



**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND  
COMMERCE, SAINIKPURI, SECUNDERABAD.**

Autonomous College  
Affiliated to OSMANIA UNIVERSITY, Hyderabad.  
(Accredited with 'A' grade by NAAC)  
Department of Microbiology

**M.Sc Microbiology CBCS Syllabus-Effective from 2016 onwards**

**SEMESTER - I**

Syllabus Ref No	Subject	Credits	Teaching Hours	Marks		
				Internal Assessment	Semester Exam	Total
<b>THEORY</b>						
PMB 101	General Microbiology & Microbial physiology (Core)	4	4	30	70	100
PMB 102	Virology (Core)	4	4	30	70	100
PMB 103	Research methodology & Techniques (Core)	4	4	30	70	100
PMB 104	Microbial Biochemistry (Core)	4	4	30	70	100
PMB 105	AEC Communicative English	1	2		25	25
<b>PRACTICALS</b>						
PMB 151	General Microbiology & Virology	3	6		75	75
PMB 152	Research methodology & Techniques	2	4		50	50
PMB 153	Microbial Biochemistry	2	4		50	50
	<b>Total</b>	<b>24</b>	<b>32</b>	<b>120</b>	<b>480</b>	<b>600</b>

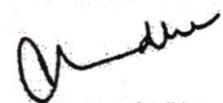
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CHAIRPERSON  
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**Dr. B. BHIMA, M.Sc., Ph.D.**  
Associate Professor  
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OSMANIA UNIVERSITY

**SEMESTER - II**

Syllabus Ref No	Subject	Credits	Teaching Hours	Marks		
				Internal Assessment	Semester Exam	Total
<b>THEORY</b>						
PMB 201	Molecular Biology and Microbial Genetics (Core)	4	4	30	70	100
PMB 202	Environmental & Agriculture Microbiology (Core)	4	4	30	70	100
PMB 203	Immunology (Core)	4	4	30	70	100
PMB 204	Pharmaceutical Microbiology (Core)	4	4	30	70	100
PMB 205	SEC Computer skill	1	2		25	25
<b>PRACTICALS</b>						
PMB 251	Molecular Biology and Microbial Genetics	2	4		50	50
PMB 252	Environmental & Agriculture Microbiology	2	4		50	50
PMB 253	Immunology and Pharmaceutical Microbiology	3	6		75	75
<b>Total</b>		<b>24</b>	<b>32</b>	<b>120</b>	<b>480</b>	<b>600</b>

  
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**Semester III**

Syllabus Ref No	Subject	Credits	Teaching Hours	Marks		
				Internal Assessment	Semester Exam	Total
<b>THEORY</b>						
PMB 301	Food Microbial technology (Core)	4	4	30	70	100
PMB 302	Medical bacteriology (Core)	4	4	30	70	100
PMB 303	DSE A. Microbial biotechnology Or B. Microbial proteomics	4	4	30	70	100
PMB 304	DSE A. Microbial Ecology and Plant Microbe Interactions Or B. Advances in Biotechnology	4	4	30	70	100
PMB 305	AEC Personality development	1	2		25	25
	SEC A. Biofertilizers and Biopesticides Or B. Microbiological Quality Control and Quality Assurance in Food & Pharma Industry	1	2		25	25

**PRACTICALS**

PMB 351	Food Microbial technology	2	4		50	50
PMB 352	Medical bacteriology	2	4		50	50
MB 353	Applied Microbiology	2	4		50	50
	<b>Total</b>	<b>24</b>	<b>32</b>	<b>120</b>	<b>480</b>	<b>600</b>

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M.Sc Microbiology CBCS Syllabus

**Semester IV**

Syllabus Ref No	Subject	Credits	Teaching Hours	Marks		
				Internal Assessment	Semester Exam	Total
<b>THEORY</b>						
PMB 401	Cell and Molecular Biotechnology (Core)	4	4	30	70	100
PMB 402	Medical virology and Parasitology (Core)	4	4	30	70	100
PMB 403	GE A. Microbiology & Human health	2	2	15	35	50
	DSE B. Bioinformatics	2	2	15	35	50
PMB 404	DSE A. Nanobiotechnology	4	4	30	70	100
PMB 406	SEC Seminar	1	2		25	25

**PRACTICALS**

PMB 451	Cell Molecular Biotechnology & Bioinformatics	2	4		50	50
PMB 452	Medical virology and Parasitology & Nanobiotechnology	2	4		50	50
PMB 405	Project	3	6		75	75
	<b>Total</b>	<b>24</b>	<b>32</b>	<b>120</b>	<b>480</b>	<b>600</b>
	<b>Grand Total</b>	<b>96</b>	<b>128</b>	<b>480</b>	<b>1920</b>	<b>2400</b>

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## Paper I PMB 101 General Microbiology (Core) (CBCS)

Month	Week	Unit	Sub. Unit	Detailed Topic	Periods	Total
Aug	1	1	A	Pioneers of Microbiology		
			A i	Anton Van Leewenhoek		
			A ii	Lious Pastuer	1	1
			A iii	Robert Koch		
			A iv	Edward Jenner	1	2
			A v	Winogradsky		
			A vi	Edward Jenner	1	3
			A vii	Winogradsky		
			A viii	Beijerinck	1	4
			A ix	Alexander Flemming		
Aug	2		A x	Selman Walkmann	1	5
			B	Microscopy		
				Principles, working and applications of		
			B i	Bright field microscope	1	6
			B ii	Flourescent microscope		
			B iii	Phase contrast microscope	1	7
			B iv	Electron microscope	1	8
Aug	3		B v	Microbial Cell Structure. Prokaryotic cell and Eukaryotic cell.	4	12
			B viii	Organisation & function of cellular organelles		
			C i	Bacterial endospore structure	1	13
eptembe	4		C ii	Biochemistry and genetics of sporulation	2	15
Sept	5	2	A	Methods of sterilization and disinfection		
			A i	Physical methods	2	17
			A ii	Chemical methods	2	19
			A iii	Containment facility.	1	20
			B	Microbiological media	2	22
			Bi	Autotrophic media		
			B ii	defined synthetic mineral media		
			B iii	heterotrophic media		
Sept	6		C	The concept of	2	24
			Ci	prototrophs		
			C ii	auxotrophs		
			C iii	prototrophic (minimal med)		
			C iv	complex media (undefined media)		
			D	Cultivation of		
				Bacteria		

				Fungi		
				Algae	2	26
			E	Routine and special culture methods	2	28
				Agar slant		
				Agar stab		
				Agar plate		
				Rolled tube		
				Test tube, Flask,		
Sept	7		F	Aerobic and Anaerobic	1	29
			G	Isolation of pure cultures		
				Preservation and Maintenance	1	30
				Routine methods		
				Liquid nitrogen preservation		
				freeze-drying (Lyophilization)		
		3	A	Identification methods and classification of bacteria		
			A i	Microscopic identification characteristics		
			A ii	staining methods.		
Oct	8		A iii	Ecological identification methods	1	31
			A iv	Nutritional (cultural) identification characters	1	32
			A v	biochemical identification methods		
Oct	9		Avi	immunological characteristics	1	33
			Avii	Molecular and genetic characteristics identification (16s rRNA).	1	34
			B	Principles of bacterial taxonomy	1	35
			C	Numerical taxonomy	1	36
			D	Bergey's manual and its importance,	2	38
Oct	10		E	general properties of bacterial groups		
			F	Microbial nutrition and metabolism	3	41
				autotrophy		
				Photoautotrophy	1	42
				bacterial photosynthesis	1	43
Oct	11			Chemoautotrophy	1	44
				heterotrophic metabolism	1	45
Nov	12	4	A	Microbial growth		

				The concept of growth and definition, formation of protoplasm		
				, building of macromolecules from elemental nutrients		
				supramolecules	5	50
				orgnelles of cell and cellular components		
	3			Cell cycle in microbes and generation time	2	52
Nov	13		B	Growth phases of bacteria	3	55
				Lag phase, exponential (logarithmic)		
				phase, stationary (ideo) phase		
				decline and survival of microbial cells		
Nov	14		C	Importance of each growth phase	2	57
	15			Synchronous cultures		
				Methods of synchronous culturing	1	58
				methods	1	59
			D	Methods of growth measurement	1	60

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**M.Sc. (Previous) I Semester Microbiology (CBCS) 2018-2019**  
**PMB 102 Virology Theory**

