

SYLLABUS

**SCHEME OF EXAMINATION AND
COURSES OF STUDY**

FACULTY OF SCIENCE

Sc. MICROBIOLOGY (SEMESTER I)

M.Sc. Previous Examination - 2018

M.Sc. Final Examination - 2019

into two parts, Part I as a previous year and Part II as a final part (year) has two Semesters. Semester first and third will have two theory papers of 50 marks (40 external + 10 internal marks) and one practical paper based on theory papers of 100 marks (75 external + 25 internal marks). Semester third and fourth will have three theory papers of 50 marks each (40 external + 10 internal marks) and a Project studies/training/dissertation of 50 marks (40 external + 10 internal marks). The dissertation will be evaluated at the end of second and third semester by an external examiner. Students are advised to complete project/case studies/training/dissertation preferably in some outside institute or industry or otherwise in the University. An educational tour may be organized for M.Sc. students within or outside the University under the supervision of faculty members of the department. The university will arrange train/bus travel assistance as per necessity and university rules. Traveling expenses of the teacher/s will be borne by the university as per rules of TA and DA.

Detailed syllabus for each paper is appended with a list of suggestions at the end of each paper.

		Max Internal Marks	Max Practical
-I (ous)	Semester-1		
	MB-101 General Microbiology and Bacteriology	10	
	MB-102 Microbial Physiology and Biochemistry	10	
	MB-103 Molecular Biology	10	
	MB-104 Microbial Genetics and Genetic Engineering Practical (Based on theory papers)	10 25	
	Tot€		
-I (ous)	Semester-2		
	MB-201 - Virology	10	
	MB-202 - Bioinstrumentation	10	
	MB-203 - Industrial and food Microbiology	10	
	MB-204 - Project/case studies/training/dissertation Practical (Based on theory papers)	10 25	
	Tot€		
-II (al)	Semester-3		
	MB-301 - Eukaryotic Microbiology	10	
	MB-302 - Soil and Agricultural Microbiology	10	
	MB-303 - Medical Microbiology	10	
	MB-304 - Immunology Practical (Based on theory papers)	10 25	
	Tot€		
	Semester-4		

Culture/Forestry/Wild life/Pharmacy/Life Sciences with 50% marks in the
Scheme of Examinations

English shall be the medium of instructions and examination. All
examinations shall be conducted at the end of each Semester as per
the Academic Calendar notified by the Maharaja Ganga Singh
University of Bikaner.

The system of evaluation shall be as follows:

Each theory paper will carry 50 marks (10 marks external + 40 marks
internal). The evaluation scheme shall comprise external evaluation
of 40 marks and internal evaluation of 10 marks. Practical papers
shall carry 100 marks (75 marks external + 25 marks internal). A
candidate who fails to participate in classes, viva-voce, practical and
laboratory work will be debarred from appearing in the end semester
examination.

The duration of written examination for each paper shall be of 3
hours and Practical examination shall be for two days (6+6 hours
duration in total).

The minimum attendance required by a candidate will be as per
University rules.

With regards to the Project/case studies/training/dissertation
Scheme of evaluation shall be as follows:

The candidate has to submit report/thesis in a spiral/bound form in
three copies at the end of semester II and IV, which would be
checked by an external examiner. Total marks for Project/case studies/
training/dissertation shall be 50 (40 external + 10 internal marks).
Regular as well as Ex-Students shall be permitted to appear for
reappear/improve in courses of odd semesters only at the end of
odd semesters and for even semester with the even and as per Maharaja
Ganga Singh University rules.

Pass percentage, award of degree, scope for improvement - as per
Maharaja Ganga Singh University rules and regulations.

MB-102	3 Hrs.	40
MB-103	3 Hrs.	40
MB-104	3Hrs.	40
Combined Practical	2 Days (6Hrs every day)	75

Instructions to Paper Setters

Question paper will consist of A, B and C parts. A part will consist of compulsory questions of 1 mark each. B part will consist of questions (two questions from each section of syllabi) and students are required to attempt three questions (5 marks each) by selecting one question from each section. C part will consist of three questions (one question from each section of syllabi) and students are required to attempt any two questions (8 marks each).

