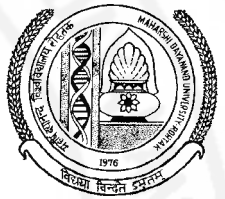
Maharshi Dayanand University
Rohtak



Syllabus and Courses of Reading for

M.Tech Bio-technology

Examination

Session - 2009-2010

Available from :

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M.D. UNIVERSITY, ROHTAK SCHEME OF STUDIES & EXAMINATION 1st YEAR TECH. IN BIOTECHNOLOGY, SEMETER I

EFFECTIVE FROM THE SESSION 2009-10

S.No.	Course No.	Subject	Teaching Schedule	Examination Schedule				
				Marks for		Credits for		
			L-T-P	Exam.	Sess	Exam.	Sess	Total
1.	BT-501	Engineering Principles in Biotech	4-0-0	100	50	4	2	6
2.	BT-503	Advanced Molecular Biology	4-0-0	100	50	4	2	6
3.	BT-505	Industrial Biotechnology	4-0-0	100	50	4	2	6
4.	BT-507	Immuno technology	4-0-0	100	50	4	2	6
5.	BT-509	Elective -I	4-0-0	100	50	4	2	6
6.	BT-511	Biotech Lab.-I	0-0-3	50	50	2	2	4
7.	BT-513	Biotech Lab.-II	0-0-3	50	50	2	2	4
	TOTAL			**600**	**350**	**24**	**14**	**38**

List of Electives I

S.No.	Code	Subject
1	BT-515	Biosensors
2	BT-517	Genomics & Proteomics
3	BT-519	Environmental Bitechnology
4	BT-521	Biosepration Engineering

Note 1. The paper setter will set each theory paper of 100 marks covering the entire syllabus however the examiner will evaluate the peroformance of the students in the theory course finally by assigning one of the grades out of A+, A, B, C, D, E and F. Examination of practical courses shall also be evaluated on the basis of grades.

2. The Sessionals of Theory and Practical courses shall also be evaluated on the basis of above grades.

3. For Grading system is defined at the end of the scheme of studies and examinations.

M.D. UNIVERSITY, ROHTAK SCHEME OF STUDIES & EXAMINATION 1st YEAR TECH. IN BIOTECHNOLOGY, SEMETER II

EFFECTIVE FROM THE SESSION 2009-10

S.No.	Course No.	Subject	Teaching Schedule	Examination Schedule				
				Marks for		Credits for		
			L-T-P	Exam.	Sess	Exam.	Sess	Total
1.	BT-502	Bioinformatics	4-0-0	100	50	4	2	6
2.	BT-504	Genetic Engineering	4-0-0	100	50	4	2	6
3.	BT-506	High Resolution techniques in Biotech	4-0-0	100	50	4	2	6
4.	BT-508	Elective-II	4-0-0	100	50	4	2	6
5.	BT-510	Elective-III	4-0-0	100	50	4	2	6
6.	BT-512	Biotech Lab.-III	0-0-3	50	50	2	2	4
7.	BT-514	Biotech Lab.-IV	0-0-3	50	50	2	2	4
	TOTAL			**600**	**350**	**24**	**14**	**38**

List of Electives II

S.No.	Code	Subject
1	BT-516	Food Processing Engineering
2	BT-518	Protein Engineering
3	BT-520	Animal Biotechnology
4	BT-522	Fermentation Technology

List of Electives III

S.No.	Code	Subject
1	BT-524	Bioreaction Engineering
2	BT-526	Reproductive genetics
3	BT-528	Clinical Genetics & Counselling
4	BT-530	Plant Metabolic Engineering
5	BT-532	Renewable Energy Technology

Note 1. The paper setter will set each theory paper of 100 marks covering the entire syllabus however the examiner will evaluate the peroformance of the students in the theory

course finally by assigning one of the grades out of A+, A, B, C, D, E and F. Examination of practical courses shall also be evaluated on the basis of grades.

2. The Sessionals of Theory and Practical courses shall also be evaluated on the basis of above grades.

3. For Grading system is defined at the end of the scheme of studies and examinations.

M.D. UNIVERSITY, ROHTAK SCHEME OF STUDIES & EXAMINATION 2nd YEAR TECH. IN BIOTECHNOLOGY, SEMETER III

EFFECTIVE FROM THE SESSION 2009-10

S.No.	Course No.	Subject	Teaching Schedule	Examination Schedule				
				Marks for		Credits for		
			L-T-P	Exam.	Sess	Exam.	Sess	Total
1.	BT-601	Advanced Plant Biotechnology	4-0-0	100	50	4	2	6
2.	BT-603	Advanced Biochemical Engg.	4-0-0	100	50	4	2	6
3.	BT-605	Elective-IV	4-0-0	100	50	4	2	6
4.	BT-607	Bio Tech. Lab.V	0-0-3	50	50	2	2	6
5.	BT-609	Bio Tech. Lab.VI	0-0-3	50	50	2	2	6
6.	BT-611	Seminar I	0-0-2	--	50	--	2	4
7.	BT-613	Dissertation Phase -I	0-0-6	--	100	--	4	4
	TOTAL			**400**	**400**	**16**	**10**	**32**

List of Electives IV

S.No.	Code	Subject
1	BT-615	Biotech Resource Planing & IPRs
2	BT-617	Biopharmaceutical tech.
3	BT-619	Process Control & Instrumentation
4	BT-621	Process Modelling & Simulation
5	BT-623	Stem Cells in Health care
6	BT-625	Nanotechnology
7	BT-627	Biomaterials
8	BT-629	Clinical Traits & Bioethics

Note 1. The paper setter will set each theory paper of 100 marks covering the entire syllabus however the examiner will evaluate the peroformance of the students in the theory course finally by assigning one of the grades out of A+, A, B, C, D, E and F. Examination of practical courses shall also be evaluated on the basis of grades.

2. The Sessionals of Theory and Practical courses shall also be evaluated on the basis of above grades.

3. For Grading system is defined at the end of the scheme of studies and examinations.

M.D. UNIVERSITY, ROHTAK SCHEME OF STUDIES & EXAMINATION 2nd YEAR TECH. IN BIOTECHNOLOGY, SEMETER IV

EFFECTIVE FROM THE SESSION 2009-10

S.No.	Course No.	Subject	Teaching Schedule	Examination Schedule				
				Marks for		Credits for		
			L-T-P	Exam.	Sess	Exam.	Sess	Total
1.	BT-602	Seminar-II	0-0-2	--	50	--	2	2
2.	BT-604	Dissertation Phase -II Final	0-0-26	500	100	20	4	24
	TOTAL			**500**	**150**	**20**	**6**	**26**

Note 1. The paper setter will set each theory paper of 100 marks covering the entire syllabus however the examiner will evaluate the peroformance of the students in the theory course finally by assigning one of the grades out of A+, A, B, C, D, E and F. Examination of practical courses shall also be evaluated on the basis of grades.

2. The Sessionals of Theory and Practical courses shall also be evaluated on the basis of above grades.

3. For Grading system is defined at the end of the scheme of studies and examinations.

M.D.UNIVERSITY, ROHTAK
SCHEME OF GRADING SYSTEM
M. TECH. BIOTECHNOLOGY, SEMESTER I -IV

The peformance of the students of M. Tech. Biotechnology course shall be graded on basis of percentage of marks and Corresponding grades as mentioned below :-

1.1 a)

Marks		Grade		Marks
85	≤	A+	≤	100
75	≤	A	<	85
60	≤	B	<	75
50	≤	C	<	60
40	≤	D	<	50
0	≤	E	<	40

Letter Grades	Performance	Division
A+	Excellent	First
A	Very Good	First
B	Good	First
C	Fair	Second
D	Pass	Third
E	Repeat	Fail

Note : The candidates who have passsed all the smetser examinations in the Ist attempt obtaining atleast 75% marks shall be declared to have passed in the First division with dstinction mentioned in the degree.

1.1. b) Actual percentages of marks obtaned and corresponding grades should be mentioned on detailed marks certificate of student. To obtain ' D' Grade every student must get atleast 40% amrks in each subject of the Semester examination.

1.1 c) Students who earn an 'E' Grade or less than 40% marks in any course shall have to reappear in that subject.

1.2 If a student gets 'E' Grade in the sessionals of any Thesis / Theory/ Practical course, he/ she shall be required to improve his/ her Grade by appearing in the session tests as well as by submitting the assigments. However, the marks of attendance shall remain the same as already awarded to him/ her. The candidate has to pass in sessional and University theory and practical examinations seprately. If a candidate passes in theory and fais in sesional, the candidate has to only improve the Sessional.

1.3 The examiner will be required to submit actual marks obtained for Sessional/ Theory/ Practicals/ Dissertation courses. The University will issue the detailed marks certificate showing the actual marks obtained as well corresponding grade.

M.Tech. 1st SEMESTER (Bio-Tech.)

Engineering Principles in Biotechnology

BT-501

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Basic concepts of Fluid Mechanics : Dimentional Analysis : Buckingham Pi-theorem, Dimensionless groups, Conversion of equations. Basic equations of Fluid Flow. Hagen Poiseville equation, Bernoulli Equation, Fluid Friction in flow through packed beds, fundamentals of fluidisation.

