

AC 27/2/13

Item no. 4.67

UNIVERSITY OF MUMBAI



Syllabus for Sem III & IV

Program: M.Sc.

Course: Biotechnology

(Credit Based Semester and Grading System with effect

M.Sc.
BIOTECHNOLOGY

SEMESTER- III

Course Code	UNIT	PTC and ATC	Credits	L / week
PSBT301	I	Introduction to primary and secondary metabolism, important pathways leading to biosynthesis of secondary metabolites in plants, Metabolic products produced from in vitro culturing of plant cells, selection of plant cells/ tissues for production of a specific products, culture system in secondary plant product, Biosynthesis- batch, continuous cultures, immobilized plant cell, Biotransformation of precursors by cell culturing, metabolic engineering for production of secondary metabolites, Hairy root culture, elicitation	4	1
	II	Cryopreservation -Principle and types. Germplasm conservation, Transgenic plants-Edible vaccine, Golden rice		1
	III	Biology of cultured cells Culture vessels, Culture Media, Microbial contamination, cross contamination. Cryopreservation		1
	IV	Primary culture: Types, isolation of tissues, culturing of different cells. Cell lines: Development, Subculture and propagation, immortalization of cell line, cell line designation, selection of cell lines, routine maintenance, Cytotoxicity Transformation Culture of tumor cells		1
Course Code	UNIT	Medical microbiology	Credits	L / week
PSBT302	I	Chromosomal disorders-	4	1

		Karyotyping, G banding, Chromosome analysis, variations, chromosome painting		
	II	Infections of Respiratory tract- Pneumonia, Tuberculosis. Nosocomial- Psuedomonas. Viral infections-HIV, Hepatitis. Fungal-Candidiasis		1
	III	Molecular diagnostics for Pneumonia, Tuberculosis, Pseudomonas, HIV, Hepatitis. Candidiasis		1
	IV	Biofilms in medicine		1
Course Code	UNIT	Bioprocess and applied biotechnology	Credits	L / week
PSBT303	I	Fermentor Design and Scale up, Types Mechanically and pneumatically agitated Bioreactors, Solid state reactors	4	1
	II	Aeration and agitation - Gas and liquid systems- Oxygen Requirement in fermentation, Gas liquid mass transfer, Mass transfer coefficient, Determination of mass transfer coefficient, Fluid Rheology,		1
	III	Industrial production & application 1. Polysaccharides/Micropolymers/ biopolymers – xanthan 2. Enzymes: Proteases, Lipases, amylase, pectinase. 3. Nutraceutical – probiotics, prebiotics 4. Antibiotics-erythromycin 5. Production of vitamin B12		1
	IV	Preparation and Quality control of – Vaccines, Invivo diagnostic, Immune sera, Human immune globulins- source materials, fractionation and quality control. Quality control and quality assurance of sterile products- bioburden, test for sterility, parametric release and pyrogens		1
Course Code	UNIT	Developmental Biology	Credits	L / week
PSBT304	I	Human Embryonic development: Events during fertilization, in-vitro fertilization, Zonapellucidaa, glycoprotein, Oelemma protein and their role in fertilization, sperm	4	1

		antigens and their functional significance. Molecular and biochemical events during sperm function		
	II	Post fertilization events: early embryonic development, establishing multi-cellularity, formation of blastula, embryonic germ layer, tracking of migrating cells.		1
	III	Molecular mechanism of sex hormone action and regulation of gene expression. Implantation and endometrium antigens involved in implantation. Immunology of pregnancy. Superovulation, embryo culture and embryo transfer technology.		1
	IV	Infertility and reproductive vaccines. Frontiers in contraceptive research. Cryopreservation of sex gametes and embryos. Ethical issues related to embryo research.		1
PSBTP301	PTC and ATC		2	4
PSBTP302	Medical microbiology		2	4
PSBTP303	Bioprocess and applied biotechnology		2	4
PSBTP304	Developmental Biology		2	4

Practicals for Semester III

Sr No.	Experiment
1	PTC <ul style="list-style-type: none"> - Media preparation - Seed sterilization - Callus induction - Synthetic seed - Protoplast isolation <li style="padding-left: 20px;">Somatic embryogenesis
2	ATC <ul style="list-style-type: none"> -Trypsinization -Monolayer formation (fibroblast) -Cytotoxicity -Short term culture of humans lymphocytes for G banding of chromosomes and Karyotyping
3	Protein content of mushrooms on dry weight basis, spawn development
4	Alcohol fermentation: determination of alcohol content, sugar content Cole's method
5	Medical diagnostic – Identification of organisms from specimens (Multiple drug resistant <i>S. aureus</i> , <i>Pseudomonas spps</i> , <i>Klebsiellapneumoniae</i> , <i>E. coli</i>).
6	Sterility testing of injectable material-saline, injections, etc
7	Isolation and purification of specific metabolite and its identification- enzyme assays, bioassay
8.	Demonstration of Germ tube in <i>Candida albicans</i>