Paper MB-101: General Microbiology and Bacteriology

Section A

History and Scope of Microbiology, Culturable and unculturable bacteria. Microbial Taxonomy: Taxonomic ranks, Phenetic and Phylogenetic classification approaches, Numerical taxonomy and Polyphasic classification approaches, Major groups of bacteria according to Bergey's manual of systematic bacteriology. Ultra structure, chemistry and function of prokaryotic cells.

Section B

Microorganisms: autotrophs, heterotrophs, lithotrophs, chemotrophs and phototrophs. Microbial Growth: Growth factors, Growth curve, kinetics, synchronous growth of bacteria. Control of Micro-organisms: Sterilization; Dry heat, Autoclaving, Filtration, Radiation. Evaluation of effectiveness of physical and chemical antimicrobial agents. Media preparations, types of media. Differential, Selective and enrichment media. Aerobic and Anaerobic cultivation.

Section C

General Characters of Important Bacteria- Escherichia, Salmonella, Vibrio, Bacillus, Lactobacillus, Streptococcus, Staphylococcus, Clostridium, Treponema, Mycobacterium, Pseudomonas, Klebsiella, Bacillus, Rhizobium, Azotobacter, Acetobacter, Streptomyces

Microbiology A laboratory manual by Cappuccino, G. Sherman Natalie, Pearson Education; 2011.

Microbiology by Pelczar J. Michael, Chan E.C.S, Krieg R. ata McGraw-Hill Publishing Company Limited, 1998.

The Prokaryotes. A handbook on the biology of bacteria: ecology, isolation, identification, applications. Volumes I-IV by Ba..., Truper, H. G., Dworkin, M., Harder, W., Schleifer, K. H. Springer-Verlag, New York; 1992.

Bacterial Systematics, by Logan, A., Niall A. Logan, Wiley-Blackwell; 1994.

Bergey's Manual of Determinative Bacteriology (8th edition) by E. Murray and Buchanan; 1974.

Bergey's Manual of Determinative Bacteriology (9th edition) by E. Murray and Buchanan; 1982.

Bergey's Manual of Systematic Bacteriology (2nd edition) by E. Murray and Buchanan. (Volumes. 1 - 5); 2001- 2003.

Principles of Microbiology by R.M. Atlas, Mosby publishers, St. Louis; 1995.

Brock Biology of Microorganisms (12th edition) by Madigan and M. Martinko, Paul V. Dunlap, David P. Clark Benjamin Cummings; 2008.

Microbiology: An Introduction by Gerard J., Tortora, Berdell R. Fundamentals of Microbiology by Christine L Case Benjamin-Cummings Publishing Company; 2004.

Paper MB-102: Microbial Physiology and Biochemistry

Section A

Structure of atom, molecules and chemical bonds. Biochemistry of microorganisms: classification, nomenclature, specificity, isolation and purification. Enzyme kinetics and inhibition. Co-enzymes. Allosteric and regulation of enzyme activity, Mechanism of action of enzymes.

Section B

Metabolism: anabolic principles and synthesis of fatty acids, lipids, nucleic acids and proteins in microbes. Studies of biosynthesis of antibiotics. Synthesis of vitamins and their role as coenzymes. Basic principles of bioenergetics, entropy and enthalpy. Electron carriers, art

ay, Krebs cycle, oxidative and substrate level phosphorylation, reverse TCA cycle, Gluconeogenesis, Pasteur effect; Fermentation of carbohydrates: homo and heterolactic fermentations.

RECOMMENDED READINGS:

Biochemistry by Geoffrey L. Zubay. Fourth Edition, Addison-Wesley Educational publishers Inc., 2008.

Lehninger: Principles of Biochemistry by David L. Nelson and Michael M. Cox. Fifth Edition, W.H. Freeman and Company; 2008.

Biochemistry, (2nd edition) by Voet Donald & Voet Judith G., John Wiley & Sons New York; 1995.

Physiology and Biochemistry of Prokaryotes (2nd edition) by David White, Oxford University Press, NY; 2000.

Microbial lipids edited by C. Ratledge and SG Wilkinson, second edition, Academic Press; 1988.

Microbial Physiology by Albert G. Moat and John W. Foster (2nd edition), John Wiley and Sons; 2002

The Physiology and Biochemistry of Prokaryotes by David White (2nd edition), Oxford University Press; 2000.