Unit II

Energy and Material Balance

Unit operations and unit processes : historical and more recent developments in biochemical engineering; Process variables and degree degrees of freedom; Differential and integral balances.

Unit III

Probability : Definition of Sample Space, Event, Event Space, Conditional Probabality, Additive and Multicative law of probablity, Baye's Law theorem, application in biotechnology.

Presentation and analysis of data : Statistical analysis, mean, mode/ median/ standard deviation etc. Histogram, Scatter plot, Distributions (binomial, poission and normal). Tests of significance (x2 and t) regression and correlation, Analysis of variance.

Unit IV

Introductoion to transport phenomena :

Flow through pipes and open chnnels, Orifice and Venturi meters, Pitot Tube, Weirs, Rotameters and other types of meters Transportation of fuilds, Pipe Fittings and values Pumps -

classification, centrifugal and positive displacement type - peristaltic Blowers and Compressors (oil free).

Unit V

Heat & Mass transfer

Classification of heat flow processes, conduction, Thermal conductivity. Heat flow in fluids by conduction and convection. Countercurrent and parallel flow. Enthalpy balance in heat exchange equipment. Individual heat transfer coefficients, overall coefficient, Heating and cooling of flids. Heat transfer equipment. Unsteady state heat transfer, Radiation.

Text/ Reference

1. Unit Operations of Chemical Engineering : Mc Cabe, Smith & Harriot, TMH, 5th edition.
2. Transport Processes & Unit operations : Geankopolis, PHI, 3rd edition,
3. Chemical Engineering, Vol-I & II : Coulson & Richardson, Butterworth Heinemann
4. Heat Transfer : D.Q. Kern, MGH
5. Badger, W.L. Banchero J.T., Introduction to Chemical Engineering, MGH.
6. Foust, A.S. Wenzel, L.A. et.al.Principles of Unit Operations, 2nd edition JWS.
7. Perry, Chilton & Green, Chemical Engineers' Handbook, MGH

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Advanced Molecular Biology

BT-503

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Genome organization

Organization of bacterial genome; Structure of eukaryotic chromosomes; heterochromatin and Euchromatric; DNA reassociation kinetics (Cot curve analysis) : Repetitive and unique sequences; satellite DNA ; DNA ,melting; DNA methylation & Imprinting.

Unit II

DNA Structure; Replication ; Repair & Recombination

Structure of DNA -A-, B-,Z- abnd triplex DNA : Replication initiation, elongation and termination in prokaryotes and eukaryotes; Enzymes and accessary proteins; Fidelity; Replication of single Stand and circular DNA; Gene stability and DNA repair - enzymes; Photoreactivation; Nucleotide excise repair; Mismatch correction; SOS repair recombination : Homologous and non- homologous; Site specfic recombination; Chi sequences in prokaryotes.

Unit III

Prokaryotic & Eukaruotic Transcription

Prokaryotic Transcription; Transcription unit : Promoters - Constitutive and Inducible Operators : Regulatory elements ; Initiation ; Attenuation : Termination - Rho- dependent and independent;Anti - termination; Transcriptional regulation- Postive and negative :Operon concept-lac, trp,ara, his,a nd gal operons ; transcriptional control in lambda phage; Transcript processing; Processing of tRNA and rRNA Eucaryotic transcription and regulation : RNA polymerase structure and assembly; RNA polymerase I, II, III; Eukaryotic promoters and enhancers; Genral Transcription factors; TATA binding

proteins (TBP) and TBP associated factors (TAF) ; Activators and repressors; Transcriptional and post - transcriptional gene silencing.

Unit IV

Post Transcriptional Modifications

Processing of hnRNA, tRNA, rRNA ; 5-Cap formation; 3'-end processing and polyadenylation; Splicing; RNA editing; Nuclear export of mRNA; mRNA stability; Catalytic RNA.

Translation & Transport

Translation machinery : Ribosomes; Composition and assembly; Universal genetic code; Degeneracy of codons : Termination codons; Isoaccepting tRNA : Wobble hypothesis; Mechanism of inititaion, elongation and termination; Co-and post- translational modifications; Genetic code in mitochondria : Transport of proteins ands molecular chperones : Protein stabiltiy; Protien turnover and degradation.

Unit IV

Mutations Oncogenes and Tumor Suppressor genes

Nonsense, missense and point mutations; Intragenic and Intergenic suppression : Frameshift mutations; Physical, chemical and biological mutagens; Transposition Transposable genetic elements in prokaryotes and eukaryotes; Mechanisms of transposition; Role of transposons in mutation Viral and cellular oncogenes : Tumor suppressor genes from humans : Structure function and mechanism of action of pRB and p53 tumor suppressor proteins; Activation of oncogenes and dominant negative effect; Suppression of tumor suppressor genes.

Text/ Reference

1. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.
2. J.D. Watson, N.H. Hopkins, J.W. Roberts, J.A. Seitz & A.M.Weiner : Molecular Biology of the Gene, 6th Edition, Benjamin Cummmings Publishing Company Inc. 2007.
3. Alberts et al.; Molecular Biology of the Cell, 4th Ed. Garland, 2002.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Industrial Biotechnology

BT-505

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Fundamentals of Industrial Microbiology : Introduction, objectives and applications Cultivation & Maintenance of Microorganism : Different types of culture medium; C/N/Pbalance and design of culture medium. Substrates for industrial microbial processes. Industrially important microbes : Isolation, preservation and improvement of industrially important microorganisms, selection of mutants, use of rDNA technology.

Unit II

Process technology for the Production of various Products :primary metabolite : ethanol, citric acid, vineger and aino acid. Production of alcoholic beverages - wine and beer. Microbial production of industrial enzymes : Cellulase, glucose isomerase and lipase.

Unit III

Production of secondary metabolites : Antibiotics e.g. penicillin tetracycline.

Process tehnology for the production of microbial biomass : Introduction, conventional protein sources, substrates, Microorganisms used, SCP from CO_2 Carbohydrates, Hydrocarbons.

Unit IV

Microbial Transformations

Transformation of alkaloids, steroids, carotenids and sterols. Transformation of non-steroidal compounds and pesticides, Applications of microbes for designing vaccines and drugs. Production of rDNA products including DNA vaccines. Taq polysmerase

Unit V

Uses of microbes in - biosensors, fuel, cells, cancer therapy, Biofertilizer Bioremediation, Paper industry, Biohydrometallurgy and Biomineralization and coal solubilization.

Text/ Reference

1. Industrial Microbiology, Casida Jr. L. E. 1968) new Age International (P) Ltd. New Delhi.
2. Presott & Dunn's Industrial Microbiology. Ed. E.G. Reed (1987). CBS Publishers, New Delhi.
3. Biotechnology : A Text book of Induxctrial Microbiology 2nd Edition. Crueger, W. and Cruger, A. (2000) Panima Publishing Corporation, New Delhi.
4. Enzmes : Biochemistry, Biotechnology, Clinical Chemistry, Palmer, T.(2000) Horwood Publishing Colphon.
5. Manual of Industrial Microbiology and Biotechnology 2nd Edition. Ed. Arnold L. Demain and Julian E. Davies (1999) ASM Press Washington D.C.
6. Microbiology, Pelzar Jr. M.J. : Chan E.C.S. and Krieg, N. R. (1993) Tata Mc Graw Hill, New Delhi.
7. Microbiology : Present et ai., 2003, 5th edition, Mc Graw Hill, USA.
8. Comprehensive Biotechnology Vol.1-4 : M.Y. Young (Eds.) Pergamon Press.
9. Biotechnology : A text Book of Industrial Microbiology : T.D. Brock Smaeur Associates. 1990.
10. M.T. Madigan and J.M. Martinko, Brock Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, 2006.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Immunotechnology

BT-507

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Innate and acquired immunity, cells and organs of the immune system, Primary and secondary lymphoid organs, humoral and cell medicated immune response.

Unit II

Antigens, antigenic determinants : Isotype, allotype & idiotype: Immunoglobulins : structure and fucntion, Organization and expression of immunoglobulin genes, Generation of Ab. Diversity, class switching and Ab. Engg.

Unit III

Major histocompatibility complex, Peptide binding by class I and II molecules, Ag. Processing presentation, T- Cell receptor, T- cell maturation, activation & differtiation, Positive & negative selection, signalling pathways.

Unit IV

Cytokines properties, the complement system, Role of T-helper cells in cytokine production, celll medicated effector responses. Hypersensitive reaction, auto immunity and immune response to infectious disease, tumor immunity.

Unit V

Tissue and organ transplant, vaccines & peptide vaccines, Monoclonal Ab, Hybridoma technology, ELISA, radio imunoassay, immunoprecipitin reactions.

Text/ Reference

1. **Kuby,s Immunology** 4th edition R.A. Goldsby, T.J. Kindt, B. A. Osborne, W.H. Freeman & company, New York.
2. **Essential Immunology** (10th edition), Ivon Roitt, Peter Delves Blackwell, Sceintific Publications, Oxford.
3. **Fundamental of immunology** Paul W.E. (Eds) Raven Press, New York.
4. **Immunology** by Presscot.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Biosensors

BT-515

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

History & scope, definition, principle of biosensors : Classification of biosensors based of transducer & recognition element.Components & basic designing of biosensor.

