B. K. Birla College (Autonomous), Kalyan

Department of Biotechnology

M.Sc. Part II

Syllabus for Autonomy

Year
2018-19

M.Sc. Part II

Course Code	SEMESTER III	credits
BPSBT301	Plant Tissue Culture and Animal Tissue Culture	04
BPSBT302	Medical Microbiology	04
BPSBT303	Clinical Studies	04
BPSBT304	Developmental Biology	04
	Practicals	
BPSBTP301	Plant Tissue Culture and Animal Tissue Culture	02
BPSBTP302	Medical Microbiology	02
BPSBTP303	Clinical Studies	02
BPSBTP304	Developmental Biology	02
Course Code	**SEMESTER IV**	
BPSBT401	Drug development and Nanotechnology	04
BPSBT402	GMO and environment	04
BPSBT403	Bioinformatics	04
BPSBT404	Biostatistics	04
	Practicals	
BPSBTP401	Drug development and Nanotechnology	02
BPSBTP402	GMO and environment	02
BPSBTP403	Bioinformatics	02
BPSBTP404	Biostatistics	02

	SEMESTER III		Credits
BPSBT301	**Plant Tissue Culture and Animal Tissue Culture**		**04**
Unit I	1.1 Introduction to primary and secondary metabolism, important pathways leading to biosynthesis of secondary metabolites in plants, 1.2 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, 1.3 Biosynthesis- batch, continuous cultures, immobilized plant cell, 1.4 Biotransformation of precursors by cell culturing, metabolic engineering for production of secondary metabolites, 1.5 Hairy root culture, elicitation	15 lectures	
Unit II	2.1 Cryopreservation -Principle and types. 2.2 Germplasm conservation, 2.3 Transgenic plants-Edible vaccine, Golden rice	15 lectures	
Unit III	3.1. Biology of cultured cells, Culture vessels, Culture Media, 3.2 Microbial contamination, cross Contamination, 3.3 Cryopreservation	15 lectures	
Unit IV	4.1 Primary culture: Types, isolation of tissues, culturing of different cells. 4.2 Cell lines: Development, Subculture and propagation, immortalization of cell line, cell line designation, selection of cell lines, routine maintenance, 4.3 Cytotoxicity. 4.4 Transformation. Culture of tumor cells	15 lectures	
	Ref: • Plant Cells in liquid culture (1991) Payne Shuler Hanser Publishers • Culture of Animal Cells : A Manual Of Basic Techniques (4TH Edition, 2000) R. Ian Freshney Wiley-Liss • Principles and Practice of Animal Tissue Culture (2007) Sudha Gangal Universities Press		

BPSBT302	**Medical Microbiology**		**04**
Unit I	1.1 Chromosomal disorders- Karyotyping, G banding, 1.2 Chromosome analysis, variations, chromosome painting	15 lectures	
Unit II	2.1 Infections of Respiratory tract Pneumonia,Tuberculosis. 2.2 Nosocomial- Pseudomonas. 2.3 Viral infections-HIV, Hepatitis. 2.4 Fungal-Candidiasis	15 lectures	
Unit IIII	Molecular diagnostics for 3.1 Pneumonia, 3.2 Tuberculosis, 3.3 Pseudomonas, 3.4 HIV, 3.5 Hepatitis. 3.6 Candidiasis	15 lectures	
Unit IV	4.1 Biofilms in medicine	15 lectures	
BPSBT303	**Clinical Studies**		**04**
Unit I	1.1 Types of clinical trials, single blinding, double blinding, Open access, randomized trials and their examples, 1.2 Interventional study, ethics committee and its members. 1.3 Cross over design, 1.4 Institution ethics committee, independent ethics committe	15 lectures	
Unit II	2.1 Pre clinical toxicology; general principles, systemic toxicology (single dose and repeat dose toxicity studies), 2.2 Carcinogenicity, 2.3 Mutagenicity, teratogenicity, 2.4 Reproductive toxicity, Local toxicity, 2.5 Genotoxicity, animal toxicity requirements.	15 lectures	
Unit III	3.1 New drug discovery process- purpose, main steps involved in new drug discovery, process, timelines of each step, advantages and purposes of each step, 3.2 Ethics in clinical research, unethical trails, thalidomide tragedy, phase I, II, III, IV trails. 3.3 Introduction and designing – Various phases of clinical trials; 3.4 Post marketing surveillance - methods	15 lectures	