Month	Week	Unit	Detailed topic	No.of Periods	Total
August	1	1	History of virology (latest Scientific investigations),	2	2
			Viral classification and nomenclature (ICTV system of classification).	2	4
	2		Virus structure and morphology		
			Detection of viruses: physical, biological, immunological, serological and molecular methods.	3	7
	2&3		Isolation, purification, propagation, characterization, identification and quantification of bacteriophages, plant viruses and animal viruses	2	9
			Sub-viral particles: Discovery, structure, replication and diseases caused by satellites virus, viroids and prions.	2	11
Sep	4		General idea about cyanophages, actinophages and mycophages.	2	13
			Metagenomics for virus characterization.	2	15
Sep	4&5	2	Virus replication Strategies: Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, intracellular trafficking, assembly, maturation and release.	2	17
			Viral-host interaction, Host response to viral infection.	2	19
Sep	6		An Overview of Cellular interactions—clathrin coated pits, lipid rafts, endocytosis and virus uncoating mechanisms.	2	21
			Comparision of Lytic cycle and lysogeny cycle - Lambda	2	23
	6&7		T4 Bacteriophage,	2	25

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			Morphology, Ultrastructure, Genome organization and Replication strategies of Adenovirus	1	26
			Banana bunchy top virus	1	27
			Reovirus	1	28
Oct	8		TMV	2	30
			Influenza virus	1	31
			HIV	1	32
Oct	9		HBV	1	33
		3	Recombination in phages	3	36
			multiplicity reactivation	1	37
			phenotypic mixing	1	38
Oct	10&11		General account of Tumor virus (RNA and DNA).	2	40
			Viral Interference and Interferons	2	42
			Nature and source of interferons	1	43
			Classification of interferons	1	44
November	12		Induction of interferons.	1	45
			Antiviral agents (chemical and biological) and their mode of actions	3	48
Nov	13	4	Introduction to viral vaccines	1	49
			preparation of vaccines	1	50
			Viruses as cloning vectors	2	52
Nov	14		Vectors used for cloning and sequencing: $\lambda$ phage, M 13, retro viruses.	2	54
			CaMV 35S promoter and its application	1	55
			Baculovirus System for insect cell	1	56
Nov	15		Silver lining: viruses as therapeutic	1	57
			viruses for gene delivery	1	58
			viruses to destroy other viruses	1	59
			Importance of studying modern virology	1	60

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**GENERAL MICROBIOLOGY PRACTICALS****PMB 151****SEMESTER I (2018-2019)****(6HRS PER week)**

<b>Month</b>	<b>Week</b>	<b>Exp No.</b>	<b>Experiments</b>	<b>Classes</b>	<b>Total</b>
August	1	1	Handling of Microscopes	3	3
August	2	2	Caliberation and Measurement of Objects	3	6
Sep	3	3	Staining techniques: Simple/Differential/Special	3	9
	4	4	Sterilization procedures and methods	3	12
	5	5	Preparation of microbiological media	3	15
Oct		6	Isolation and Cultivation of Pure Cultures	3	18
Oct	7	7	Identification methods of bacteria	3	21
Nov	7&8	8	Isolation and Culturing of Fungi and algae	4	25
Oct.	9&10	9	Culturing methods of microbes	3	28
Oct.	11&12	10	Anaerobic Culturing methods of microbes	3	31
Oct/Nov	13&14	11	Microbial growth experiments	3	34
		12	Study of bacterial growth curve	3	37
Nov	14&15	13	Factors effecting microbial growth	8	45



Virology Practicals					
					2018-2019
PMB 151					
Month	Week	Expt No.	Experiments	Classes	Total
August	1&2	1	Isolation of phage from soil samples using lab bacterial cultures Staphylococcus and Bacillus	8	8
August	3&4	2	Isolation of Phage from sewage using Psuedomonas and E.coli as host.	4	12
September	5&6	3	Cultivation and preservation of phages	4	16
September	7&8	4	Quantitation of phages	4	20
September	9&10	5	Growth phases of phage and Burst size	4	24
October	11	6	Phage induction	4	28
October	12&13	7	Cultivation of animal viruses in egg,allantoic,amniotic,CAM	8	36
November	14	8	Demonstration of cytopathological changes. Of animal viruses	4	40
November	15	9	Symptomatic observations of plant viral infections.	5	45

## SEMESTER-I

2018-2019

## Paper III MB 103 Research Methodology &amp; Techniques (Theory) (CBCS)

Month	Week	Unit	Detailed Topic	No of Periods	Total
			<b>Optical methods:</b>		
Aug	1	1	colorimetry and spectrophotometry	2	2
			fluorimetry	1	3
			optical rotation	1	4
	2		Circular dichroism,	1	5
			NMR, ESR spectroscopy	3	8
	3		X-ray diffraction	1	9
			types of mass spectrometry.	2	11
Aug/Sep	3&4		Electrophoretic techniques and application	3	14
			counter current distribution	1	15
		2	<b>Separation methods:</b>		
September	4&5		Chromatographic techniques - HPLC, FPLC	2	17
			paper, thin layer	1	18
			ion exchange, gel filtration and affinity ch	2	20
Sep	6		Diffusion, dialysis	1	21
			cell disruption methods	1	22
			centrifugation techniques	2	24
Sep	7		cell free extracts and their use in metabolic studies.	1	25
			Radio isotopes		
			radioactivity – scintillation counters, autoradiography	2	27
			Safety precautions		
			stable isotopes and their use	1	28
Oct	8		General method of study of intermediary metabolism in microbes	1	29
			Uses of mutants in study of metabolism	1	30
		3	<b>Biometry</b>		
			Population, samples and sampling procedures	1	31
			variables, variations and frequency distributions	1	32
Oct	9		measures of central tendency and dispersion	2	34
			element of probability		

			gaussian or normal distribution, binomial distribution, poisson distribution, 't' distribution, 'F' distribution and Chi-square distribution	2	36
Oct	10		correlation and linear regression.	2	38
			Normal curve test, 't' test, 'F' test	2	40
Oct	11		ANOVA, analysis of covariance	2	42
			Chi-square test, and confidence intervals.	2	44
Nov	12		Experimental designs using statistical tools	1	45
		<b>4</b>	<b>Computers</b>		
			Introduction to Windows	2	47
			Word Processing	1	48
Nov	13		Electronic Spread Sheet	1	49
			Data collection, Data representation, Data analysis	3	52
Nov	14		Manuscript preparation	2	54
			Research ethics	1	55
Nov	14&15		QA, QC	2	57
			GLP, GMP	2	59
			Patents & IPR	1	60

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**I Semester Paper II MB152 Research Methodology and techniques (Practicals) CBC**  
**PMB 152** **2018-2019**

Month	Week	Expt. No	Experiment	No. of Periods	Total
Aug	1	1	Creating documents using word processor	8	8
Aug	2	2	Usage of spread sheet to biological applications	8	16
Aug	3	3	Biological data analysis using software	8	24
Sep	4&5	4&5	Absorption maxima of proteins, NA, Aromatic aa and riboflavin( Determination of molar extinction coefficient ,calculations based on Beer Lambert's law)	8	32
Sep	6&7	6&7	Estimation of inorganic and organic phosphate by Fiske -Subbarow method	8	40
Sep	8	8	Estimation of protein concentration by UV-Vis spectrophotometry and Folin Lowry method.	4	44
Sep	9	9	Differential centrifugation	4	48
Oct	10	10	Paper chromatography of amino acids	4	52
Oct	11	11	Dialysis for desalting of proteins	4	56
Nov	12	12	Demonstration of Gel filtration technique	2	58
Nov	13	13	Demonstration of electrophoresis of proteins and DNA	2	60

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BIOCHEMISTRY THEORY					
SEMESTER-I					
Paper IV PMB 104 Biochemistry ( Theory)CBCS restructured 2018-2019					
Month	Week	Unit	Detailed Topic	No of Periods	Total
August	1	1	pH & its biological relavence.	2	2
			Determination of pH		
			preparation of buffers	2	4
			Types of Buffers		
August	2		Concept of entropy, free-energy, free energy changes	2	6
			High energy compounds	1	7
			Equilibrium constraints	1	8
August	3		Redox potentials	1	9
			Biological redox systems.	1	10
			Biological oxidation		
			Biological redox carriers.	1	11
			Biological membranes	1	12
Sep	4		Electron transport	2	14
			Oxidative phosphorylation & mechanism.	2	16
Sep	5		Lipid classification	2	18
			Bacterial lipids		
			Prostaglandins: Structure & function.	1	19
			Major steroids of biological importance.	1	20
Sep	6	2	Carbohydrates: Classification	2	22
			basic chemical structure of monosaccharides		
Sep			aldoses & ketoses ,cyclic structure of monosaccharides.		
			stereoisomerism, anomers and epimers	2	24
			Sugar derivatives, deoxy sugars, amino sugars, and sugar acids		
Sep	7		Respiration (Aerobic and anaerobic) and fermentation. Glycolysis (EMP, HMP and ED) pathways. TCA Cycle and its integration	2	26
			Nucleic acids:		
			*structure & properties of purines & pyrimidins.	2	28
			*nucleosides& nucleotides.		
			Metabolism of purines		
Oct	8		*biosynthesis & degradation of Pyrimidins	2	30
			biosynthesis & degradation of Purines.		
		3	Proteins &Amino acids		
			*introduction	2	32
			*properties of amino acids		

