

The University of Burdwan
Syllabus for B.Sc. (HONS.) (1+1+1 Pattern)
in
Microbiology
(with effect from 2010-2011 onward)

Distribution of Marks

<p>Part I Theory Papers</p> <p>Paper-I - 100 marks Paper-II - 50 marks</p> <p>Practical Papers Paper-III - 50 marks</p> <p>Total marks – 200</p>	<p>Part II Theory Papers</p> <p>Paper-IV - 100 marks Paper-V - 50 marks</p> <p>Practical Papers Paper-VI - 50 marks</p> <p>Total marks – 200</p>
<p>Part III Theory Papers</p> <p>Paper-VII - 100 marks Paper-VIII - 100 marks</p> <p>Practical Papers Paper-IX - 100 marks Paper-X - 100 marks</p> <p>Total marks – 400</p>	
<p>Total marks for Part I, II, III - 800</p>	

Outline Syllabus for Part-I

Theory

Paper I : : Diversity of microorganism 100 marks
Group A: Basic knowledge on Prokaryotic microorganisms 50 marks
Group –B : Eukaryotic Microorganisms and Virus 50 marks

Paper II- General Biochemistry 50 marks

Practical

Paper III: 50 marks

Total : 200 marks

Part-I I

Theory

Paper IV: Physiology of Microorganisms 100 marks
Group A: Growth and Nutrition of Microorganisms 50 Marks
Group B- Microbial Metabolism 50 Marks

Paper V: Biophysical Chemistry & Bioinfotmatics 50 marks

Practical

Paper VI: 50 marks

Total : 200 marks

Part- III

Theory

Paper-VII: Genetics of Microorganisms & Medical Microbiology 100 marks
Group A: Microbial Genetics & Gene Manipulation 50 marks
Group B: Microbial Pathogenicity & Immunity 50 marks

Paper VIII Ecology & Application of Microorganisms 100 marks

Group A: Environmental Microbiology 50 marks

Group B: Food & Industrial Microbiology:

Practical

Paper IX: 100 marks

Paper X: 100 marks

Total : 400 marks

Total marks for Part I, II, III - 800

Part-I
Paper I. Diversity of microorganism (100 Marks)

Group A: Basic knowledge on Prokaryotic microorganisms (50 Marks)

1. History and development of microbiology; contributions of Leeuwenhoek, Koch, Pasteur, Jenner and Fleming; scope of microbiology. (5)
2. Staining and staining techniques: Classification of stain, principles of staining, negative, simple and differential staining. (5)
3. Principles and modern approaches of bacterial taxonomy. Basic idea about Hackel and Whittaker's kingdom concept and domain concept of Carl Woese. Out line classification of bacteria and archaea as per 2nd edition of Bergy's Manual. (8)
4. General characteristics, economic importance and example of representatives from the following Phylum- Proteobacteria (Chlamydia & Rickettsia); Low G + C Pharmicutes (Mycoplasma), Actinobacteria, Cyanobacteria. (8)
5. Morphology and structure: Bacterial morphology- shape size structure, chemistry and function of cell wall, membrane, capsule, pili, flagella, plasmid, bacterial chromosome. (7)
6. Resting structure: Endospore- structure, formation, germination, resistance. (4)
7. Reserve materials- carbon and phosphate reserve, cyanophycin. (4)
8. Cytoplasmic inclusions: Chlorosome, magnetosome, carboxysome, gas vesicles, ribosome. (4)
9. Archaea: General characteristics, major groups, economic importance. (5)

Group –B : Eukaryotic Microorganisms and Virus (50 Marks)

1. Algae: Classification of Lee (2009), General characteristics, Plant body types and reproduction of the following groups- Chlorophyta, Xanthophyta; Economic uses of algae. (10)
2. Fungi: Classification of Ainsworth, general characteristics, plant body types and reproduction of the following groups- Phycomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Economic importance of Fungi. (12)
3. Protozoa-: Classification of Levine (up to subkingdom), general characteristics, reproduction. Economic importance. (8)
4. History and development of virology, structural organization and chemistry of viruses. (6)
5. Classification of virus according to ICTV. Virus assay (Pluck and Pock test). (5)
6. Lytic cycle of bacteriophages, with reference to E. coli and T4. (2)
7. Lysogeny- lysogenic conversion, induction and significance. (3)

