

DEPARTMENT OF MICROBIOLOGY

**B.SC
ACADEMIC
ORGANIZER
(THEORY & PRACTICAL)**

2015-16

ACADEMIC ORGANIZER – 2015-16

B.SC. I YEAR SYLLABUS (2015-16)

SUBJECT -MICROBIOLOGY (TOTAL HRS OF TEACHING-60@ 4hrs/week)

I SEMESTER

(INTRODUCTORY MICROBIOLOGY- Paper I)

Month	Week	Unit	Detail/topic	No. of classes	Total
		I	History of microbiology		
July	1		Meaning, Definition and Scope of Microbiology	1	1
	1		History of Microbiology– An overview till 21 st century.	2	3
	1,2,3		Contributions of Antony Von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky, Selman Walksman, Paul Ehrlich, and Alexander Fleming.	9	12
	4		Branches of Microbiology and Applications of Microbiology	3	15
		II	Microscopy and Prokaryotic Cell		
Jul/Aug	4,5,6	4,5,6	Principles of Microscopy. Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). Micrometry - Units of microscopic measurements.	6	21
	6,7	6,7	Types of stains and Principles of staining - Simple stain, Differential stain, Negative stain, Structural stains - Spore, Capsule, Flagella and Storage granules.	4	25
	7	7	<i>ultrastructure</i> Motility in Bacteria. Hanging-drop method.	1	26
		III	Microbial Sterilization Techniques		
<i>Sep</i>	7,8	7,8	Sterilization and Disinfection techniques. Principles and methods of Sterilization.	3	33
	8	8	Physical methods – Autoclave, Hot-air oven,	3	36

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			Pressure cooker, Tyndallization Laminar air flow, Filter sterilization.		
	9		Radiation methods – UV rays, gamma rays, Ultra sonic methods, Microwave.	3	39
Sep/Oct	9,10,11		Chemical methods – Use of Alcohols, Aldehydes, Fumigants, Phenols, Halogens, and Hypochlorites. Phenol coefficient.	6	45
		IV	General characters of viruses		
	11,12, 13		General characteristics, Cultivation, Maintenance and ICTV Classification of Viruses- Plant, Animal and Bacteriophage.	8	53
	13		Structure of TMV	1	54
	13		Structure of HIV	1	55
	13		Structure of T2 bacteriophage	1	56
NOV	14		Structure and multiplication of lambda bacteriophage	4	60

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B.SC. I YEAR SYLLABUS (2015-16)

SUBJECT -MICROBIOLOGY I SEMESTER PRACTICALS

(INTRODUCTORY MICROBIOLOGY- Paper I)

Month	Week	S.No	B.Sc I Year Practicals	Hrs	Total
July	1	1	Precautions to work in Microbiology laboratory	1	1
	1	2	Light compound microscope and its handling	1	2
	2	3	Calibration of microscopic measurements (Ocular, Stage micrometers)	2	4
	3	4	Measuring dimensions of Protozoa	1	5
	3	5	Microscope observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Cyanobacteria (Nostoc, Oscillatoria, Anabaena, Spirulina), Algae (Scenedesmus Sps., Diatoms), and Fungi (Saccharomyces, Rhizopus, Aspergillus, Penicillium, Fusarium)	1	6
Aug	4	6	Simple and Differential staining (Gram staining)	2	8
	5,6	7	Spore staining, Capsule Staining and Negative staining	3	11
	6	8	Sterilization techniques : Autoclaving, Hot-Air oven and Filtration	1	12
	7	9	Hanging drop technique for observation of motility in Bacteria.	2	14
Sep	8	10	Diagrammatic or Electron photomicrographic observation of TMV, HIV, T2 Phage and Adeno virus)	1	15

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B.Sc II year -Microbial Physiology & Genetics (Theory)

Month	Week	Unit	Details/topic		Total
			Nutrition, Growth and Enzymes		
June	1,2	I	Microbial nutrition-Nutritional requirements of bacteria. Uptake of nutrients by cells. Nutritional groups of microorganisms- autotrophs, heterotrophs, mixotrophs, methylophs	5	5
	2		Growth media-synthetic, nonsynthetic, selective, enrichment and differential media	3	8
	3		Microbial growth-different phases of growth in batch cultures	2	10
	3		Factors influencing microbial growth	1	11
Jun/July	3,4		continuous ,synchronous growth and biphasic growth	2	13
	4		Methods for measuring microbial growth-Direct microscopy, viable count estimates, turbidometry, biomass	3	16
	5		Enzymes- properties and classification, enzyme unit	3	19
	5,6		Biocatalysis-induced fit and lock and key model, co-enzymes, cofactors, factors affecting catalytic activity of enzymes	4	23
	6,7		Inhibition of enzyme activity- competitive, non-competitive, uncompetitive and allosteric	2	25
			Intermediary metabolism		
Jul/Aug	7,8,9,10	II	Aerobic Respiration- glycolysis, HMP, ED, TCA cycle, electron transport, oxidative and substrate level phosphorylation. Anaplerotic reactions. Beta oxidation of fatty acids	12	37



