M.Sc Biotechnology Syllabus Semester III & IV

Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for the M.Sc. Part II

Program: M.Sc.

Course: Biotechnology

(Adapted from the Credit Based Semester and Grading System MSc Biotechnology Syllabus of University of Mumbai 2018-19)

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER III				
Course code	Course type	Title	Credits	Lectures/ week
RJPSBT301	Core subject	Plant and animal tissue culture	4	4
RJPSBT302	Core subject	Medical microbiology	4	4
RJPSBT303	Core subject	Clinical studies	4	4
RJPSBT304	Core subject	Developmental biology	4	4
RJPSBTP301	Practicals	Practicals of RJPSBT301	2	3
RJPSBTP302	Practicals	Practicals of RJPSBT302	2	3
RJPSBTP303	Practicals	Practicals of RJPSBT303	2	3
RJPSBTP304	Practicals	Practicals of RJPSBT304	2	3
SEMESTER IV				
Course code	Course type	Title	Credits	Lectures/ week
RJPSBT401	Core subject	Nanotechnology	4	4
RJPSBT402	Core subject	GMO and environment	4	4
RJPSBT403	Core subject	Bioinformatics	4	4
RJPSBT404	Core subject	Biostatistics	4	4
RJPSBTP401	Practicals	Practicals of RJPSBT401	2	3
RJPSBTP402	Practicals	Practicals of RJPSBT402	2	3
RJPSBTP403	Practicals	Practicals of RJPSBT403	2	3
RJPSBTP404	Skill based Project		2	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER III		
Course Code	Title	Credits
RJPSBT301	Plant and animal biotechnology	4
Course objectives: To introduce students to Primary and secondary plant metabolites, Cryopreservation and biology of cultured cells. **Learning outcomes:** By the end of the course the student will be able to: • Gain an understanding of the basic concepts of Biosynthesis and biotransformation of plant metabolites, Transgenic plants. • Understand the types, isolation and culturing of animal cells.		
Unit	Topics	
UNIT I Genetic engineering of plants	Production of haploid plants, somatic variation, germplasm Conservation; genetic engineering of plants – methods, application of transgenic plants – herbicide resistance, abiotic and biotic stress tolerance.	
UNIT II Transgenic plants	Transgenic plants as bioreactors, molecular-marker aided breeding, RFLP, PCR- amplification, RAPD, AFLP, molecular marker assisted selection, green house and green home technology.	
UNIT III Basics of Animal cell culturing	Biology and characterization of cultured cells, Culture vessels, Culture Media, Microbial contamination, cross contamination. Cryopreservation.	
UNIT IV Cell culture techniques	Primary culture and Cell lines; cell viability and cytotoxicity; cell transformation; organ, histotypic cultures and tissue engineering.	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER III		
Course Code	Title	Credits
RJPSBT302	Medical microbiology	4
Course objectives: To introduce students to infection and Biofilms. **Learning outcomes:** By the end of the course the student will be able to: • Gain an understanding of infections caused by virus, bacteria, fungi and protozoa. • Understand the importance of Biofilms in environment and health.		
Unit	Topics	
UNIT I Viral Infections	Airborne – Chicken pox and Shingles Arthropod – Yellow fever Direct contact – Hepatitis Food borne – Poliomyelitis	
UNIT II Bacterial infections	Airborne – Diphtheria Direct contact – Clostridial myonecrosis Food borne – Cholera, *S aureus* Food poisoning Nosocomial infections	
UNIT III Bacterial, Fungal and Protozoal Infections	Chlamydial infections - Trachoma Mycoplasmal infection – genitourinary diseases, atypical pneumonia Rickettsial infection – Rocky mountain spotted fever Fungal mycosis Protozoal diseases – Malaria, Amoebiasis	
UNIT IV Biofilms	Structure, formation and control, consequences in environment and health.	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER III		
Course Code	Title	Credits
RJPSBT303	Clinical Research	4
Course objectives: To introduce students to clinical trials, preclinical toxicology, New drug discovery and Medical writing. Learning outcomes: By the end of the course the student will be able to: • Gain an understanding of the basic concepts of single and double blind studies and systemic toxicology • Carry out literature search, Scientific article writing and generate clinical study report.		
Unit	Topics	
UNIT I New drug discovery process	Purpose of new drug discovery process, main steps involved in new drug discovery, process, timelines of each steps, advantages and purposes of each steps, ethics in clinical research, unethical trials, thalidomide tragedy, Phase-I,II,III,IV trials. Introduction and designing- various phases of clinical trials- Post Marketing surveillance – methods	
UNIT II Pre clinical toxicology	General principles, Systemic toxicology (Single dose and repeat dose studies) Carcinogenicity, Reproductive, Local toxicity, Genotoxicity, animal toxicity requirements.	
UNIT III Clinical trials	Types of clinical trials, single blinding, double blindings, open label, randomized trials and their examples, interventional study and its members, cross over design, Project management and data management, Pharmacovigilance, Trial Monitoring. Ethics Committee/ Regulatory bodies.	
UNIT IV Medical writing	Literature search & Medical Articles, Contract writing, Publication, Abstracts, Bibliography, Clinical Study Reports; Principles and software's in Clinical data management.	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER III		
Course Code	Title	Credits
RJPSBT304	Developmental biology	4
Course objectives: To introduce students to Human embryonic development, post fertilization events and Infertility. Learning outcomes: By the end of the course the student will be able to: • Gain an understanding of the basic concepts of events during fertilization, early embryonic development and molecular mechanisms of sex hormones. • Understand the new frontiers in contraceptive research and ethical issues related to embryo research.		
Unit	Topics	
UNIT I Post fertilization events	Early embryonic development, establishing multi-cellularity, formation of blastula, embryonic germ layer, tracking of migrating cells.	
UNIT II Implantation	Molecular mechanism of sex hormone action and regulation of gene expression. Implantation and endometrium antigens involved in implantation. Immunology of pregnancy.	
UNIT III Contraceptives and Infertility	Frontiers in contraceptive research. Infertility and reproductive vaccines. Ethical issues related to embryo research.	
UNIT IV Assisted reproductive technology	Manipulation of reproduction in animals – artificial insemination, Superovulation, embryo culture, embryo transfer, *in vitro* fertilization, embryo cloning; Manipulation of reproduction in humans - Causes of infertility, intra uterine insemination, *in vitro* fertilization, embryo transfer and applications of assisted reproductive technology.	