8. Prion, viroids, virusoids, satellite virus. (4)

Paper-II- General Biochemistry (50 Marks)

1. Physicochemical Properties of water: Structure of water molecule, physical properties, ionic product of water, pH & pK – their definition, relation to acids, bases & buffers in biological system. Electrostatic bond, hydrogen bond, hydrophobic bonds & Van der Waals interactions. (7)
2. Carbohydrates: Definition, classification, and structural concepts of triose, tetraose, pentose and hexose sugars, disaccharides, (sucrose, lactose and maltose), Asymmetric carbon atoms, mutarotation, and isomerism. Important derivatives and properties of mono-saccharides (glycosides, sugar acids, deoxysugars, aminosugars). Polysaccharides and glycol-proteins. (7)
3. Amino acids and peptides; Classification, acid base properties, titration curve of amino acids (neutral, acidic and basic amino acids), reaction of amino acids, peptide linkage and polypeptides. (5)
4. Proteins: Classification (only function based), primary, secondary and tertiary and quaternary (only domain and subunit) structure; Protein turn over. (7)
5. Enzymes: general characteristics, nomenclature, classification, enzyme kinetics, Michaelis-Menten equation and Lineweaver Berck Plot, co-enzymes and their function. Competitive, non-competitive and uncompetitive inhibition of enzyme activity. Allosteric inhibition. Outline idea of isozyme, abzyme, ribozyme and zymogen. (10)
6. Lipids: Nomenclature, classification (only structure based) and properties of different types of lipids. General classification of fatty acids; chemical reactions of saturated and unsaturated fatty acids. Lipid micelles, lipoproteins, liposomes, bilayer formation. (8)
7. Nucleic acids: Purine, pyrimidine bases, nucleosides and nucleotides. Structure, properties and types of DNA and RNAs. (6)

Paper-III (PRACTICAL); Full Marks-50

1. Details of microscope and its function: Standardization, Magnification
2. Preparation of basic liquid media (broth) and solid media for the routine cultivation of bacteria (Milk, Nutrient broth/agar, Davis Migolis Medium) and fungi (Lemon extract, Saboroud dextrose agar/broth, Zapek Dox medium)
3. Preparation of slant and stab
4. Pure culture technique: Spread plate, pour plate, streak plate
5. Isolation and enumeration of bacteria and fungi from natural sources: soil, air and water
6. Morphological study of eukaryotic/ prokaryotic cell types (from permanent slides):
Bacteria- Bacillus sp. Staphylococcus sp. Gloeotrichia sp., Nostoc sp.

Algae- Zygnema, Oedogonium, Chlamydomonas, Spirogyra;

Fungi- Rhizopus, Penicillium, Agaricus, Yeast;

Protozoa- Paramoecium, Euglena

7. Simple staining of microbes and study of cell types (work out specimen-curd and root nodule, Spirogyra, Penicillium, paramoecium)
8. Differential Staining: Gram's staining, Endospore staining and Acid-Fast staining
9. Chemical estimation of Sugar (DNS method), Amino Acids (ninhydrin method), Protein (Lowry method), DNA (diphenyl amine method), RNA (Orcinol method)

Books for Part-I syllabus

1. Microbiology, Volume 145, Society for General Microbiology, HighWire Press - Science – 1999
2. The desk encyclopedia of microbiology[†] - Moselio Schaechter, Joshua Lederberg - Science - 2004 –
3. Microbiology[‡]-Daniel V. Lim - Science – 2002
4. Fungi in biogeochemical cycles[‡] - Page 24-Geoffrey M. Gadd, British Mycological Society - Medical - 2006 - 469 pages
5. Microbiology Super Review[†] - Page 5-Research and Education Association - Science – 2000
6. Schaum's Outline of Microbiology, Second Edition[†] - Page 303-I. Edward Alcamo, Jennifer M. Warner - Study Aids – 2009
7. Food microbiology: an introduction[†] - Page 23-Thomas J. Montville, Karl R. Matthews - Science – 2005
8. Microbiology: An Introduction[‡]-Gerard J. Tortora, Berdell R. Funke, Christine L. Case - Science - 2009 - 812 pages
9. Textbook of Microbiology[‡]-R. Vasanthakumari - 2007 - 524 pages
10. Microbiology: principles and explorations[‡]-Jacquelyn G. Black - Science - 2002 –
11. Alcamo's Fundamentals of Microbiology[†] - Page xxv-Jeffrey Pommerville - Science - 2010