Unit II

Enzymes biosensors ; enzyme immobilization technology & electrode fabrication technology and its principle : Type of enzyme electrodes; recent developments in enzymatic sensors and commercialization.

Unit III

Immunosensors & fabrication technology and its principle : DNA sensors and its principle : application of immunosensors & DNA biosensor technology. Gold electrode and gene chips.

Unit IV

Nanotechnology and biosensors : Cabon nanotubes, Gold nanoparticales, conducting polymers and electrode designing.

Unit V

Study of recent development on glucose, Iactate, urea, cholesterol, HPV and their commercial and future prospects.

Text/ Reference

1. Commercial Biosensors Graham Ramsay, John Wiley Publishers.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Genomics & Proteomics

BT-517

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Introduction : Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA - Mitochondrial, chloroplast; DNA sequencing principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation : Tools for genome analysis - RELP, DNA fingerprnting, RAP, PCR, Linkage and Pedigree Analysis - Physical and genetical mapping.

Unit II

Genome sequencing projects : Micobes, plants and animals; Accessing and retrieving genome project information from web ; Comparative genomics, Identification and classification using molecular markers - 16SrRNA typing/ sequencing, EST's and SNP's.

Unit III

Proteins : Proteins anlayis (includes measurement of concentration, aminoacid composition, N-terminal sequencing); 2-D electrophoresis

of proteins : Microscale solution isoelectricusing, Peptide fingerpriting : LC/MS-MS for identification of proteins and modified proteins ;MALDI-TOF; SAGE and Differetial display prteomics, Protein protein interactions, Yeast two hybrid system.

Unit IV

Pharmacogenetics : High throughput screening in genome for drug discovery identification of gene targets, Pharmacogenetics and drug development.

Unit V

Functional genomics and proteoics : Analysis of microarray data ; Protein and peptide microaarray based technology; PCR directed protein in *situ* arrays; Structural Proteomics

Unit V

Functional genomics and proteomics : Analysis of microarray data : Protein and peptide microarray-based technology; PCR directed protein in *situ* arrays; Structural proteomics

Text/ Reference

1. Voet D, Voet JG a & Pratt CW, Fundamentals of Bio chemistry 2nd edition, Wiley 2006
2. Brown TA Genomes 3rd Edition Garland Science 2006
3. Campell AM & Heyer LJ, Discovering genomics, Proteins and Bioformatics 2nd Edition Benjamin Cummings 2007.
4. Primrose S & Twyman R. Principles of Gene Manipulation and Genomics, 7th Edition Blackell 2006,
5. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Environmental Engineering

BT-519

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Introduction to Environment : Environment, Pollutant and environment pollution (water, soil and air) noise and thermal pollution, their sources and effects.

Unit II

Bioremediation: What is bioremediation ? Types of bioremediation, bioaugmentation for bioremediation Bioereactors fore remediation processes. Applications of bioremediation.

Removal of Specific Pollutants : Sources of heavy metal pollution, microbial systems for heavy metal accumulation, biosorption, bioleaching.

Unit III

Bioreactors for waste Water Treatment : Biological processes for inductrial effluent tretament, aerobic biological treatment, anaerobic biological treatment, periodic biological reactors membrane bioreactors use of immobilized enzymes and microbial cells.

Unit IV

Solid waste management : landfills, composting, earthworm treatment, revycling and processing of organic residues.

Biotechnology for Hazardous Waste Management : Xenobiotic compounds recalcitrance, hazardous wastes, biodegradation of xenobiotics, biological detoxification, biotechnological management of hazardous wastes.

Restoration of degraded lands : Restroration through microorganisms Casuartinas for tropical reforestation on adverse

sites, development of stress tolerant plants, use of mycorrhizae in reforestation. Organic farming and use of microbes for improving soil fertility, reforestation of lands contaminated with heavy metals.

Unit V

Biotechnology for Waste Treatment of Food and Allied Industries : Biological treatment, methods SCP and biomass from waste and distillery industry.

Novel Methods for Pollution Control : Vermitechnology, waste water treatment using aquatic plants, root zone treatment, Aiming for biodegradable and ecofriendly products.

Microbiology and Biochemistry of Waste Water Treatment : Biological treatment impact of pollutants on biotreatment, cell physioslogy and important microorganisms plasmid borne metabolic activities, bioaugmentation, packaged microorganisms, use of genetically engineered organisms.

Text/ Reference

1. Waste water Engineering Treatment, Disposal and Reuse. Metcalf & Eddy (1991) Mc Graw Hill.
2. Environmental Biotechnology, Forster, C. F and Wase, D.A. J. (1987) Ellis Horwood Halsted Press.
3. New Processes of Waste water treatment and recovery. G. Mattock E.D. (1978) Ellis Horwood.
4. Biochemical Engineering Fundmanetals 2nd Ed. Bailey, J. E. and Ollis, D. F. (1986) Mac Graw Hill, New York.
5. Environmental Biotechnology, Jogdand, S.N. (1995) Himalaya Publishing House, New Delhi.
6. Comprehensive Biotechnology (Vol. 1-4) Young Murray Moo (Ed.) (1985) Elsever Sciences.
7. Standard Method for Examination of Water & Waste water 14th Ed.(1985) American Public Health Ass.
8. Environmental Biotechnology by Alan Scragg (1999); Longman.
9. An Introduction to Environmental Biotechnology by Milton Wainwright (1999) : Kluwezr Academic Press.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Bioseperation Engineering

BT-521

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Principles of enzyme catalysis : Michaelis Menten linetics : KInetics and Statistics; Inhibition Effect of pH and temperature; Enzymology; Immobilized enzymes; methods, mnass transfer considerations; Industrial enzymes.

Unit II

Microbial growth

Introduction to metabolism : Nutrient transport; Glycolysis; TCA cycle and other pathways; Control of metabolism; Factors affectingmicrobial growth; Stoichiometry : mass balance; Stoichometry : energy balances; Growth balances; Growth kinetics; Measuremnt of growth

Unit III

Bioreactors

Introduction to biorecators; Batch and fed-batch biorecators, Continuous biorecators; Immobilized cells; Bioreactor opertaion : Sterilization : Aeration; Sensors : Instrumentation ; Culture specific design aspects : plant. mammalian cell culture reactors.

Unit IV

Bioseparations

Biomass removal : Biomass disruption : Membrane-baseed techniques : Extraction Adsorption and Chromatography.

Ultra filtration membrance processes - Types of equipment, flux equation, effects of Ultra filtration membrance processes - Types

of equipment, flux equation, effects of processing variables.

Supercritical fluid extraction.

Unit V

Industrial Processes and Process economic

Description of inductrial processes; Process flow sheeting; Process economics.

Text/ Reference

1. Bioprocess engineering Basic concepts M. A. Shuler, Fikiret Kargi, PHI India.
2. Coulson & Richardson's Chemical Engineering - Volume 3 (Chemical and Biochemical reactors and process controls) ed. Richardson, J. F. Peacock, D.G., First Indian ed. Asian Books Pvt. Ltd. 1998.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 1st SEMESTER (Bio-Tech.)

Biotechnology Lab.-1-511

L T P **Theory : 50 Marks / 2 Credits**
0 0 3 **Sessional : 50 Marks / 2 Credits**
Total : 100 Marks / 4 Credits

Laboratory I work to be carried out as per BT-505.

M.Tech. 1st SEMESTER (Bio-Tech.)

Biotechnology Lab.-1I-513

L T P **Theory : 50 Marks / 2 Credits**
0 0 3 **Sessional : 50 Marks / 2 Credits**
Total : 100 Marks / 4 Credits

Laboratory I work to be carried out as per BT-507.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Bioinformatics

BT-502

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Sequence-alignment related problems

Sequence database ; Similarity matrics : Pairwise alignment : BLAST : Statistical significance of alignemnt; Sequences assembly : Multiple sequence alignment; Clustal; Phylogenetics : Distance based approaches, maximum parsimony.

Unit II

Pattern analysis in sequences

Motif representation : consensus, regular expressions; PSSMs : Marov Models : regulatory seuqence identification using Meme : Gene finding; Composition based finding sequence motif based finding.

Unit III Unit IV

Structures related problems

Representation of molecular structures (DNA, m RNA, protein), secondary structures, domains and motifs : Structure classification (SCOP, CATH): Visualization software(Pymol, Rasmol etc.) Experimental determination of tsrutures (X-ray crystallography, (Pymol, Rasmol etc.); Experimental determination of structures (X-ray crystallography. NMR); Structure databases; Secondary structure predication; RNA structure prediction; Mfold; Protein structure prediction by comparative modelling approaches (homology modelling, threading); Ab initio structure pediction : force filed, backbone confomer generation by Monte Carlo approaches, side-chain packing; Energy minmization; Molecular dynamics; Rosetta; Structure comparison (DALI, VAST etc.)CASP; Protein ligand

docking; Computer aided drug design (pharmacophore oidentification) QSAR; Protein intercations.

