

AC 19/3/2012

Item No. 4.75

UNIVERSITY OF MUMBAI



Syllabus for the M.Sc. Sem. I & II

Program: M.Sc.

Course: Biotechnology

(Credit Based Semester and Grading System with
effect from the academic year 2012–2013)

Course Code	UNIT	Biochemistry	Credits	L / Week
PSBT101	I	Proteins	4	1
	II	Signal transduction		1
	III	Lipids		1
	IV	Neurochemistry		1
Course Code	UNIT	Immunochemistry	Credits	L / Week
PSBT102	I	Immuno-globulins	4	1
	II	Complement system		1
	III	MHC and Regulation of immune response		1
	IV	Cytokines		1
Course Code	UNIT	Genomes and Transcriptomes	Credits	L / Week
PSBT103	I	Gene evolution and the Human Genome	4	1
	II	Mapping Genomes		1
	III	Transcription Initiation in prokaryotes and eucaryotes		1
	IV	Synthesis and processing of RNA		1
Course Code	UNIT	Biophysics	Credits	L / Week
PSBT104	I	DNA Topology	4	1
	II	Protein Secondary Structure		1
	III	Advances in Microscopy		1
	IV	Membrane mimicry		1
PSBTP101	Biochemistry		2	4
PSBTP102	Immunochemistry		2	4

PSBTP103	Genomes and Transcriptomes	2	4
PSBTP104	Biophysics	2	4

SEMESTER II

Course Code	UNIT	Metabolomics	Credits	L / Week
PSBT201	I	Carbohydrate and Lipid metabolism	4	1
	II	Protein metabolism		1
	III	Nucleic Acid metabolism		1
	IV	Plant metabolism		1
Course Code	UNIT	Clinical Immunology	Credits	L / Week
PSBT202	I	Hypersensitivity and Autoimmunity	4	1
	II	Transplantation		1
	III	Tumor immunology		1
	IV	Immuno-deficiency		1
Course Code	UNIT	Genomics and Molecular biology	Credits	L / Week
PSBT203	I	Translation in eucaryotes	4	1
	II	Regulation of Genome Activity		1
	III	DNA vectors		1
	IV	Model organisms		1
Course Code	UNIT	Advanced Analytical Techniques	Credits	L / Week
PSBT204	I	Analytical Techniques	4	1
	II	Gene amplification technique		1
	III	X-Ray Crystallography		1
	IV	Spectroscopy		1

PSBTP201	Metabolomics	2	4
PSBTP202	Clinical Immunology	2	4
PSBTP203	Genomics and Molecular biology	2	4

PSBTP204	Advanced Analytical Techniques	2	4
-----------------	---------------------------------------	----------	----------

Semester- I

Course Code	Title	Credits
PSBT101	Biochemistry	4
Unit I	<p>Proteins : Primary structure of proteins and their determination – end group analysis; cleavage of disulphide bond; separation, purification, characterization of polypeptide chain; specific peptide cleavage reactions.</p> <p>Secondary structure – Ramachandran plot, helical structure, beta structure;</p> <p>Tertiary structure- fibrous (Collagen) and globular (Myoglobin) structure. Protein stability, protein denaturation.</p> <p>Quaternary structure – (Haemoglobin) subunit interaction, symmetry, subunit composition determination</p>	1
Unit II	<p>Signal transduction Cell signalling pathways that control gene activity- TGF-Beta and activation of Smads: Regulation of TGF-Beta by negative feedback loops. Cancer and loss of TGF-Beta signalling,</p>	1
Unit III	<p>Lipids Lipoproteins – structure, function, disorders and dysfunction in Alzheimer’s disease.</p>	1
Unit IV	<p>Neurochemistry Anatomy and functions of neuron, organization of brain, neuronal pathways and systems, propagation of nerve impulse, ion conducting channels, synapses and gap junction, neurotransmitters, neurotoxins</p>	1

Course Code	Title	Credits
PSBT102	Immunochemistry	4
Unit I	<p>Immunoglobulins Hematopoiesis, Immunoglobulin fine structure, Immunoglobulin superfamily ,Multigene organization of Ig gene, Variable region gene rearrangement, Generation of antibody diversity, Class switching among constant region. Synthesis, assembly, and secretion of immunoglobulins</p>	1