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	10,11		Glyoxylate cycle. Anaerobic respiration- nitrate, sulfate	4	41
	11,12		Fermentation- common microbial fermentations with special reference to Alcohol and lactic acid fermentations	4	45
Aug/Sep	12,13		Photosynthetic apparatus in prokaryotes. Outlines of oxygenic and anoxygenic photosynthesis in bacteria	5	50
			Microbial Genetics		
	13,14, 15	III	Fundamentals of genetics-Mendelian laws, alleles, crossing over and linkage. DNA and RNA as genetic materials	8	58
	15		Structure of DNA-Watson and crick model	1	59
	15,16		Extrachromosomal genetic elements-plasmids and transposons	2	61
	16		Replication of DNA-semi conservative mechanism	3	64
Oct	17		Outlines of DNA damage and repair	3	67
	17,18		Mutations-spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions	3	70
	18		Various physical and chemical mutagens	2	72
Nov	19		Brief account on horizontal gene transfer among bacteria- transformiaon, transduction and conjugation	3	75
			Gene Expression and Recombinant DNA technology		
	19,20	IV	Concept of gene-Muton, recon and cistron. one gene-one enzyme, one gene-one polypeptide, one gene one product hypotheses	2	77
	20		Types of RNA and their functions	2	79
	20,21		Outlines of RNA biosynthesis in prokaryotes	3	82
	21,22		Genetic code. Structure of ribosomes and a brief account of protein synthesis	4	86

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	22		Types of genes-structural, constitutive, regulatory	1	87
Nov/Dec	22,23,		Operon concept. Regulation of gene expression in bacteria-lac operon	2	89
	23,24		Basic principles of genetic engineering-restriction endonucleases, polymerases and ligases, vectors	4	93
	24		Outlines of gene cloning methods	2	95
	24,25		Genomic and cDNA libraries	2	97
	25		General account on application of genetic engineering in industry, agriculture and medicine	3	100



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Academic organizer (2014-15)

PAPER II - MICROBIAL PHYSIOLOGY AND GENETICS (90Hrs)

(Practical)

Month	Week	S.NO	B.Sc II Year practicals	Hrs	Total
June&July		1	Preparation of media for culturing autotrophic and heterotrophic microorganisms-Algal medium, mineral salts medium, nutrient agar medium, McConkey agar, Blood agar		
July		2	Enrichment culturing and isolation of phototrophs and chemoautotrophs		
Aug		3	Setting and observation of Winogradsky column		
		4	Determination of viable count of bacteria		
		5	Turbidometric measurement of bacterial growth		
Aug& Sep		6	Bacterial growth curve		
		7	Factors affecting bacterial growth -pH, Temperature, salts		
Sep,Oct&Nov		8	Qualitative analysis of sugars and amino acids		
Nov		9	Colorimetric estimation of DNA by diphenylamine method		
		10	Colorimetric estimation of proteins by Biuret/Lowry method		
Nov&Dec		11	Paper chromatographic separation of sugar and amino acids		
Dec		12	Starch hydrolysis, catalase test and sugar fermentation test		
Jan		13	Verification of Beer's Law		
		14	Problems related to DNA and RNA characteristics, Transcription and Translation		



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ACADEMIC ORGANIZER – 2015 -16
B.Sc III year Immunology and Medical Microbiology (Theory)