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Oct	9		Structure, conformation & properties of proteins	2	34
			Metabolism of amino acids		
Oct	9&10		Biosynthesis & degradation of amino acids -an overview	4	38
			Enzymes nomenclature, classification	2	40
Oct	11		Methods for determination of enzyme activity	2	42
			Isolation and purification of enzymes		
Oct	11		Enzyme kinetics: Effect of pH, substrate concentration , temperature and inhibitors.	4	44
Nov	12	4	Mechanism of enzyme action – Action of Hydrolases, Oxidases and reductases	4	48
Nov	13		Coenzyme catalysis(pyridoxal phosphate and TPP).	2	52
			Isoenzymes.	2	54
			Competitive and non-competitive inhibition		
Nov	14		Methods for increased microbial enzymes production and activity.	2	56
	15		Control of enzymes - Regulation of enzyme activity: allosteric enzymes and feed back mechanisms	4	60
			Metabolic compartmentalization in relation to enzyme,		
			Enzymes and secondary metabolites		

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## BIOCHEMISTRY PRACTICALS

SEMESTER I

2018-2019

### Paper II PMB 153 Biochemistry (Practicals) (CBCS)

Month	Week	Expt. No	Experiment	No. of Periods	Total
August	1	1	Safety and good lab practices	4	4
	2	2	Preparation of buffers and adjustment of pH	4	8
	3	3	Qualitative and quantitative tests for carbohydrates and analysis of unknowns	4	12
Sep	4	4	Qualitative and quantitative tests for amino acids and analysis of unknowns	4	16
	5	5	Quantitative estimation of inorganic and organic phosphate	4	20
	6	6	Tests for lipids (qualitative and quantitative)	4	24
	7	7	Quantitative estimation of glucose and fructose	4	28
Oct	8	8	Determination of Saponification of Fat.	4	32
	9	9	Partial purification of Enzymes:	4	36
			*beta - amylase		
	10	10	*urease	4	40
	11	11	*catalase	4	44
Nov	12	12	Effect of substrate concentration, pH, time & temperature on enzyme activity.	4	48
	13	13	Calculation of km for partially purified enzyme.	4	52
	14	14	Inhibition of enzyme activity.	4	56
	15	15	Record correction & certification	4	60

**MOLECULAR BIOLOGY & MICROBIAL GENETICS THEORY**

**Paper -I PMB 201**

**2018-19**

Month	Week	Unit	Sub.Unit	Detailed Topic	No.of Periods	Total
Dec	1		A I	Detailed Structure of DNA,Z-DNA,A & B DNA	2	2
			A ii	Denaturation & Melting Curves.	2	4
Jan	2		A iii	Genomic Organization in Prokaryotes & Eukaryotes.	2	6
			Aiv	Enzymes invovled in Replication.:	2	8
Jan	3		Av	Modes of DNA Replication: Detailed mechanism of Semiconservative	2	10
				Plasmids : Classification,Properties and replication.	2	12
			F	Eukaryotic telomeres & its Replication.		
Jan	4	II		Prokaryotic &Eukaryotic Transcription.	4	16
Jan	5		A	RNA Structure and processing	4	20
			A i	m-RNA		
			Aii	r-RNA		
			A iii	t- RNA .		
			B	Ribozyme	2	22
			B I	The Genetic Code & Wobble Hypothesis.		
Feb	6		B ii	Post Translation Modification	2	24
			B iii	Translation in Prokaryotes & Eukaryotes.	2	26
			B iv	Gene regulation & expression		

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Feb	7		C	Lac operon, arabinose and tryptophan Operon	2	28
			D	Gene regulation in eukaryotic systems	2	30

			E	repetitive DNA		
Feb	8		E I	Gene rearrangements	2	32
				Promoters		
			E ii	Enhancer elements		
Feb	9	III	A	Mutagenesis:	4	36
			A i	Types of Mutagens		
			A ii	Molecular Basis of Mutations.		
			A iii	Analysis of Mutations		
March	10		A iv	Site directed Mutagenesis & Reverse Genetics.	4	40
				Detailed mutagenesis and repair mechanism of UV, Ethidium bromide and Nitrous oxide	2	42
March	11		A v	DNA damage & Repair Mechanisms	2	44
			B	Isolation and application of Mutants	2	46
March	12		C	Transposable elements- definition	2	48
			D ii	Types of bacterial transposons		
			E	Applications of Transposons	2	50
March	13	IV	A I	Bacterial Recombinations- Discovery, gene transfer, molecular mechanism, detection, efficacy calculation and application	2	52
			A iii	Bacterial Transformation- Competency and resistance		
March	14		B	Bacterial Conjugation:	4	56
			B I	Sex Factors in bacteria		

			B ii	F & Hfr transfer		
			B iv	Linkage mapping.		
March	14		C	Bacterial Transduction :	2	58
April			C I	Transduction Phenomena		
			C ii	Methods of Transduction		
			C iii	Cotransduction		
			C iv	Generalized, Specialed & Abortive Transduction.		
April	15		C v	Sex ductions .	2	60

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**Semester-II Molecular Biology and Microbial Genetics-2018-2019 - PRACTICALS**  
**PMB 215**

Month	Week	Expt.No	Experiment	No of periods	Total
December & January	1&2 3	1 2	Extraction of DNA Estimation of DNA.	8 4	8 12
January	4	3	Estimation of RNA.	4	16
January	5	5	Determination of Molecular Weight of DNA, resolved on agarose gel electrophoresis.	4	20
February	6	6	Determination of Molecular Weight of	4	24
February	7&8	7	Induction of Mutations by Physical/ Chemical Mutagens  ,Screening & Isolation of Mutants	8	32
February	9&10	8	Replica Plate Technique .	8	40
March	11&12	9	Transformation in Bacteria .	8	48
March	13	10	Conjugation in Bacteria.	4	52
April	14&15	11	Protoplast Preparation & Regeneration.	8	60

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ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY THEORY					
SEMESTER II - 2018-19 Paper-2 Code: PMB 202					
Month	Week	Unit	Detailed Topic	No. of Periods	Total
Dec	1	1	Microorganisms in air and their importance	2	2
			Microorganisms and water Pollution	2	4
Jan	2		Water-borne pathogenic microorganisms and their transmission	2	6
			Sanitary quality of water.	1	7
	3		Water pollution due to degradation of organic matter	2	9
			Sewage treatment - Overview	1	10
			Aerobic sewage treatment	1	11
			Oxidation ponds, trickling filters	1	12
			Activated sludge treatment	1	13
	4		Anaerobic sewage treatment – Septic tank	2	15
	5	2	Strategies for Bioremediation technologies	2	17
			Bioaugmentation	1	18
Feb	6		Methods of enumeration and activity of microbes in environment	3	21
			Microbial biodegradation of organic pollutants.	3	24
	7		A brief account of biodegradable plastics and superbug	2	26
			Microorganisms and their roles in fundamental biogeochemical cycles.	4	30
	9	3	Degradation of carbonaceous materials in soil - Introduction	1	31
			Cellulose	2	33
			Hemicellulose	1	34
			Lignin	2	36
Mar			10	Pectin	1
			Factors governing the decomposition and biochemistry of decomposition	1	38
			Soil humus formation	2	40
	11		Nitrification –Microbes involved, factors influencing nitrification, nitrifying bacteria and biochemical mechanism.	2	42
			Denitrification – microbes involved, factors influencing and the mechanism of denitrification	2	44
	12		Nitrate and Phosphate pollution	1	45
			4	Nitrogen fixation – Overview	1
	13		Asymbiotic nitrogen fixation	1	47
			Symbiotic nitrogen fixation	2	49
			Microbes involved in Nitrogen fixation	1	50
			Biochemistry of nitrogen fixation	1	51
			Measurement of Nitrogen fixation	1	52
			13&14	Genetics of Nitrogen fixation	1
			Ecological and economic importance of nitrogen fixation.	1	54