- 12 Laboratory Exercises in Microbiology† - Page xii-John P. Harley, John P Harley - Science - 2004
- 13 Microbiology Experiments to Accompany Microbiology† John Kleyn, Mary Bicknell - Medical - 2008 -
- 14 Biochemistry†Pamela C. Champe, Richard A. Harvey, Denise R. Ferrier - Medical - 2005
15. Biochemistry†Mary K. Campbell, Shawn O. Farrell - Science - 2007
16. Biochemistry†Reginald H. Garrett, Charles M. Grisham - Science - 2008
- 17 Biochemistry: the chemical reactions of living cells, Volume 2†David E. Metzler, Carol M. Metzler - Science - 2003
- 18 Biochemistry: the molecular basis of life‡Trudy McKee, James R. McKee - Science - 2008 -
19. Textbook of biochemistry: with clinical correlations‡Thomas M. Devlin - Medical - 2002
- 20 Marks' basic medical biochemistry: a clinical approach† Michael A. Lieberman, Michael Lieberman, Allan Marks - Medical - 2008 -
- 21 Biochemistry Explained: A Practical Guide to Learning Biochemistry† Thomas Millar - Science - 2002
- 22 Harper's illustrated biochemistry‡Robert K. Murray - Medical - 2003 -
- 23 The Prokaryotes: Ecophysiology and biochemistry‡Martin Dworkin - Science – 2006
- 24 The physiology and biochemistry of prokaryotes‡David White - Medical - 2007
- 25 Physical biochemistry: principles and applications-David Sheehan - Science - 2009 -
- 26 Biochemistry Demystified‡Sharon Walker, David McMahon - Medical - 2008
- 27 Experimental biochemistry‡Robert L. Switzer, Liam F. Garrity - Science - 1999 -
- 28 Biochemistry‡David Hames, N. M. Hooper - Science - 2005
- 29 Biochemistry: the molecular basis of life‡Trudy McKee, James R. McKee - Science - 2008
- 30 Textbook of biochemistry: with clinical correlations‡Thomas M. Devlin - Science - 2006
- 31 Lehninger principles of biochemistry‡Albert L. Lehninger, David Lee Nelson, Michael M. Cox - Science - 2005
- 32 Principles of biochemistry‡H. Robert Horton - Science - 2006 -
- 33 Concepts in biochemistry‡Rodney F. Boyer - Science - 2006
- 34 Marks' Basic Medical Biochemistry: A Clinical Approach‡Michael A. Lieberman, Allan D.

Marks - Medical - 2009

- 35 Fundamentals of Biochemistry: Life at the Molecular Level†Donald Voet, Judith G. Voet, Charlotte W. Pratt - Science - 2011 -
- 36 Biochemistry Lecture Notebook†Jeremy M. Berg, John L. Tymoczko, Lubert Stryer - Science - 2006
- 37 Molecular biology†Phil Turner, Philip C. Turner - Science - 2005
- 38 Essential cell biology: an introduction to the molecular biology of the cell†Bruce Alberts - Science -
- 39 Molecular cell biology†Harvey F. Lodish, Arnold Berk - Science - 2008
- 40 Molecular biology and biotechnology: a comprehensive desk reference†Robert A. Meyers -
41. Algae: an introduction to phycology†Christiaan Hoek, D. G. Mann, Hans Martin Jahns - Science - 1995
42. Algae: anatomy, biochemistry, and biotechnology†L. Barsanti, Paolo Gualtieri - Science - 2006
43. Algae†Linda E. Graham, Lee Warren Wilcox - Science - 2000
- 44 Fungi: biology and applications† Kevin Kavanagh - Science – 2005
45. Introductory Mycology, 4Th Ed†- Page 563-Alexopoulos - 2009
46. Virus!: the secret world of computer invaders that breed and destroy†Allan Lundell - Computers - 1989
47. Virus taxonomy: classification and nomenclature of viruses : eighth report ...†C. Fauquet, International Committee on Taxonomy of Viruses - Science - 2005
- 48 Advances in Virus Research, Volume 62†Karl Maramorosch, Frederick A. Murphy, Aaron J. Shatkin - Science – 2003
49. Virus†S. D. Perry - Fiction - 1998
50. Introduction to modern virology†N. J. Dimmock, Andrew Easton, Keith Leppard - Science - 2001

