

**ETHIRAJ COLLEGE FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF MICROBIOLOGY
B.Sc. MICROBIOLOGY
SYLLABUS TO BE EFFECTIVE FROM 2018-2019**

**ETHIRAJ COLLEGE FOR WOMEN
DEPARTMENT OF MICROBIOLOGY**

Revised Syllabus of JUNE 2018

Department of Microbiology is revising syllabi with effect from the academic year 2018 - 2019 with Part IV and Part V components. Part IV and Part V components will seek to build the capacity of the students and provide inputs for his/her social service and social analyzing capabilities.

The course duration is three years. Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

PREAMBLE

The Department of Microbiology submits changes and additions suggested in the UG curriculum that are

- Improvisation of course content in Core and Elective paper
- Repetition of course content was avoided and shifting of papers were done

REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Microbiology course shall require to have passed Biology / Botany and Zoology / Microbiology along with Physics and Chemistry in the Higher Secondary Examinations conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the syndicate of the University of Madras.

2. ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study for a period of not less than three academic years, passed the examination of all Six Semesters prescribed.

3. COURSE OF STUDY:

The main subjects of study for Bachelor Degree shall consist of the following:

PART – I : Foundation Courses exclusive for Languages.

PART – II : Foundation English

PART – III : Core subjects and Allied Subjects

PART – IV : Non Major Electives and Soft Skills.

PART – V : Extension Activities / Sports / NCC.

4. PASSING MINIMUM:

A candidate shall be declared to have passed in each Paper/Practical of all subject of the study wherever prescribed, if she secured NOT LESS THAN 40% of the marks prescribed for the end semester examinations and the total marks of continuous assessment and the end semester examinations.

5. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Successful candidates passing the examinations and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

Candidates who pass all the examination (Part I, II, III & IV) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

DEPARTMENT OF MICROBIOLOGY
ETHIRAJ COLLEGE FOR WOMEN (Autonomous)

B.Sc., Microbiology
Course Profile (2018-2019)

	Course Code	Course Title	Hours/ Wk	Credits	CA Marks	End Sem Marks	Total
SEMESTER- I							
Part I		Language I	6	3	40	60	100
Part II		English-I	4	3	40	60	100
Part III	MB18/1C/FM1	Fundamentals of Microbiology-I	7	5	40	60	100
Part III		Allied Biochemistry –I	4	4	40	60	100
Part III	MB18/2C/PR1	Basic Techniques in Microbiology	3	-	-	-	-
Part III		Allied Biochemistry Practical	2	-	-	-	-
Part IV	MB18/1N/PCH 1a/b/c	Pet Care and Hygiene	2	2	-	-	50
Part IV		Soft Skill	2	3	-	-	50
SEMESTER- II							
Part I		Language II	6	3	40	60	100
Part II		English-II	4	3	40	60	100
Part III	MB18/2C/FM2	Fundamentals of Microbiology-II	7	5	40	60	100
Part III		Allied Biochemistry –II	4	4	40	60	100
Part III	MB18/2C/PR1	Basic Techniques in Microbiology	3	4	40	60	100
Part III		Allied Biochemistry Practical	2	2	40	60	100
Part IV	MB18/2N/GAL 1a/b/c	Gardening and Landscaping	2	2	-	-	50
Part IV		Soft Skill	2	3	-	-	50
Credits for I and II Semester = 46							

SEMESTER- III							
Part I		Language III	6	3	40	60	100
Part II		English-III	4	3	40	60	100
Part III	MB18/3C/BAI	Basic and Applied Immunology	7	5	40	60	100
Part III	MB18/3A/BIT	Allied-Bioinstrumentation	4	4	40	60	100
Part III	MB18/4C/PR2	Basic and Applied Immunology	3	-	-	-	-
Part III	MB18/4A/PR1	Bioinstrumentation, Computers and Biostatistics	2	-	-	-	-
Part IV		Soft Skill	2	3	-	-	50
Part IV		Environmental Studies	2	2	-	-	50
SEMESTER- IV							
Part I		Language IV	6	3	40	60	100
Part II		English-IV	4	3	40	60	100
Part III	MB18/4C/CMG	Basic concepts of Microbial Genetics	7	5	40	60	100
Part III	MB18/4A/BCA	Allied - Biostatistics and Computer Application	4	4	40	60	100
Part III	MB18/4C/PR2	Basic and Applied Immunology	3	4	40	60	100
Part III	MB18/4A/PR1	Bioinstrumentation, Computers and Biostatistics	2	2	40	60	100
Part IV		Soft Skill	2	3	-	-	50
Part IV		Value Education	2	2	-	-	50
Credits for III and IV Semester = 46							

SEMESTER- V							
Part III	MB18/5C/BAC	Bacteriology	5	4	40	60	100
Part III	MB18/5C/SAM	Soil and Agricultural Microbiology	5	4	40	60	100
Part III	MB18/5C/MPL	Medical Parasitology	5	4	40	60	100
Part III	MB18/5E/FMB	Food Microbiology	4	5	40	60	100
Part III	MB18/5E/BIO	Biotechnology	5	5	40	60	100
Part III	MB18/6C/PR3	Medical Microbiology	3	-	-	-	-
Part III	MB18/6C/PR4	Applied Microbiology	3	-	-	-	-
SEMESTER- VI							
Part III	MB18/6C/MML	Medical Mycology	6	4	40	60	100
Part III	MB18/6C/ENM	Environmental Microbiology	6	4	40	60	100
Part III	MB18/6C/VIR	Virology	6	4	40	60	100
Part III	MB18/6E/INM	Industrial Microbiology	6	5	40	60	100
Part III	MB18/6C/PR3	Medical Microbiology	3	4	40	60	100
Part III	MB18/6C/PR4	Applied Microbiology	3	4	40	60	100
Credits for V and VI Semester = 47							
Part V- Extension Activity – 1 credit							
II B.Sc. BIOCHEMISTRY							
SEMESTER III							
Part III	MB18/3A/AM1	Allied Microbiology-I	4	4	40	60	100
Part III	MB18/4A/PR2	Allied Microbiology Practical	2	-	-	-	-
SEMESTER IV							
Part III	MB18/4A/AM2	Allied Microbiology-II	4	4	40	60	100
Part III	MB18/4A/PR2	Allied Microbiology Practical	2	2	40	60	100