Unit II	Complement system Activation, Regulation, Biological consequence of complement activation, Complement deficiency	1
Unit III	MHC and Regulation of immune response Cellular distribution of MHC molecule, Antigen processing and presentation – exogenous and endogenous antigen processing. Self - MHC restriction of T cells. Presentation of non-peptide antigens. Activation of B and T lymphocytes, T-cell regulation.	1
Unit IV	Cytokines Properties, receptors, antagonists, diseases, therapeutic use of cytokines	1

Course Code	Title	Credits
PSBT103	Genomes and Transcriptomes	4
Unit I	Gene evolution and The human genome Human genome project, the content of human nuclear genome, tandemly repeated DNA, interspersed genome-wide repeats. Human mitochondrial genome. Genome evolution-Acquisition of New Genes (gene duplication, from other species, transposable elements), Non-coding DNA	1
Unit II	Mapping Genomes Genetic Mapping: DNA markers for genetic mapping, Physical Mapping: Restriction Mapping, Fluorescent <i>in situ</i> hybridization (FISH), Sequence tagged site (STS) mapping.	1
Unit III	Transcription Initiation in prokaryotes and eukaryotes DNA-Protein interactions during Transcription Initiation, Regulation of Transcription initiation.	1
Unit IV	Synthesis and Processing of RNA Synthesis of eukaryotic mRNAs by RNA polymerase II, Intron splicing. Synthesis and processing of Non-coding RNAs: Transcript elongation and termination by RNA polymerases I and III, Introns in eukaryotic pre-rRNA and pre-tRNA. Processing of Pre-RNA. Degradation of mRNAs	1

Course Code	Title	Credits
PSBT104	Biophysics	4
Unit I	DNA Topology Different forms of DNA, - A/B/C/Z and RL form of double helical DNA, Triple Helix, Nucleic acid binding protein – Leucine Zipper, Zinc fingers, OB fold, Beta Barrel, Helix-turn-helix, Helix-loop-helix. Linking number, Supercoiling, Topoisomerases.	1
Unit II	Protein secondary structure Protein folding. The different pathways of protein folding and its co-relation with protein stability. Molecular chaperons	1
Unit III	Advances in Microscopy Different versions of electron microscopy, Confocal Microscopy	1
Unit IV	Membrane mimicry Liposome structure and their uses in drug targeting. solubilisation of the membrane by using different detergents. Membrane mimicry.	1

Practical Semester-I

PSBTP101	Biochemistry <ol style="list-style-type: none">1. Preparation of buffers used in laboratory(Phosphate, Citrate, acetate and Tris buffer)2. Detection of LDH isozymes by electrophoresis.3. Protein estimation by Bradford's method4. Study of protein complexes using PAGE and detection with CBB and Silver staining.	2
PSBTP102	Immunochemistry <ol style="list-style-type: none">1. Perform serum electrophoresis (horizontal)2. Perform iso-agglutination titre3. Perform Affinity chromatography for purification of antibodies from serum.4. Perform SDS and native PAGE for studying immunoglobulins structure	2
PSBTP103	Genomes and Transcriptomes <ol style="list-style-type: none">1. Restriction digestion reaction2. Demonstration of ligation reaction.3. Perform transformation of bacteria	2
PSBTP104	Biophysics <ol style="list-style-type: none">1. Viscosity studies of proteins (Std BSA & varying concentration of urea.)2. Present a seminar on any research paper obtained from a recent (past 5 years) journal with reference to any topic of choice. (Internal)	2

Semester II

Course Code	Title	Credits
PSBT201	Metabolomics	4
Unit I	<p>Carbohydrate metabolism HMP, uronic acid pathway, glycogenolysis and glycogen storage diseases.</p> <p>Lipid metabolism Synthesis of essential fatty acids</p>	1
Unit II	<p>Protein metabolism Biosynthesis of essential amino acids. Metabolic breakdown of amino acids leading to Krebs cycle intermediate. Disorders of amino acid metabolism</p>	1
Unit III	<p>Nucleic acid metabolism Biosynthesis and degradation of purines and pyrimidines with regulation, disorders of Nucleic acid metabolism.</p>	1
Unit IV	<p>Plant metabolism C-3 cycle and C-4 cycles, CAM, glyoxalate pathway, photosynthetic formation of hydrogen Nitrogen fixation and role of nitrogenase</p>	1