PART II

Paper IV (Theory)- Physiology of Microorganisms

Full Marks: 100

Group A: growth and Nutrition of Microorganisms Full Marks 50

1. Microbial Nutrition: Nutritional types (Definitions and examples) - Photoautotrophs, Photoorganotrophs, Chemo-lithotrophs (ammonia, nitrate sulphur, hydrogen, iron oxidizing bacteria), Chemo-organotrophs; effects of oxygen on growth, Classification on the basis of oxygen requirement and tolerance. (7)
2. Media type and Preservation: Components, criteria and role of macro and micro-nutrients. Natural, Synthetic, Complex, Selective media & Differential Media. Preservation of Microorganisms.(4)
3. Bacterial Growth:Growth phases, Generation Time, Kinetics of Growth, Batch Culture, Continuous culture, Synchronous culture, Chemostat, Turbidostat, Diauxic Growth, Enrichment Culture. Physical factors influencing growth: Temperature, PH, Atmospheric Pressure, Salt Concentration, Chemical factors: heavy metal (copper), surfactants (Triton X 100 and SDS). (10)
4. Control of Microorganisms: Physical methods- heat (dry and wet heat) , filtration, radiation, chemical methods: Ethanol, phenolics, ethylene oxides, formaldehyde, halogens. (6)
5. Bacterial Photosynthesis:Photosynthetic microorganisms; Bacterial photosynthetic apparatus; Pigments; Bacterial photosynthesis mechanism and differences from Eukaryotic photosynthesis. (8)
6. Biological Nitrogen Fixation:Symbiotic and Non-symbiotic nitrogen fixation; Nodule formation in leguminous plants; Biochemistry/mechanisms of nitrogen fixation; Component of nitrogenase system.(7)
7. Chemotherapeutic agents: Sulphonamides, Antibiotics, Mechanisms of action and antimicrobial spectrum of Penicillin, Streptomycin, Tetracyclines, Chloramphenicol, Nalidixic acid and Metronidazole. Drug resistance- phenomenon and mechanism. (8)

Group B: Microbial Metabolism Full Marks 50

1. Carbohydrate Metabolism:Glycolysis, TCA cycle, Pentose Phosphate Pathway, Entner Doudroff Pathway, Stickland-reaction, Phosphoketolase pathway, Gluconeogenesis, Glycogen Synthesis and lysis, Glyoxalate Cycle. (10)
2. Energy Production: Substrate level Phosphorylation, Electron Transport System, Phosphotransferase system, Energy Yield and ATP generation sites. (6)
3. Anaerobic respiration (Nitrate respiration), Fermentation (Homolactic and Heterolactic Fermentation)-their utility. (5)

4. Amino acid and Protein Metabolism: Concept of endo- and exo-peptidase, Transamination, Deamination, Transmethylation and decarboxylation. Biosynthesis of Aminoacid (Aspartate family). (6)
5. Lipid Metabolism: Detailed account of beta-oxidation of even and odd number, saturated and unsaturated fatty acids, biosynthesis of fatty acids, degradations of fatty acids. (8)
6. Protein Biosynthesis- Genetic Code:Nature, Character, Deciphering of Code, Wooble Hypothesis, Universality & non universality of genetic code, Non Watson & Crick Codes. Transcriptional Mechanism (Initiation, Elongation, Termination), Post Transcriptional modification of mRNA in Eukaryotes (only basic idea). Genetic Code and it's Characters. Translation including phenomena of Initiation, Elongation, Termination. (15)