Biochemistry by Berg Jeremy, Tymoczko John, Stryer Lubert 6th edition, W. H. Freeman, New York. (2001)

Paper MB-103: Molecular Biology

Section A

Genetic Material : Chemical composition and organization, 3-D structure of DNA, linking number, topological properties, super coiling of DNA, packaging of DNA in pro & eukaryotes. DNA denaturation and renaturation. Coding and non-coding DNA, repetitive DNA sequences, DNA replication and repair mechanism: comparison between prokaryotes and eukaryotes, inhibitors of DNA replication, DNA damage, DNA recombination. Transposons and mechanism of transposition.

Section B

Transcription in pro and eukaryotes, Reverse transcription, inhibition of transcription, post transcriptional processing. Translation in prokaryotes, Genetic code. Inhibitors of translation, post translational modifications.

Gene IX by Benjamin Lewin, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2007.

Molecular Biology by R.F. Weaver, 4th edition, McGraw Hill, New York, USA, 2007.

Molecular Biology of the Gene by J.D. Watson, T.A. Baker, S.P. Kim, A. Gann, M. Levin, R. Losick, 6th edition, Benjamin Cummings, San Francisco, USA, 2007.

Molecular Biology of the Cell by B. Alberts, A. Johnson, J. Lewis, D. Raff, K. Roberts, P. Walter, 5th edition, Garland Science, New York and London, 2007.

Biochemistry (5th edition) by J.M. Berg, J.L. Tymoczko, L. Stryer, W.H. Freeman and Company, New York, USA, 2008.

Current Protocols in Molecular Biology Edited by: Fred M. Ausubel; Roger Brent; Robert E. Kingston; David D. Moore; John A. S. Schlesselman; Kevin Struhl, John Wiley and Sons, Inc. 2007

Paper MB-104: Microbial Genetics and Genetic Engineering

Section A

Bacterial genome, Plasmids: Structure, classification, copy control, incompatibility, F-factor, col and R plasmids. Gene transfer in bacteria: transformation, transduction, conjugation (F+, F- and Hfr cells), Genetic mapping of E. coli. Mutation versus adaptation, Luria-Delbrück experiment and significance, Mutagenesis: Spontaneous and induced mutations, deletions, insertion and point mutations, physical agents of mutation, mutant selection.

Section B

Nucleic Acid Hybridization: Southern, Northern, Western Blotting, DNA fingerprinting, Foot printing, Gel retardation assay, Restriction endonucleases, Restriction mapping, Polymerase chain reaction, Gel electrophoresis (DNA, RNA and Protein).

DNA and RNA sequencing, (16S-23S rRNA), DNA Probes and the Southern blot, RFLP, RAPD, AFLP, Use of micro arrays to study gene expression.

Section C

Genetic Engineering: Plasmids pBR322, PUC18, phagemids, cos

Principles of Gene Manipulation: An introduction to Gene Engineering by R. W. Old, S. B. Primrose, University of California Press, 1980.

Molecular Genetics: An Introductory Narrative by Stent, Calendar, R. 2nd ed. San Francisco: W.H. Freeman, 1978.

Molecular Genetics of Bacteria by Larry Snyder and William Champness, 3rd edition; ASM press; 2007.

Fundamental Bacterial Genetics by Nancy Trun and Janine Treist edition; Blackwell Science Publishers; 2004.

Modern Microbial Genetics by U.N. Streips and R.E. Yasbin edition; Wiley Publishers; 2002.

Microbial Genetics by Stanly R. Maloy, John E. Cronan, Jr. & D. Reifelder, 2nd edition; Narosa Publishing House; 1987.

Molecular Biology by David P. Clarke, 1st edition; Elsevier Academic Press; 2005.

Molecular Cloning: A laboratory manual by Joseph Sambrook & Russell, 3rd edition; CSHL press; 2001.

DNA Technology: The Awesome Skill by I. Edward Alcamo edition; Hardcourt Academic Press; 2001.

Molecular Biology of the Gene by James Watson, Tania Baker, Steve Bell, Alexander Gann, Michael Levine & Richard Losick, 6th edition; CSHL Press; 2007.

ACTICALS

Isolation and identification of bacteria by phenotypic and biochemical methods.