PART IV- NON MAJOR ELECTIVE OFFERED BY THE DEPARTMENT

Semester	Course Code	Course Title	Hours/ Wk	Credits	End Sem Marks
Semester I	MB18/1N/PCH	Pet Care and Hygiene	2	3	50
Semester-II	MB18/2N/GAL	Gardening and Landscaping	2	3	50

Part V NCC/NSS/SPORTS/CSS/SPORTS/CSS/YRC/RRC/ROT/CERTIFICATE COURSE

**TEMPLATE FOR EVALUATION PATTERN
CONTINUOUS ASSESSMENT –THEORY (CORE AND ELECTIVE)**

Semester	Course Code	Course Title	Continuous Assessment				
			Test I	Test II	Quiz/ Assignment/ Seminar/ Field Visit	Participatory Learning	Total
			10	10	10	10	40
I	MB18/1C/FM1	Fundamentals of Microbiology-I	10	10	10	10	40
II	MB18/2C/FM2	Fundamentals of Microbiology-II	10	10	10	10	40
III	MB18/3C/BAI	Basic and Applied Immunology	10	10	10	10	40
	MB18/3A/BIT	Allied-Bioinstrumentation	10	10	10	10	40
IV	MB18/4C/CMG	Basic concepts of Microbial Genetics	10	10	10	10	40
	MB18/4A/BCA	Allied - Biostatistics and Computer Application	10	10	10	10	40
V	MB18/5C/BAC	Bacteriology	10	10	10	10	40
	MB18/5C/SAM	Soil and Agricultural Microbiology	10	10	10	10	40
	MB18/5C/MPL	Medical Parasitology	10	10	10	10	40
	MB18/5E/FMB	Food Microbiology	10	10	10	10	40
	MB18/5E/BIO	Biotechnology	10	10	10	10	40

VI	MB18/6C/MML	Medical Mycology	10	10	10	10	40
	MB18/6C/ENM	Environmental Microbiology	10	10	10	10	40
	MB18/6C/VIR	Virology	10	10	10	10	40
	MB18/6E/INM	Industrial Microbiology	10	10	10	10	40
II B.Sc. BIOCHEMISTRY							
III	MB18/3A/AM1	Allied Microbiology-I	10	10	10	10	40
IV	MB18/4A/AM2	Allied Microbiology-II	10	10	10	10	40

RUBRICS FOR CONTINUOUS ASSESSMENT EVALUATION

Assignment - Appearance/Content/Originality/Presentation/Schematic Representation and Diagram/Bibliography

Seminar - Organization/Subject Knowledge/Visual Aids/Confidence Level/Presentation

Participatory Learning - Answering Questions/Clearing Doubts/ Participation in Discussion/ Attendance/Communication and Language

CONTINUOUS ASSESSMENT - PRACTICALS

TYPE OF VALUATION	VALUATION PATTERN	MARKS
CONTINUOUS ASSESSMENT	I Model Test (50 marks converted to 10 marks)	10
	II Model Test (50 marks converted to 10 marks)	10
	Maintenance of Observation	10
	Participation Learning	10
END SEMESTER EXAMINATION	End Semester Examination	60
	Total	100

SEMESTER- I FUNDAMENTALS OF MICROBIOLOGY- I

Teaching Hours : 105 Hours
Paper Code : MB18/1C/FM1

Credits : 5
L T P: 4 3 0

OBJECTIVES:

This paper provides

- Knowledge in scope of Microbiology.
- Understanding the diversity of microbial world.
- Basic concepts of Microbiological techniques

COURSE CONTENT :

UNIT I

20 Hours

History of Microbiology- Contributions of Scientists - Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Alexander Flemming, Joseph Lister. Spontaneous generation Vs Biogenesis hypothesis - Germ theory of diseases- Koch postulates. Classification of Microorganisms - Three Kingdom, Whittaker's Five Kingdom and Eight kingdom. General characteristics of acellular microorganisms - (Viruses, Viroids, Prions) and cellular microorganisms (Bacteria, algae, fungi and protozoa), Differences between prokaryotic and eukaryotic microorganisms.

UNIT II

20 Hours

Prokaryotic cell structure – cell size, shape, arrangements, capsule, slime, S layer, fimbriae, flagella, pili, Cell wall, Cell membrane, periplasmic space, ribosomes, mesosomes, nucleoid, inclusions bodies, gas vacuoles, Bacterial endospore and process of sporulation. Eukaryotic cell structure- Cytoskeleton, Cytoplasmic membrane, Golgi apparatus, Endoplasmic Reticulum, Mitochondria, Ribosomes, Nucleus and Chloroplast.

UNIT III

25 Hours

Microscopy - General Principles of optics in relation to Microscopy. Different components of Light wave - UV, IR, Visible. Principles and Applications of Microscope - Magnification, Resolving power, Numerical Aperture. Principles and Applications - Bright Field, Dark Field, Phase Contrast, and Fluorescence Microscopy. Electron Microscope - Principles, Specimen preparation and Applications of Scanning and Transmission Electron Microscopy.