Paper V -Biophysical Chemistry & Bioinformatics FM : 50

1. Thermodynamics :Laws of thermodynamics, concept of free energy, entropy & enthalpy, standard free energy change & high energy bond. (7)
2. Biophysical Principles: Osmosis, osmotic pressure, Donan equilibrium, diffusion potential, diffusion coefficient, endocytosis & exocytosis, gradient of chemical potential as driving force in transport, membrane potential & ionophores. (5)
3. Microscopy: General principles of optics, compound microscope, dark-field, bright-field, microscopy; concept of phase contrast, electron microscopy (SEM and TEM) (7).
4. Spectrophotometry:Concept of electromagnetic radiation, Beer-Lambert's Law, derivation & deviation. Extinction co-efficient, absorptivity & working principle of Colorimeter & Spectrophotometer. Application of UV-VIS Spectrophotometer. (6)
5. Fundamental of Radioactivity:Radioactive & non radioactive isotopes, Laws of Radioactivity, Half life & Average life, types of radiation (α , β , γ radiations) application of radioactive isotopes in biology. (5)
6. Chromatographic Tecniques:Principle & application of Paper, Thin Layer (TLC), Column, Gas- Liquid, High Performance Liquid (HPLC), Ion-exchange, Absorption & Affinity Chromatography. (6)
7. Electrophoresis: Principle & application of Gel Electrophoresis, Iso-electric Focusing & Immuno-electrophoresis.(4)
8. Bioinformatics- definition and its application in Microbiology. Different types of sequence DADTABASE (EMBL, Gene Bank, SWISPROT),; Concept of sequence alignment (pair wise and multiple) and their importance. Search engines-definition and importance. Definition, concept and importance of phylogenetic tree. (5)
- 9. Sample and population: Sampling methods, construction of histogram, interpretation of histogram, sample mean, sample standard deviation, the normal distribution, the mean,**

mode, median and standard deviation of the normal distribution, Uncertainties in estimation of a mean. Testing of hypothesis, T-test and Chi-square test. (5)

Paper (Practical) VI

FM : 50

1. Enrichment culture technique – enrichment of spore formers, N₂ fixer, Cellulose decomposer & Photosynthetic Bacteria.
2. Study of bacterial growth by optical density.
3. Study of bacterial growth by cell number counting (Breed Method Haemocytometer Method), & determination of generation time.
4. Study of different factors affecting growth (Temperature, pH, Osmotic pressure, Heavy metals (copper using copper sulphate), Different chemicals- combination of sugar (glucose + lactose i.e. di-auxic growth) and Vitamin B₁₂.
5. Biochemical Tests- Catalase, Protease, Indole Production, VP Test, Amylase Test, Acid-Gas production, MR, Citrate utilization,, nitrate reductase test.
6. Chromatography – TLC & Paper Chromatography of Sugar & Amino acids.
7. Isolation of *Rhizobium* from root nodule.
8. Control of microbial growth – moist heat, dry heat and UV irradiation.

Books for Part-II Syllabus

1. Microbiology[†]-Daniel V. Lim - Science – 2002
2. Schaum's Outline of Microbiology, Second Edition[†]- Page 303-I. Edward Alcamo, Jennifer M. Warner - Study Aids – 2009
3. Advances in Microbial Physiology, Volume 37[†]- Page 265-Robert K. Poole - Science – 1995
4. Microbial physiology[†]-Albert G. Moat, John Watkins Foster, Michael P. Spector - Science - 2002 –
5. Microbial physiology and metabolism[†]-Daniel R. Caldwell - Science - 1999 –
6. Food microbiology: an introduction[†]- Page 23-Thomas J. Montville, Karl R. Matthews - Science – 2005
7. Microbiology: An Introduction[†]-Gerard J. Tortora, Berdell R. Funke, Christine L. Case - Science - 2009 - 812 pages
8. Textbook of Microbiology[†]-R. Vasanthakumari - 2007 - 524 pages
9. Microbiology: principles and explorations[†]-Jacquelyn G. Black - Science - 2002 –
10. Alcamo's Fundamentals of Microbiology[†]- Page xxv-Jeffrey Pommerville - Science - 2010