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			Biofertilizers – bacterial fertilizers		
		4	Production of rhizobial inoculants	1	55
			Production of blue-green algae	1	56
April	15		Quality control tests	1	57
			Microbes and plant interactions		
			Rhizosphere	1	58
			Phyllosphere	1	59
			Mycorrhizae.	1	60

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ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY Practicals

Sem II -2018-19, Paper-II, Code : PMB: 252

EXP NO	Month	Week	Unit	Experiments	No. of Periods	Total
1	Dec	1		Isolation and observation of air microflora	4	4
2	Jan	2		Enumeration of soil microorganisms (bacteria, actinomycetes, fungi) by standard plate count	4	8
3		3		Estimation of soil microbial activity by CO <sub>2</sub> evolution	4	12
4		4		Estimation of BOD	4	16
5		5		Testing for microbial sanitary quality of water (coliform test )	4	20
6		6		Bioremediation plastics	4	24
7				Bioremediation of organic pollutants and their effect on soil microbial activity		
8	Feb	7		Isolation of cellulose decomposing microbes and estimation of cellulose activity	4	28
9		8		Estimation of ammonifiers, nitrifiers and denitrifiers in soil by MPN Method	4	32
10		9		Isolation and culturing of Rhizobium sp from root nodules and Azospirillum from grasses (Cyanodon)	4	36
11		10		Biological enrichment isolation of Rhizobium from soil by Leonard Jar experiment	4	40
12	Mar	11		Nodulation testing by tube/jar method	4	44
13		12		Observation and assessment of soil algae/algal biofertilizers	4	48
14				Estimation of N <sub>2</sub> fixation (Micro Kjeldahl method/GC method)		
15		13		Isolation and observation for phyllosphere microflora	4	52
16		14		Isolation and observation for rhizosphere microflora	4	56
17	April	15		Observation for Mycorrhizae	4	60

**IMMUNOLOGY**  
**PMB-203 SEMESTER II - 2018-19**

Month	Week	Unit	Detailed Topic	No. of Periods	Total
Dec	1	1	History of immunology. Hematopoiesis, Cell lineage, components of immune system, cells and organs of immune system	4	4
Jan	2		Antigens –Nature, properties and types. Haptens	2	6
	2		Antibody -Structure , functions and classification. Isotypes, allotypes and idiotypes	2	8
	3		Immunoglobulin genes. Generation of antibody diversity. Clonal nature of the immune response - clonal selection theory.	3	11
	3&4		Generation of T cell receptor diversity by genomic rearrangement	2	13
	4		Structure of B and T cell receptors	2	15
	4	2	Overview of Innate and adaptive immunity	1	16
	5		Toll-like receptors, cell-mediated and humoral immune responses,	2	18
Jan/Feb	5&6		Major Histocompatibility Complex (MHC). Human leucocyte antigen (HLA) restriction Processing and presentation of antigen by MHC. Transplantation immunity,	4	22
	6		Immunosuppression and its mechanism of action	2	24
	7		Immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, Immune evasion by bacteria and viruses.	2	26
	7		Congenital and acquired immunodeficiencies	2	28
	8		Immunological tolerance-central and peripheral	2	30
	8	3	Auto immunity and Hypersensitivity - immediate and delayed type hypersensitivity reactions.	2	32
	9		Classical and alternate Complement pathways	2	34
Feb/Ma	9,10&11		Precipitation, neutralization, and function. Labeled antigen-antibody reactions- ELISA, RIA, immune blotting, CFT, immunofluorescence. Flow cytometry (Fluorescence activated cell sorter), ChIP, Surface Plasma Resonance and its applications in Immunology	9	43
	11&12		Development Of immuno diagnostic kits.	2	45
	12	4	Types of conventional vaccines and principles of I	2	47
	12&13		Modern vaccines; peptide, DNA, recombinant / vector, and anti-idiotypic vaccines Schedules of common vaccination, Benefits and adverse consequences of vaccination	4	51
	13&14		Production of polyclonal antibodies; Animals models for production of antibodies	3	54



	14&15	Hybridoma techniques and monoclonal antibody production. Applications of monoclonals in biomedical research, clinical diagnosis and treatment. Chimeric Antibodies.	3	57
April	15	Tumor immunology. Immuno diagnosis and immune therapy of cancer	3	60

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M.Sc.(PREVIOUS) SEMESTER MICROBIOLOGY (CBCS)						
PAPER IV PMB 204 PHARMACEUTICAL MICROBIOLOGY (4 HPW-4 CREDITS)						
ACADEMIC YEAR 2018-2019						
Month	Week	Unit No	Sub Unit	Topic	No. of Periods	Total
DEC	1	1	A	<b>Microorganisms affecting pharmaceutical industry</b>		
				The atmosphere, water, skin & respiratory flora	1	1
				of personnel, raw-materials, packing, equipments, building, utensils etc.	1	2
			B	<b>Types of microorganisms occurring in pharmaceutical products.</b>	1	3
JAN	2		C	<b>Microbiological spoilage</b>	2	5
				prevention of pharmaceutical products.	2	7
			D	<b>Preservation of pharmaceutical products</b>		
				antimicrobial agents	1	8
JAN	3			used as preservatives	1	9
				evaluation of the microbial stability of formulation	2	11
				The sterilization in pharmaceutical industry	2	13
JAN	4		E	<b>Good manufacturing practices</b>	1	14
				in pharmaceutical industry	1	15
JAN	5	2	A	<b>History of chemotherapy</b>	2	17
		2		Inoculum media	2	18
				– plants and arsenicals as therapeutics,	2	19
					1	
				Paul Ehrlich and his contributions, selective toxicity	2	21
				target sites of drug action in microbes.		
			B	<b>Development of synthetic drugs –</b>	1	22
FEB	6			Sulphanamides, antitubercular compounds, nitrofurans	2	24
				nalidixic acid, metronidazole group of drugs.		
			C	<b>Antibiotics - The origin, development</b>	2	26
				definition of antibiotics as drugs		
FEB	7			types of antibiotics and their classification.		
				Non-medical uses of antibiotics.		
FEB	8		D	<b>Cosmetics microbiology</b>	2	28
				testing methods and preservation		
			E	<b>Antimicrobial preservation</b>	1	29
				efficacy and microbial content testing	1	30
FEB	9	3	A	<b>Principles of chemotherapy</b>	2	32
				Clinical and lab diagnosis, sensitivity testing,	2	34
MAR	10			choice of drug, dosage, route of administration,	2	36

				combined/mixed multi drug therapy, control of antibiotic/drug usage.	2	38
MAR	11		B	<b>Mode of action of important drugs</b>	2	40
				Cell wall inhibitors (Betalactam – eg. Penicillin),	1	41
				membrane inhibitors (polymyxins),	1	42
				macromolecular synthesis inhibitors (streptomycin),		
MAR	12		C	<b>antifungal antibiotics (nystatin)</b>	3	45
		4	A	<b>The drug resistance</b>	3	48
MAR	13			The phenomenon, clinical basis of drug resistance, biochemistry of drug resistance, genetics of drug resistance in bacteria.		
			B	<b>Microbiological assays:</b>	3	51
				Assays for growth promoting substances, nutritional mutants and their importance		
				vitamin assay, amino acid assay		
MAR	14		C	<b>Assay for growth inhibiting substances</b>	3	54
				Assay for non-medicinal antimicrobials (Phenol coefficient/RWC). Drug sensitivity testing methods and their importance	2	56
				Assay for antibiotics – Determination of MIC, the liquid tube assay,	1	57
				solid agar tube assay, agar plate assay (disc diffusion, agar well and cylinders cup method).	1	58
APR	15		D	<b>Introduction to pharmacokinetics and pharmacogenomics</b>	2	60