Unit V

System wide analyses

Transcripomics : Microaaray technology, expression profiles, data analysis; SAGE; Proteomics 2D gel electrophoresis : Mass Spectrometry; Protein arrays; Metabolomics 13 C NMR based metabolic flux analysis.

Test References :

1. David W. Mount Bioinformatics :Sequence and Fenome Analysis 2nd Ed. to the analysis of Press 2004.
2. A Baxebvains and F. B. F. Ouellette, Bioinformatics a practical guide to the analysis of genes and pevsner, 2nd Ed. John Wiley 2001
3. Jonathan Pevesner and H, Wessig Structural Bioinformatics, Wiley 2003
4. P.E. Bourne and H. Weissig Structural Bioinformatics Wiley 2003.
5. C. Branden and H. Tooze, Introduction to Protein Structure, 2nd Ed. Garland Publishing 1999.

Note for paper setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Genetics Engineering

BT-504

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Bascis Concepts

DNA Structure and properties : Restriction Enzymes ; DNA ligase, Klenow enzymes, T4 DNA polymerase, Polynucleotide kinase, kinase, Alkaline phosphatase; Cohesive and blunt end DNA ligation; linkers; Adaptors; Homopolymeric tailing; labeling of DNA; Nick translation, Random priming, Radioactive and non-radioactive probes, Hybriddization techniaues : Northern, Southern and Colony hybridization. Fluorescene in situ hybridization; Chromatin Immunoprecipitation : DNA Protein Interactions Electromobility shift assay : DNasel footprinting;

Unit II

Cloning Vectors

Plasmids : Bacteriophages; M13 mp vectors; PUC 19 and Bluescript vectors. Phagemids; Lamba vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs) Animal Virus derived vectors- SV-40; vaccinia/ bacculo purification; Histag; GST-tag MBP- tag etc. Baculovirus vectors system. Plant based vectors. Ti and Ri as vectors, Yeast vectors, Shuttle vectors.

Unit III

Cloning Methodolgies

Insertion of Foreign DNA into Host Cells : Transformation : Construction of libraries ; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Southwestern and Farwestern cloning : Protein- protein interactive cloning and Yeast two hybrid system : Phage display :Principles in maximizing gene expression.

Unit IV

PCR and Its Applications :

Primer design; Fidelity of thermostable enzymes ;DNA polymerase : Types of PCR- multiplex, nested reverse transcriptase, real time PCR touchdown PCR hot start PCR colony PCR, cloning of PCR products; Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection : PCR based mutagenesis, Mutation detection SSCP, DGGE, RFLP, Oligo Ligation Assay (OLA), MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification) PTT (Protein Truncation Test)

Unit V

Sequencing methods : Enzymatic DNA sequencing; Chemical sequencing of DNA : Automated DNA sequencing; Chemical Synthesis of oligonucleotides;

Introduction of DNA into mammalian cells ; Translation techniques : Gene silencing techniques; Introduction to siRNA; si RNA technology; Micro RNA Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knock out mice; Disease model; Somatic and germ- line therapy in vivo and ex-vivo; Gene replacement ; Gene targeting; Transgenics; cDNA and intragenic arrays; Differential gene expression and protein array.

Reference Books

1. S.B. Primrose R.M. Twyman and R.W. Old : Principles of Gene Manipulation. 6th Edition, S.B. University Press, 2001.
2. J. Sambrook and D.W. Russel: Molecular Cloning : A Laboratory Mnaula, Vol. 1-3, CSHL, 2001
3. Brown TA, Genomes, 3rd ed. Garland Science 2006.
4. Selected papers from scientific journals.
5. Technical Literature from Stratagene, Promega, Novagen,New England Biolab etc.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

High Resolution Techniques in Biotech.

BT-504

L	T
4	0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Applications of spectroscopic and other techniques to the study of biomolecules : UV-Vis spectroscopy, Circular dichrosim. Fluorescence, NMR, Mass IR and raman spectroscopy, X-ray differaction

Unit II

Cellular Imaging Techniques ; Microscopy ; Phase contrast. Flurescence. Atomic Force and confocal.

Unit III

Biophysical techniques to study purify and study proteins. Dialysis, salting out and precipitation by organic solvents, Ion exchange, gel filtration, reversed phase, affnity chromatography, ultracentrifugation.

Unit IV

Gel elelctrophoresis. Analysis of Proteins : Electrophoretic sepration of proteins (single dimension native and denaturing gels 2I) and digital electrophoretic analysis) detection(staining, blotting and immuno-detection. ELISA, RIA) and purification of proteins (various chromatography, HPLC, immunoprecipitation) and specilized applications (in vitro synthesis of protein, labelling. microsequence analysis.

Unit V

Need for high resolution separation for value added biotechnological products; Difficulties with traditional methodologies; Affinity precipation and partitioning MF/UF/NF for high resolution separation. Applications of radioisotopes in advanced research.

Reference Books

1. Biological Spectroscopy : Campbell and Durek.
2. Physical Biochemical, 2nd edition by D. Friefelder, W. H. Freeman and company U.S.A.
3. Introduction to instrumental anlysis : Robert D. Braun (1987) Mc Graw Hill International Edition, Chemistry Series.
4. Analytical Chemistry for technicians : John kenkel (1994) Lewis Publishers . boca Raton.
5. Principles and techniques of Practical Biochemistry : K Wilson and J. Walker (1994), Cambridge University Press, Cambridge
6. Bophysical Chemistry : Principle and Techniques, 2nd eddition by A. Upadhyay.K. Upadhayay and N. Nath (1998) Himalaya Publication House Delhi.
7. Physical Biochemistry, 2nd edition by K. E. Vanholde (1985) Prentice Hall Inc. New Jersey.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Food Processing Engineering

BT-516

L	T
4	0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Statusof food processing industry in India and abroad; propectus and constraints in devdelopments of Indian food industry. Basic principles inolved in fermentation, Technological aspects of picked vegetables like sauerkraut, cumcumbers.Technology of wine, beer and distilled alcoholic beverages, defects in alcoholic beverages.

Unit II

Definition, classfication and technologies of fabricated and formulated, food and their nutritional aspects. Food addivtives including stabilizers, emulsifiers, antioxidants, preservatives, etc. for formulated foods.

Strategic interventions to minimize post harvest losses including vapour heat tretament, wax coating, chemicals etc.

Unit III

Principles of chilling refrigeration storage of foods, quality chrages in cold stored products, controlled and modified atmospheric storage. Freezing of food,principle and equipments for freezing, defects in frozen foods, re-crystallization.

Unit IV

Application of heat energy to foods for preservation and processing concept of drying rate of foods, industrial drying processes of foods; changes during drying, advanced drying proceses (Freeze drying infra red drying and microwave drying), Canning of fruits & vegetables ,unit processses involved in canning.

Unit V

Advances in milling ofrice (solvent extractive milling) and Turbo milling of wheat,. Developoments in manufacturingprocesses for bakery products such as breads; biscuits; cake etc; changes during processing of bakery products. Application of enzymes in food processes like enzymes juice extraction, juice clarification, in bread manufacture, ice cream manufacture, etc. Newer concepts in food processing including organic fods, processing oforganic raw material, genetically modified foods.

Reference Books

1. Fellows PJ. 2000. Food processing Technology :Principles and Practices. 2nd Ed. CRC- Woodhead Publ.
2. Fennema CR. 1975. Principles of Food Science. Part II Physical Principles of Food Preservation. Marcel Dekker.
3. Guy R. 2001 Extrusion cooking. technologies and Applications.

CRC Woodhead Publ.
4. Honseney RC. 1986 Cereal Sceince and Technology. American Association of Cereal Chemists. St. Paul. Minnesota.
5. Hui YH, Meunix- Goddick L, Hansen AS, Josephsen J. NP WK, Stanfield PS & Toldra F. 2004. Handbook of food and Beverages Fermentation. Marcel Decker.
6. Norman W & Desrosier IN 1987. the technology of Food Preservation. 4th Ed. CBS Publ. Penfield MP & Campbell AM. 1990. Experimental Food Sceince. 3rd Ed. Academic Press.
7. Ramaswamy H & Marcotte M. 2006. Food Processing :Principles and Application. Taylor & Francis.
8. Vangarde JS & Woodburn M. 1994. Food Preservation and Safety : principles and Safety lowa State University Press. Lowa.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Protein Engineering

BT-518

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Protein engineering - definition, applications; Features or characteristics of protein tht can be engineered (definition and methods of study)- affinity and specificity; Spectroscopic properties; Stability to changes in parameters as pH, tempearture and amino acid sequence, aggregation propensies etc.

Unit II

Methods of measuring the stability of a protein : Spectroscopic methods to study physicochemical properties of protein : far UV and near - UV CD; Flurescence; UV absorbance; ORD; Hydrodynamic properties - viscosity, hydrogen-deuterium exchange; Brief introduction to NMR spectroscopy - emphasis on parameters that can be measured/ obtained from NMR and their interpretation.

Unit III

Forces stabilizing proteins - Van der waals, electrostatic; hydrogen bonding weakly polar interactions, hydrophobic effects; Entropy - enthalpy compensation; Experimental methods of protein engineering : directed evolution like gene site saturation mutagensis; Module shuffling; Guided protein recombination etc., Optimization and high throughtput screening methodologies like Giga Metrix,High throughput microplate screens etc., Application to devices with bacteriohodopsin as in example; Engineering antibody affinity by year surface display; Applications to vaccines.