UNIT IV

20 Hours

Stains and Staining Techniques - Definition of auxochrome, Chromophores - Acidic and Basic Dyes, Natural dyes, Mordant and its functions. Classification of stains - Simple and Differential Staining. Principles and Procedures of Gram Staining, Acid Fast Staining, Endospore Staining, Metachromatic granule staining, Nuclear staining, Flagellar staining. Negative Staining - Capsule Staining.

UNIT V

20 Hours

Methods of Sterilization- Physical Methods - Mode of Action and Applications of Heat- Dry and Moist, Pasteurization and Tyndallisation, Radiation – UV rays, X rays, γ rays, Filtration - HEPA

filters and Membrane filters. Chemical Methods - Mode of action and applications and quality control- Alcohol, Acid, Alkali, Halogen, Heavy Metals, Phenol and Phenol derivatives, Formaldehydes, Ethylene Oxide, Detergents.

Learning Outcome:

- Students acquire knowledge on microbial structure, Microscopy, Staining techniques and scope of Microbiology.

RECOMMENDED TEXT BOOKS:

1. Pelczar M.J., Chan E.C.S. and Kreig N.R. (2007) Microbiology 7th edn, McGraw-Hill New York
2. Prescott L.M, Harley J.P and Klein D.A, (2013) Microbiology 9th edn, McGraw-Hill Publications
3. A.J.Salle, (1984) Fundamental Principles of Bacteriology, 7th edn, Tata McGraw-Hill Publications Ltd.

REFERENCES:

1. Stainer R.Y, Ingharam, Wheelis M.L. Painter (2010) General Microbiology, 5th edn Edition, MacMillan Press Ltd.
2. Tortora, G.J., Funke, B.R., Case, C.L (2013) Microbiology-An Introduction-11th edn.
3. Madigan M.T., Martinko J.M, Parker J. (2005). Brock - Biology of Microorganisms, 11th edn, Pearson Prentice Hall International, Inc.
4. Nester E.W, Anderson D.G (2004) Microbiology-A Human Perspective, 4th edn McGraw Hill Publications.
5. Atlas R (1997) Principles of Microbiology, 2nd edn, Wm.C.Brown publishers.

WEBSITES:

http://www.microbes.info/resources/general_microbiology/
<http://www.simhq.org/microbiology>
<http://www.brookscole.com/microbio>
<http://www.austincc.edu/rohde/noteref.htm>
<http://www.vvc.edu/academic/biology/MacKayP2/pamshome.htm> (bau)

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

- Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks
- Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks
- Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER – I

NON MAJOR ELECTIVE SUBJECT

PET CARE AND HYGIENE
(For other discipline students)

Teaching Hours: 30
COURSE CODE: MB18/1N/PCH

Credits: 2
LT P: 2 0 0

OBJECTIVE:

This course will focus on health and care for animals

COURSE CONTENT

UNIT I:

10 hrs

Grooming and nutrition of pet-Introduction to pet animals-Dog and Cat-Bathing-Grooming aids-General care- Ear, Toe nails, Teeth -Nutrition-Home diet, Nutrient requirement-Feeding. Common pet problems, such as: allergies, bad breath, ear mites, fleas, itchy skin, paw problems, teething pain, weepy eyes and wounds

UNIT II:

10 hrs

Training of Pets -Training of Dogs-punishment-Picking up by scruff of neck, pushing nose down-Obedience training-Place of their own-Chewing

UNIT III:

10hrs

Immunization of Pet animals-Preventive vaccination procedure - Rabies, Leptospirosis, Internal and External Parasites - First aid-Emergency medicines - How to find a good veterinarian. Ethics in pet management.

Learning Outcome:

- Students learn about grooming, training and the various ailments encountered by a pet animal. They also learn about the different vaccines and treatments available for pets.

RECOMMENDED TEXTBOOKS:

1. Tom Reed D.V. M. (1974) The Well Dog Books.A Random inc.

REFERENCES

1. Martin Dvm Goldstein,(1999), The Nature of Animal Healing: The Path to Your Pet's Health, Happiness, and Longevity, Hardcover, Publisher: Knopf
2. Kymthy Schultze, (1999), Natural Nutrition for Dogs and Cats: The Ultimate Pet Diet, Paperback, Publisher: Hay House
3. Sue Dallas, Emily Jewell, (2014). Animal biology and care, 3rd edn, Wiley Blackwell.

QUESTION PAPER PATTERN

Max.Marks: 50

Time: 2Hrs

SECTION A

Answer 10 questions (12 questions will be given)

10x5marks =50

SEMESTER - II
FUNDAMENTALS OF MICROBIOLOGY- II

Teaching Hours: 105 Hours
Paper Code : MB18/2C/FM2

Credits: 5
L T P: 4 3 0

OBJECTIVES:

This paper provides

- Cultivation of Bacteria and Pure Culture Techniques.
- Understanding of Microbial Growth and Physiology.
- Basics of cell division

COURSE CONTENT :

UNIT I

20 Hours

Nutrition and Growth of Bacteria - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen, Iron oxidizing Bacteria), Chemoorganotrophs with examples. Nutrition transport mechanisms. Culture media -Types. Microbial Growth, Generation time and Growth rate. Growth Curve and Phases of Growth in Bacteria. Batch, Continuous and Synchronous cultures. Diauxic growth. Anaerobic culture techniques.