- 11 Laboratory Exercises in Microbiology†- Page xii-John P. Harley, John P Harley - Science - 2004
- 12 Textbook of biochemistry: with clinical correlations‡Thomas M. Devlin - Medical - 2002
- 13 Biochemistry Explained: A Practical Guide to Learning Biochemistry†Thomas Millar - Science - 2002
- 14 The physiology and biochemistry of prokaryotes‡David White - Medical - 2007
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- 16 Experimental biochemistry‡Robert L. Switzer, Liam F. Garrity - Science - 1999 -
- 17 Biochemistry‡David Hames, N. M. Hooper - Science - 2005
- 18 Biochemistry: the molecular basis of life‡Trudy McKee, James R. McKee - Science - 2008
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- 20 Lehninger principles of biochemistry‡Albert L. Lehninger, David Lee Nelson, Michael M. Cox - Science - 2005
- 21 Marks' Basic Medical Biochemistry: A Clinical Approach‡Michael A. Lieberman, Allan D. Marks - Medical - 2009
- 22 Fundamentals of Biochemistry: Life at the Molecular Level‡Donald Voet, Judith G. Voet, Charlotte W. Pratt - Science - 2011 -
- 23 Molecular biology‡Phil Turner, Philip C. Turner - Science - 2005
- 24 Molecular biology‡Robert Franklin Weaver - Science - 2008
- 25 Molecular biology‡David P. Clark - Science - 2005 -
- 26 Essential cell biology: an introduction to the molecular biology of the cell†Bruce Alberts - Science -
- 27 Molecular cell biology‡Harvey F. Lodish, Arnold Berk - Science - 2008
- 28 Molecular biology and biotechnology: a comprehensive desk reference†Robert A. Meyers -
- 29 Principles and techniques of biochemistry and molecular biology‡Keith Wilson, John M. Walker - Science – 2005
30. Biotechnology: applying the genetic revolution‡David P. Clark, Nanette Jean Pazdernik - Science - 2009
30. Biotechnology, patents, and morality†- Page i-Sigrid Sterckx - Law - 2000

31. Biological mass spectrometry† - Page 150- A. L. Burlingame - Science - 2005
32. Cell biology and instrumentation: UV radiation, nitric oxide ..., Volume 2004†
33. Electrophoresis in practice: a guide to methods and applications of DNA and ...†
Reiner Westermeier, Sonja Gronau - Science – 2005
34. Molecular cell biology‡ Harvey F. Lodish - Science – 2004

Part III

Paper VII (Genetics of Microorganisms & Medical Microbiology) FM: 100

Group A: Microbial Genetics & Gene Manipulation: FM: 50

1. Bacterial Mutation: Spontaneous & induced Mutation of Bacteria, Fluctuation Test, Types of Mutants (auxotrophs, conditional mutants) & their selection, Molecular basis of Mutation, Mode of action of Mutagen. (6)
2. Outline of Mendelian genetics: Laws, Test cross, Back cross, deviations (incomplete dominance, hypostasis, epistasis, complementation) (5)
3. Genetic recombination in bacteria: Transformation, Conjugation- F^+ , F^- , Hfr & F' strain, Transduction, Generalised & specialized types. (7)
4. Concept of Central Dogma, DNA replication: Meselson-Stahl Experiment as Evidence for semi-conservative replication, Rolling Circle Model and Theta Model (bi-directional). Recombination in viruses, packaging & concatamer. (4)
5. Replication of plant and animal viruses; differences between DNA and RNA viruses, replication of viral DNA and RNA. Genomic organization and mode of reproduction of Retroviruses, SV40, Polio virus. (8)
6. Gene Regulation: Positive & negative control, Inducible system & repressible system. Lac – operon, Catabolite repression, Lysogenic control. (6)
7. Genetic Engineering: Principles, Vectors (Plasmid based- pUC & pBR 322, YAC, BAC, λ phage, cosmid), Enzymes, Gene transfer, Methods of Screening (blue-white), Application in Agriculture, Health & Industry. (7)
8. Molecular Bio-assay Technique: RFLP, Southern Blotting, Northern Blotting, western Blotting Technique, PCR Technique (general and reverse transcriptase). (7)