Unit IV

Computational approaches to protein engineering : sequence and 3D structure analysis. Data mining, Ramachandan map, Mecahnism of stabilization of protein from psychrophiles and thermophiles vis-a-vis those from mesophiles; Protein design.

Unit V

Case Studies

Reference Books

1. Edited by T.E. Creighton, Protein structure : A practical approach, 2nd Edition, Oxford University Press, 1997.
2. Edited by T.E. Creighton, Protein Function : A practical approach, 2nd Edition, Oxford University Press, 1997.
3. Edited by T.E. Creighton, Protein Function : A practical approach, 2nd Edition, Oxford University Press, 1997.
4. Cleland and Craik,Protein Engineering, Principles and Practice, Vol 7, Springer Netherlands 1998.

5. Mueller and Arndt., Protein Engineering protocols, Ist Edition, Humana Press, 2006
6. Ed. Robertson DE, Noel JP, protein Engineering Methods in Enzymology, 388 Elsevier Academic Press 2004
7. J Kyte, Structure inprotein chemistry, 2nd Edition, Garland publishers, 2006.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Animal Biotechnology

BT-520

L	T
4	0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Primary culture, secondary culture, sub-culturing, Cell lines, cloning & selection, Media, serum free media (advantage & disadvantages).

Unit II

Large scale culturing,Preservation and maintenance of animal cell lines. Cryo preservation, Cell culture products, Hybridoma technology.

Unit III

Gene transfer(transfection) methods, Embryonic stem cell transfer, In Vitro fertilization and embryo transfer. Gene therapy, Animal cloning & ethical issues.

Unit IV

Tissue and organ transplant, vaccines & peptide vaccines,Proteins as therapeutic agents. Applications, delivery and targeting of therpeutic proteins. Engineering human interferons and human growth hormones. Enzymes as therapeutic agents : Use of genetically engineered DNase I

and alginate Lyase for treatment of Cystic Fibrosis.

Unit V

AIDS and its clinical focus; Cancer immunotherapy & vaccines; Experimental Animal models, Genetic diagnostic methods and microarray technology.

Reference Books

1. Molecular Bitechnology by Old and Primrose.
2. Molecular Biotechnology :Principles and Application of recombinant DNA By Bernard R. Glick, Jack Pasternak, 2nd Edition ASM press Washington DC.
3. Animal Cell biotechnology : R.E. Spier and J.D. Griffiths (1988) Academic Press.
4. Living resources for Biotechnology :Animal cells : A. Doyle, R. Hay and B. E. Kirsop (1990), Cambridge University Press, Cambridge.
5. Animal biotechnology : Murray Moo- Young (1989), Pergamon Press, Oxford.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Fermentation Technology

BT-522

L	T	
4	0	**Theory : 100 Marks / 4 Credits**
		Sessional : 50 Marks / 2 Credits
		Total : 150 Marks / 6 Credits
		Time : 3 Hrs.

Unit I

Fermentation : History, Introduction, application and a skill for the Future, Fermentation Equuipment Selection : Laboratory Scale Bioreactor, Modes of Fermenter Opertaion, constructionm of fermenter.

In situ and ex-situ sterilization process in fermenters.

Unit II

Non ideality and RTD in bioreactors; stability analysis of multiple interacting microbial populations; the design and Preparation of Media for fermentation,Preservation of Cultures for Fermentation processes, Design Considertaions for Production of Membrane Proteins, stability of recombinant cells in bireactors.

Unit III

Physiology of immobilised cells; pacakeded birecators ; fluidized-bed bioreactors; air lift bioreactors; bubble column bioreactors; immmobilized enzymes bireactors; special reactors for naimla and plant cells; integrated systems of bioreaction and bioseparation.

Unit IV

Modelling and the Kinetics of Biological Activity in Fermentation System, Scale Up and Scale Down of fermentation Processes, On -line, In-situ, Measuremnts within Fermentation, SCADA Systems for Bioreactors, Basic Statistical Analyses in Fermentation.

Unit V

Major uit operations and unit processes in fermentation bnased industries. Case study : failure of fermentation based industry in India.

Reference Books

1. Bioprocess Engineering, Second Edition, Shuler ML; Kargi F, 2002,Prentice Hall PTR, New Jersey.
2. Bioprocessing, Ward O.P. (1991),New York.
3. Biosepratains, Van Nostrand Reinhold. Belter,P.A. Cussler , E.L. Hu, W.S. (1988), New York, John Wiley and Sons.
4. Process Engineering in Biotechnology, A.T. Jackson.
5. Bioprocess Technology Fundamentals, Baily and Ollis.
6. Biochemical Reactor, B. Atkinsom
7. Chemical Engineering Vol. 1-6 J.M. Coulson and J.F. Richardson Pergamon Press.

8. Bioprocess Engineering : Systems, equipments and facilities (1994) Eds. K.B. Lyderson, N.A. D'elia and K.L. Nelson, John Wiley & Sons, New York.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Bioreaction Engineering

BT-524

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Structured growth models; Compartmental models : Cybernetic models.

Unit II

Immobilized biocatalysts : external mass transfer; internal diffusion; Reaction within catalysts.

Unit III

Reactor design (batch, continous, fed-batch, plug flow, packed bed, airlift, immobilized enzymes/ cell); Optimal bioreactor operation using simple reaction kinetics.

Unit IV

Dynamic simulation of bioreactor processes (batch, fed-batch, contonuous etc.) Reactors in series.

Unit V

Pathway analysis : Stoichiometric anlysis; Thermodynamic- derived constraints; Flux balancing techniques; Metabolic control analysis.

Text / Reference :

1. J. Nielsen and J.Villadsen and G. Liden, Bioreaction Engineering Principles, 2nd Edition, Kluwer Academic, 2003.
2. Irving J. Dunn, Elmar Heinzle, John Ingham, Jiri E. Presil, Biological Reaction Enginerring : Dynamic Modelling Fundamentals with Simulation Examples, 2nd Edition, Wiley -VCH, 2003.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Reproductive Genetics

BT-526

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

The similarities and differences between the processes of mitosis and meiosis and between the results of asexual and sexual reproduction : The relationship between an organisms ' DNA, genes and chromosomes, and the traits that result from this information; How genetic information is passed from parents to offspring andhow it results in various traits?

Germ cells and sex : Genotypic & phenotypic sex determination in mammals, D melanogaster and C elelgans, structure and formation of germ cell; fertilization; Imprinting and primordial germ cells, sex reversal.

Unit II

Animal odels in human genetics research.

Molecular biology, cytology and biochemistry of ovogenesis : Synthesis and storage of maternal transcripts, protein and cell organelles. rDNA amplification in ambphibia; transcription on

lampbrush chrosomes, ovulation and hormonal control in mamals.

Molecular and cellular biology of fertilization : acrosome reaction and signal transduction, monospermy and species - specificity.

Unit III

Structure, chemistry, dynamic and regulation of sperm locomotion, capacitation and egg-surface targeting.

Egg activation, early cleavages and blastocyst formation n mammals and biochemical and cellular changes during the passage down the oviduct to the uterus.

Implantation and formation of the placentra in mammals.

Unit IV

Gastrulation in mammals- formation of primitive streak, morphogenetic movements and neural induction.

Organogenesis and fetal development

Pattern forming genes and expression in Drosphila and mammalian embryos

Recapitulation of Mendelian principles.

Unit V

Animal Reproduction and Embryology : Reproductive Strategies (parthenogenesis asexual reproduction, sexual reproduction, oviviporous, viviparous, ovoviviparous) : Male and Female Reproductive Anatomy and Physiology; Pregnancy; Comparative embryology- starfish, frog, chick, mammal; Fertilization, cleavage, gastrulation, germ layers and their derivaties; Induction, determination and differentiation; reproductive cloning and its ethical issues.

Plant reproduction : Alternation of generations in moss, fern, pine and flowering plants; Spore and gamete formation; Fertilization and sporophyte formation; Seed structure and germination; Growth and development; hormonal control.

Text / Reference :

1. Besser & Thorner, Comprehensive clinical endocrinology, 3rd Edition, Mosby 2002.
2. Emergy and Rimons, Principles & Practice of Medical Genetics Vol.I-III, Chuchchill Livingstone., 2002.
3. Chaudhuri, Concise Medical Physiology, New Central Book Agency, 2002.
4. Gardner, In vitro fertilization : A practical approach, Informa healthcar, 2007.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Clinical Genetics & Counsling

BT-528

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

The history and impact of genetics in medicine : early beginnings, Gregor Mendel and the law of inheritance, chromosomal basis of heritance, the fruit fly, the origin of medical genetics, classification of genetic disease, the impact of genetic disease, major new developments.

Patterns of heritance : Family studies, Mendelian inheritance, Non-menedelian inheritance.

Risk Calculation : Probability theory, Autosomal dominant inheritance, Autosomal recessive inheritance,sex linked recessive inheritance, the use of linked markers, Bayes theorem and prenatal screeining, Empiric risks.