UNIT II

20 Hours

Measurement of Microbial growth - Quantitative Measurement of Bacterial growth by Cell mass, Cell number and Turbidity methods, Chlorophyll Estimation. Maintenance and Preservation of cultures – Sub-cultures, Mineral oil method, Lyophilisation. Reproduction - Binary fission, Mitosis and Meiosis- I and II

UNIT III

25 Hours

An overview of Metabolism - Break-down of Glucose - Embden Meyerhof Pathway, Entner-Doudoroff Pathway, Pentose Phosphate Pathway,. An overview of Mitochondria structure. Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. Chemiosmosis. ATP synthesis. Fermentation-Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation, Butanediol Fermentation. Stickland Reaction.

UNIT IV

20 Hours

Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction- Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.

UNIT V

20 Hours

Chemotherapeutic Agents – Definition of Antibiotics and Sulphonamides. Mechanism of action and Antimicrobial spectrum and Drug Resistance mechanism of Penicillin, Streptomycin, Tetracycline, Chloramphenicol, Nalidixic acid and Metronidazole.

Learning Outcome:

- Students get an insight on microbial metabolism, Microbial growth and cultivation .They also acquire knowledge about chemotherapeutic agents and drug resistance mechanisms of microorganisms.

RECOMMENDED TEXT BOOKS:

1. Pelczar M.J., Chan E.C.S. and Kreig N.R.(2007) Microbiology 7th edn, McGraw-Hill New York
2. Prescott L.M, Harley J.P and Klein D.A,(2013) Microbiology.9thedn, McGraw-Hill Publications
3. Madigan M.T., Martinko J.M, Parker J. (2005). Brock - Biology of Microorganisms, 11th edn, Pearson Prentice Hall International, Inc.

REFERENCES:

1. Stainer R.Y, Ingharam, Wheelis M.L and Painter. (2010). General Microbiology, 5th edn, MacMillan Press Ltd.
2. Tortora, G.J.,Funke, B.R.,Case, C.L (2013) Microbiology-An Introduction, 11th edn. Benjamin Cummings.
3. Lim D. (1998) Microbiology, 2nd edn, WCB McGraw Hill Publications.
4. Nester E.W, Anderson D.G, (2014) Microbiology-A Human Perspective, 4th edn, McGraw Hill Publications.
5. Wheelis M, (2010) Principles of Modern Microbiology, 1st edn. Jones and Bartlett Publication.

WEBSITES:

<http://www.cyanosite.bio.purdue.edu/index.html>
<http://www.beijerinck.bt.tudelft.nl>
http://www.eurekascience.com/Ican Do that/bacteria_cells.htm
<http://www.ucmp.Berkeley.edu/Bacteria/bacterialh.html>
<http://www.austincc.edu/rohde/noteref.htm>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
 10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
 5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
 2 x 20 marks = 40 marks

MAJOR PRACTICAL

BASIC TECHNIQUES IN MICROBIOLOGY

Teaching Hours: 90 Hours
Paper Code MB18/2C/PR1

Credits: 4
L T P: 0 0 3

OBJECTIVE:

This paper focuses on

- Basic concepts of Microbiological techniques.
 - Study on bacterial growth characteristics.
1. Cleaning of Glassware and Laboratory rules.
 2. Microscopy - Compound microscope - Principle, Operation, Uses and Maintenance.
 3. Principle and Methods of sterilization - Moist heat - Autoclave, Dry heat - Hot air oven and Filtration method - Membrane filtration technique.
 4. Quality control of sterilization- chemical and biological methods.
 5. Smear Preparation and Simple staining
 6. Differential staining-Gram staining
 7. Endospore Staining
 8. Negative Staining- Capsule Staining
 9. Direct examination of Algae - *Oscillatoria*, *Volvox*, *Nostoc*
 10. Staining of fungi-LPCB - Yeast- *Candida*; Mold- *Aspergillus*, *Mucor*, *Rhizopus* & *Penicillium*
 11. Micrometry - Determination of size of Yeast.
 12. Demonstration of motility by Hanging drop method.
 13. Measurement of pH of medium - pH strips and pH meter.
 14. Preparation of saline- Bacteriological and normal.
 15. Preparation of Liquid media - Peptone Water and Nutrient Broth
 16. Solid media - Basal- Nutrient agar & NA Slant, Enriched-Blood Agar, Selective - EMB agar
 17. Pure culture method- Streak plate technique and study of colony morphology
 18. Enumeration of bacteria- serial dilution-Pour plate and Spread plate method.
 19. Antibiotic sensitivity testing - Disc Diffusion- Kirby Bauer method.
 20. Biochemical analysis- Catalase, Oxidase, IMViC, Urease & Carbohydrate Fermentation

Learning Outcome:

- Students learn the fundamental principles of various microbial techniques.
- They also learn the key salient feature of bacteria, fungi and algae.

QUESTION PAPER PATTERN:

Time: 6 Hours (3 Hrs, Two days)

Max Marks: 60

Major practical : 25 marks
Minor practical : 15 marks
Spotters (5 x 2) : 10 marks
Record : 10 marks

SEMESTER – II
NON MAJOR ELECTIVE SUBJECT
GARDENING AND LANDSCAPING
(For other discipline students)

Teaching Hours: 30
COURSE CODE: MB18/2N/GAL

Credits: 2
LT P 2 0 0

OBJECTIVES:

This paper provides basic knowledge of theoretical and technical aspects of gardening and landscaping

COURSE OUTLINE:

UNIT I :

10 hrs

Introduction to Horticulture - Gardening - Layout and components of a garden. Techniques in gardening – cutting, grafting, and layering. Important plant species.

UNIT II:

10 hrs

Landscaping I - Lawn making and designs.

UNIT III:

10 hrs

Landscaping II – Principles of Landscaping. Indoor landscaping, industrial landscaping and landscaping in residential areas and urban avenues.