Isolation and identification of members of Rhodospirillaceae: analysis of pigments.

Isolation of β -galactosidase gene in *E. coli*.

Isolation techniques.

Isolation curve analysis.

Isolation, preparation, sterilization, inoculation and incubation methods for biological studies of air, water and soil.

Isolation of antimicrobial chemical agents by log reduction method.

Isolation of following on the growth of microbes-

9
 amplification of DNA
 electrophoresis of DNA/RNA/Protein.
 isolation of DNA/RNA from plant, animal cell, bacteria.
 transformation and conjugation in Bacteria
 restriction digestion, ligation of DNA and cloning in bacteria
 Randomly Amplified Polymorphic DNA (RAPD) analysis in bacteria
 DNA gene amplification analysis for sequencing

Semester 2

Examination Papers	Duration	Max. Marks
MB-201	3 Hrs.	40
MB-202	3 Hrs.	40
MB-203	3 Hrs.	40
MB-204 Project/case studies/training		40
Combined Practical	2 Days (6Hrs every day)	75

Instructions to Paper Setters

The question paper will consist of A, B and C parts. A part will consist of compulsory questions of 1 mark each. B part will consist of questions (two questions from each section of syllabi) and students are required to attempt three questions (5 marks each) by selecting one question from each section. C part will consist of three questions (one question from each section of syllabi) and students are required to attempt any two questions (8 marks each).

Paper MB-201: Virology

Section A

Virology: Brief outline on discovery of viruses, Classification and nomenclature of viruses: distinctive properties and ultra structure of virus and RNA viruses, Replication of different group of viruses; Culture of viruses in embryonated eggs, experimental animals and cell

Section B

Isolation of viruses: physical and chemical methods (Protein, nucleic acid activity, electron microscopy), Infectivity assay (plaque method)

of RNA viruses Picorna, Ortho Myxo, Paramyxo, Toga vir
do, Rota, HIV and Oncogenic Viruses; DNA viruses; Pox, He
o SV40; Hepatitis viruses, viral vaccines.

GESTED READINGS:

Principles of Virology: Molecular Biology, Pathogenesis and C
f Animal Viruses by S.J. Flint, L.W. Enquist, V.R. Racaniello
.M. Skalka 2nd edition, ASM Press, Washington, DC, 2004
Introduction to Modern Virology EPZ by Nigel Dimmock, Ar
aston and Keith Leppard, 5th edition, Blackwell Publishing, 2
Human virology by Collier, L H (Leslie Harold), Kellam, Paul; O
S (John Sidney). 4th ed., Oxford : Oxford University Press, 2
Basic Virology by Edward K. Wanger, Martinez Hewiett, David E
and David Camerini, 3rd edition, Blackwell Publishing, 2007.
Principles of Molecular Virology by Alan J. Cann, 3rd edition, Els
cademic Press, 2001.

Plant Virology by Roger Hull, 4th edition, Academic press, 20

Paper MB-202: Bioinstrumentation

Section A

scopy: Principles and use of light microscope, bright-field,
phase-contrast, fluorescent, electron microscopy (SEM, T
cal microscopy and scanning probe microscopy. Specimen p
a for light microscopy and electron microscopy, staining of sp
ures, fixatives and dyes, principle and uses of simple staining
ential staining. Principle and working of instruments used for
n.

Section B

rophoresis: zonal techniques, supporting medium, vertical, su
gradient and two dimensional electrophoresis. Isoelectric focu
roscopy: Beer-Lambert relationship, components of a spectro
ter, type of detectors; UV-Vis spectrophotometry, atomic ab
pectroscopy. Applications of spectroscopy.

Section C

matography: Adsorption Chromatography, liquid Chromatography,
d Chromatography, Ion exchange Chromatogra

V.H. Freeman and Company, New York; 2007.

Foundations in Microbiology (6th edition) by Talaro K. P. & Talaro K. P. McGraw-Hill College, Dimensi; 2006.

McGraw-Hill College, Dimensi; 2006.

Analysis of Biological Molecules: An Introduction to Principles and Techniques, by Potter G. W. H. & Potter G. W. H. Elsevier Academic Publishers; 1995.

Instrumentation and Techniques, by Potter G. W. H. & Potter G. W. H. Elsevier Academic Publishers; 1995.