Unit II

Biochemical Genmetics : The inborn errors of metabolism , Disorders o amino acid metabolism, Disorders of steriod metabolism. Disoredres of lipid metabolism. Lysosomal storage disorders. Disorders of purine/ pyrimidine metabolism, Disorders of porphyrin metabolism, organic acid disordres, disorders of copper metabolism, peroximal disorders.

Pharmacogenetics :Definition, Drug metabolism, Genetic varations revealed solely by the effects of drugs, hereditary disorders with altered drug response. Evolutionary origin of variations in drug responses, Pharcogenomics.

Unit III

The Genetics of Cancer : Differentiating between genetic and environmental factors in cancer, oncogenes, tumor suppressor genes, genetics of common cancers, genetics counselling in familial cancer.

Genetics and congential abnormalities : Incidence, definitions and classification of birth defects, genetic causes of malformations, environmental agaents (teratogens), malformations of unknown cause.

Unit IV

Genetics factors in common diseases : Genetic susceptibility to common diseases, Diabetes mellitus, Hypertension. Coronary artery disease, schizophrenia Affective disorders, Alzhemer's disease.

Genetic detection and presymptomatic diagnostic : carrier testing for autosomal recessive and X-linked disorders, presymptomatic diagnosis of autosomal dominant disorders, ethical considerations in cancer detection and preductive testing.

Unit V

Prenatal diagnosis of genetic disease : Techniques used in prenatal diagnosis, New prenatal diagnosis techniques under development. Indications of prenatal diagnosis, special problems in prenatal diagnosis, termination of pregnancy, prenatal treatment.

Genetic Counselling : Definition, establishing the diagnosis, calculating and presentinf the risk,discussing the options, communication and support, genetic counselling- directive or non directive : Outcomes in genetics counselling special problems in genetic counselling.

Text / Reference :

1. Baker el al, Guide to Genetic Counselling, Wiley - Liss, 1998.
2. Pastemak, An Introduction to Molecular Human Genetics :Mechanisms of Inherited Diseases, 2nd Edition, Fritzgarald, Wiley Liss, 2005.
3. Inakowski and Polak, Clinical gene Analysis and Manipulation : Tools, Techniques and Troubleshooting, Cambridge University Press, 1996.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Plant Metabolic Engineering

BT-530

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Metabolism and Metabolic Engineering

Carbon Assimilation ; Light absorption and energy conversion; Calvin Cycle; Hatch slack pathway; Reductive pentose phosphate pathway; Carbon dioxide uptake and assimilation; Photorespiration; Glycolate metabolism.

Biologcal Oxidation and Release of Energy

Enzymes Kinetics and Analysis of Sequences of Reactions ; Glycolytic pathway; Kreb;s Cycle; High energy compounds; Oxidative phosphorylation; Chemsiosmotic hypothesis Pentose phosphate shunt pathway.

Unit II

Metabolism of Macromolecules : Biosynthesis and inter- conversion of carbohydrates; Biosynthesism inter conversion and degradation of lipids; Regulation of Metabolic Metworks : Metabolic Flux Analysis; Metabolic Control analysis.

Long Distance Transport Mechanisms : Turgor and stomatal movements; solute movement; source sink relationship; water relations.

Unit III

Nitrogen, Sulphur and Phosphorus Metabolism : General aspects of nitrogen economy; Nitrate reduction; Pathways of ammonia assimilation; Reductive amination; Transmination; regulation of nitrogen assimilation; Uptake, transport and assimilation of sulphate and phosphate.

Nitrogen Fixation : Symbiotic nitrogen fixation; Role of lectins : nodgenes; nif genes Structure, fucntion and regulation of nitrogenase; Leghaemoglobin; Nodulins; Regulation and enhancement of nitrogen fixation.

Unit IV

Secondary Metabolism

Importance of Secondary Metabolites :Biosynthesis of phenolic compounds, isoprenoids, alkaloids and flavonoids; Metabolism of nucleotides amino acids and vitamins; Bioproduction; biological treatment; and related natural and engineered systems.

Unit V

Bioinformatics for Metabolic Networks

Systems biology frameworks for metabolic engineering; Concepts of metabolic networks; Establishment of metabolic flux analysis and metabolic control analysis Systems biology framework for integration of mathmatical modeling and global measuremnts at metabolite, protein and transcription levels.

Text / Reference :

1. Adrian Slater, Nigel Scott and Mark Fowler, Plant Biotechnology : The genetic manipulation of plants, Ist Edition, Oxford University Press, 2003)
2. Chrispeels, MJ and Sadava, DE, Plants Genes and Crop Biotechnology 2003 2nd Edition, American Society of Plant Biologists, Jones and Barlett Publishers, USA.
3. Arie Altman, Marcel Dekkers, Inc 2001 Agricultural Biotechnology
4. Biochemistry and Molecular Biology of Plants Edited by Buchanan, Gruissem and Jones 2000, American Society of Plant Biologists, USA.
5. Edited by BR Jordan, 2nd Edition, The Molecular Biology and Biotechnology of Flowering, CABI, 2006.
6. Neil Wille, Phytoremediation : methods and Reviews, Ist Edition, Humana Press, 2007.
7. Denis Murphy,Plant Breeding and Biotechnology ; Societal Context and the Future of Agriculture, Cambrdge University Press, 2007.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Renewable Energy Techology

BT-532

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Biological fuel generation : Biomass as a renewable energy source; types of biomass - forest agricultural and animal residues, indutrial

and domestic organic wastes; conversion of biomass to clean fuels and petrochemical substitutes by physicochemical and / or fermentation processes.

Unit II

Sources of biomass : biogas from anaerobic digestion; thermal energy from biomass combustion; ethanol from biomass.

Unit III

Hydrogen production by photosynthetic bacteria , biophotolysis of water and by fermentation; Microbial recovery of petroleum by biopolymers (Xanthum gum), biosurfactants.

Unit IV

Solar Energy : Solar collectors, solar pond, photovoltaic cells, chemical storage. Geothermal energy and wind energy : Use of geothermal energy, operating principles of differnt types of wind energy mills Nuclear energy : nuclear reactions and power generating tidal wave energy.

Unit V

Production process of Bio diesel, introduction,process development,problems related to scale up process.

Text / Reference :

1. J.E. Smith - Biotechnology, 3rd ed. Cambridge Univ. Press.
2. S. Sarkar - Fuels and combustion, 2nd Ed. University Press.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Biotechnology Lab.-III-512

L T P **Theory : 50 Marks / 2 Credits**
0 0 3 **Sessional : 50 Marks / 2 Credits**
Total : 100 Marks / 4 Credits

Laboratory I work to be carried out as per BT-502.

M.Tech. 2nd SEMESTER (Bio-Tech.)

Biotechnology Lab.-IV-514

L T P **Theory : 50 Marks / 2 Credits**
0 0 3 **Sessional : 50 Marks / 2 Credits**
Total : 100 Marks / 4 Credits

Laboratory I work to be carried out as per BT-502.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Advanced Plant Biotechology

BT-601

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Plant Tissue Culture

Historical perspective; Totipotency; Organogenesis; Somatic embryogenesis; Regulation and appliactions; Artificial seed production; Micropropagation; Somaclonal varaition; androgenesis and its applications in genetics and plant breeding; Germplasm conservation and cryopreservation.

Protoplast Culture and Somatic Hybridization

Protoplast isolation; Culture and usage; Somatic hybridization- methods and applications Cybrids and somatic cell genetics.

Unit II

Agrobiology

Agrobacterium- plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; T- DNA transfer; Disanning the Ti plasmid.

Genetic Transformation

Agrobacterium - mediated gene delivery; Cointegrate and binary vectors and their utility; Direct gene transfer - PEG - mediated, electroporation, particle bombardment and alternative methods; Screenable and seletable markers; Characterization of transgenics : Chloroplast transformation ; Marker- free methodologies; Gene targeting.

Unit III

Molecular Mapping & Marker Assisted Selection (MAS)

Quantitative and qualitative traits; MAS for genes of agronomic importance, e.g. insect resistance grain quality and grain yield, Molecular polymorphism, RFLP, RAPD, STS, AFLP, SNP markers, Construction of genetic and physical map : gene mapping and cloning : QTL mapping and cloning.

Strategies for Introduction Biotic and Abiotic Stress resistance/ Tolerance

Bacterial resistance; Viral resitancel Fungal resitance; Insects and pathogenes reistance : Herbicide reistance :Drought, salinity, thermal stress, flooding and submergence tolerance

Unit IV

Genetic Engineering for plant Architecture and Metabolism

Seed storage preoteins, Protein engineering; Vitamins and other value addition compounds; Source sink relationships for yield increase; Post harvest bioengineering Plant architecture; Flowering behaviour.

Plants as Biofactories

Concepts of biofactories :fermentation and production of industrial enzymes, vitamins and antibiotics and other biomolecules; Cell cultures for secondary metabolite production :Production of pharmaceutically important compound; Bioenergy generation

Unit V

Plant Genomics

Dentification of candidate genes using genetic information (positional cloning) using biochemical and expression analysis(microarray analysis, proteomics, metabolomics); Characteristics and fucntional analysis of candidate genes ; transformation, mutant populations, knockout systems; Heterologous expression systems; Protein analysis; Bioinformatics and databases; Genoinformatics.