Learning Outcome:

- Students learn the basic principles, designing and various techniques involved in gardening.
- They also learn about various types of urban and rural landscaping.

RECOMMENDED TEXT BOOKS:

1. Taylor, P. (2006) Garden. Oxford University Press

REFERENCES:

1. William Flemer. (1972). Nature's guide to successful gardening and landscaping. Crowell publications.
2. Reilly, A. (1990) Home Landscaper. Home Planners.
3. Black and Decker. (1993). Landscape design and construction. Creative Pub Intl.

QUESTION PAPER PATTERN

Max.Marks: 50

Time: 2Hrs

SECTION A

Answer 10 questions (12 questions will be given)

10x5marks =50

SEMESTER – III
BASIC AND APPLIED IMMUNOLOGY

Teaching Hours: 105 Hours
Course code: MB18/3C/BAI

Credits: 5
L T P 4 3 0

OBJECTIVES:

- Basic concepts in Immunology
- Human Defense Mechanisms against Infections.
- Applications of Immunological Techniques
- Knowledge in Immune Response and Vaccines

COURSE CONTENT:

UNIT I:

20hrs

Introduction - History, Scope of Immunology and Recent developments. Cells of Immune System. Hematopoiesis - Lymphoid and Myeloid Lineage, Mononuclear - Phagocytic System. Mechanism of Inflammation. Lymphoid Organs. Primary – Thymus, Bone Marrow, and Bursa of Fabricius, Secondary - Lymph Node and Spleen Tertiary - CALT, GALT and MALT..

UNIT II:

22hrs

Host parasite relationship and immunity- Introduction and classification of immunity. Innate and acquired. Factors involved in immunity. Complement, immunoprophylaxis- importance and applications. Active and passive immunization- advantages and disadvantages of immunization. Latest immunization schedule, Vaccine- types of vaccine- Live attenuated, killed, subunit.

UNIT III:

20hrs

Antigens and Antibodies. Antigens - Factors influencing Antigenicity and immunogenicity. Epitopes, Haptens, Super Antigen, Mitogen, Adjuvants. Antibodies – Structure. Classification. Types and Functions. Hybridoma technology. Antigen and Antibody Interactions. Agglutination reactions – Hemagglutination, Bacterial agglutination, Latex agglutination - CRP, ASO, RF. Precipitation reactions - Double Immunodiffusion, SRID, Immuno-electrophoresis. RIA, ELISA.

UNIT IV:

20hrs

Major histocompatibility complex (MHC)- Introduction, MHC genes, MHC types and pathways, Applications of MHC, Graft rejection, Transplantation Immunology

UNIT V:

23 hrs

Hypersensitivity – Introduction to Hypersensitivity Reactions. Type I – Mechanism, Primary Mediators, Secondary Mediators, Symptoms and test for Type I Hypersensitivity. Type II - Mechanism and Symptoms. Type III- Mechanism and Diseases - Serum sickness, Arthus reaction, Glomerular Nephritis, Rheumatoid Arthritis. Type IV- Mechanisms & types - Tuberculin, Contact Dermatitis and Granuloma. Skin test – Immediate and Delayed. Autoimmune disorders.

Learning Outcome:

- Students learn the basic concepts of immunity and immunological techniques.
- They gain a wider knowledge about the current scenario of immunity and infection

RECOMMENDED TEXT BOOKS:

1. Kuby, J., (2007) Immunology, 2nd edn. H.W.Freeman and company. New York.
2. Janeway C, Travers P, Walport M, Shlomchik M., (2011) Immunobiology, 6th edn, Gerald Science
3. Stites D.P., Abba I. Terr, Parslow T.G. (1997). Medical Immunology. 9th edn, Prentice-Hall Inc.

REFERENCES:

1. Roitt R.I.M, (2005) Essential Immunology. 10th edn. Blackwell Scientific Publishers.
2. Tizard, R.I. (2010), Immunology An Introduction. 4th edn. Saunders College Publishing, Philadelphia.
3. Nairn, R., and Helbert, M. (2005) Immunology for Medical Students. 2nd edn. Mosby International limited.
4. Pelczar M.J., Chan E.C.S. and Kreig N.R. (2007) Microbiology 7th edn, McGraw-Hill New York
5. Ananthanarayan and Jayaram Panicker. (2009) Textbook of Microbiology 8th edn Orient Longman

WEBSITES:

www.frontiersin.org
www.immunologylink.com
<http://www.cell.com/trends/immunology/>
<https://immunologynotes.com>
www.nlm.nih.gov

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER – III
ALLIED – BIOINSTRUMENTATION

Teaching Hours: 60 Hours
Course code: MB18/3A/BIT

Credits: 4
L T P 3 1 0

OBJECTIVES:

This paper provides

- Theoretical aspects of various instruments used in Microbiology
- Understanding of careful handling of laboratory instruments.
- Knowledge about applications of these instruments.

COURSE CONTENT:

UNIT I:

10 hrs

Measurement of pH- Principle and working of pH strips and pH meter. Balances- physical and electronic balances. Micropipette - working, parts and its uses. Laminar air flow, Biosafety cabinets, Incubator and BOD incubator

UNIT II :

15hrs

Centrifugation - Principle, working, uses and maintenance of Centrifuge - types of rotors and centrifuge. Electrophoresis - Definition, types - Paper Electrophoresis, Gel electrophoresis - Agarose gel, Polyacrylamide, Immunoelectrophoresis and isoelectric focusing.

UNIT III:

10 hrs

Spectroscopy - Principles and Applications of Colorimetry, UV and Visible Spectrophotometry, Turbidometry, Raman Spectroscopy, Fluorimetry. Atomic absorption spectroscopy.