Group B: Microbial Pathogenicity & Immunity

FM: 50

1. Predominant Normal Microbial Flora of Human Body: Skin, Respiratory Tract, gastrointestinal Tract, Urinogenital Tract. (5)
2. Mechanism of Bacterial Pathogenicity: Invasiveness, Entry, colonization, Growth, Mechanism of damage of Host cell, Production of exo & endo Toxin – definition &

general characters. Neuro-toxin, Entero-toxins & Cyto-toxins

(10)

3. Common Microbial Diseases: Name of pathogen, symptoms, pathogenesis, mode of action & preventive measures of following diseases:

i) Bacterial- Typhoid, Staphylococcal Food Poisoning

ii) Viral- AIDS

iii) Fungal- Candidiasis

iv) Protozoal- Malaria.

(10)

4. Immunity:

(25)

a) Fundamental concepts of Immune System

b) Immune elements – Types, characteristics & function of T-cells, B-cells, macrophages, NK-cells.

c) Types of Immunization – Active & passive (Characteristics & Function).

d) Types of Immunity:

i) Humoral T cell dependent & T cell independent mechanisms .

ii) Cell mediated mechanisms.

e) Immunoglobulins : Types, Structure & Function.

f) Antigen : Types & characteristics

g) Haptens: Characteristics& Function.

h) Ag-Ab reaction – agglutination, precipitation, opsonisation, lysis, neutralization.

i) Complement fixation pathways.

j) Immunological techniques- ELISA

Paper (Ecology & Application of Microorganisms) – VIII FM-100

Group A: Environmental Microbiology:

FM: 50

1. Microbial Participation in natural cycles: Elements of the cycles (N, P), interrelationships of microorganisms in soil & natural ecosystems. (5)

2. Waste as Resources: Organic compost, green manure, biogas production . (5)

3. Potability of water: Microbial assessment of water quality, water purification, Coli form test. (4)

4. Biological waste water treatment: Waste water characteristics, BOD, COD, Secondary treatment (Activated Sludge, Oxidation Pond, Trickling filter). (8)

5. Microbial Leaching: Copper, Uranium. (4)

6. Bioremediation or Biodegradation: Microbial tolerance to heavy metals (Pb, Hg),

Mechanisms of resistance, remediation of soil by microbes. Microbial plastics & biodegradation of petroleum. Brief idea about bio-magnification. (10)

7. Biofertilizers:Types (Rhizobium, Phosphate solublizer, BGA & VAM), Production & application of Biofertilizers. Importance of Biofertilizers in Agriculture. (8)

8. Rhizosphere, Phyloplane:Types of Microorganisms & their interactions, Importance. (6)

Group B: Food & Industrial Microbiology:

FM: 50

1. Food production by Microorganism:Fermented dairy products (Cheese, Yogurt), Fermented Food (Saurkrauts, Ensilage, Single Cell Protein), Probiotics- general idea. (9)

2. Role of Microorganisms in spoilage of Food:Meats, egg , fruit and vegetables. (6)

3. General principle of food preservation:Low temperature, High temperature, Dehydration, Radiation, Pasteurization, Chemical base preservation. (6)

4. Milk Microbiology:Milk as a source of microorganisms, Types of microbes in milk, Pasteurization of milk, Testing of milk. (6)

5. Fermenter:Fermenter operation, sterilization, aeration,agitation, control of temperature and foaming. (6)

6. Industrial Microbiological products:Alcohol and alcoholic breverages (beer), organic acids (lactic acid), antibiotic (penicillin), amino acid (lysine), vaccine (Hep-B) & Vit B12 production. (9)

7. Application of Genetic engineering in Microbiology:Biodegradation of xenobiotics & toxic wastes, Production of Chemicals (organic acids, steroids) & fuels (Ethanol), Bioinsecticides (Bacillus thurigiensis & nuclear polyhedrosis viruses). (8)

Paper IX (Practical)

FM: 100

1. Antibiotic (Penicillin & streptomycin) assay by agar cup method using one Gram positive and one Gram negative bacteria..