**II SEMESTER PRACTICALS PAPER III PMB 253(6 HRS PER WEEK)**

**IMMUNOLOGY AND PHARMACEUTICAL MICROBIOLOGY (CBCS) ACADEMIC**

EXP	Month	Week	Experiments	No. of Periods	Total
			Agglutination reactions		
1	DEC	1	- Widal	5	5
		2	VDRL,	5	10
	JAN		HA, Blood typing		
			tube method Precipitation test: Ring interphase,		
			single radial diffusion.	5	15
2		3	Ouchterlony double diffusion.	5	20
3	JAN		Immunoelectrophoresis	5	25
4			Neutralization test – Plaque neutralization, Haeme adsorption test.	5	30
5		4	WBC and RBC count and differential blood picture.	2	32
6	JAN		Separation of serum proteins.	3	35
7		5	Blot transfer and detection of protein on blot by staining	2	37
8			ELISA		
9		6	Purification of IgG from serum		
10		7	Lymphocyte culture, viable staining and heamocytomet	3	40
11	JAN	8	Indirect agglutination (Pregnancy hCG Ag)	5	45
12		9	Sterility testing methods for pharmaceutical and cosme	5	50
13	FEB	10	Tests for disinfectants (Phenol coefficient/RWC)	5	55
14		11	Determination of antibacterial spectrum of drugs/antibiotics		
15	FEB	12	Chemical assays for antimicrobial drugs	5	60
16			Testing for antibiotic	5	65
			drug sensitivity/resistance	5	70
17	MAR	13	Determination of MIC valued for antimicrobial chemicals		
18	MAR	14	Microbiological assays for antibiotics	5	75
			Liquid tube assay	5	80
			agar tube assay	2	82
			agar plate assays)	3	85
19	APR	15	Efficacy testing of preservatives like parabens	5	90



PMB 301 FOOD MICROBIAL TECHNOLOGY						
SEMESTER III Theory 2018						
Month	Week	Unit	Sub.Unit	Detailed Topic	No. of Periods	Total
June	1	1	A	Introduction to Fermented foods	1	1
			A i	Microbial Product of Milk	1	2
			A ii	Microbiology of Cheese	1	3
			A iii	Microbiology of Butter	1	4
June	2		A iv	Microbiology of Yogurt	1	5
			A v	Microbiology of Bread.	1	6
			A vi	Microbiology Saurkraut	1	7
			A vii	Microbiology of Idly.	1	8
July	3		B	Microbial Spoilage of Foods.	1	9
			B i	Factors Influencing the Spoilage.	2	11
			B ii	Food safety issues	1	12
			C	Food Preservation Methods.	3	15
July	4		D	Health aspects of fermented foods	1	16
		2	A	Diary Microbiology.	1	17
			Ai	Types of Microbes In Milk	2	19
July	5		Aii	Significance of Microbes in Milk	1	20
			Aiii	Microbial examination of milk	3	23
July/Au	6/7		Aiv	Control of Microbial Flora of Milk.	2	25
			B	Microbes & Animal Interaction.	1	26
			Bi	Rumen Microbiology.	3	29
			C	Production of silage	2	31
			Ci	Importance of silage	1	32
Aug	8	3	A	Probiotics,prebiotics,synbiotics	1	33
			Ai	Probiotics properties	3	36
Sep	9		Aii	Beneficial effects of probiotics	2	38
			Aiii	Screening methods of probiotics	2	40
Sep	10		Aiv	Genetically modified probiotics	1	41
			B	Edible mushrooms	1	42
			Bi	Therapeutic value of mushrooms	2	44
Oct	11		Bii	Cultivation of mushrooms	4	48
Oct	12	4	A	Bacterial examination of fresh foods	1	49
			Ai	Bacterial examination of canned food	1	50
			B	Food borne infections-Intro	1	51
Nov	13/14		Bi	Food intoxication	1	53
			Biii	Food poisoning	1	54
			Biv	Risks and hazards	1	55
Nov	15		C	Mycotoxins	1	56
			Ci	Effect on human health	1	57
			D	Detoxification methods	1	58
			E	Mechanism of toxicity	2	60

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FOOD MICROBIAL TECHNOLOGY-PRACTICALS					
SEMESTER-III 2018-2019					
PMB 351					
Month	Week	S.No	Experiment	No.of periods.	Total
JUNE	1/2	1	Microbiological examination of fresh & Canned foods& Mushrooms.	2	8
JULY	3	2	Microbial examination of spoilage foods and fruits	1	12
JULY	4	3	Microbiological examination of milk & milk products.	1	16
JULY	5	4	Microbiological quality testing of milk (MBRT test ).	1	20
AUG	6/7	5	Isolation & cultivation of anaerobes from rumen & termites.	2	28
AUG	8	6	Isolation of probiotics-LAB	1	32
Sept	9	7	Isolation of probiotic-Yeast	1	36
Sept	10/11	8	Production of mushrooms	2	44
Oc	12	9	Screening of probiotic organisms	1	48
Oct	13	10	Production of probiotic biomass	1	52
Nov	14/15	11	Isolation & analysis of mycotoxins.	2	60

**PMB 302 MEDICAL BACTERIOLOGY THEORY**  
**SEMESTER III (2018-2019)**

Month	Week	Unit	Sub.Unit	Detailed Topic	Periods	Total
June	1	1	A	Principles of Medical Microbiology : Classification of Medically important Microbes.	4	4
June	2	1	B I	Normal flora of Human Body-Origin of Normal Flora, Role of the Resident Flora , Effect of Antimicrobial agents on Normal Flora, Characteristics of Normal Flora.	4	8
July	3		B ii	Distribution & Occurrence of Normal Flora-Skin, Conjunctiva, Nose, Nasopharynx, Sinuses, Mouth, Upper Respiratory Tract, Urogenital Tract.	4	12
July	4		B iii	Bacteria in Blood & Tissues, Factors Influencing Normal Flora.	4	16
July	5	2	A	Properties of Pathogenic Microbes .	2	18
			B	Factors That Influence Pathogenicity		
			C I	Types of Infections	2	20
			C ii	Source of Infection		
			C iii	Different modes / Means of Infection.		
July	6		D	Diagnostic Microbiology- Types of specimen, specimen collection , Transportation of specimen, Processing, Laboratory investigation, Specific Laboratory test, Non- specific Laboratory test, Diagnosis & Report.	4	24
August	7		E	Use of animals in Diagnostic Microbiology.	2	26
		3	A	Systemic bacteriology: Detailed study of Morphology , Cultural Characteristics, Antigenic structure, Pathogenesis, Diagnostic lab tests, Epidemiology, Prevention & Treatment of the following Bacterial Pathogens.	2	28
August	8		B	Bacterial Air Borne Infection:		
			B I	$\beta$ - Hemolytic Streptococci	2	30
			B ii	Pneumococci	1	31
Aug	9		B iii	Corynebacterium diptheriae	1	32
			B iv	Mycobacterium tuberculosis	3	35
Sep	10		B v	Mycobacterium leprae	1	36
			B vi	Neisseria meningitidis.	1	37
Sep	11		B vii	Hemophilus influenzae.	2	39
			C	Sexually transmitted diseases caused by bacteria;	2	41

Sep	12		C I	Treponema pallidum	2	43
Oct			C ii	Neisseria gonorrhoea	2	45
Oct		4	A	Systemic bacteriology: Detailed study of Morphology , Cultural Characteristics, Antigenic structure, Pathogenesis, Diagnostic lab tests, Epidemiology, Prevention & Treatment of the following Bacterial Pathogens.		
	13		B	Water Borne Infections:	1	46
			B I	E.coli	1	47
			B ii	Salmonella typhi	2	49
Oct	14		B iii	Shigella dysenteriae	1	50
			B iv	Vibrio cholera	2	52
			C	Wound Infections	1	53
Nov	15/16		C I	Staphylococcus aureus	2	55
			C ii	Clostridium tetani	2	57
			C iii	Clostridium welchii	2	59
			C iv	Pseudomonas	1	60

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**PMB 302 MEDICAL BACTERIOLOGY THEORY**  
**SEMESTER III (2018-2019)**

Month	Week	Unit	Sub.Unit	Detailed Topic	Periods	Total
June	1	1	A	Principles of Medical Microbiology : Classification of Medically important Microbes.	4	4
June	2	1	B I	Normal flora of Human Body-Origin of Normal Flora, Role of the Resident Flora , Effect of Antimicrobial agents on Normal Flora, Characteristics of Normal Flora.	4	8
July	3		B ii	Distribution & Occurrence of Normal Flora-Skin, Conjunctiva, Nose, Nasopharynx, Sinuses, Mouth, Upper Respiratory Tract, Urogenital Tract.	4	12
July	4		B iii	Bacteria in Blood & Tissues, Factors Influencing Normal Flora.	4	16
July	5	2	A	Properties of Pathogenic Microbes .	2	18
			B	Factors That Influence Pathogenicity		
			C I	Types of Infections	2	20
			C ii	Source of Infection		
			C iii	Different modes / Means of Infection.		
July	6		D	Diagnostic Microbiology- Types of specimen, specimen collection , Transportation of specimen, Processing, Laboratory investigation, Specific Laboratory test, Non- specific Laboratory test, Diagnosis & Report.	4	24
August	7		E	Use of animals in Diagnostic Microbiology.	2	26
		3	A	Systemic bacteriology: Detailed study of Morphology , Cultural Characteristics, Antigenic structure, Pathogenesis, Diagnostic lab tests, Epidemiology, Prevention & Treatment of the following Bacterial Pathogens.	2	28
August	8		B	Bacterial Air Borne Infection:		
			B I	$\beta$ - Hemolytic Streptococci	2	30
			B ii	Pneumococci	1	31
Aug	9		B iii	Corynebacterium diptheriae	1	32
			B iv	Mycobacterium tuberculosis	3	35
Sep	10		B v	Mycobacterium leprae	1	36
			B vi	Neisseria meningitidis.	1	37
Sep	11		B vii	Hemophilus influenzae.	2	39
			C	Sexually transmitted diseases caused by bacteria;	2	41