Course Code	Title	Credits
PSBT202	Clinical Immunology	4
Unit I	<p>Hypersensitivity Gel and Coomb's Classification; Type I, II, III, IV hypersensitivity</p> <p>Autoimmunity Organ specific, systemic, mechanism, treatment</p>	1
Unit II	<p>Transplantation Basis of Graft rejection, clinical manifestation of graft rejection; immunosuppressive therapy; immune tolerance; clinical transplantation.</p>	1
Unit III	<p>Tumor immunology Oncogenes and cancer induction, Tumor of immune system, Tumor antigens, Tumor evasion of immune system, Cancer immunotherapy</p>	1

Unit IV	Immuno-deficiency Primary immunodeficiency and secondary immunodeficiency	1
Course Code	Title	Credits
PSBT203	Genomics and Molecular Biology	4
Unit I	Translation in eukaryotes Post-translational Processing: Processing by proteolytic cleavage, Processing by chemical modification, Inteins, Protein Degradation.	1
Unit II	Regulation of Genome Activity Genome rearrangements, gene silencing by modification of histones and DNA . RNA in gene regulation, Regulation of Genome Activity During Development: Vulva development in <i>Caenorhabditis elegans</i> , Development in <i>Drosophila melanogaster</i> .	1
Unit III	DNA vectors Expression vectors- for maximizing protein synthesis, to facilitate protein purification, to promote protein solubilization, to promote protein export. Vectors for making RNA probes. BACs, PACs.	1
Unit IV	Model organisms <i>S.cereviceae</i> -Genome,existence of haploid and diploid cells, facilitating genetic analysis, generating mutations in yeast, <i>Arabidopsis</i> - genome life cycle , ease of transformation epigenetics, response to environment. <i>Mus musculus</i> - mouse embryonic development and stem cells, ease of introduction of foreign DNA, epigenetic inheritance.	1

Course Code	Title	Credits
PSBT204	Advanced Analytical Techniques	4
Unit I	Analytical Techniques 2-D Page, Capillary isoelectric focusing- electro spray ionization-mass spectrometry, MALDI-TOF-MS/MS, Biochips (DNA, Protein and Biosensors). Flow cytometry	1
Unit II	Gene amplification technique PCR and its types (nested, arms, inverse, real time, SSCP)	1
Unit III	X-Ray Crystallography Protein crystallization and visualization, Method of data collection, factors affecting the measurement of integrated intensities, photographic methods, diffractometers, area detectors and image plates.	1
Unit IV	Spectroscopy Basic principles, instrumentation and applications of IR, Raman, ORD, CD spectroscopy, NMR and ESR.	1

Practical Semester-II

PSBTP201	Metabolomics <ol style="list-style-type: none">1. Detection of Phenylalanine for PKU by spot test and chromatography done with std. Phenylalanine.2. Isolation of chloroplast by sucrose density gradient centrifugation.3. Uric acid estimation from serum/urine4. Determination of acid number and iodine number of lipids	2
PSBTP202	Clinical Immunology <ol style="list-style-type: none">1. Perform Western blotting2. Perform DOT-blot for protein3. Demonstration Practical – Flow Cytometry4. Demonstration Practical- ELISA reader.	2
PSBTP203	Genomics and Molecular biology <ol style="list-style-type: none">1. Plasmid isolation4. Extraction of genomic DNA from bacteria and blood5. Expression of recombinant protein	2
PSBTP204	Advanced Analytical Techniques <ol style="list-style-type: none">1. PCR amplification.2. Validation of Autoclave, Micropipette, Colorimeter, Spectrophotometer and measuring containers.3. Calibration of pH meter and weighing balance	2

Reference book-list

Paper101 and 201, References:

Sr.No	Title of the Book	Author	Publisher
1	Biochemistry, 5 th edition	J. Berg,J. Tymoczko & L. Stryer	W. H. Freeman & Company
2.	Biochemistry, 4 th Edition	G. Zubay	Wm .C. Brown
3	Biochemistry, The chemical reactions of living cells, Volume I and II.	David E. Metzler	Elsevier
4.	Lehninger's Principles of Biochemistry, fourth edition.	Nelson and Cox	Macmilan Worth
5.	Biochemistry third edition, 2004	Donald Voet and Judith Voet.	John Wiley and sons, Inc
6.	Textbook of Biochemistry with clinical correlations, Fifth Edition	Thomas Devlin	John Wiley and sons, Inc
7.	Fundamentals of biochemistry	A C Deb	New Central Book Agency
8.	Biochemistry, second ed.	Mathews, Van Holde	The Benjamin/ Cummins publishing Company
9.	Biochemistry, fourth and fifth ed	Campbell and Farrell	Thomson Brooks/Cole
10.	Harpers Illustrated biochemistry, 26 th Edition	R Murray, D Granner, P Mayes	McGraw Hills
11	Diagnostic Recognition of Genetic Disease	William I Nyhan, Nadia A Sakati	Library of Congress cataloging in publication data.

Paper 102 and 202, References:

Sr.No	Title of the Book	Author	Publisher
1.	Immunology, fifth Ed	Goldsby, T J. Kindt, Osborne, Janis Kuby	Freeman and company.
2.	Immunology, sixth Ed	Roitt, Brostoff, Male	Mosby, An imprint of Elsevier science Ltd
3.	Cellular and molecular immunology. Fourth edition	Abbas , Abul K & Lichtman	W B Saunders company
4.	Immunology, An introduction, fourth edition.	Ian R Tizard	Thomson
5.	Immunology the experimental series	Wener Luttmann, K Bratke, M. Kupper, D Myrtek	Elsevier
6.	An introduction to Immunology	C V Rao	Narosa Publishing house
7.	Immunology essential and fundamental, Second edition	S Pathak & U Palan	Parveen Publishing House

8.	Elements of Immunology	S C Rastongi	CSB Publishers and distributors
9.	Immunology, fourth edition.	Gordan Reeve and Ian Todd	Blackwell Publishing House
10	Microarray and Microplates	S Ye and I N M Day	Bios

Paper 103 and 203 References:

Sr.No	Title of the Book	Author	Publisher
1	Gene VII	Benjamin Lewin	Oxford Publishers
2.	Genome, Second edition	T A Brown	Bios Scientific
3	Principles of Gene Manipulation.	Old and Primrose	Blackwell Science
4.	Principles of genetics	Simmons, Gardner	John Wiley and sons, Inc
5.	Biochemistry third edition, 2004	Donald Voet and Judith Voet.	John Wiley and sons, Inc
6.	Molecular biology of the gene	T D.Watson and others	Pearson education ltd.
7.	The Cell, a molecular approach	G M Cooper	Library of Congress cataloging in publication data.
8.	An introduction to genetic analysis	Griffiths, A. and Miller J	Freeman
9.	Molecular cell biology	Lodish.H, Berk A	John Wiley and sons, Inc
10.	Molecular cloning, Vol I, II , III	Sambrook J, Russell.	CSHL Press
11	Gene cloning and DNA analysis	T A Brown	Bios Scientific

Paper104 and 204, References:

Sr.No	Title of the Book	Author	Publisher
1	Biochemistry, second ed.	Mathews, Van Holde	The Benjamin/ Cummins publishing Company
2.	Biochemistry third edition, 2004	Donald Voet and Judith Voet.	John Wiley and sons, Inc
3	Molecular biology of the gene	T D.Watson and others	Pearson education ltd.
4.	Gene VII	Benjamin Lewin	Oxford Publishers
5.	Biophysics	V Pattabhi, N Gautham	Narosa
6.	Biophysics, An Introduction	R Cotterill	John Wiley and sons, Inc
7.	Principles of instrumental analysis	Skoog, Holler, Nieman.	Thomson
8.	Basic Biophysics 2004	Daniel M	Student Edition
9.	PCR protocols, 2 nd ed	Bartlett & Stirling	Humana
10	Introduction to Protein science Architecture, Function and Genomics	Arthur M Lesk	Oxford