Unit IV	4.1 Medical writing : Literature Search and medical articles, contract writing, Publication, Abstracts, Bibliography, Clinical Study Reports, 4.2 Principles and software in CDM (Clinical Data Management)	15 lectures	
	Ref: • Basic and Clinical Pharmacology, Katzung, B.G., Prentice hall, International • Clinical Pharmacology, Laurence, DR and Bennet, PN. Scientific book agency • Clinical Pharmacokinetics, Dr. DR Krishna, V.Klotz, Pub. Springer Verlabs • Remington Pharmaceutical Sciences, Williams and Wilkins, Lippincott • Drug Interaction. Hamsten, Kven Stockley • Drug interaction. Jk Mehra, Basic Business Publ, Bombay. • Practical guide to clinical data management, Susanne prokscha.		
BPSBT304	**Developmental Biology**		**04**
Unit I	1.1 Human Embryonic development: Events during fertilization, in-vitro fertilization, 1.2 Zonapellucida, glycoprotein, Oelemma protein and their role in fertilization, 1.3 Sperm antigens and their functional significance. 1.4 Molecular and biochemical events during sperm function	15 lectures	
Unit II	2.1 Post fertilization events: early embryonic development, 2.2 Establishing multi-cellularity, 2.3 Formation of blastula, embryonic germ layer, 2.4 Tracking of migrating cells.	15 lectures	
Unit III	3.1 Molecular mechanism of sex hormone action and regulation of gene expression. 3.2 Implantation and endometrium antigens involved in implantation. 3.3 Immunology of pregnancy. Superovulation, embryo culture and embryo transfer technology.	15 lectures	
Unit IV	4.1 Infertility and reproductive vaccines. 4.2 Frontiers in contraceptive research. 4.3 Cryopreservation of sex gametes and embryos.	15 lectures	

	4.4 Ethical issues related to embryo research.		
	Ref: • Langman's Medical Embryology (9th Edition 2004) T. W. Sadler. Lippincott Williams & Wilkins • Essential Developemental Biology (2nd Edition 2006) J. M. W. Slack Blackwell Publishing • Developemental Biology (8th Edition 2006) Scott F. Gilbert \ Sinauer Associates, Inc.		

PRACTICALS SEM III

Sr No.	Experiment (BPSBTP301-304)
1	**PTC** Media preparation Seed sterilization Callus induction Protoplast isolation Somatic embryogenesis
2	**ATC** Trypsinization Monolayer formation (fibroblast) To assay the radical scavenging activity of a tissue hydrolysate -DPPH Method Techniques of Cell Preservation Toxicology - MTT assay
3	**Medical diagnostic –** Identification of organisms from specimens (*S. aureus, Pseudomonas spps, Klebsiella pneumoniae, E. coli*). Staining of Biofilms
4	Study and present a published clinical case report
5	Candling, Observing chick embryo- stages of development; prepared slides/ preserved specimen