Eco- biotechnology

Biosensors; Biofuels Marine biofarming ; Plant resources, Patenting of biological matreial, Plant breeders rights (PBRs) and farmers rights, Biosafety and containment practices.

Text / Reference :

1. Adrian Slater, Nigel Scott and Mark Fowler,Plant Biotechnology ; the genetic manipulation of plants, Ist Edition,Oxfrod University Press, 2003.
2. Chrispeels, MJ and Sadava, DE, Plants Genes and Crop Biotechnology 2003 2nd edition. American Society of Plant Biologists, Jones and Barlett Publishers, USA
3. Arie Altman, Marcel Dekker, Inc, 2001 Agricultural Biotechnology
4. Biochemistry and Molecular Biology of Plants; Edited by Buchanan, Gruissem and Jones 2000, American Society of Plant Biologists, USA
5. Edited by BR Jordan, 2nd Ed.. The Molecular Biology and Biotechnology of Flowering, CABI, 2006.
6. Neil Wile, Phytoremediation : Methods and Reviews, Ist Ed. Humana Press, 2007.
7. Denis Murphy, Plant Breeding and Biotechnology : Societal Context and the Future of Agriculture, cambridge University Press, 2007.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Advanced Biotechnology Engineering

BT-603

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Biochemical Engineering :Overview of biotechnology , Enzymes Catalusis and Immobilized biocatalysts (princioples of enzymes catalysis; kinetics of single substrate reactions; enzyme inhibition, denaturation and inactivation; methods of immobilizations Electrostalic, external and internal mass transfer effects or immobilized kinetics.

Unit II

Microbial growth (stocichiometry and energetics; unstructured and structured models transport and Reactor Process) continuous stirred tank, plug flow and packed bed bioreactors; gas liquid mass transfer; mass balance for two phase reactors; power requirements; sterilization) Kinetics of cell growth; Mathematical models for sustrate uptake and product formation; Plasmid stability in recombinant cell cultures; Media and air sterilization

Commerical strain development : Induced mutation, over producing decontrolled mutants, genetically engineered strain.

Unit III

Downstream processing - Product recovery and purification (Centrifugation ultrfiltraion : precipation : chromotography, electrophoresis and crystallization; solvent mediated separation.

Unit IV

General Bioprocess plant design information : Piping and instrumentation; Material of construction for bioprocesse plants; Mechanical design of process equipment; Vessels for biotechnology application; Novel bioreactor designs; developments in aeration & agitation in bioreactors

; RTD and mixing in biorecators; Reactor dynamics Scale up and scale down of bioreactors.

Unit V

Design of fermenters : Design considerations for maintaining sterility of process streams processing equipments; Selection and specification of equipment for handling fluids and solids; Selection, specification design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocesse validation; Safety considerations; Case studies.

Text / Reference :

1. Industrial Microbiology,Perscot and Dunn,
2. Biochemical Engineering and Biotechnology Handbook, Atkinson B and Marituna, F The Nature Press,Macmillan Publ. Ltd.
3. Biochemical Engineering Fundamentals, Bailey & Olis. MGH.
4. Comprehensive Biotechnology By Moo-Young VoII-4
5. Biotechnology by Rehm and Reed Vol. 1-12
6. Unit Operations of Chemicals Engineering : mc Cabe, Smith & Harriot, TMH 5th Ed.
7. Treybal, R.E., Mass Transfer Operations, MGH
8. Perry, Chilton & Green, Chemical Engineers; handbook, MGH
9. Process system analysis & Control - D.R. Coughanowr MGH.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Biotech Resource Planning & IPR

BT-615

L	T
4	0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

An Overview of commericail products services through process biotechnology; Issues pertaining to development of biotechnology; general aspects related to the quality control of bioprocesses.

Unit II

Quality criterion for representative bioprocesse :Bioinoculants, Antimicrobial agents metabolites, enzymes, therapeutic proteins; Helath hazards in biotechnology and containment. Biosafety considerations and containments.

Unit III

Introduction to Intellectual Property

Types of IP : Patents, trademarks, Copyrights & Related Rights, Industrial Design Traditional Knowledge, Geographical Indications, Protection of GMOs IP as a factor in R & D; IPs of relevance to Biotechnology and few Case Studies

Unit IV

Agreement and Treaties

History of GATT & TRIPS Agreement : Madrid Agreement; Hague Agreement :WIPO Treats : Budapest Treaty : PCT :Indian Patent Act 1970 & recent amendments

Bioinformatics and databases in biotechnology; Academic industry interaction and technology transfer; Social and ethical issues related to biotechnology.

Unit V

Patent filling procedures

National & PCT filling procedure; Time frame and cost; Status of the patent applicatsions filed; Precautions while patenting - disclosure/ non- disclosure; Financial assistanmce for patenting- introduction to existing schemes Patent licensing and agrremnt Patent infringement-meaning, scope, litigation case studies.

Text / Reference :

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publsihing Co. Pvt. Ltd., 2007
2. Kankanala C., Genetic Patent LAw & Strategy, Ist Ed. Manupatra Information Solution Pvt. Ltd. 2007

Important Links :

http://www.w3.org/IPR/

http://www.wipo.int/portal/index.html

http://www.ipr.co.uk/IP_conventions/ patent cooperation treaty. html

www.patentoffice.nic.in

www.iprlawindia.og/-31k-Cached - Similar page

http://www.cbd.int/biosafety/background,shtml

http://www.cbd.gov/OD/ohs/symp5/jyrtext.htm

http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/ section3.html.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Biopharmaceutical technology

BT-617

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Drug Development in Pharmaceutical Process

- Production of pharmaceuticals by genetically engineerind cells (hormones, interferrons)
- Microbial transformations for production of important pharmaceuticals (alkaloids, steroids and semi-synthetic antibiotics)
- Techniques for development of new generation antibiotics.
- Protein engineering, drug design, drug targeting

Unit II

Disease Diagnostic and Therapy

- ELISA and hybridoma technology
- DNA vaccine
- Gene Therapy
- Toxicogenomics

Unit III

Proteomics in Drug Development

- Role of Proteomics in Drug Development
- Diagnosis of disease by Proteomics
- Separation and identification techniques for protein analysis
- Development of antibody based protein assay for diagnosis

Unit IV

Diagnosis and Kit Development

- Use of Enzymes in clinical diagnosis

- Use of biosensors for rapid clinical analysis
- Diagnostic kit development for microanalysis

Unit V

Nutraceeutical : Water soulble and fal soluble vitamins, their fucntions; GMP, GLP and clean room concept, Role of US-FDA in biotech based industry.

Text / Reference :

1. Balasubramanium, Bryce, Dharmalingam, Green and Jayaraman(ed.), Concept in Biotechnology, Uiversity Press, 1996.
2. Epenetos A.A.(ed.) Monoclonal antibodies : applications in clinical oncology, Chapman and Hall Medical, London.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Process Control and Instrumentation

BT-619

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Complex analysis - definition and properties of analysis fucntions, Cauchy- Riemann equation, harmonic functions; Power series and their properties; Elementary fucntions Cauchy;s theorem and its applications; Taylor series and Laurent expansions; Residues and the Cauchy residue formula; Evaualtion of improper integrals; Conformal mappings' Inversion of laplace transforms.

Unit II

First Proinciples model development: Process dynamics for first,s

econd and higher order systems; Inerization, transfer function models, effect of poles zeros and time delays on system response

Unit III

Instrumentation : controlk of pH, dissolved oxygen, temperature, redox potential etc. Introduction to feedback control; objectives,PID control

Unit IV

Analysis of closed loop systems; stability, root locus, frequency response using Bode and Nyquist plots

Unit V

Control design techniques criteria, time and frequency domain techniques; Model based design ; Tunning.

Text / Reference :

1. D.E. Seborg, T.F. Edgar, D.A. Mellichamp, Process Dynamics and Control, 2nd Edition, John Wiley & Sons, 2004.
2. B.W. Bequette, Process Control : Modelling, Design and Simulation, Prentice Hall, New Delhi, 2003.
3. W.L. Luyben, Process Modelling Simulation and Control for Chemical Engineers, 2nd Edition, Mc Graw Hill, 1990.
4. G. Stephanopoulos, Chemical Process Controkl : An Introduction to Theory and Practice, Prentice Hall, New Delhi, 2001.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Process Modelling and Simulation

BT-621

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Approach to modelling, Unstructured and structured modelling, Deterministic and stochastic models, Segregated and unsegregated models, Shu's segregated models for Lactic acid fermentation.

Unit II

Structured kinetic models : Compartmental models (two and three), Product formation Unstructured models, Genetically structured models.

Unit III

Stochastic model for thermal sterilization of the medium, Modelling for activated sludge process, Model for anaerobic digestion, Models for lactic fermentation and antibiotic production.

Unit IV

Process simulation techniques, equation oriented approach, Equation oriented simulators (SPEED UP, ASCEND, FLOWSIM, QUASILIN, DYNIM), simulation programs based on Euler's methds, Newton - Raphsen methods, Runga - Kutta methods, Simulation of biochemical system models.