UNIT IV:

10hrs

Chromatography - Types, Principle and Applications of- TLC, Column Chromatography - Adsorption, Ion exchange, Affinity, Gas-Liquid, HPLC and HPTLC.

UNIT V:

15 hrs

Biosensors - Definition, Components of Biosensors, Types –Electrochemical, Enzyme, Environmental Biosensors. Applications - in Medicine, Pollution control, Industry and Military. Uses of radioisotopes in life sciences, radioactive labeling, Geiger-Muller and scintillation counter, autoradiography and its application

Learning Outcome:

- Students learn the working principles of various instruments used in a biology laboratory.
- They gain knowledge about recently developed techniques in instrumentation field.

RECOMMENDED TEXT BOOKS:

1. Veerakumari,L. (2009). Bioinstrumentation-MJP publishers, Chennai.
2. Wilson K, and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th edn Cambridge university press.
3. Webster, J.G. (2004). Bioinstrumentation. John Wiley & Sons (Asia) Pvt. Ltd, Singapore.

REFERENCES:

1. Rodney.F.Boyer, (2000), Modern Experimental Biochemistry, 3rd edn. Pearson Publication.
2. Jayaraman J (1989). Laboratory Manual in Biochemistry – Wiley Eastn Ltd., New Delhi.
3. Skoog A.,West M. (1988). Principles of Instrumental Analysis – W.B.Saunders Co., Philadephia.
4. N.Gurumani. (2009). Research Methodology for biological sciences. MJP publishers.
5. Ponnuragan. P and Gangathara PB (2013). Biotechniques. MJP publishers.

WEBSITES:

<http://www.slideshare.net/karanppt/electrophoresis-13738605>

<https://en.wikipedia.org/wiki/Spectroscopy>.

<http://study.com/academy/lesson/what-is-chromatography-definition-types-uses.html>.

<http://ebooks.cambridge.org/chapter.jsf?bid=CBO9780511802737&cid=CBO978051180273A080>

<http://www.bme.ncku.edu.tw/files/classoutline/bioinstrumentation.pdf>.

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)

10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)

5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)

2 x 20 marks = 40 marks

SEMESTER – IV
BASIC CONCEPTS OF MICROBIAL GENETICS

Teaching Hours: 105 Hours
Course code: MB18/4C/CMG

Credits: 5
L T P 4 3 0

OBJECTIVES:

This paper focuses on

- DNA and RNA Structure and Replication
- Mutation and DNA repair mechanism.
- Gene Expression and transfer mechanism.

COURSE CONTENT:

UNIT I : 20hrs

DNA as genetic material with experimental evidences– Griffith’s, Avery’s, Hershey and Chase’s experiments. Structure of DNA. Factors that affect the Structure of DNA- Temperature, pH. Forms of DNA –A, B and Z. Supercoiling. Structure of RNA- tRNA, rRNA and mRNA. Plasmid –Classification, Structure and importance of Natural Plasmids

UNIT II: 22hrs

Prokaryotic DNA Replication – Proof for Semi-Conservative Replication, Events involved in Replication fork, Enzymes involved in DNA Replication, Unidirectional and Bidirectional Replication. Rolling Circle Replication. Bacteriophage - Structure and Life cycle of Phage- Lambda, M13, T4

UNIT III: 20hrs

Gene expression in Prokaryotes–Genetic Code, Transcription and Translation. Regulation of Gene Expression – Operon – lac, trp, Regulon- SOS

UNIT IV: 20hrs

Mutation -Definition and Types – Spontaneous and Induced mutations. Ames test. DNA Repair Mechanism- Photo reactivation, Nucleotide repair. Excision repair, Methyl Directed Mismatch repair, SOS repair.

UNIT V: 23hrs

Gene Transfer Mechanisms - Conjugation - and its uses. Transduction- Generalised and Specialised, Transformation–Natural Transformation. Transposition and types of Transposition reactions. Recombination- Homologous and Site specific recombination.

Learning Outcome:

- Students learn about Prokaryotic DNA and RNA with types and replication.
- They also learn about mutation , gene transfer mechanism, Operons and Regulons.

RECOMMENDED TEXT BOOKS:

1. Friefelder,D.(2008) Molecular Biology. Narosa Publishing House,New Delhi.
2. Trun., and Trempy, (2004) Fundamental Bacterial Genetics.Black well Science Ltd., Oxford.
3. Peter Paoella, (1998), Introduction to Molecular Biology, International edn, McGraw-Hill.

REFERENCES:

1. Russell P.J, (2009). Genetics- A Molecular Approach. 3thedn. Pearson international
2. Old R.W. and Primrose S.B. (1985) Principles of Gene Manipulation 4thedn. Blackwell Scientific Publication, London.
3. Hays W, (1969)The Genetics of Bacteria and Viruses. 2ndedn. Blackwell
4. R.C Dubey and D.K.Maheshwari, (2007) A Textbook of Microbiology, 1st revised edn, S.Chand and company Ltd.
- 5 Prescott Harley Klein, (2009), Microbiology, 8thedn, McGraw- Hill International edn.

WEBSITES:

<http://www.nature.com/nrg/focus/microgen/>
<http://microbiology.ucdavis.edu/>
<https://www.cliffsnotes.com/>
<https://www.britannica.com/science/microbial-genetics>
<https://www.sciencedirect.com/topics/biochemistry-genetics-and.../microbial-genetics>
<https://www.slideshare.net/welfredoyu1/final-genetic-microbiology>
<https://micro.otago.ac.nz/courses/200-level-overview/gene-221/>
<https://onlinelibrary.wiley.com/doi/book/10.1002/047122197X>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER - IV

ALLIED - BIOSTATISTICS AND COMPUTER APPLICATION

Teaching Hours: 60 Hours.
Course Code: MB18/4A/BCA

Credits: 4
L T P 3 1 0

OBJECTIVES:

This paper provides

- Understanding the basics of Biostatistics.
- Theoretical aspects of applications of Computers.