	SEMESTER IV		Credits
BPSBT401	**Drug development and Nanotechnology**		**04**
Unit I	**Drug discovery** 1.1 Steps involved in drug discovery, Production and characterisation, 1.2 Preclinical studies and Validation studies 1.3 Computer aided drug designing and docking 1.4 General Principles of CADD 1.5 Types of drug designing 1.6 Ligand based molecular interactions 1.7 Structure based Drug designing. Examples of Ligand and structure based drug designing 1.8 Applications and importance of CADD	15 lectures	
Unit II	**General principles of Pharmacology** 21. Mechanism of drug action**;** 2.2 drug receptors and biological responses**;** 2.3 second-messenger systems, the chemistry of drug–receptor binding**;** 2.4 dose–response relationship: therapeutic index; 2.5 ED, LD,**;** Potency and Intrinsic Activity**;** 2.6 Drug antagonism	15 lectures	
Unit III	3.1 Introduction, synthesis of nanomaterials, 3.2 Biological methods, use of microbial system & plant extracts, use of proteins & templates like DNA. 3.3 Characterization of nanomaterials, analysis techniques, 3.4 properties of nanomechanical, optical, magnetic properties, electrical conductivity, thermal conductivity.	15 lectures	
Unit IV	**Application of nanomaterials** 4.1Nanomedicine: biopharmaceutics, implantable materials, implantable chemicals, surgical aids, diagnostic tools, nanosensors, nano scanning, 4.2 Nano enabled drug delivery system, 4.3 Nanorobotics in medicine, 4.4 Food, 4.5 Cosmetics, 4.6 Agriculture, 4.7 Environment management	15 lectures	
	Ref: • Crommelin, Daan J.A.; Sindelar, Robert D. & Meibohm, Bernd: Pharmaceutical Biotechnology :		

	• fundamentals and applications. [ed. by] (4th ed.) New York. Springer Science+Business Media, • 2013. 978-1-4614-6485-3--(615Cro) • Hornyak, Gabor L.; Moore, John J.; Tibbals, Harry F. & Dutta, Joydeep: Fundamentals of • nanotechnology. Boca Raton. CRC Press, 2008. 1-4200-4803-2--(620.5Hor) • Walsh, Gary: Biopharmaceuticals : Biochemistry and Biotechnology. (2nd Ed.) Chichester. John • Wiley & Sons, 2003. 0-470-84326-8--(615.36WAL) • Kewal K. Jain (2008) The handbook of nanomedicine. Humana Press • The Nanoscope encyclopedia of nanoscience and nanochehnology, Vol. I (2005) Dr.Parag Diwan and Ashish Bharadwaj. Pentagon Press New Delhi • The Nanoscope encyclopedia of nanoscience and nanochehnology, Vol V (2005) Dr.Parag Diwan and Ashish Bharadwaj Pentagon Press New Delhi • The Nanoscope encyclopedia of nanoscience and nanochehnology, Vol VI (2005) Dr.Parag Diwan and Ashish Bharadwaj Pentagon Press New Delhi • Nano forms of carbon and its applications (2007) Prof.Maheshwar Sharon and Dr.Madhuri Sharon, Monad Nanotech Pvt. Ltd. • Biotechnanotechnology lessons from Nature (2004) David Goodsell Wiley-Liss A John Wiley and sons • Nanotechnology- Basic science and emerging technologies (2005) Willson Kannangava, Smith, Simmons, Raguse Oversease Press • Texbook of Biotechnology (2005) R. C. Dubey S. Chand and Co. • Nanotechnology- Principles and practices S. K. Kulkarni \ Capital Publishing Co.		
BPSBT402	**GMO and environment**		**04**
Unit I	1.1 Genetically modified microorganisms, Examples and method, 1.2 Humulin, Ice minus Bacteria, GM bacteria in Bioremediation, 1.3 Use of PCR as a GMO identification tool,	15 lectures	