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Sep	12		C I	Treponema pallidum	2	43
Oct			C ii	Neisseria gonorrhoea	2	45
Oct		4	A	Systemic bacteriology: Detailed study of Morphology , Cultural Characteristics, Antigenic structure, Pathogenesis, Diagnostic lab tests, Epidemiology, Prevention & Treatment of the following Bacterial Pathogens.		
	13		B	Water Borne Infections:	1	46
			B I	E.coli	1	47
			B ii	Salmonella typhi	2	49
Oct	14		B iii	Shigella dysenteriae	1	50
			B iv	Vibrio cholera	2	52
			C	Wound Infections	1	53
Nov	15/16		C I	Staphylococcus aureus	2	55
			C ii	Clostridium tetani	2	57
			C iii	Clostridium welchii	2	59
			C iv	Pseudomonas	1	60

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**Medical Bacteriology - Practicals**  
**SEMESTER III (2018-2019)**  
**PMB 352**

Month	Week	S.No.	Experiments	No. of classes	Total periods
June	1	1	Preparation of different types of culture media/observation	4	4
			Types of culture media.		
			*Blood Agar, Chocolate agar		
			*Mannitol salt agar.		
			*Baired parker media.		
June	2		*MacConkey agar.	4	8
			*Lowenjein.		
			*Jensen media.		
			*Wilson & Blair bismuth sulphite media		
July	3		*Biochemical media.	4	12
July	4	2	Staining technique		
Aug	5		*Gram staining	4	16
Aug	6		*A F B staining	8	24
Sept	7		*Albert staining	4	28
Sept	8		*Capsular staining	4	32
Sept	9&10	3	pathogenic bacteria by microscopic, macroscopic, biochemical, enzymatic & serological tests (coagulase, catalase,	8	40
Oct	11,12	4	Bacteriological examination of different specimens from patients for diagnosis.	8	48
Oct	13		*Urine	4	52
Nov	14		*Pus/Throat Swab	4	56
Nov	15/16		PCR demonstration -Diagnosis	4	60



## M.Sc.(FINAL) SEMESTER MICROBIOLOGY (CBCS)

PAPER II PMB (A)303 MICROBIAL BIOTECHNOLOGY (DSE (A) :ELECTIVE -1) (4 HPW-4 CREDITS)

**ACADEMIC YEAR -2018-2019**

Month	Week	Unit No	Sub Unit	Topic	No. of Periods	Total
JUNE	1	1	A	<b>Introduction to Industrial Microbiology</b>		
				Definition ,Scope and History	1	1
				Properties of Industrial Microorganisms Industrial Products	1	2
			B	<b>Screening for microbes of Industrial importance</b>		
				Primary Screening- Screening for Amylase Organic acid , Antibiotic, Amino acid & Vitamin producing Microorganisms..	1	3
				Secondary Screening	1	4
JUNE	2			Further evaluation of Primary isolates.	1	5
			C	<b>Detection and assay of Fermentation Products</b>		
				Physico chemical methods &	1	6
				Biological assay	1	7
			D	<b>Fermentation equipment and its use.</b>		
				Design of Fermentor	1	8
JULY	3			Types of Fermentor	1	9
				Agitation	1	10
				Aeration	1	11
				Antifoam	1	12
				pH and temperature control.	1	13
JULY	4		E	<b>Strain development :</b> strategies Environmental factors for improvement	1	14
				Genetic factors for improvement	1	15
JULY	5	2	A	<b>Inoculum media AND Inoculum preparation</b>	2	17
			B	<b>Raw materials</b>	2	19
			C	Solid state Fermentation Surface Fermentation	2	21
				Fermentation media & Sterilization.	1	22
JULY	6		D	<b>Types of Fermentation Processes:</b>		
				Solid State, Surface and Submerged Fermentations.	2	24
AUGUST	7			Batch , Fed- batch and Continuous Fermentations.	2	26

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				Direct, Dual or multiple Fermentation		
				Scale up of fermentations		
AUGUST	8			Product recovery methods.	2	28
			<b>E</b>	<b>Fermentation type reactions :</b>		
				Alcoholic Type	1	29
				Lactic Acid Type	1	30
AUGUST	9	3	<b>A</b>	Fermentative production and down stream processing of Citric acid.	2	32
			<b>B</b>	Fermentative production and down stream processing of Vitamin B12.	2	34
SEPT	10		<b>C</b>	Fermentative production and down stream processing of Glutamic acid.	2	36
			<b>D</b>	Comercial production of Benzyl Penicillin, Semisynthetic penicillins.	2	38
SEPT	11		<b>E</b>	Comercial production of Tetracylines.	2	40
				Fermentative production of Beer-Medium components, Malt, Malt adjuncts, Hops Water.	1	41
SEPT	11			Preparation of Wort , mashing, Wort boiling, Microorganisms, Inoculum preparation Fermentation, Cold Storage maturationn, Carbonation, Packing & preservation.	1	42
Oct	12		<b>F</b>	Principles of Wine making -Fruit Selection, Picking, Crushing, Sulphite addition, Pressing, Fermentation , Aging & Botling.	3	45
		4	<b>A</b>	Production & applications of Microbial enzymes- Amylases & Proteases, Uses.	3	48
Oct	13		<b>B</b>	Steroid Bio- transformations .Substrates, Typical Structure, Microbes, Inoculum Preparation, 11-Hydroxylation, Process & Recovery.	3	51
Nov	14		<b>C</b>	Microbial Bio-Pesticides.	3	54
	15		<b>D</b>	Microbial Products from Genetically Modified (cloned) organisms Ex: Insulin.	3	57
Nov			<b>E</b>	<b>Immobilization methods :</b>	3	60
				Advantages and disadvantages		
				Adsorption		
				Covalent linkage		
				Cross linkages		
				Entrapment		

**M.Sc.(FINAL) III SEMESTER-MICROBIOLOGY**

**2018-2019**

**PMB:353 APPLIED MICROBIOLOGY (Practicals)**

Month	Week	Experiments	No. of Periods	Total
JUNE	1&2	Screening for Amylase producing organisms	8	8
JULY	3&4	Isolation of Antibiotic producing organisms by crowded plate technique	8	16
JULY	5&6	Screening for Organic acid producing organisms	4	20
AUGUST	7	Isolation & Culturing of Yeasts .	4	24
AUGUST	8	Seperation of amino acids by chromatography	4	28
September	9	Estimation of glucose by DNS method	4	32
September/October	10,11&12	Estimation of Ethanol by Dichromate method	12	44
October	13	Estimation of maltose	4	48
November	14&15	Immobilisation of microbial cells by Entrapment method.	12	60



<b>Microbial Ecology and Plant Microbe Interaction</b>					
<b>PMB 304 DSE-A</b>					
<b>Semester III</b>			<b>2018-2019</b>		
<b>Month</b>	<b>Week</b>	<b>Unit</b>	<b>Detailed Topic</b>	<b>No. of Periods</b>	<b>Total</b>
June	1	1	<b>Microbial Ecology:</b>		
			Concept of habitat and niche	4	4
			Concept of population and community		
			Development of microbial communities		
June	2		Microbial growth curve representing r and k reproductive	4	8
			Planktonic growth and Biofilm formation		
			Concept of plant probiotics (Seed endophytes and plant endophytes).		
July	3		Microbial communities of spermosphere, rhizosphere,	4	12
			<b>Microbial community diversity analysis:</b>		
			Phylogenetic based approach (16s rRNA, Internal transcribed region),		
July	4		Taxon based approach (gene diversity index, Shannon's diversity index),	4	16
			Sequence based approach (Pyrosequencing, NGS).		
		2	<b>Plant growth promoting microorganisms (PGPM):</b>		
July	5		Plant growth promoting rhizobacteria	4	20
			Direct and Indirect mechanisms of plant growth promotion		
July	6		Microbial formulations (peat, lignite, talc) and mode of inoculation in soil conditions.	4	24
			Detection of microbial inoculants by staining, biochemical and molecular methods.		
August	7		<b>Plant-microbe beneficial interactions</b>	4	28
			Pseudomonas-Plant Interaction and		
			and Bacillus Plant Interactions		