2. Determination of MIC of antibiotic (penicillin/ streptomycin)

3. Examination of urine by culture & isolation of Human pathogen (bacteria) & determination of antibiotic sensitivity pattern of the isolated bacterial strain.

4. Isolation & characterization of Bacteria & fungi from rotten food- bread & carrot.

5. Determination of microbial population in water by filter disc method.

6. Microbiological examination of water (drinking water, supply water & pond water).

k) Presumptive test

ii) Confirmatory test

iii) Completed test for coliform

iv) Determination of MPN index

v) IMViC reaction

7. Methylene blue reduction test for milk.
8. Plaque assay for coliphage.

PAPER (PRACTICAL)- X

Full marks – 100

1. Isolation of mutants of bacteria by UV exposure.
2. Isolation of amino acid auxotrophic mutant by replica plating technique (Penicillin enrichment technique)
3. Isolation of Ampicillin resistant mutants by selection by gradient plate method..
4. Blood grouping
5. Isolation of plasmid, chromosomal DNA by standard method.
6. Agarose Gel Electrophoresis.
7. Cultivation of edible mushroom
8. Determination of Thermal Death Point(TDP) of a bacteria
9. Widal Test (Determination Ab titers using kit)
10. Production of alcohol by Yeast and estimation of alcohol.
11. Dot ELISA
12. Quantitative estimation of alpha-amylase, effect of PH and temperature of alpha-amylase activity.

Books for Part-III Syllabus

1. Environmental microbiology[†] Raina M. Maier, Ian L. Pepper, Charles P. Gerba - Science - 2009 - 598
2. Medical microbiology[†]Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller - Medical - 2005
3. Fundamental food microbiology[†]Bibek Ray - Technology & Engineering – 2004
4. Sherris medical microbiology[†]C. Ray George, Kenneth J. Ryan, C. George Ray, Nafees Ahmad - Medical - 2010
- 5.- Modern food microbiology[†]- Page 1-James Monroe Jay, Martin J. Loessner, David A. Golden - Technology & Engineering – 2005
6. Principles of Modern Microbiology[†]Mark Wheelis - Medical - 2007 –
7. Modern industrial microbiology and biotechnology[†]Nduka Okafor - Science – 2007
8. Industrial Microbiology: An Introduction[†]Neil L. Morgan, Gary Higton, John S. Rockey - Medical – 2001
9. Industrial Microbiology[†]S.C. Prescott, Cecil Gordon Dunn – 2009
10. Industrial microbiology: fundamentals and applications[†]A. K. Agrawal, Pradeep Parihar -

Industrial microbiology – 2006

11. Fungi in biogeochemical cycles[†]- Page 24-Geoffrey M. Gadd, British Mycological Society - Medical - 2006 - 469 pages
12. Manual of Industrial Microbiology and Biotechnology 3e[†]Richard H. Baltz, Julian E. Davies, A. L. Demain - Science – 2010
13. Fuel and fuel system microbiology-- fundamentals, diagnosis, and ...[†]- Page -15 Frederick J. Passman - Technology & Engineering – 2003.
14. Handbook of industrial mycology[†]- Page 560-Zhiqiang An - Science – 2005
15. Applied microbiology[†]Alain Durieux, Jean-Paul Simon - Science - 2001 –
16. Agricultural Microbiology[†]- Page 2-G. Rangaswami, D. J. Bagyaraj, D.G. Bagyaraj - Technology & Engineering - 2004 –
17. Environmental microbiology: methods and protocols[†]- Page 124-J. F. T. Spencer, Alicia L. Ragout de Spencer - Science – 2004
18. Food biotechnology[†]- Page 131-Kalidas Shetty - Science – 2006
19. Microbial processes and products[†]- Page 19-José-Luis Barredo - Science – 2005
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