COURSE CONTENT:

UNIT I: 10 hrs

Introduction to Bio-statistics, basic concepts and role of biostatistics in modern research. Definition of data, types and its collection. Sampling and its types. Diagrammatic and graphical representation of data.

UNIT II: 15 hrs

Measure of Central Tendency- Mean, Mode and Median. Measure of Dispersion- Standard deviation and Standard error. Probability- Definition, Random experiment, sample space and events, Mutually exclusive events, exhaustive events and equally likely events- Addition and Multiplication Laws.

UNIT III: 10 hrs

Testing of Hypothesis- Chi square, t-test, Z Score. Analysis of Variance- One way and two-way ANOVA and a few simple problems.

UNIT IV: 10 hrs

Introduction to Computer, parts of Computer, concept of Hardware and Software, types of computer and its applications. Low level and high level languages. Binary coding system. Windows – introduction and working with windows. Concept of file, folder and directories.

UNIT V: 15hrs

Introduction to MS office software concerning word processing, spreadsheets and presentation software. Internet and its Applications. Computer oriented statistical techniques. Computation of mean and standard deviation.

Learning Outcome:

- Students acquire knowledge on basics of biostatistics, data collection and analysis.
- They also learn the application of computers in data processing.

RECOMMENDED TEXT BOOKS:

1. Pranab Kr. Banerjee. (2009). Introduction to biostatistics. 3rdedn. S. Chand and Company Ltd.
2. N. Gurumani. (2009). An Introduction to Biostatistics- 2ndedn. MJP publishers.
3. Peter Norton. Introduction to computers. Tata Mac Graw Hill Pub.

REFERENCES:

1. Norman T.J. Bailey (1981). Statistical methods in Biology 2ndedn. Hodder & Stoughton.
2. Palanichamy S. and Manoharan M (1994). Statistical methods for Biologists 1stedn. Palani Paramount Publishers.
3. Veer Bala Rastogi. (2009). Fundamentals of Biostatistics. 2ndedn. Ane Books Pvt Ltd.
4. Arora and Malhan. (2009). Biostatistics. Himalaya Publishing House.
5. C.R. Kothari and Gaurav Garg (2014). Research Methodology-Methods and techniques. 2ndedn. New age Publication.

WEBSITES:

http://www.tutorialspoint.com/computer_fundamentals/computer_fundamentals_tutorial.pdf.
<http://www.nios.ac.in/media/documents/sec229new/lesson%201.pdf>.
http://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_biostatisticsbasics/.
<http://www.biostat.ucla.edu/>
<http://www.biostatistics.com/>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

**MAJOR PRACTICAL
BASIC AND APPLIED IMMUNOLOGY**

Teaching Hours: 90 Hours
Course code: MB18/4C/PR2

Credits: 4
L T P 0 0 3

OBJECTIVE:

This paper focuses on

- Basic concepts of Immunological Techniques.
- Understanding Principles of various Antigen and Antibody reactions

COURSE CONTENT

1. Hemagglutination - Blood grouping ABO and Rh – typing- Slide method.
2. Total count of RBC
3. Total count of WBC
4. Differential count of Blood cells.
5. Separation of Buffy coat - Ficoll Hypaque method.
6. Bacterial Agglutination.
7. Agglutination- ASO
8. Agglutination - RA
9. Agglutination-HCG
10. Agglutination-CRP
11. Flocculation – RPR
12. WIDAL - Slide method.
13. WIDAL - Tube method.
14. Precipitation Reaction – Immunodiffusion - Ouchterlony patterns.
15. Precipitation Reaction – Immunodiffusion – SRID
16. Immunoelectrophoresis –Double Immunodiffusion
17. Serum immunoelectrophoresis
18. Counter Immunoelectrophoresis
19. Coomb’s test
20. ELISA – Demonstration

Learning Outcome:

- Students learn about the basic principles involved in various haematological and immunological techniques.

QUESTION PAPER PATTERN:

Time: 6 Hours (3 Hrs, Two days)

Max Marks: 60

Major practical : 25 marks
Minor practical : 15 marks
Spotters (5 x 2) : 10 marks
Record : 10 marks

ALLIED PRACTICAL
BIOINSTRUMENTATION, COMPUTERS AND BIOSTATISTICS

Teaching Hours: 60 Hours **Credits: 2**
Course code: MB18/4A/PR1 **L T P 0 0 2**

OBJECTIVE:

- Knowledge in working principles of laboratory instruments.
- Knowledge in application of biostatistics and computers in biology

COURSE CONTENT

1. Preparation of buffer solutions-phosphate buffer, acetate buffer, tris buffer. Measurement and adjustment of pH for prepared media or solution.
2. Principle and working of Micropipette.
3. Principle & working of –
 - a. Colorimeter
 - b. UV-Spectrophotometer
4. Principle and Working of BOD Incubator
5. Separation of serum, plasma and bacterial culture using centrifuge
6. Separation of lipids/ amino acids/ sugars/ organic acids by paper/TLC Chromatography
7. To separate a mixture of compounds (plant pigments, dyes) by Column Chromatography.
8. Agarose Gel electrophoresis
9. ELISA Reader
10. Demonstration of PCR
11. Representation of statistical data by (a.) Histograms (b) Ogive curve c) Pie diagrams.
12. Determination of Statistical Averages / Central Tendency.
 - (a). Arithmetic Mean (b) Median (c) Mode
13. Determination of measures of dispersion
 - (a) Mean Deviation (b) Standard Deviation (c) Standard error
14. Tests of significance – application of following;
 - (a) Chi Square test (b) t–test
15. Computer Operations – getting acquainted with different parts of Computer.
16. Creating Files, Folders and Directories.
17. Applications of Computer in Biology using MS – Office
 - (a) MS – Word (b) MS – Excel (c) Power Point
18. Creating an e- mail account. Sending and receiving mails.
19. An introduction to Internet, Search Engines, Websites.
20. Browsing and Downloading.