Elsevier Academic Publishers; 1995.

Prescott/Harley/Klein's Microbiology by Willey J., Sherwood L. & Woelverton C. McGraw Hill; 2007.

Woolverton C. McGraw Hill; 2007.

Paper MB-203: Industrial and Food Microbiology

Section A

Introduction to fermentation processes, history of fermentation processes, types of fermenters.

Bioreactors: Design and components- vessel materials, baffles, impellers, agitators, etc.

Inoculation and sampling devices, biosensors etc., biohazardous waste management.

Types of bioreactors: airlift, fluidized bed, micro carrier bioreactor, stirred bioreactor.

Immobilization of cells and its industrial application (Pharmaceutical, food and chemical industries).

Application (Pharmaceutical, food and chemical industries).

Section B

Isolation, selection, screening, preservation and maintenance of important microorganisms.

Isolation, selection, screening, preservation and maintenance of important microorganisms.

Formulation of fermentation media: energy source, water, nitrogen source, vitamins, minerals, chelators, growth factors, buffers, precursors, inhibitors, antibiotics, etc.

Optimization of media. Media and air sterilization. Temperature control.

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Optimization of media. Media and air sterilization. Temperature control.

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Optimization of media. Media and air sterilization. Temperature control.

Section C

Production process for Yeast (Bakers, food and fodder), Single cell protein (SCP), Single cell and Single cell oil (SCO), lactic acid, Beer, Wine, etc.

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taylor & Francis, London, Philadelphia, 1999.

Fermentation Biotechnology by O.P. Ward, Open University Press, Milton Keynes, U.K., 1989

Industrial Microbiology: An Introduction by Waites, M. O. R. & Highton, Blackwell Science, 2001.

Bioprocess Engineering and Biotechnology by B. Atkinson & M. Mavituna, The Nature Press, 1982

Microbial Biotechnology: Fundamentals of Applied Microbiology by G. Glazer & N. Nikaido, W.H. Freeman and Co., New York, 1995.

Modern Food Microbiology, 4th edition by J.M. Jay, Springer, 2000.

Fundamental Food Microbiology, 3rd edition by B. Ray., CRC press, 2006.

Food Microbiology: Fundamentals and Frontiers, 2nd edition by Michael P. Doyle, Larry R. Beuchat, Thomas J. Montville, ASM press, 2001.

Food Microbiology by M.R. Adams & M.O. Moss., Royal Society of Chemistry, 2000.

Food Microbiology by M.R. Adams, Royal Society of Chemistry, 2000.

PRACTICALS

1. Inoculation of virus into embryonic cells.

2. Determination of infectivity titre of a virus sample using Plaque assay.

3. Production of purified virus stock and its quantification.

4. Isolation of virus infected plant material.

5. Isolation of Probiotic bacteria from milk and curd.

6. Morphology of important Protozoa and Viruses.

7. Demonstration of dimorphism in yeast.

8. Sterilization of milk by MBRT.

9. Cell count by viable collection and biomass determination for small scale fermentation.

10. Determination of specific growth rate and generation time of a bacterium in submerged fermentations.

11. Determination of R: S ratio of bacteria by CFU counts.

12. Determination of Thermal death time and thermal death point.

13. Calibration of spectrophotometer.

Marking Scheme for External

Examination Papers	Duration	Max. Marks
MB-301	3 Hrs.	40
MB-302	3 Hrs.	40
MB-303	3 Hrs.	40
MB-304	3Hrs.	40
Combined Practical	2 Days (6Hrs every day)	75

Instructions to Paper Setters

The question paper will consist of A, B and C parts. A part will consist of compulsory questions of 1 mark each. B part will consist of questions (two questions from each section of syllabi) and students are required to attempt three questions (5 marks each) by selecting one question from each section. C part will consist of three questions (one question from each section of syllabi) and students are required to attempt any two questions (8 marks each).

Paper MB-301: Eukaryotic Microbiology

Section A

General Characteristics and Life Cycle of important Fungi- Dictyostelium, Saccharomyces, Candida, Penicillium, Fusarium, Rhizoglyphus, Trichosporium, Alternaria and Albugo. Fungal endophytes of trees and their applications: Endophytic fungi, colonization and diversity of endophytes. Agriculturally important toxigenic fungi: Biodiversity of toxic fungi in sustainable agriculture with special emphasis on aflatoxins. Applications of Trichoderma and Gliocladium as biocontrol agents.