			Trichoderma-Plant Interactions.		
Aug	8		Role of biotic and abiotic factors in plant- microbe interactions	4	32
		<b>3</b>	<b>Plant Pathology and pests</b>		
Aug	9		Introduction to Phytiatary science and its importance	4	36
			Plant Disease Triangle		
Aug	10		Diseases caused by fungi: <i>Sclerotium rolfsii</i> and <i>Macrophomina phaseolina</i> (collar rot disease, charcoal rot),	4	38
			bacteria: <i>Xanthomonas campestris</i> (black rot), actinomycetes: <i>Streptomyces scabies</i> (common scab).		
Sep	11		Infections caused by pest: <i>Helicoverpa armigera</i> and	4	42
Sep	12		Biological and chemical control methods for plant diseases and pest management.	4	46
		<b>4</b>	<b>Molecular plant microbe-interactions</b>		
Sep	13		Impact of root-beneficial microbe interactions on aboveground plant phenotypic plasticity	4	50
Oct	14		Two-component signal transduction system (Gac S and Gac A) in plant growth promoting bacteria	2	52
			Cell signaling and Quorum sensing in		
			Gram negative bacteria, acylated homoserine lactones (AHLs),	2	54
			Gram positive bacteria (peptides), yeast (Farnesols), Fungi (Oxylipins).	2	56
Oct			Intra and inter species communication, Inter-kingdom signaling.		
			Host-pathogen interactions.		
Nov	15		Basic concept of plant immunity (MAMPs, PAMPs).	2	58
Nov	15		Plant defense mechanisms (induced systemic resistance (ISR); systemic acquired resistance (SAR).	2	60

Microbial Ecology and Plant Microbe Interactions - Practicals					
			<b>PMB 353</b>		
			<b>Semester -III</b>	<b>2018-2019</b>	
Month	Week	Unit	Detailed Topic	No. of Periods	Total
June	1	1	Isolation of plant growth promoting bacteria (PGPB) from soil, compost, vermicompost	4	4
June	2	2	Screening PGPB for nitrogen fixation, P-solubilisation, Siderophore production on selective medium	4	8
July	3	3	Isolation of Pseudomonas on Kings B medium and microscopic identification	4	12
July	4	4	Isolation of Actinomycetes on selective medium and microscopic identification	4	16
July	5	5	Isolation of Trichoderma on selective medium and microscopic identification	4	20
August	6	6	Isolation of bacteria with ability to produce plant growth hormone Indole acetic acid (IAA)	4	24
August	7	7	Quantification of IAA by spectrophotometric method	4	28
Sept	8	8	Quantification of phosphate by spectrophotometric method	4	32
Sept	9	9	Isolation of antagonistic microbes using dual-culture method	4	36
Sept	10	10	Pseudomonas and its metabolites for anti-fungal activity	4	40
Oct	11	11	Bacillus and its metabolites for anti-fungal activity	4	44
Oct	12	12	Trichoderma and its metabolites for anti-fungal activity	4	48
Nov	13	13	Isolation of plant pathogenic fungi <i>S. rolfsi</i> , <i>Fusarium</i> spp. etc. on specific media	4	52
Nov	14	14	Detection of QS compounds in Bacteria.	8	60

B.Sc. III Semester Microbiology (CBCS) 2018-2019						
Q.C and Q.A in Food & Pharma Industry (Elective-I) (2 HPW-1Credits)						
PMB 305B SEC						
ACADEMIC YEAR 2018-2019						
Month	Week	Unit No	Sub Unit	Topic	No. of Periods	Total
JULY	1& 2	1	1	Concept of Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP) and Standard Operating Practices (SOP)	4	4
JULY	3&4	1	2	Overview of Quality Control (QC) in fermentation processes: Principles of validation for Food and pharmaceutical industry	4	8
Aug	5&6		3	Tests used for quality assurance (QA) of finished product.	4	12
Sept	7&8			Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.	4	16
Sept	9&10	2	4	Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts, Limulus lysate test for Endotoxin detection, gel diffusion, sterility testing for pharmaceutical products.	4	20
OCT	11			Enrichment culture technique, Detection of specific microorganisms on selective media like XLD agar, Mannitol salt agar, EMB agar, McConkey Agar, Saboraud Agar.	2	22
OCT	12&13			Microbial quality testing of milk by MBRT, DMC and Plat form tests like COB, 10 min Resazurin assay .	4	26
Nov	14&15			Microbial quality testing of water by coliform test, Pathogen detection in water samples.	4	30

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**CELL AND MOLECULAR BIOTECHNOLOGY THEORY  
PMB 401**

SEMESTER IV

2018-2019

Month	Week	Unit	Sub.Unit	Detailed Topic	No.Of Periods	Total
Nov	1	1	a	Cell cycle: Cell division regulation and cancer	4	4
			b	Role of protein Kinases in cell cycle		
Nov	2		d	Programmed cell death	4	8
			e	Geno toxicity assays.		
Dec	3		f	Signal transduction : G- Protein linked receptors	4	12
			g	Concept of second messenger, cAMP & cGMP.		
Dec	4		h	Steroid/peptide hormone regulation	4	16
			i	tissue specific regulation		
			j	Protein folding and the roles of Molecular chaperones.		
Dec	5	2	a	Vectors in Molecular Biology	4	20
			b	Artificial chromosomes		
			c	Enzymes		
			d	Polymerase chain reaction	2	22
Dec	6		e	DNA/Protein sequencing	2	24
			f	rRNA/ Genomic/ c DNA Library construction and screening.	2	26
Jan	7		g	Cloning Techniques: cloning in <i>E-coli</i>	2	28
			h	Cloning in <i>Bacillus subtilis</i>	2	30
Jan	8		i	Cloning in Yeast	2	32
Jan	9		j	promoters, Vectors, cloning strategy, Transformation, Selection, Expression and detection of cloned genes.	4	36
		3	a	Production of recombinant antibodies,	2	38
			b	Protein-protein and protein-DNA interactions		
Jan	10		c	Biochips (DNA chips and Protein chips)	2	40
			d	Pharmacogenomics		
			e	Molecular diagnostics		
			f	DNA markers: rRNA		
Feb	11		g	Molecular hybridization	4	44

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			h	RAPD, AP-PCR, DAF AFLP and analysis		
			i	Simple sequence repeat markers		
			j	DNA fingerprinting		
Feb	12		k	Gene knock out – RNAi and Gene silencing,	4	48
			l	Gene therapy		
			m	Metagenomics.		
Feb	13	4	a	Bioinformatics -Databases,	4	52
			b	Primer Design		
Mar	14		c	finding and multiple sequence alignment	4	56
			d	Protein structure analysis-Modeling.		
			e	Protein engineering and drugs design		
Mar/Apr	15		f	Rational of protein engineering, steps involved in protein engineering and drug design.	4	60

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## Semester-IV Cell and Molecular Biotechnology AY 2018-2019.