Unit V

Case study of a industry producting biotechnological products.

Text / Reference :

1. G. Francis, Modelling and Simulation
2. A. Haerder and J.A. Roels " Application of simple structured I Bioengeering, and P 55 in Advances In Biochemical engineering Vol 21, a. Fiechts (ed.) Spring - Verlag, Berli 1982.
3. J.E. Bailey and D.F. Ollis, Biochemical Engg. Fundmentals, 1986, Mc Graw Hill Book Company.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Stem Cells in Helath care

BT-623

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

- **Introduction :** Stem Cell Biology, Fate Mapping of Stem Cells.
- **Cell Cycle Control,** Checkpoints, and Stem Cell Biology, Senescenece of Dividing Somatic Cells.
- **The Drosphila Ovary :** An In Vivo Stem Cell System.

Unit II

- **Male Germline Stem Cells.**
- **Stem Cell Pattern :** Differentiated Parental DNA Chain Causes Stem Cell Pattern of Cell type Switching in *Schizoaccharomyces pombe*l
- **On Equivalence Groups** and the Notch/LIN-12 Communication System

Unit III

- **Epidermal Stem cells :** Liver Stem Cells, Pancreatic Stem Cells, Stem Cell In the Epithelium of the Small Intestine and Colon.
- **Mesenchymal Stem Cells** of Human Adult Bone Marrow.
- **Stem Cells and Neurogenesis**

Unit IV

- **Hematopoietic Stem Cells** : Repopulating Patterns of Primitive Hematopoietic Stem Cells : Molecular Diversification and Developmental Interrelationships, Hematopoietic Strem cells : Lymphopoiesis and the Problem of Commitment Versus Plasticity, Hemanigioblast
- **Stem Cells in gene therapy** : Principles and Promise

Unit V

- **Primordial Germ Cells** : as Stem Cells, Embryonic Stem Cells, Embryonal Carcinoma Cells as Embryonic Stem Cells, Trophoblast Stem Cells.
- **Stem Cells biosafety**
- **Ethical issues in stem cell research and use.**

Text / Reference :

1. Ann A. Kiessling, Human Embryonic Stem Cells : An Introduction to the Science and Therapeutic Potential, Jones and Bartett,m, 2003
2. Peter J. Quesenberry, Stem Cell Biology and Gene Therapy, 1st Ed., Wiley Less 1998
3. Robert Lanja, Essential of Stem Cel Biology, 2nd Ed. Academic Press, 2006
4. A.D. Ho. R. Hoffiman,Stem Cell Transplanation Biology Processes Therapy, Willey VCH, 2006.
5. C.S. Potten Stem Cells, Elsevier, 2006

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Nanobiotechnology

BT-625

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Introduction to Nanoscience and Nanotechnology,. Techniques used in Nanobiotechnology : Optical Microcopy, Atomic Force Microscopy, SEM etc.

Unit II

Production of nanoparticles : Coolision / Coalescence mechanism of primary particle formation, nanoparticles agglomerates & aerogels Biological production of nano particles : Fungi, bacteria, yeasr and actinomycetes.

Unit III

Nano Structures :Introduction :Buckminsterfullerenes, Carbon nanotubes, Quantum nanodots, Dendrimers, Superparamagnet cnanoparticles, Nanorods, Nanoshells. Nanostructures, Properties & Applications (mechanical,optical and electrical).

DNA based nanomechanical devices. Biosensor and Biochips.

Unit IV

Biological Nanodevices, nanosensors :Temperature Sensors, Smoke Sensors, Sensors for aerospace and defense : Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutiing tools, Integration of sensor with actuators and electronic circuitry Biosensors.

Unit V

Use of nanoparticles as molecular imaging probes Use of optical microscopy to study the dynamic events in cells.

Nanobiotechnology for human health and food applications : nanoparticles for drug delivery, gene delivery, understanding the mechanism of macromolecular interactions etc.

Use of nanoparticles as sensors.

Nanoparticles for cleaning environment particularly heavy metal bioremediation.

Text / Reference :

1. Sensors : Micro & nanosensors, Sensor Market trends (Part 1 & 2) by H. Meixner.
2. nano sceince & Technology :Novel Structre and phenomea by Ping Sheng (Editor)
3. Physical properties of carbon Nanotube - R Satio.
4. Applied Physics of Crbon Nanotubes : Fundamnetals of Theory, Optics and Transport Devices - S. Subramony & S.V. Rotkins.
5. Carbon Nanotubes :properties and Applications - Michael J. O. Connell.
6. Carbon Nanotechnology - Liming Dai
7. Nanotubes and Nanowires - CNR rao and A Govindaraj RCS Publishing.
8. Nanostructures and Nanomaterials - Synthesis, Properties and Apllications - cao, Guozhong.
9. Nanoparticles : From theory to applications - G. Schmidt, Wiley Weinheim 2004

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Biomaterials

BT-627

L T **Theory : 100 Marks / 4 Credits**
4 0 **Sessional : 50 Marks / 2 Credits**
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Unit I

Definition of biomaterials - biologically derived materisl compatible with biology. Common biomaterisl :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 a and its use. production of these proteins by conventional cloning methods.

Unit II

Carbohydrates : Modified carbohydrates actin gas lubricants for biomedical applications : Polydextrose made from bacteria; Carbohydrates modified from enzymes ; artificail wood.

Unit III

Biopolymers :Syntheiss from a simple bilogical monomer (eg. hyaluronate polymerd) : Dextrans (used in chromatography columns) ; Rubberllike materils produced by bacteria and fungi (Polyhydrate PHB), Polycaprolactone (PVCL)

Unit IV

Industrial biopolumers : Production of poluphenol resins by the enxyme soybean peroxidase; Evaluation of the properties of biopolymers to make good biomaterials; Tensile strength (both elasticity and breaking strength); Hydration, visco - elastic properties; viscosity.

Unit V

Production of acopolymer of PHB and PHV (polyhydrovaleric acid), sold as Biopol by fermentation on *Alcaligenes eutrophus :* Biodegradable polymers.

Text / Reference :

1. Ratledge C Nad Krishansen B, Basic Biotechnology, Cambrdige University Press, 2nd Ed., 2001
2. Doi Y, Microbial Polymers, VCH Weinheim, 1990

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Clinical Trails & Bioethics

BT-629

L T
4 0

Theory : 100 Marks / 4 Credits
Sessional : 50 Marks / 2 Credits
Total : 150 Marks / 6 Credits
Time : 3 Hrs.

Clinical Trails & Bioethics

Unit I

Clinical Research : Definition and basic concept; Pre clinical, toxicity studies evolution of drugs and Indian regulatory framework; Guidelines for undertaking clinical trails. Structure, content & format for clinical study report; Approval for clinical tails; Responsibility of sponsor, investigator & ethical committee.

Unit II

Clinical Trails types phases of clinical tails ethical issues in research involving human partciplants.

Eugenics; Genetic diseases : screening and treatment; Genetic therapy; reproductive technologies (Artificial Insemination, In-vitro Fertilization, Gamete Intrafallopian Transfer & Zygote Intrafallopian Transfer).

Unit III

Biomedical basis of Diseases. General Pharmacology, organization and functions of various systems including drug used in the management of various disease. Drug discovery and development. Clinical data Management.

Ethical issues in Human Immuno-deficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/ AIDS) and issues regarding day-to-day health care and organ transplant.

Unit IV

Animal toxicology (Non-clinical toxicity study), Animal Pharmacol-

ogy, Human Pharmacology (Phase I), Therapeutic exploratory trail (Phase II). Therapeutic confirmatory trails (Phase II), Post marketing trails (Phase IV), Studies in special population.

Responsibility for safety : Saftey and risk - assessment of safety and risk - risk benefit analysis reducing risk.

Unit V

Bioethics : Legality, moarality and ethics the principles of bioethics : autonomy, human rights, beneficence, privacy, justice, equity etc.

Bitechnology and Bioethics : The expanding scope of ethics from biomedical practice to biotechnology, ethics conflicts in biotechnology- interference with nature, fear of unknown, unequal distribution of risks and benefits of biotechnology, bioethics vs, business ethics.

Text / Reference :

1. Wilson, Clinical Genetics, Wiley- Liss, 2000
2. Robinson and Linden, Clinical Genetics Handbook, 2nd Ed. Blackwell Science 1994.
3. Rasko and Downes, Genes inMedicine, Chapman & Hall, 1996
4. Young, Introduction to Risk calculation in Genetic Counselling, 3rd Edition Oxford University Press, 2006.

Note for paper Setter :

Eight questions will be set in the question paper. Candidates will be required to attempt five questions.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Biotechnology Lab.-V-607

L	T	P	
0	0	3	**Theory : 50 Marks / 2 Credits**
			Sessional : 50 Marks / 2 Credits
			Total : 100 Marks / 4 Credits

Laboratory I work to be carried out as per BT-601.

M.Tech. 3rd SEMESTER (Bio-Tech.)

Biotechnology Lab.-VI-609

L	T	P	
0	0	3	**Theory : 50 Marks / 2 Credits**
			Sessional : 50 Marks / 2 Credits
			Total : 100 Marks / 4 Credits

Laboratory I work to be carried out as per BT-603.