M.Sc Biotechnology Syllabus Semester III & IV

	SEMESTER III	
	Practicals	
Course code	Title	Credits
RJPSBTP301	1. Hairy root culture 2. Abiotic stress tolerance 3. Establishing primary culture (ATC) 4. To assay the radical scavenging activity of a tissue hydrolysate – DPPH Method	2
RJPSBTP302	1. Medical diagnostic – *S. aureus, Pseudomonas spps, Corynebacterium diphtheriae*. 2. Staining of Biofilms 3. Weil – Felix reactions.	2
RJPSBTP303	Study and present published findings of any clinical trial.	2
RJPSBTP304	1. Candling, Observing chick embryo- stages of development 2. Developmental Biology – Visit to laboratory/video lectures for latest developments in the field. To be documented.	2

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER IV		
Course Code	Title	Credits
RJPSBT401	Nanotechnology	4
Course objectives: To introduce students to synthesis, characterization and applications of nanomaterials Learning outcomes: By the end of the course the student will be able to: • Gain an understanding of the basic concepts of biological methods of nano material synthesis and analysis techniques. • Understand the applications of carbon nano-tubes and other materials in medicine, food, cosmetics and environment management.		
Unit	Topics	
UNIT I Synthesis and characterization	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.	
UNIT II Nanorobotics	Carbon nanotubes, Nanorobotics devices of nature: ATP synthese, the kinen, myosin, dynein, flagella modulated motion.	
UNIT III Nanomedicine	Biopharmaceutics, implantable materials, implantable chemicals, surgical aids, diagnostic tools, nanosensors, nano scanning, nano enabled drug delivery system, nanorobotics in medicine.	
UNIT IV Applications	Application of nanomaterials in food, cosmetics, agriculture, environment management	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER IV		
Course Code	Title	Credits
RJPSBT402	GMO and environment	4
Course objectives: To introduce students to Role of GMOs in bioremediation, solid waste management and environment protection. Learning outcomes: By the end of the course the student will be able to: • Gain an understanding of the basic concepts of Food and Feed safety assessment, live stock feeding study and biodegradation of xenobiotics. • Understand the concepts of bioremediation of petrochemical and paper industry waste and Indian GMO research information system.		
Unit	Topics	
UNIT I Genetically Modified Organisms	Genetically Modified Organisms, examples and methods HUmulin, ice minus bacteria, GM bacteria in bioremediation, and use of PCR as a GMO identification tool, risks and controversies related to use Genetically Modified Microrganisms. Indian GM research information system. About Indian GMO Research Information System (IGMORIS); about the website; Biosafety data of any two approved genes available on the databse.	
UNIT II GE- crops	GE- crops- Arabidopsis as a model plant for studies in genetic engineering; Protocols on Food and feed safety in rats and mice, subchronic feeding study in rodents, Protein thermal stability, pepsin digestibility, Live stock feeding study.	
UNIT III Bioremediation	Solid waste treatment, pollution indicators and biosensors, biodegradation of Xenobiotics, pesticides, phytoremediation	
UNIT IV Biodegradation	Biodegradation of waste from food, textile, petrochem, paper industries, biological detoxification, Removal of oil spillage and grease deposits.	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER IV		
Course Code	Title	Credits
RJPSBT403	Bioinformatics	4
Course objectives: To introduce students to Bioinformatics which includes Organization of biological data, Databases, Quering in data bases, Gene expression profiling. Learning outcomes: By the end of the course the student will be able to: • Gain an understanding of the basic concepts of Genomics and Proteomics • Understand in detail tools and techniques used for gene finding, gene expression, microarray analysis and exon intron finder.		
Unit	Topics	
UNIT I Phylogenetics	Allignment and phylogenetic analysis, Submitting data sequences to data bases, Quering in data bases.	
UNIT II Proteomics	Protein classification and structure visualization. Motifs, profiles, patterns and fingerprints, tools and techniques.	
UNIT III Genomics	Gene identification and prediction, Gene expression profiling and its applications. Microarray analysis and organization of data Primers in biology (Designing of primers, kinds of primers)	
UNIT IV Drug discovery	Introduction to drug discovery, technologies and strategies	