PMB 451

Month	Week	Expt.No.	Experiment	No of periods	Total
November	1,2 & 3	1,2,3	Isolation of DNA ,RNA and protein from bacteria	12	12
December	4	4	Restriction Mapping.	4	16
December	5	5	PCR Technique - Demonstration.	4	20
December	6	6	Gene cloning in bacteria - Demonstration	4	24
January	7	7	Southern Transfer.- Demonstration.	4	28
January	8	8	Demonstration of RFLP	4	32
January	9	9 & 10	Recombinant confirmation ( gel shift assays, blue white selection)	4	36
February	10	11 & 12	Separation of Proteins by Column Chromatography	4	40
February	11	13	Data base searching ,BLAST & MSA	4	44
March	12 & 13	14	Primer design	8	52
Mar/April	14 & 15	15	Protein Modeling	8	60

## MEDICAL VIROLOGY & PARASITOLOGY THEORY

### SEMESTER IV 2018-2019, PMB-402

Month	Week	Unit	Sub.Uni	Detailed Topic	No.of Periods	Total
NOV	1	1	A	Diagnostic Virology	1	1
			A1	Cultivation of Pathogenic Viruses in lab ,Animals & Tissue culture,	1	2
NOV	2		A2	Identification of pathogenic Viruses & establishment of Viral etiology	3	5
			B	Air Borne Viral Infections (detailed study)	1	6
			B I	Influenza virus	2	8
DEC	3		B ii	Rhino virus	1	9
			B iii	Rubella virus	1	10
DEC	4		B iv	Adeno virus (type 2)	1	11
			B v	Mumps virus	2	13
			B vii	Measles virus.	2	15
DEC	5	2	A	Detailed study of Viruses transmitted by Water	2	17
			A I	Hepatitis (HAV)	2	19
JAN	6		A ii	Polio myelitis	3	22
			B	Detailed study of Viruses transmitted by Zoonosis	2	24
JAN	7		B I	Rabies	4	28
JAN	8		B ii	Japanese encephalitis.	2	30
		3	A	Detailed study of Contact & Sexually transmitted Viral Diseases:	2	32
FEB	9		A I	Small pox	2	34
			A ii	Herpes (Herpes simplex Virus)	3	37
FEB	10		Bii	Hepatitis Viruses & their Diseases.	4	41
FEB	11		Bii	Acquired Immunodeficiency Syndrome (AIDS).	4	45
MAR	12	4	A	Detailed study of Parasitic Diseases	1	46
			Ai	Malaria,Trichomonas	2	48
			A ii	Amoebiasis	1	49
MAR	13		B	Helmentheic infections	1	50
			Bii	Round worm	1	51
			Bii	Hook worm	1	52
MAR	14		C	Medical Mycology	3	55
mar/Apr	15		Ci	Dermatomycosis	3	58
			Cii	Systemic mycosis	2	60



**Medical Virology & Parasitology**  
**Nanobiotechnology**  
**SEMESTER - IV 2018-19**  
**Practicals**  
**PMB 452**

MONTH	Week	Experiment	No.of Periods	Total
Dec	1,2	Tissue culture techniques (demonstration), Microscopic studies of viruses infected materials (demonstration)	8	8
Dec	3,4	Examination of pathogenic fungi, Examination of stool for Hookworm, Round worm, Examination of stool for Entamoeba histolytica	8	16
Jan	5,6	Examination of blood smear by Leishman stain for Malarial parasites, Immunodiagnosis - Tridot test for HIV, Hepstic test for HBV, ELISA.	8	24
Jan	7,8	Chemical Synthesis of Nano Biomaterials, Microbiological Synthesis of Nano Biomaterials	8	32
Feb	9,10	Green synthesis of metal nanoparticles - Copper, Zinc and Silver using plants extracts	8	40
Feb	11,12	Characterization of Nanoparticles by UV spectrometry, SEM Analysis of nanoparticles	8	48
Mar/Apr	13,14,15	Antimicrobial effect of Ionic silver and Nanosilver prepared by above methods.	12	60

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**BIOINFORMATICS**  
**PMB-403 DSE-B; Paper-III; SEMESTER IV - 2018-19**

Month	Week	Unit	Detailed Topic	No. of Periods	Total
		1	<b>Bioinformatics and genomics</b>		
NOV	1		Introduction to Bioinformatics and Molecular Databa	2	2
	2		Primary Databanks – NCBI, EMBL, DDBJ; Secondary Databases – UNIPROT; Structural Database –PDB	2	4
NOV/DEC	3&4		Database similarity search (FastA, BLAST); Alignment: Pairwise and Multiple sequence alignment, Phylogenetics analysis and Tree construction	3	7
	4&5		Genomics and whole genome sequencing	2	9
	5&6		HGP, Genome Annotation and Gene Prediction	2	11
	6&7		Primer Designing	2	13
DEC/JAN	7&8		SNPs, WGA (WGS) (Whole genome analysis and whole genome studies)	2	15
		2	<b>Transcriptomics and proteomics</b>		
	9		Transcriptomics and sequencing a transcriptome, mic	3	18
	10		ENCODE	1	19
	10&11		Proteomics and sequencing a proteome	2	21
	11&12		Protein folding <i>in vivo</i> and the roles of Molecular chaperones	2	23
JAN/FEB	12&13		Protein Sequence Analysis; Approaches for Protein Structure Prediction (folding <i>in silico</i> )- Homology modeling of protein; Energy Minimization Methods; Active site identification	3	26
FEB/MAR	14		Protein engineering	2	28
MAR/APR	15		Structure Based Drug Design and Ligand-based drug Design; Docking studies	2	30

**MICROBIOLOGY AND HUMAN HEALTH****PMB-403 GE-A; PAPER III; SEMESTER IV - 2018-2019**

Month	Week	Unit	Detailed Topic	Periods No. of Periods	Total
Nov	1	1	Health and hygiene		
Nov	2&3		Bacterial, Viral, fungal, Parasitic.	1	1
			Normal flora of human body and its significance.	2	3
Dec	4		Infection: Types of Infections, Sources of infections, Mode of infections.	1	4
Dec	5		Concept of Immunity, Immunization, Vaccines and vaccination schedule.	1	5
Dec	6		Prevention, control and treatment of infectious diseases.	1	6
Jan	7&8	2	Food and water borne Infections	2	8
Jan	9&10		Air borne Infections	2	10
Feb	11		Zoonotic Infections	1	11
Feb	12		Contact/sexually transmitted Infections	1	12
MAR/APR	13		Nosocomial Infections	1	13
MAR/APR	14&15		Insectborne Infections	2	15

**M.Sc. (Final) IV Semester Microbiology (CBCS)**  
**Paper IV PMB 404 Nanobiotechnology (Theory)-CBCS**  
**(4 HPW-4Credits) 2018-2019**

Month	Week	Unit	Topic	No.of periods	Total
		<b>I</b>	<b>Basic concepts of Nanobiotechnology</b>		
NOV	1	1	Nanobiotechnology-Introduction	1	1
	1	2	Development of nanobiotechnology	2	3
NOV	1,2	3	Nanoparticles -Origin and their classification, Nanoscale systems	3	6
NOV	2,3	4	Nano structures-Carbon nanotubes, quantum dots,Semiconductor nano particles, metal based nanostructures, nanowires- polymerbased nanostructures, gold nanostructres.	4	10
DEC	3,4	5	Protein based Nanostructures: Nanomotors- Bacterial E.coli, Mammalian myocin family	3	13
DEC	4	6	Properties of nanomaterials	2	15
		<b>II</b>	<b>Synthesis and Characterization</b>		
DEC	4,5	1	Synthesis of nanostructures – physical, chemical and biological	2	17
DEC	5	2	Methods of biological synthesis- Use of plants, bacteria,algae, fungi, actinomycetes for nanoparticle synthesis.	3	20
JAN		3	Characterization techniques for nanaomaterials		
			Optical- UV-Visible spectroscopy, X-ray diffraction		
JAN	6,7		Imaging and Size- Scanning Electron Microscope (SEM), Transmission,Electron Microscopy (TEM), Atomic Fluorescence Microscopy (AFM),STEM	5	25
		4	Surface and composition-ECSA,EDAX		
JAN	7,8		Vibrational analysis- FTIR Spectroscopic analysis, SERS , Magnetic, electrical and electrochemical	5	30
		<b>III</b>	<b>Environmental Nanotechnology</b>		
JAN	8	1	Nano fibres and nanobiocides in water purification, Nanomembranes in Sea desalination.	2	32
FEB	9	2	DNA based biosensors for heavy metal complexing with DNA, Use of these in water and food sample analysis.	3	35
FEB	9,10	3	Biosensors: different classes –molecular recognition elements and Transducing elements.	3	38



	10	4	Miniaturized devices in nanobiotechnology –Types and applications	2	40
FEB	11	5	Nanobiotechnological applications in Environmental Bioremediation	2	42
FEB	11,12	6	Environmental implication of nanomaterials – Occurrences, Fate and Characterization of Nanomaterials in the environment	3	45
		<b>IV</b>	<b>Nanotechnology in Pharma and Medicine</b>		
MAR	12	1	Applications of Nanostructures in drug discovery , drug delivery and its controlled release	3	48
MAR	13	2	Studies on Nanoparticles for antimicrobial properties	1	49
	13	3	Nanostructures in cancer research and therapy	3	52
MAR	14		Nanotechnology for tissue engineering- Use of synthetic nanocomposites for bone, teeth replacement	2	54
MAR	14,15	4	Diseased tissue destruction using nanoparticles	3	57
MAR/APR	15	5	Cytotoxicity and genotoxicity of Nanoparticles	3	60

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