Month	Week	Unit	Detail/topic	No. of classes	Total
		I	History of Immunology and Immune system		
June	1		Development of immunology	2	2
	1&2		Types of immunity- innate and aquired, active and passive, humoral and cell mediated.	4	6
	3		Primary and secondary organs of immune system- thymus, bursa fabricus, bone marrow, spleen and lymph nodes	4	10
July	4&5		Cells of immune system- B and T-lymphocytes, null cells, monocytes, macrophages, neutrophil, basophiles and eosinophiles.	3	13
	5		Identification and function of B and T lymphocytes, Nullcells, monocytes, macrophages, Neutrophils, Basophils and eosnophils	2	15
		II	Basics of Immunology		
	6		Antigens-types, chemical nature antigenic determinants, haptens.	1	16
			Factors affecting antigenicity	1	17
	6&7		Antibodies- basic structure, types, properties and functions of immunoglobulins	3	20
	7&8		Components of complement and activation of complement	2	22
Jul/Aug	8&9		Types of antigen-antibody reactions- agglutination, blood groups, precipitation, neutralization, complement fixation.	4	26
	9&10		Labeled antibody based techniques- ELISA, RIA, immunofluorescence.	3	29
	10		Polyclonal and monoclonal antibodies- production and applications.	1	30
	11		Types of hyper sensitivity-Immediate and delayed	2	32
	11&12		Auto immunity and its significance	2	34
		III	Clinical Microbiology		
	12		History of medical microbiology	1	35
Aug/Se p	12&13		Normal flora of human body	4	39
sep	14		Definition of infection, non-specific defence mechanisms: (mechanical barriers, antagonism of indigenous flora)	1	40
			Anti-bacterial substances- lysozyme,	1	41

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		complement, properdin, anti-viral substances, phagocytosis.		
		General principles of diagnostic microbiology	1	42
	15	collection transport and processing of clinical samples.	2	44
	15&16	General methods of laboratory diagnosis-cultural, biochemical, serological and molecular methods	3	47
	16	Tests for anti-microbial susceptibility	1	48
Oct	17	Anti-viral agents- interferons and base analogues	1	49
	17&18	Host-pathogen interactions. Bacterial toxins, virulence and attenuation	3	52
		IV Microorganisms and disease		
	18	Elements of chemotherapy-therapeutic drugs. Drug resistance	2	54
Nov	19	Mode of action of penicillin and sulfa drugs and their clinical use	2	56
	19	Preventive control of diseases-active and passive immunization	1	57
	20	Vaccines- natural and recombinant	1	58
	20&21	General account of the following diseases-causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control. Air borne diseases Tuberculosis Influenza	3	61
Nov/Dec	21&22 &23	Food and water borne diseases Cholera, Typhoid, Hepatitis-A, Poliomyelitis Amoebiasis	6	67
Dec	23&24	Insect borne diseases Malaria Filariasis Dengue fever	3	70
	24	Contact diseases Syphilis Gonorrhoea	2	72
	25	Zoonotic diseases Rabies Anthrax	3	75
	26	Blood borne diseases Serum hepatitis AIDS	2	77
		General account of nosocomial infections	1	78

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ACADEMIC ORGANIZER (2015-16)
PAPER III -Immunology and Medical Microbiology
PRACTICAL

Month	Week	Sl.No.	Experiments	Number of Practical Classes	Total
June&July	1,2,3&4	1	Blood Tests-DC,TC and ESR	4	
	5	2.	Estimation of Blood Haemoglobin	1	5
	6	3.	Determination of Blood Groups and Rh Typing.	1	6
Aug	7,8,9&10	4.	Antigen-antibody Reactions; i. Widal test ii. VDRL Test iii. Precipitation-Ochterlony Double Diffusion Test	4	10
	11	5.	Acid Fast Staining of Mycobacteria.(Stained or Permanent slides.)	1	11
Sep/Oct/ Nov	12,13,14, 15, 16,17&18	6.	Isolation and identification of medically important bacteria(E.coli, Klebsiella,Pseudomonas,Staphylococcus, Streptococcus) by cultural, microscopic &biochemical tests.	7	18
Nov/Dec	19&20	7.	Antibiotic Sensitivity testing;Disc Diffusion Method	2	20
Dec	21&22	8.	Parasites ; Malarial Parasite,Entamoeba,(study of Permanent Slides)	2	22
Jan	23	9.	Observation of Fungal Pathogen(Candida)	1	23
	24&25	10	Tests for Disinfectant (Phenol Co-efficient)	2	25
	26	11	Pre-final Practical examination	1	26



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B.Sc III year- Applied Microbiology (Theory)