M.Sc Biotechnology Syllabus Semester III & IV

SEMESTER IV		
Course Code	Title	Credits
RJPSBT404	Biostatistics	4
Course objectives: To introduce students to biostatistical analysis which includes central tendency, Test of significance, ANOVA. Learning outcomes**:** By the end of the course the student will be able to: • Gain an understanding of the basic concepts of Sampling in statistics, Gaussian distribution, Hypothesis testing • Understand the concept of correlation and regression.		
Unit	Topics	
UNIT I Central Tendency	Statistical population, sample from population, Random sample. Central Tendency: Mean, Median and Mode, Standard Deviation Confidence intervals	
UNIT II Non-parametric tests	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	
UNIT III Statistical tests	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. Use of softwares in biostatistics.	
UNIT IV ANOVA	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.	

M.Sc Biotechnology Syllabus Semester III & IV

	SEMESTER III	
	Practicals	
Course code	Title	Credits
RJPSBTP401	Nanoparticles – synthesis chemical and biological methods; Spectroscopic analysis	2
RJPSBTP402	1. Bioremediation- isolation of metal tolerant organisms & study their growth characteristics and pattern 2. GMO – Validation – kit based/ demo 3. Composting – physical & chemical parameters	2
RJPSBTP403	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. Use protein docking tools.	2
RJPSBTP404	Project	2

M.Sc Biotechnology Syllabus Semester III & IV

Reference

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: Afoundation For Analysis In Health Sciences (7th 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 000)	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
9	Plant Cells in liquid culture (1991)	Payne Shuler	Hanser Publishers
10	Culture of Animal Cells : A Manual Of Basic Techniques (4TH Edition, 2000)	R. Ian Freshney	Wiley-Liss
11	*Principles and Practice of* Animal Tissue Culture (2007)	SudhaGangal	Universities Press
12	Langman's Medical Embryology (9th Edition 2004)	T. W. Sadler	Lippincott Williams & Wilkins
13	Essential Developmental Biology (2ndEdition 2006)	J. M. W. Slack	Blackwell Publishing
14	Developmental Biology (8th Edition 2006)	Scott F. Gilbert	Sinauer Associates, nc.
15	The Nanoscopeencyclopedia of nanoscience and nanochehnology, Vol. I (2005)	Dr.Parag Diwan and Ashish Bharadwaj	Pentagon Press New Delhi
16	The Nanoscopeencyclopedia of nanoscience and nanochehnology, Vol V (2005)	Dr.Parag Diwan and Ashish Bharadwaj	Pentagon Press New Delhi
17	The Nanoscopeencyclopedia of nanoscience and nanochehnology, Vol VI(2005)	Dr.ParagDiwan & AshishBharadwaj	Pentagon Press New Delhi
18	Nano forms of carbon and its applications (2007)	Prof.Maheshwar Sharon and Dr.Madhuri Sharon	Manad Nanotech Pvt. Ltd.
19	Biotechnanotechnology lessons from Nature (2004)	David Goodsell	Wiley-Liss A John Wiley and sons
20	Nanotechnology- Basic science and emerging technologies (2005)	WillsonKannanga, Smith, Simmons, Raguse	Oversease Press

M.Sc Biotechnology Syllabus Semester III & IV

21	Texbook of Biotechnology (2005)	R. C. Dubey	S. Chand and Co.
22	Nanotechnology- Principles and practices	S. K. Kulkarni	Capital Publishing Co
23	Basic and clinical pharmacology	Katzung, B.G	Prentice Hall International
24	Clinical Pharmocology	Laurence D. R and Bennet P.M	Scientific book agency
25	Clinical Pharmacokinetics	Krishna D.R & Klotz V.	Springer Verlab
26	Remington Pharmaceutical sciences	Williams and Wilkins	Lippincott
27	Drug Interaction	Hamsten	Kven Stockley
28	Drug Interaction	J K Mehra	Basic Bussiness Publ., Bombay
29	Practical Guide to clinical data management	Sussane Prokscha	
30	Clinical pharmacology and Drug Therapy	Grahame smith & Aroson	
31	Clinical Data Mangement	Richard Rondel	Wiley
32	Medical Writing	Taylor Robert	Springer