SEMESTER IV

Course Code	UNIT	Nanotechnology	Credits	L / Week
PSBT401	I	Introduction, synthesis of nanomaterials, biological methods, use of microbial system & plant extracts, use of proteins & templates like DNA. Characterization of nanomaterials, analysis techniques, properties of nanomechanical, optical, magnetic properties, electrical conductivity, thermal conductivity.	4	1
	II	Carbon nanotubes Nanorobotiocs devices of nature: ATP synthese, the kinen, myosin, dynein, flagella modulated motion.		1
	III	Nanomedicine: biopharmaceutics, implantable materials, implantable chemicals, surgical aids, diagnostic tools, nanosensors, nano scanning, nano enabled drug delivery system, nanorobotics in medicine.		1
	IV	Application of nanomaterials in food,cosmetics, agriculture, environment management		1
Course Code	UNIT	IPR and environment	Credits	L / Week
PSBT402	I	1. Biotechnology & the law: objective, evolution, basic structure of gene techniques, applications, commercial potential of biotech inventions, rational for IPR protection. 2. Patenting biotech inventions: objectives, concept of novelty, concept of inventive step, microorganisms, and moral issues in patenting biotech inventions.	4	1

		3. Plant varieties protection: objectives, justification, international position, plant varieties protection in India.		
	II	1. Protection of geographical indications: objectives, justification, international position, multi lateral treaties, national level, Indian position 2. Protection of traditional knowledge: objective, concept of traditional knowledge, holders, issue concerning, bio-prospecting and bio-piracy, alternative ways, protectability, need for a Sui-generis regime, traditional knowledge digital library 3. Case study related to basmati rice & erythropoietin by Genetech 4. Environmental laws: acts concerning land, water and air. History of amendments. Pollution boards and their role, Socail movements. Role of NGOs. World scenario		1
	III	Solid waste treatment, pollution indicators & biosensors biodegradation of xenobiotics, pesticides, phytoremediation		1
	IV	Biodegration of waste from food, textile, petrochem, paper, industries, biological detoxification, Removal of oil spillage & grease deposits		1
Course Code	UNIT	Bioinformatics	Credits	L / Week
PSBT403	I	Organization of biological data, databases (raw and processed), Quering in data bases. Primers in biology(Designing of primers, kinds of primers)	4	1
	II	Gene finding, motif finding and multiple sequence alignment. Protein sequence analysis (theory and algorithms) Protein structure analysis and applications.		1
	III	Gene expression profiling and its applications. Microarray technology and basics. Microarray analysis and		1

		organization of data Human genome analysis		
	IV	Proteomics. Exploration of data bases, retrieval of desired data, BLAST etc. Gene clusters and fusions, consensus sequences, exon intron finder, sequence logo.		1
Course Code	UNIT	Biostatistics	Credits	L / Week
PSBT404	I	Statistical population, sample from population, Random sample. Central Tendency: Mean, Median and Mode, Standard Deviation Confidence intervals	4	1
	II	Gaussian Distribution and testing for normality, Non-parametric tests (Sign test, Wilcoxon test, Mann-Whitney Test, Krushkal-Whllis test.), transforming data to create Gaussian Distribution		1
	III	Test of Significance. Hypothesis testing:- Theory of errors- Type I and Type II errors, Null hypothesis, P values-one v/s two tail P values, t-test(paired & unpaired), z-test, Chi square test, contingency table.		1
	IV	Comparing three or more groups- Introduction to ANOVA, One way ANOVA, repeated measures ANOVA, Friedman Test. Correlation and Regression: Linear and multiple Correlation and Regression.		1

Semester IV Practicals

Project's done by the students for 6 months will be included in this semester for 100marks- Dissertation (inclusive of Viva, Presentation, Project Report)

Sr No.	Experiment
1	Multiple alignment - Phylogenetic tree
2	BLAST - orthologs and paralogs , homologs
3	Motif finding
4	KEGG
5	Structure of proteins - identification of chains helices, special groups, metal ions etc. CATH / SCOP classification of a given protein
6	Growth analysis shake flask – cell yield
7	Bioremediation- isolation of metal tolerant organisms & study their growth characteristics and pattern
8	Composting – physical & chemical parameters

PSBTP401	Nanotechnology	2	4
PSBTP402	IPR and environment	2	4
PSBTP403	Bioinformatics	2	4
PSBTP404	Biostatistics	2	4

