-I

Introduction to Animal Tissue Culture: Background, Advantages, Limitations, Application, Culture Environment, Cell Adhesion, Cell Proliferation, Differentiation.
Design, Layout and Equipment: Planning, Construction, Layout, Essential Equipments, Aseptic Technique, Objectives, Elements, Sterile Handling, Safety, Risk Assessment, General Safety, Fire, Radiation, Biohazards

UNIT-II

Media: Physicochemical Properties, Balanced Salt Solutions, Complete Media, Serum, Serum-Free Media, Disadvantages of Serum, Advantages of Serum-Free media
Primary Culture: Isolation of Tissue, Steps involved in primary cell culture, Cell Lines, Nomenclature, Subculture and Propagation, Immortalization of cell lines, Cell line designations, Routine maintenance

UNIT-III

Characterization & Quantitation of Cell Line: Need for characterization, Morphology, Chromosome Analysis, DNA Content, RNA and Protein, Enzyme Activity, Antigenic Markers, Transformation, Immortalization, Aberrant Growth Control, Tumorigenicity, Cell counting, DNA content, Protein, Rates of Synthesis, Cell Proliferation, Plating Efficiency, Labeling Index, Generation Time.
Contamination: Source of contamination, Type of microbial contamination, Monitoring, Eradication of Contamination, Cross-Contamination

UNIT-IV

Cryopreservation: Need of Cryopreservation, Preservation, Cell banks, Transporting cells
Cytotoxicity: Introduction, *In vitro* limitations, Nature of assay, Viability assay, Survival assay, Microtitration assay, Transformation assay
Transgenic Animals: Methodology, Embryonic Stem Cell method, Microinjection method, Retroviral vector method, Applications of transgenic animals

UNIT-V

Gene Therapy: *Ex-vivo* gene therapy, *In vivo* gene therapy, Viral gene delivery system, Retrovirus vector system, Adenovirus vector system, Adeno-Associated virus vector system, Herpex simplex virus vector system, Non-viral gene delivery system, Prodrug activation therapy, Nucleic acid therapeutic agents.
In Vitro **Fertilization and Embryo Transfer:** Composition of IVF media, Steps involved in IVF, Fertilization by means of micro insemination, PZD, ICSI, SUZI, MESA

Text / Reference Books:

1. Animal Cell Culture by John R.W. Masters, Oxford University Press
2. Introduction to Cell and Tissue Culture by Jennie P. Mather and Penelope E. Roberts, Plenum Press, New York and London
3. Molecular Biotechnology: Primrose.
4. Animal Cell Biotechnology: R.E. Spier and J.B. Griffiths (1988), Academic press.

PROGRAMME : B.E. Bio-Technology, VII Semester

Course: BT-702

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Inter Disciplinary DID-7	Bioinformatics	BT-702	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 2

Course: Bioinformatics

UNIT-I

The Internet and Biologist: Internet basics, FTP, Gopher, World wide web.
The Gen Bank Sequence Database: Introduction, Primary & Secondary databse, Format vs content: computer vs humans, GenBank Flat File dissection, GCG, ACDEB.
Structure Databases: Introduction to structures, PDB, MMDB, Structure file formats, Visualizing structural information, Database structure viewers.

UNIT-II

Information Retrieval from Biological Databases: Retrieving database entries, Integrated information retrieval: The entrez system, sequence databases beyond NCBI, Medical Databases
The NCBI Database: Introduction, SeqIDS, Bioseq: Sequences, Bioseqsets: Collections of sequences, Seq. Annot: Annotating the sequence, Seqdiscr: Describing the sequence
Sequence Alignment and Database Searching: Introduction, Evolutionary basis of sequence alignment, Optimal alignment methods, Substitution scores & gap penalties, Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements

UNIT-III

Multiple Sequence Alignment: Progressive alignment methods, Motifs and patterns, Hocks, MOST, Probe, Presentation methods, Abscript
Phylogenetic Analysis: Elements of phylogenetic models, data analysis: Alignment, substitution model building, tree building and tree evaluation, building methods, searching for trees, hooting trees, Evaluating trees and data, phylogenetic software Some simple practical consideration

UNIT-IV

Predictive Methods Using Nucleotide Sequence: Framework, marking repetitive DNA, Database search, Codon bias detection, Detecting function sites in the DM, Integrated gene passing, Finding tRMA genes

Predictive methods Using Protein Sequences: Protein identity based on composition, Propsearch, Physical properties based on sequences, secondary structure and folding classes, Sspread sopma, Specialized structures of features, Tertiary structure

UNIT-V

Genome Mapping: Different types of maps: physical, genetical, etc. Synteny, Humangenome project, Application of genome mapping, Chromosome maps.
Submitting DNA Sequences to the Databses: Introduction, Where to submit, what to submit, how to submit on the world wide web, how to submit with sequin.