	1.4 Risk and Controversies related to the use of GMO; 1.5 About Indian GMO Research Information system (IGMORIS); 1.6 About the website; Bisafety data of any two approved genes available on the database		
Unit II	2.1 GE- crops Arabidopsis as a model plant for studies in genetic engineering; 2.2 Protocols on Food and Feed safety assessments, 2.3 Acute oral safety study in rats and mice, 2.4 Subchronic feeding study in rodents, 2.5 Protein thermal stability, 2.6 Pepsin digestibility, 2.7 Live stock feeding study	15 lectures	
Unit IIII	3.1 Solid waste treatment, 3.2 Pollution indicators and biosensors; 3.3 Biodegradation of Xenobiotics, pesticides , 3.4 Phytoremediation	15 lectures	
Unit IV	4.1 Biodegradation of waste from food, textile, petrochem, paper industries, 4.2 Biological detoxification, 4.3 Removal of Oil spillage and grease deposites	15 lectures	
	Ref: • Genetically modified bacteria in agriculture, N Amarger, Biochimie 84, (2002), 1061-1072 • Detection of genetically modified organisms in food, Farid E Ahmed. Trends in Biotechnology, 20(5) , (2002): 215-223 • Genetic analysis, Gene, genomes and networks in Eukaryotes. Philp Meenly, oxford University press.		
BPSBT403	**Bioinformatics**		**04**
Unit I	1.1 Organization of biological data, databases (raw and processed), 1.2 Quering in data bases. 1.3 Primers in biologyv(Designing of primers, kinds of primers)	15 lectures	
Unit II	2.1 Gene finding, motif finding and multiple sequence alignment. 2.2 Protein sequence analysis (theory and algorithms) 2.3 Protein structure analysis and applications	15 lectures	
Unit III	3.1. Gene expression profiling and its	15 lectures	

	applications. 3.2 Microarray technology and basics. 3.3 Microarray analysis and organization of data 3.4 Human genome analysis		
Unit IV	4.1 Proteomics 4.2 Exploration of data bases, retrieval of desired data, BLAST etc. 4.3 Gene clusters and fusions, consensus sequences, exon intron finder, sequence logo.	15 lectures	
	Ref: • Computer Based Decision Making in Medicine E. A. Shortifile American Elsevier • Bioinformatics : Sequence and Genome Analysis (Second Edition 2004) David W. Mount Cold spring Harbor Laboratory Press • Bioinformatics and Functional Genomics (2003) Jonathan Pevsner John Wiley & Sons Publications		
BPSBT404	**Biostatistics**		**04**
Unit I	Statistical population, sample from population, Random sample. Central Tendency: Mean, Median and Mode, Standard Deviation	15 lectures	
Unit 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	15 lectures	
Unit 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.	15 lectures	
Unit 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.	15 lectures	
	Ref: • A Introduction to Biostatistics (Second Edition-2005) N. Gurumani M J P Publishers • Basic Biostatistics (2008) B. Burt Gerstman Jones and Bartlett Publishers • Biostatistics: A foundation For Analysis In Health Sciences (7th Edition 1999) Wayne W. Daniel John Wiley & Sons Inc. • Fundamentals of Biostatistics (2006) Veer Bala Rastogi Ane Books India		

	• Biostatistics- The Bare Essentials (Second Edition 2000) Nosman Streiner B. C. Decker Inc.		

PRACTICALS SEM IV

BPSBTP401

Project (100 marks)

It is mandatory for students to undergo Hands-on Project training in a established lab for 3 months; this should involve one or more relevant instrumentation techniques. Thesis on the same to be evaluated by the guide alternatively by the internal examiner for 100 M based on the students performance, written matter and experimentation. A certificate/Marklist to be appended with the thesis. External examiner to assess for 100 marks as a presentation during practical exams.

BPSBTP402	**Experiment**
1	**Bioinformatics** Multiple alignment - Phylogenetic tree BLAST - orthologs and paralogs , homologs Motif finding KEGG Structure of proteins - identification of chains helices, special groups, metal ions etc. CATH / SCOP classification of a given protein
2	Nanoparticle – synthesis chemical and biological methods, Spectroscopic analysis
3	Bioremediation- isolation of metal tolerant organisms & study their growth characteristics and pattern
4	Composting – physical & chemical parameters
5	GMO- Validation- Kit based/ Demo