Section B

Arbuscular mycorrhizal fungi: Diversity of endo- and ectomycorrhizal fungi. Biotechnological applications of yeasts: Yeasts as producers of secondary metabolites such as pigments, lipids, organic acids and enzymes as probiotics, yeasts in bioremediation, yeasts in alcoholic fermentations.

fundamentals of the fungi by Elizabeth Moore, Fourth edition
Benjamin Cummings; Landecker; 1996.

Mycotechnology: Present status and future prospects. Edited by
Mahendra Rai. I.K., International Publishing House Pvt. Ltd.; 2006.
The Yeast Handbook: Biodiversity and Ecophysiology of yeasts
Carlos A. Rosa and Gabor Peter. Springer-Verlag Berlin Heidelberg
2006.

Algae: Anatomy, Biochemistry and Biotechnology by Laura B. Baer
and Paolo Gualtieri. Taylor and Francis Group, LLC; 2006.

Paper 302: Soil and Agricultural Microbiology

Section A

Origin and evolution, soil profiles. Major physiochemical and
biological characteristics. Soil microflora: distribution and contribution
to the ecosystem.

Biogeochemical cycles: Carbon cycle, Nitrogen Cycle, Phosphorus cycle,
Sulphur cycle, Iron and Manganese cycle. Bioleaching and bioremediation
of agricultural and urban waste compost, vermicompost, mushroom
compost. Silage, methane production, biogas plants. Microbiology of
rhizosphere, phyllosphere and spermosphere,

Section B

Diseases: Physiology of parasitism, mechanism of disease
transmission, host-parasite relationship. Symptomatology and control
measures of various diseases.

Viral diseases: TMV, Yellow vein mosaic of Bhindi, and Papaya leaf
roll. Bacterial diseases: Citrus canker, Crown gall
Fungal diseases: Green ear of bajra, Wheat rusts and Loose and
downy mildews.

Plasmal diseases: Witches broom of potato, Stripe disease of
potato.

Section C

Fertilizers: Production technology, standards, storage and application
methods for Rhizobium, Azotobacter, Azospirillum, Cyanobacteria.
Biological nitrogen fixation - nitrogenase enzyme - nif genes
Symbiotic nitrogen fixation - (Rhizobium, Frankia) - non-symbiotic

Book R. J. & Baker K. F.; 1983.

AmerecaPhytopathological Society Press, St. Paul, MN.

Environmental Biotechnology by Forster C. F. & John D.A. EL

lorwood Ltd. Publication;2000.

A Manual of Environmental Microbiology by Christon J. H.

Publications;2001.

Soil Microbiology by Rao, N.S.S. Oxford & IBH Publishing Co.

Delhi;1999.

Paper 303: Medical Microbiology

Section A

discovery of pathogenic microorganisms. Pathogenicity and
; Quantitative measures of virulence: minimal lethal dose (M
, ID 50, TCID 50. Normal microbial flora of human body; role
ent flora. Nosocomial infection, common types of hospital i
and their diagnosis and control. Establishment, spreading, t
age and anti- phagocytic factors; mechanism of bacterial adhe
zation and invasion of mucous membranes of respiratory, e
rogenital tracts.

Section B

rtant diseases of human beings (short description of causal a
ogenesis, diagnosis and treatment)

erial diseases: Typhoid, Syphilis, Cholera, Gonorrhoeae, Tub

Diphtheria, Tetanus, Plague, Botulism, Meningitis, Pneum

ritis.

diseases: Influenza, Herpes, AIDS, Rabies, Human Pox, Y

Mumps and Measles.

al diseases: Ringworm, Toxoplasmosis.

rtant bacterial (Anthrax, Black quarter, Tuberculosis, Brucel

iral (Foot and mouth disease, Rinderpest, Cow pox, Rabies

s of domestic animals, their causal agents, epidemiology, p

sis, diagnosis, vaccine and treatment).