Text / Reference Books:

1. Bioinformatics: A practical guide to the analysis of genes and proteins A.D. Baxevanis and B.F.F. Ouellette (Eds). John Wiley and Sons, 2002.
2. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.3 5
3. David W. Mount. Bioinformatics: Sequence and Genome Analysis 2nd Edition, CSHL Press, 2004.
4. A. Baxevanis and F. B. F. Ouellette, Bioinformatics: a practical guide to the analysis of genes and proteins, 2nd Edition, John Wiley, 2001.
5. Jonathan Pevsner, Bioinformatics and Functional Genomics, 1st Edition, Wiley-Liss, 2003.
6. P. E. Bourne and H. Weissig. Structural Bioinformatics. Wiley. 2003.
7. C. Branden and J. Tooze, Introduction to Protein Structure, 2nd Edition, Garland Publishing, 1999.

PROGRAMME : B.E. Bio-Technology, VII Semester

Course: BT-703

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core DC-14	**Commercialization, Marketing & Management of Biotechnology**	BT-703	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 3

Course: **Commercialization, Marketing & Management of Biotechnology**

UNIT-I

Why there is a need to commercialize biotechnology. Discovery, market needs, development process, success rates and costs etc.

Creating and marketing the image of the biotechnology Company. Art of negotiation & effective communication.

UNIT-II

Role of venture capitalism, business plan, selection of CEO and personnel, real estate for a biotech start-up.

How to portray management and role of a biotechnology manager, technology decisionmaking, and resource decision-making etc., Product marketing decision.

UNIT-III

Role of Research & development University-industry technology transfer arrangements, how and why a biotech company can benefit.

UNIT-IV

Positioning, power and importance of positioning of a company name and product, Workable marketing and the strength of distribution.

Effective advertising and marketing. Opportunities international, marketing and lessons to be learned.

UNIT-V

Indian and foreign prospective of biotechnology, and current challenges for the biotechnology based products.

Text / Reference Book:

1. Positioning by All Rise and Jack Trout (1986), Warner Books.
2. Biotechnology: The science & the business by V. Moser & R.E. Cape (1999) Harwood.
3. Latest review articles and papers on the subject.

PROGRAMME: B.E. Bio-Technology, VII Semester

Course: BT-704

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core Elective DCE-1	**Protein Biotechnology**	BT-704 Elective (i)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 4
Course: **Protein Biotechnology**

UNIT-I

Protein Structure: Introduction, Overview of protein structure, Higher level structure, Protein post-translational modification, Protein stability and folding.
Protein Sources: Introduction, Microorganisms as sources of proteins, Proteins from plants, Animal tissue as a protein source, Direct chemical synthesis, Conclusion.

UNIT-II

Protein Purification and Characterization: Introduction, Initial recovery of proteins, Removal of whole cells and cell debris Concentration and primary purification, Column chromatography, Protein inactivation and stabilization, Protein characterization.
Large-Scale Protein Purification: Some general principles, Therapeutic protein production: some special issues, Range and medical significance of impurities potentially present in protein-based therapeutic products, Labelling and packing of finished products.

UNIT-III

Therapeutic Proteins: Introduction, Blood products, Haemophilia A and B, Anticoagulants, Thrombolytic agents, Additional blood-related products, Vaccine technology, Vaccines for AIDS.

UNIT-IV

Interferons, Interleukins and Additional Regulatory Factors: Regulatory factors; cytokines versus hormones, Interferons, Interleukins, Tumour necrosis factors, Colonystimulating factors, Cytokine toxicity.
Therapeutic Antibodies and Enzymes: Introduction, Antibodies for in vivo application, Therapeutic enzymes.
Hormones and Growth Factors used Therapeutically: Introduction, Insulin, Glucagon, Gonadotrophins, Growth hormone, Erythropoietin, Other growth factors, Thyrotrophin, Corticotrophin, Prolactin, Peptide Regulatory Factors.

UNIT-V

Proteins Used for Analytical Purposes: Introduction, Enzymes as diagnostic/analytical reagents, Biosensors, Antibodies as analytical reagents.
Non-catalytic Industrial Proteins: Introduction, Functional properties of proteins, Milk and milk proteins, Animal and microbial proteins, Sweet and taste modifying proteins.

