

SPPU S. Y. B. Sc. Microbiology Sem I and Sem II Syllabus 2020-21

Titles of the Papers

Semester	Paper Code	Paper	Paper title
III	MB 211	I	Medical Microbiology and Immunology
	MB212	II	Bacterial Physiology and Fermentation Technology
	MB 213	III	Practical based on MB211 & MB 212
IV	MB 221	I	Bacterial Genetics
	MB 222	II	Air, Water and Soil Microbiology
	MB 223	III	Practical based on MB221 & MB 222

S. Y. B. SC. MICROBIOLOGY SYLLABUS (SEM I)

MB – 211: MEDICAL MICROBIOLOGY AND IMMUNOLOGY		[30]
Credit I	MEDICAL MICROBIOLOGY	(15)
1	Definitions: Incubation period, Viability, Susceptibility, Pathogenicity, Virulence, Pathogenesis, Lab diagnosis, Epidemic, Sporadic, Endemic, Pandemic	2
2	Study of following pathogens with respect to –Classification, Morphological, Cultural and Biochemical characters, Antigenic structure, Viability characteristics, Pathogenicity, Pathogenesis, Symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Chemotherapy: Bacteria: a) <i>Escherichia coli</i> b) <i>Staphylococcus aureus</i> Fungi: a) <i>Candida</i> b) <i>Dermatophytes</i>	8

3	Introduction to Chemotherapy i. Selective toxicity, Bioavailability MIC, MBC, LD ₅₀ ii. Antagonism and synergism in drug administration iii. Antibiotic sensitivity, iv. Antibiotic misuse/antibiotic overuse v. Concept of drug resistance (e.g. MRSA, ESBL)	5
Credit II	IMMUNOLOGY	(15)
1	Immunity: Definition, types (Innate and acquired, active and passive, humoral and cell mediated)	2
2	Formation of blood cells (hematopoiesis) Myeloid and lymphoid lineages and differentiation process Lymphocytes types	4
3	Antigens and antibodies: definition and concept	1
4	Immunohematology a. ABO and Rh blood group systems b. Bombay blood group c. Biochemistry of blood group substances d. Inheritance of ABH antigens e. Medico legal applications of blood groups	6
5	Active and Passive Immunization a. Active Immunization Whole organism vaccines i. Attenuated vaccines ii. Inactivated Vaccines b. Passive Immunization Transfer of preformed antibodies c. Latest Immunization schedule in India	2

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MB – 212: BACTERIAL PHYSIOLOGY AND FERMENTATION TECHNOLOGY [30]		
Credit I	BACTERIAL PHYSIOLOGY	[15]
1.	Enzymes	(7)
	a. Introduction to Enzymes: Properties of enzymes, Nature of active site, Structure of active site, commonly occurring amino acids at active site. Ribozymes, coenzymes, apoenzymes, prosthetic group and cofactors.	2
	b. Nomenclature & classification as per IUB (up to class level).	2
	c. Models for catalysis – i. Lock and key ii. Induced fit iii Transition state.	1
	d. Effect of pH & temperature, substrate concentration & enzyme concentration, activators, and inhibitors of enzyme	2
2	Bacterial Physiology	(8)
	a. Definitions of Metabolism, catabolism, anabolism, respiration, and fermentation	1
	b. Metabolic pathways (with structures) 1. Embden Meyerhof Parnas pathway (Glycolysis) 2. Hexose monophosphate pathway 3. Entner Doudoroff pathway 4. Phosphoketolase pathway (Pentose and hexose) 5. TCA cycle (with emphasis on amphibolism) and Glyoxylate bypass 6. Gluconeogenesis and its significance	1 1 1 1 2 1