Section C

microbial therapy; Antibiotics and their classification, mode o

Antimicrobial resistance: Multidrug efflux pumps, Methicillin-

ds. 2nd edition. American Society for Microbiology Press. 2002.
Bacterial Pathogenesis: A molecular approach by Salyers AA, Whitt DD eds. American Society for Microbiology Press, Washington DC USA. 2002.

Pathogenomics: Genome analysis of pathogenic microbes by Hahn B and Dorbindt U. ed. Wiley-VCH. 2006.

Molecular Microbiology: Diagnostic Principles and Practice by Pridmore RH, Tenover FC, Versalovic J, Tang Y, Unger ER, Relman DA, White J eds. American Society for Microbiology Press, 2004.

Infectious Disease Epidemiology: Theory and Practice by Nelson KE, Williams CM, Graham NMH eds. An Aspen Publication. 2002.

Paper 304: Immunology

Section A

Historical background: Humoral and Cellular components of the immune system. Innate Immunity: Skin & mucosal surface, Physiological barriers, Phagocytic barriers, Inflammation, Adaptive immunity. Cells and Molecules of Immune System. Antigens: Structure, properties, types, epitopes. Immunogens, Adjuvants.

Section B

Antibodies: Structure, function and diversity, antibody mediated immunity, antibody classes and biological activities. Monoclonal antibodies. Antigen-Antibody Interaction. Major Histocompatibility Complex- structure, function, genes. Cytokines (Properties, receptors, antagonists, signaling). The complement system (functions, components, activation and deficiencies). Cell mediated effector responses: Cytotoxic T cells, natural killer cells, antibody-dependent cell-mediated cytotoxicity.

Section C

Hypersensitive reactions (Type I, II, III and delayed type (DTH). Immune response to infectious diseases: viral, bacterial and protozoan. Immuno-deficiencies.

Organ transplantation; Graft rejection, mechanism and prevention, HLA and disease.

Autoimmunity: Organ specific and systemic. Autoantibodies, experimental

Medical Microbiology and Immunology by Levinson W, Jawetz
2nd edition; 2001.

Fundamental Immunology by Paul WE: 4th edition. New York. R
Springer; 2000.

Roitt's Essential Immunology by Delves PJ, Martin SJ, Burton
Roitt IM; 11th, edition. Blackwell Publishing/Oxford Univ. Press; 2001.

PRACTICALS

Isolation and cultivation of Azotobacter, Rhizobium, Azospirillum
and other nitrogen-fixing bacteria, Actinomycetes, Mycorrhiza.

Estimation of fertilizer production using Rhizobium

Estimation of fertilizer production using Mycorrhiza

Analysis for various parameters like moisture content, water holding
capacity, Micro and macronutrients like carbon, nitrogen, carbonate

Determination of following enzyme activities in the soil sample:
Cellulase, xylanase, protease and phosphatase.

Laboratory methods for studying soilborne diseases

Isolation of soilborne pathogen

Chemical control of soilborne pathogens using acylanilide and
phosphonates.

Bacterial diseases of food plants

Isolation of pathogenic bacteria from rotten vegetables and fruits
Biochemical and physiological tests for detection of pathogenic

vegetables and fruits

Study normal micro-flora of Skin, Respiratory tract, Gastro-intestinal
and uro-genital tract.

Study cultural characteristics of pathogenic bacteria on various solid
and differential media.

Study pathogenicity of Staphylococcus aureus by coagulase test
Study antimicrobial susceptibility using an octadisc.

Determine the minimal inhibitory concentration (MIC) of an antibiotic
against bacteria and fungi

Determination of Blood group and Rh factor. Blood cell counts. Serological
tests: Radio immuno-diffusion, Immuno-electrophoresis, DOT E

and sandwich ELISA.

MB-404 Project/case studies/training		40
Combined Practical	2 Days (6Hrs every day)	75

Instructions to Paper Setters

Question paper will consist of A, B and C parts. A part will consist of compulsory questions of 1 mark each. B part will consist of questions (two questions from each section of syllabi) and students are required to attempt three questions (5 marks each) by selecting one question from each section. C part will consist of three questions (one question from each section of syllabi) and students are required to attempt any two questions (8 marks each).

Paper MB-401: Microbial Ecology and Environmental Biotechnology

Section A

Microbiology: Droplet nuclei, aerosol, assessment of air quality by direct impingement methods, Assessment of air quality for microorganisms of viruses, bacteria and fungi.