Text / Reference Books:

1. Proteins: Biochemistry and Biotechnology by Gary Walsh. (2002): John Wiley & Sons Ltd.
2. Fundamentals of Protein Biotechnology: Edited by Stanley Stein (1990): Marcel Dekker, Inc.

PROGRAMME: B.E. Bio-Technology, VII Semester

Course: BT-704

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core Elective DCE-2	**Human genomics**	BT-704 Elective (ii)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 4
Course: **Human genomics**

UNIT-I

Patterns of genome organization, Structural genomics, Functional genomics, Reverse genetics, Gene patenting.

UNIT-II

Electronic PCR, Genome mapping and genome sequencing, Specialized database in molecular biology.

UNIT-III

Human genome project, Human genome progress, Genes in health and disease, Genomic disorders and molecular medicine, Minimal cell Genome.

UNIT-IV

Transfer of Genes to Humans, Nucleic acids and Protein sequences database, Pharmacogenomics.

UNIT-V

Gene bank, Legal status of gene bank

Text / Reference Books:

1. H.D. Kumar, Molecular Biology,2nd edition, Vikas Publishing House pvt ltd.
2. Singer.M, and Berg.P – Genes and genomes, Blackwell Scientific Publication, Oxford ,1991
3. Beebe.T, and Burke.T, Gene Structure and Transcription, 2nd edition,1992, Oxford Univ Press

PROGRAMME: B.E. Bio-Technology, VII Semester

Course: BT-704

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core Elective DCE-3	**Proteomics**	BT-704 Elective (iii)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 4
Course: **Proteomics**

UNIT-I

Introduction: The proteome and the Genome, life and death of a protein , protein a modular structure functional protein famities deducing the protein for Genome Gene expression, codon Bias and Protein levels.

UNIT-II

Bridging genomics and proteomics: The generation of cDNA expression libraries, their robotic arraying, construction of PCR filters, generation of a nonredundant set by oligonucleotide fingerprinting, complex hybridizatino on DNA chips, Protein arrays. Genration of cDNA expression libraries, use of automated technolgoeis to generate protien arrays and chips, and the application of protein chips in proteomics, The characterization of the protein complement of a specific cell type or tissue at a certain time by high-resolution 2-DE, Bridging the current proteomics and genomic aproaches by mass spectrometry, Future perspectives and developments.

UNIT-III

Two-dimensional polyacrylamide gel electrophoresis for proteome analysis: Brief history of 2-DE, 2-DE with immobilized pH gradients, sample preparation, solubilization, Reduction, The first dimension: IEF with IPG, Equilibration between dimensions, The second dimension: SDS-PAGE, resolution, reproducibility of 2-DE, outlook.
Detecting proteins in polyacrylamide gels and on electroblot membranes: Organic dyes and silver stains, Reverse stains, Colloidal dispersion stains, organic fluorophore stains, metal chelate stains.

UNIT-IV

Mass spectrometry-based methods for protein identification and phosphorylation site analysis: Background to mass spectrometry, Correlative mass spectrometric-based identification strategies, *De novo* sequencing using mass spectrometric data, Separation methods for phosphorylation site analysis, present and future challenges and opportunities.
Image analysis of two-dimensional gels: Data acquisition, digital image procesing,

Protein spot detection and quantitation, Gel matching, Data analysis, data presentation, data bases.

UNIT-V

Enhancing high-throughput proteome analysis: the impact of stable isotope labeling: Sample preparation, two-dimensional gel separation and analysis, Mass spectrometry: protein identification using MS data, Mass spectrometry: protein identification using MS/MS data.
Applications of Proteome analysis: Mixing proteomes, protein expression profile, identification of protein-protein interactions and protein complexes, mapping proteins complexes, new approaches in proteomics.
Recent advances in Proteomics.

Text / Reference Books:

1. Proteomics: From Protein Sequence to Function by S.R. Pennington and M.J. Dunn. Viva Books. Private Limited (2001).
2. Introduction to Proteomics by Daniel C. Liebler. Humana Press 57

PROGRAMME : B.E. Bio-Technology, VII Semester

Course: BT-705

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core Elective DCE-1	**Concepts in Biomedical Engineering**	BT-705 Elective (i)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 5

Course: **Concepts in Biomedical Engineering**

Unit -I

Introduction to Biomedical Engineering

Historical prospective, Role of biomedical engineers in healthcare system, Professional status of biomedical engineering.