Credit II	FERMENTATION TECHNOLOGY	15
1.	<p>Concept of fermentation technology</p> <ul style="list-style-type: none"> a. Microbial biomass- based fermentation (Biofertilizer, biopesticide, Probiotics) b. Production of Primary metabolites (Organic acids, amino acids, vitamins, enzymes) c. Production of Secondary metabolites (Antibiotics) d. Production of recombinant products (insulin and growth hormones) e. Production of Fermented food products (Cheese, yoghurt) f. Microbial bio transformation (Steroid transformation) 	3
2	<p>Strains of industrially important microorganisms:</p> <ul style="list-style-type: none"> i. Desirable characteristics of industrial strain ii. Principles and methods of primary and secondary screening iii. Master, working and seed culture; development of inoculum iv. Preservation and maintenance of industrial strains. 	4
3	<p>Design of a Fermenter (typical CSTR Continuous stirred Tank Reactor): Different parts and their working</p>	1
4	<p>Monitoring of different fermentation parameters (Temperature, pH, aeration, agitation, foam)</p>	2
5	<p>Types of fermentations: Batch, continuous, dual</p>	2
6	<p>Media for industrial fermentations: Constituents of media (Carbon source, nitrogen source, amino acids vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors, and inducers)</p>	2
7	<p>Contamination: Sources, precautions, and consequences</p>	1

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S. Y. B. SC. MICROBIOLOGY SYLLABUS (SEM II)

MB 221- BACTERIAL GENETICS		[30]
Credit I		(15)
1	Understanding DNA	9
	<p style="text-align: center;">i. Experimental evidences for nucleic acid as genetic material.</p> <p style="margin-left: 40px;">a. Discovery of transforming material (hereditary material): Griffith's experiment</p> <p style="margin-left: 40px;">b. Avery and MacLeod experiment</p> <p style="margin-left: 40px;">c. Gierer and Schramm</p> <p style="margin-left: 40px;">d. Fraenkel-Conrat & Singer experiment (TMV virus)</p> <p style="margin-left: 40px;">e. Hershey & Chase experiment</p>	6
	ii. Types of nucleic acids (DNA and RNAs)	1
	<p style="text-align: center;">iii. Structure of DNA</p> <p style="margin-left: 40px;">a. Structure of Nitrogen bases, Nucleoside, Nucleotide and polynucleotide chain</p> <p style="margin-left: 40px;">b. Bonds involved in DNA structure</p> <p style="margin-left: 40px;">c. Different forms of DNA</p>	2
2	Prokaryotic DNA replication	7
	<p style="margin-left: 40px;">i. Models of DNA replication. (Conservative, semiconservative, and Dispersive)</p> <p style="margin-left: 40px;">ii. Meselson and Stahl's experiment (semiconservative)</p>	2
	<p style="margin-left: 40px;">iii. Six basic rules of DNA replication</p> <p style="margin-left: 40px;">iv. Enzymes, proteins and other factors involved in DNA replication.</p> <p style="margin-left: 40px;">v. Modes of DNA replication Rolling circle mechanism, theta and linear DNA replication</p>	5

	Credit II	(15)
1	<p>Gene expression</p> <ul style="list-style-type: none"> i. Concept of Genetic code and its properties ii. Concept of transcription and translation 	2
2	<p>Mutations and reversions</p> <p>Concept of Mutation and Types of mutations: Nonsense, Missense, Silent, Conditional lethal- temperature sensitive, Amber, Reverse, suppressor</p> <ul style="list-style-type: none"> i. Spontaneous Mutation <ul style="list-style-type: none"> a. Discovery of spontaneous mutation (Fluctuation test) b. Mechanism of spontaneous mutation c. Isolation of Mutants: Replica plate technique ii. Concept of Induced Mutations <ul style="list-style-type: none"> a. Base pair substitution (Transitions, Transversions), Insertions and deletions- Frame /Phase shift mutations b. Physical Mutagenic agent: UV and Xray c. Chemical mutagenic agents <ul style="list-style-type: none"> ➤ Base analogues (2amino purine, 5bromo uracil), ➤ HNO₂, Alkylating agents ➤ Intercalating agents (EtBr, acridine orange) 	8
3	<p>Plasmid genetics</p> <ul style="list-style-type: none"> i. Types of plasmids ii. Properties of Plasmid iii. Plasmid replication iv. Plasmid incompatibility v. Plasmid curing vi. Plasmid amplification Concept 	5