Environmental microbiology: Water ecosystems - types, fresh water (ponds, streams) - marine habitats (estuaries, mangroves, deep sea hydrothermal vents, salt pans, coral-reefs). Potability of water- microbial assessment of water quality- water purification. Brief account of water borne diseases. Eutrophication.

Water treatment: Wastes - types- solid and liquid wastes classification- solid - liquid; treatments- physical, chemical, biological- aerobic - primary - secondary- tertiary (trickling- activated sludge, oxidation pond- oxidation ditch).

Section B

Microbial ecology: Concepts, microbial behavior in ecosystems, microbial diversity, development of microbial communities. Inter species interactions: Antagonism, competition, commensalisms, synergism, mutualism and predation. Gause and Hardin's principles of competition. Bioremediation in microbiology, digestion, fermentation and detoxification by microorganisms influencing rumen microbes.

Bioremediation: Transformation of metals: sulfur oxidation, iron oxidation

Microbial Ecology By Atlas R.M., Bartha R., Benjamin Cummings Publishing Co, Redwood City, CA., 1993.

Environmental Microbiology by A.H. Varnam & M.G. Evans, Macmillan Publishing Ltd., 2000.

Manual of Environmental Microbiology by Christon J. Hurst, Robert Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, Academic Press, 2007.

Environmental Microbiology by W.D. Grant & P.E. Long, Kluwer Academic Publishers, 1981.

Paper MB-402: Biostatistics

Section A

Definition of statistics, symbols, notations and terminology of statistical inference. Classification of data: primary and secondary data; parameter and sample statistics. Sampling and estimation of population parameters, Random sampling, Sample size in random sampling, stratified two stage cluster sampling, sequential sampling; Bias in sampling. Presentation of results, Graphic presentation. Construction of histograms and theoretical distributions.

Section B

Measures of central tendency & partition values: Mean, mode, median; quartiles, deciles and percentiles. Measure of dispersion: mean deviation, standard deviation and variance. Probability: the probability concepts, measures of probability. Probability distributions: Normal distribution, Binomial distribution, Poisson distribution. Student Regression and Correlation: Scatter diagram, simple linear regression, correlation coefficient.

Section C

Statistical tests: t-test and ANOVA. Test of significance of mean: standard error, standard deviation, t-test. The chi-square test. Statistical basis of biological assays: Dose-Response relationship. Introduction to research methods: research question, literature review, theoretical framework or model, formulation of objectives and research hypothesis, population under study, statistical design, sample size, methods of data collection, data processing.

fundamentals of statistics. Goon, Gupta and Dasgupta- World F
Kolkata.

Design and analysis of experiments by Montgomery D. C., Jo
Wiley and Sons.

Biostatistics, a foundation for analysis in the health Sciences
(edition), Wayne Daniel; 2007.

Paper MB-403: Bioinformatics and Computer Application

Section A

formatics: Introduction, objectives. Bioinformatics and data a
Database concept, elementary knowledge of structure query
e. Microbiological and Virology databases, cell gene banks re
biodiversity information databases.

Section B

politic pathway engineering. DNA sequencing. Finding and retri
ences. Sequence data base. Phylogenetic tree, Dendrogram
ce formats. Protein and nucleic acid sequence database, Ide
protein sequence from DNA sequence.

Section C

puter applications: Computers and their organization, Hard
are, operating system (Command line and WIMP) Application
for microbiologists, Data processing and presentation (Spread
Statistical analysis) LIMS, computer graphics, Computer : C
biology, Use of computer as audio visual aid.

SUGGESTED READINGS:

bioinformatics: A Practical Guide to the Analysis of Genes
Proteins by Baxevanis A.D. and Ouellette, Third Edition. John
and Son Inc., 2005.

Bioinformatics Sequence and Genome Analysis by Mount
CSHL Press, 2004.

Introduction to Bioinformatics by Tramontano A., Chapman &
CRC, 2007.

Understanding Bioinformatics by Zvelebil, M. and Baum, Chap
Hall/CRC, 2008.

Bioinformatics: Methods Express By: Paul H Dear, S

of Bacterial interactions (antagonism etc)