Month	Week	Unit	Detail/topic	No. of classes	Total
June		I	Agricultural Microbiology		
	1		Physical and chemical characteristics of soil	1	1
	1		Rhizosphere and Phyllosphere	2	3
June/July	2,3,4,5		Plant growth promoting organisms (mycorrhizae, rhizobia, azospirillum, azatobacter, cyanobacteria, frankia and phosphate solubilizing organisms) Outlines of biological nitrogen fixation (symbiotic, non-symbiotic)	10	13
	5		Bio-fertilizers-Rhizobium	1	14
	5		Concept of disease in plants	1	15
	6		Symptoms of plant disease caused by fungi, bacteria and viruses.	3	18
	7		Plant diseases caused by fungi(Groundnut rust),Bacteria(angular Leaf spot of cotton) and Viruses(Tomato leaf curl)	3	21
	8		Principles of plant disease control	2	23
July/Aug	8,9		Biological control of plant diseases Biopesticides- bacillus thuringiensis, nuclear poly hedrosis virus (NPV),Trichoderma	2	25
		II	Environmental Microbiology		
Aug	9		Microorganisms of the environment (soil, water and air)	2	27
	10		Role of Microorganisms in nutrient cycling- carbon, nitrogen and phosphorus	3	30
	11		Microbial interactions- mutualism, commensalism, antagonism, competition, parasitism, predation	2	32
	11,12		Microbiology of potable and polluted waters. <i>Ecoli</i> and <i>Streptococcus faecalis</i> as indicators of water pollution Sanitation of potable water	3	35
Aug/Sep	12,13		Sewage treatment(primary, secondary and tertiary)	3	38
Sep	13,14		Outlines of biodegradation of environmental pollutants- pesticides	3	41
			Solid waste disposal- sanitary land fills, composting		
	14,15		Microbiology of air and air sampling	2	43



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			methods		
		III	Food Microbiology		
	15		Microorganisms of food spoilage and their sources	1	44
Sep	15,16		Spoilage of different materials (fruits, vegetables, meat, fish)	4	48
Oct	17,18		canned foods -Food intoxication(Botulism and staph poisoning), food borne diseases (salmonellosis and shigellosis)and their detection	4	52
	18		General account of food preservation	2	54
Nov	19		Microbial production of fermented foods- Bread, cheese, yoghurt	3	
	20		Biochemical activities of microbes in milk	1	55
	20		Microorganisms as food- SCP, edible mushrooms(white button,oyster and paddy straw)	2	57
	21		Concept of probiotics	2	59
		IV	Industrial Microbiology		
	21,22		Microorganisms of industrial importance- yeast and moulds, bacteria, actinomycetes	2	61
	22		Screening and isolation of industrially useful microbes	2	63
Dec	23		Outlines of strain improvement	2	65
	23,24		Types of fermentation- aerobic, anaerobic, batch, continuous, sub-merged, surface and solid state	4	69
	25		Design of a stirred tank fermentor. Fermentation media	2	71
Dec,Jan	25,26, 27,28		Industrial production of A. Alcohol- ethyl alcohol B. Beverages-beer C. Enzymes-amylases D. Antibiotics- penicillin E. Amino acids- Glutamic acid F. Organic acid- citric acid G. Vitamins- B ₁₂ H. Biofuels- biogas(methane)	8	79



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Applied Microbiology (paper IV)
PRACTICAL

Month	Week	S.No.	Experiments	Number of Practical Classes	Total
June	1 & 2	1	Isolation and identification of Rhizosphere & Phyllosphere microorganisms	2	
July	3	2.	Study of root nodules and isolation of Rhizobium from legume root nodules	1	3
	4&5	3.	Isolation of Azospirillum or Azotobacter	2	5
		4.	Staining and observation of Vesicular Arbuscular Mycorrhizal(VAM)fungi	1	6
		5.	Observation of plant diseases of local importance: Rusts, Smuts, Powdery mildews, Tikka disease of ground nut, Citrus canker, Bhendi yellow vein mosaic, Tomato leaf curl Little leaf of brinjal	1	7
	6	6.	Isolation of antagonistic micro organisms by crowded plate technique	1	8
Aug	7 & 8	7.	Isolation of Microorganisms of air by Petri plate exposure method.	1	9
Aug & Sep	9,10& 11	8.	Determination of Biological Oxygen Demand (BOD) of water.	2	11
Sep& Oct.	12,13, 14,15 &16	9.	Microbiological testing of water by coliform test (multiple tube fermentation method)	2	13
Nov	16	10	Determination of Microbiological quality of milk-MBRT	1	14
	17	11	Isolation of Fungi and bacteria from Spoiled fruits and vegetables	1	15
	18 &19	12.	Observation of different Spoiled Foods	1	16
Dec	20,21 &22	13.	Alcohol production and estimation; calculation of fermentation efficiency	3	19
Dec & Jan	23&24	14.	Isolation of amylase producing organisms.	2	21
Jan	25	15.	Citric acid production and estimation.	2	23
	26		Estimation of ascorbic acid	1	24
	27	16.	Pre-final Practical examination	1	25



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