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MB – 222: Air, Water and Soil Microbiology		[30]
Credit I	AIR MICROBIOLOGY and WATER MICROBIOLOGY	15
1	AIR MICROBIOLOGY	05
	a. Air flora	
	i. Transient nature of air flora	1
	ii. Droplet, droplet nuclei, and aerosols	
	b. Methods of Air sampling and types of air samplers	
	i. Impaction on solids	
	ii. Impingement in liquid	2
	iii. Sedimentation	
	iv. Centrifugation	
	c. Air sanitation: Physical and chemical methods	1
	d. Air borne infections	1
2	WATER MICROBIOLOGY	10
	a. Types of water: surface, ground, stored, distilled, mineral and de-mineralized water	1
	b Recommended Bacteriological standards of Water Quality	
	i. Maharashtra pollution control board (MPCB)	
	Main Functions of MPCB	1
	Water quality standards for best designated usages	
	ii. Central pollution control board, (CPCB)	

	<p>Main Functions of CPCB</p> <p>Designated Best Use Water Quality Criteria</p>	
	c. Water purification methods	1
	d. Water borne Infections	1
	<p>e. Indicators of faecal pollution</p> <p>i. <i>Escherichia coli</i></p> <p>ii. <i>Bifidobacterium</i></p> <p>iii. <i>Streptococcus faecalis</i></p> <p>iv. <i>Clostridium perfringens</i></p> <p>v. New indicators: <i>Campylobacter</i> and <i>Pseudomonas</i></p>	2
	<p>f. Bacteriological analysis of water for potability</p> <p>i. Bacteriological standards of potable water: Bureau of Indian standards (BIS) World health Organization (WHO)</p> <p>ii. Presumptive coliform count</p> <p>iii. Confirmed test</p> <p>iv. Completed test</p> <p>v. Eijkman test</p> <p>vi. Membrane filter technique</p>	4
Credit II	SOIL MICROBIOLOGY	15
	a. Rhizosphere microflora and its role in the rhizosphere	1
	b. Role of microorganisms in composting and humus formation	2
	c. Biofertilizers: Bacterial, Cyanobacterial, fungal and their large-scale production	

		3
	d. Biocontrol agents: Bacterial, Viral, Fungal and their large-scale production	3
	e. Brief account of microbial interactions: Symbiosis, Neutralism, Commensalism, Competition, Ammensalism, Synergism, Parasitism, and Predation	3
	f. Role of microorganisms in elemental cycles in nature: Carbon, Nitrogen	3

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S. Y. B. Sc. Microbiology Practical Course MB 213

Semester I: Practical course based on MB211 & MB 212		
Expt. No.	Topics	No. of Practicals
1	Measurements of cell dimension by micrometry using 10x,45x,100x objectives	1
2	Blood grouping	1
3	<p>I. Biochemical characterization of bacteria:</p> <p>a. Sugar utilization test (minimal medium + sugar)</p> <p>b. Sugar fermentation test</p> <p>c. IMViC</p> <p>d. Enzyme detection – Gelatinase, Catalase, Oxidase</p> <p>e. Oxidative-fermentative test</p> <p>II. Isolation and identification of <i>E. coli</i>, <i>Staphylococcus aureus</i> and <i>Candida</i> from clinical samples using</p> <p>a. Gram staining, motility/ slide culture</p> <p>b. Cultural and biochemical characterization</p>	6
4	<p>Primary screening of industrially important organisms:</p> <p>a. Organic acid / Antibiotic producing microorganisms by crowded plate technique</p> <p>b. Microorganisms producing industrially important enzyme- amylase</p>	2
5	Industrial visit	1
	Total	11

S. Y. B. Sc. Microbiology Practical Course MB 223

Semester II: Practical course based on MB221 & MB 222		
Expt. No.	Topics	No. of Practicals
1	Air sampling using an air sampler calculation of air flora from different locations with the knowledge of respective standards of bacterial and fungal counts.	1
2	Air Flora: a. Diversity determination. b. Simpson index and settling velocity determination	1
3	I. Bacteriological tests for potability of water a. MPN, Confirmed and Completed test. b. Membrane filter technique (Demonstration)	4
4	Enrichment, Isolation, Preparation and Application of Bioinoculant (Azo-Rhizo / Blue Green Algae (cyanobacteria))	2
5	a. Induction of mutations by using physical mutagen (e.g. UV rays) and chemical mutagen (e.g. HNO ₂) b. Isolation of mutants by any suitable method c. Demonstration of UV survival curve	3
	Total	11