Anatomy, Physiology and Bioelectric Phenomena

Cellular organization, Tissue, Major organ system, Homeostasis, Neurons, Basic Biophysics tools and relationship, Equivalent circuit model for the cell membrane, Hodgkin-Huxley model of action potential

Unit -II

Modelling of Physiology System

Modelling of human regulatory systems, Modelling of body dynamics, computer aided modeling. Simulation & analysis of physiological system, Network representation & biomechanical analysis, Experimental approach to measurement of electrical, mechanical & chemical parameter of human body, Biomedical signal processing & Imaging modalities.

Unit -III

Compartmental Analysis

Introduction model postulates, Compartmental structure, Compartmental analysis, Convective transport between physiologic compartments.

Biomechanics

Principle of mechanics, Bone mechanics, Orthodental Electromechanical properties, Muscle mechanics, Monitory device.

Unit -IV

Biomaterial used in Medicines

Synthetic polymers, Biopolymers, Bioresorbable & bioerodible materials, metals, thin film grafts & coating, biological functional materials, Host reaction to biomaterials,

Implants, Polymers used in vascular prosthesis, Contact lense, Rconstructive materials, Cellular response to foreign materials.

Unit -V

Research Techniques in Biomedical Engineering
Simulation & analysis of physiological system, Network representation & biomechanical analysis, Experimental approach to measurement of electrical, mechanical & chemical parameter of human body, Biomedical signal processing & Imaging modalities.
Therapeutic Equipment
MRI, CT Scan, PET Scanner, Cardiac pacemaker & defibrillator, Electrical Nerve & muscle stimulator.

Text / Reference Books:

1. Introduction to Biomedical Engineering by John D. Enderle, Susan M. Blanchard, Joseph Bronzino, Academic Press.
2. Biomechanics Principle & Application by Daniel J. Schneck
3. Biomaterial & Bioengineering Handbook by Donald L. Wise
4. Biomedical Engineering Handbook Vol. 1 by Joseph D Brongino, CRC Press
5. Standard Handbook of Biomedical Engineering & Design by Myer Kutz.

PROGRAMME : B.E. Bio-Technology, VII Semester

Course: BT-705

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core Elective DCE-2	**Total Quality Management**	BT-705 Elective (ii)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 5
Course: **Total Quality Management**

Unit –I

Introduction: Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Unit –II

TQM Principles: Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

Unit –III

Statistical Process Control: The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

Unit –IV

TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

Unit –V

Quality Systems: Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

Text / Reference Books:

1. Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).
2. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
3. Feigenbaum.A.V. "Total Quality Management, McGraw-Hill, 1991.
4. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.
5. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
6. Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991.

PROGRAMME : B.E. Bio-Technology, VII Semester

Course: BT-705

CATEGORY OF COURSE	COURSE TITLE	COURSE CODE	CREDIT-4C			THEORY PAPER
Departmental Core Elective DCE-3	**Bio-reactor Design & Analysis**	BT-705 Elective (iii)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

COURSE CONTENTS

Branch: Biotechnology; Semester – VII; Paper – 5
Course: **Bio-reactor Design & Analysis**

Unit -I

Basic Principles: Recapitulation of the principles of Kinetics for chemical and Bio-chemical Reactions. Fundamentals of homogeneous reactions for batch, plug flow, semi-batch, stirred tank/ mixed reactors, adiabatic and programmed reactors.

Unit -II

Reactor Design: Types of reactors – batch, plug low reactor (PFR), continuous stirred rank reactors (CSTR), fluidized bed reactor bubble column, air lift fermenter etc.

Unit -III

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Analysis of Non-ideal Reactor Analysis: Concept of ideal and non-ideal reactor; residence time distribution; models of non-ideal reactors – plug flow reactor for microbial processes.

Unit -IV

Mass transfer in biochemical processes; Multiphase bioreactors – packed bed with immobilized enzymes or microbial cells; three – phase fuidized bed trickling bed reactor; Design and analysis of the above reactor systems; Gas liquid reactors, Reactor stability.

Unit -V

Unconventional bioreactors: Hollow fiber reactor, membrane reactor, perfusion reactor for animal and plant cell culture. Advanced Concepts: Scale up concepts, Bioprocess control and computer coupled bioreactors; Growth and product formation by recombinant cells.

Text / Reference Books:

1. Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern Ltd.
2. Bailey & Olis, Biochemical Engg. Fudamentals, MGH, 1990
3. Atkinson, B., Biological Reactors, Pion Ltd., London,1974