References

Sr No	Title of the Book	Author	Publisher
1	A Introduction to Biostatistics (Second Edition-2005)	N. Gurumani	M J P Publishers
2	Basic Biostatistics (2008)	B. Burt Gerstman	Jones and Bartlett Publishers
3	Biostatistics: A foundation For Analysis In Health Sciences (7 th Edition 1999)	Wayne W. Daniel	John Wiley & Sons Inc.
4	Fundamentals of Biostatistics (2006)	Veer BalaRastogi	Ane Books India
5	Biostatistics- The Bare Essentials (Second Edition 2000)	NosmanStreiner	B. C. Decker Inc.
6	Computer Based Decision Making in Medicine	E. A. Shortifile	American Elsevier
7	Bioinformatics : Sequence and Genome Analysis (Second Edition 2004)	David W. Mount	ColdSpringHarbor Laboratory Press
8	Bioinformatics and Functional Genomics (2003)	Jonathan Pevsner	John Wiley & Sons Publications

Sr No	Title of the Book	Author	Publisher
1	Plant Cells in liquid culture (1991)	Payne Shuler	Hanser Publishers
2	Culture of Animal Cells : A Manual Of Basic Techniques (4 TH Edition, 2000)	R. Ian Freshney	Wiley-Liss
3	<i>Principles and Practice of Animal Tissue Culture</i> (2007)	SudhaGangal	Universities Press
4	Langman's Medical Embryology (9 th Edition 2004)	T. W. Sadler.	Lippincott Williams & Wilkins
5	Essential Developmental Biology (2 nd Edition 2006)	J. M. W. Slack	Blackwell Publishing

6	Developmental Biology (8 th Edition 2006)	Scott F. Gilbert	Sinauer Associates, Inc.
7	The Nanoscopeencyclopedia of nanoscience and nanochehnology, Vol. I (2005)	Dr.ParagDiwan and AshishBharadwaj	Pentagon Press New Delhi
8	The Nanoscopeencyclopedia of nanoscience and nanochehnology, Vol V (2005)	Dr.ParagDiwan and AshishBharadwaj	Pentagon Press New Delhi
9	The Nanoscopeencyclopedia of nanoscience and nanochehnology, Vol VI (2005)	Dr.ParagDiwan and AshishBharadwaj	Pentagon Press New Delhi
10	Nano forms of carbon and its applications (2007)	Prof.Maheshwar Sharon and Dr.Madhuri Sharon	Manad Nanotech Pvt. Ltd.
11	Biotechnanotechnology lessons from Nature (2004)	David Goodsell	Wiley-Liss A John Wiley and sons
12	Nanotechnology- Basic science and emerging technologies (2005)	WillsonKannangava, Smith, Simmons, Raguse	Oversease Press
13	Texbook of Biotechnology (2005)	R. C. Dubey	S. Chand and Co.
14	Nanotechnology- Principles and practices	S. K. Kulkarni	Capital Publishing Co.

Sr No	Title of the Book	Author	Publisher
1	Fermentation Microbiology & Biotechnology. (2005)	EL- Mansi& CFA Bryce	Taylor & Francis USA.
2	Bioprocess Engineering (2 nd Edition 2006)	M. Shuler & F. Kargi	Dorling Kindersley Pvt. Ltd.
3	Entrepreneurship & Business of Biotechnology	S N Jogdand	Himalaya publishing house
4	Manual of Industrial Microbiology & Biotechnology 2 nd edition (2004).	Arnold & Julian	ASM press Washington.
5	Process Biotechnology fundamentals 2 nd edition (2004)	S N Mukhopadhyay	Viva books pvt ltd.
6	Industrial Microbiology an Introduction	Michael, Neil, John & Gary	
7	Diagnostic Microbiology 5 th edition	Elmer Koneman, Stephen Allen	Lippincott
8	Molecular Microbiology: Diagnostic	Persing, Tenover,	ASM press Washington

	principles & Practice (2004)	Versalone	DC
9	Pharmaceutical microbiology 7 th ed., (2004)	Hugo Russell's	Edited by Stephen P. Denyer, Hodges and Sean P. Gorman

Sr No	Title of the Book	Author	Publisher
1	Law Of Intellectual Property Rights	Shiv Sahai Singh	Deep & Deep Publications (p) Ltd
2	WTO And Intellectual Property Rights	By TalwarSabanna (2007)	Serials Publications
3	IPR: Unleashing the Knowledge Economy (2003)	PrabuddhaGanguli	Tata Mcgrow Hill publication
4	Environmental Biotechnology (2 nd Edition, 2005)	Alan Scragg	Oxford University Press
5	Environmental Biotechnology- Basic Concepts and Applications (2006)	InduShekhar Thakur	I. K. International Pvt. Ltd.
6	Environmental Biotechnology	M. H. Fulekar	Oxford & IBH Publishing