Learning Outcome:

- Students acquire knowledge on working of instruments, data collection and analysis using biostatistics tools.
- They also learn the application of computers in data processing.

QUESTION PAPER PATTERN

(Time-3hrs, One day)

Max Marks-60

Major practical : 30 marks
Minor practical : 20 marks

Record : 10 marks
SEMESTER V
BACTERIOLOGY

Teaching Hours: 75 Hours
Course code: MB18/5C/BAC

Credits: 4
LT P: 3 2 0

Objectives:

This paper focuses on

- Understanding the mechanisms of bacterial infections
- Knowledge to prevent and manage the infections

COURSE CONTENT:

UNIT I: 15 hours

General Bacteriology-Principles of bacterial Classification. Bacterial virulence factors in pathogenicity. Clinical bacteriology- Collection, transport and processing of clinical samples for bacterial identification.

UNIT II: 20 hours

Gram Positive Bacteria - Morphology, classification, cultural characteristics, pathogenicity, laboratory diagnosis, prevention and control of infections caused by *Staphylococcus aureus*, *Streptococcus pyogenes*, *Corynebacterium diphtheriae*, *Mycobacterium tuberculosis* and *Mycobacterium leprae*.

UNIT III: 20 hours

Gram Negative Bacteria - Morphology, classification, cultural characteristics, pathogenicity, laboratory diagnosis, prevention and control of infections caused by *Escherichia coli*, *Salmonella*, *Shigella*, *Vibrio cholerae*, *Pseudomonas aeruginosa*, *Haemophilus influenzae*, *Bordetella pertussis*, *Neisseria gonorrhoeae* and *Neisseria meningitidis*.

UNIT IV: 10 hours

Spiral Forms and Non-cultivable Bacteria - Morphology, classification, cultural characteristics, pathogenicity, laboratory diagnosis, prevention and control of infections caused by *Helicobacter pylori*, *Spirochaetes – Treponema pallidum*, *Leptospira*, *Borrelia*, *Mycoplasma pneumoniae*, *Rickettsiae- pox, typhus, Chlamydia trachomatis*.

UNIT V: 10 hours

Zoonotic Bacterial Infections – Morphology, classification, cultural characteristics, pathogenicity, laboratory diagnosis, prevention and control of infections caused by *Bacillus*, *Yersinia*, *Brucella*.

Learning Outcome:

- Students get a detailed insight about the classification, pathogenesis and laboratory diagnosis of various medical important bacteria.

RECOMMENDED TEXT BOOKS:

1. Ananthanarayanan, R, & Panicker, C.K.J. (2005). Textbook of Microbiology- Orient Longman.
2. Greenwood, D., Slack, R.B., & Peutherer, J.F. (2002) Medical Microbiology 14th edn. Churchill Livingstone London.
3. Medical Microbiology. (2008) MIMS. Elsevier Ltd. 5th edition.

REFERENCES:

1. Topley And Wilson's , (1990), Principles of Bacteriology, Edward Arnold, London.
2. Topley And Wilson's . (1997), Bacterial Infections. Edward Arnold, London.
3. Jawetz, E., Melnic, J.L. and Adelberg, E.A. (2000), Review of Medical Microbiology ,19th edn. Lange Medical Publications, U.S.A.
4. Williams and Wilkins, Holt.(1994), Bergey's Manual of Determinative Bacteriology , 9th edn. Baltimore, USA.
5. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. (1996), Mackie and McCartney Practical Medical Microbiology, 14th edn. Churchill Livingstone, London.

WEBSITES

- <http://www.microbiologyonline.org.uk/>.
- <http://www.asm.org/>.
- <http://www.textbookofbacteriology.net/>.
- <https://search.nih.gov/>
- <http://www.who.int/ihr/lyon/surveillance/methods/en/>
- www.ncbi.nlm.nih.gov/pmc/articles/

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER V
SOIL AND AGRICULTURAL MICROBIOLOGY

Teaching Hours: 75 Hours
Course code: MB18/5C/SAM

Credits:4
LT P: 3 2 0

OBJECTIVES:

This paper focuses on

- Understanding Soil microbes and the Interactions among them.
- Role of microbes in Soil Fertility and Plant Diseases.

COURSE CONTENT:

UNIT I:

10 hrs

Soil Microbiology – Physical and Chemical Properties of Soil. Soil Profile and Structure. Diversity and Distribution of Microbes in Soil - Bacteria, Actinomycetes, Algae, Fungi and Viruses.

UNIT II:

20 hrs

Microbial Interactions - Mutualism, Commensalism, Amensalism, Synergism, Competition, Parasitism. Rhizosphere, Phyllosphere, Mycorrhizae

UNIT III:

10 hrs

Biogeochemical Cycles - Carbon Cycle, Nitrogen Cycle - Fixation of Molecular Nitrogen, Nitrification and Denitrification, Sulphur Cycle and Phosphorus Cycle.

UNIT IV:

20hrs

Plant Pathology - Microbial Diseases of Plant-Bacterial - Citrus Canker, Soft Rot in Carrot, Bacterial blight of paddy Fungal – Red Rot of Sugar Cane, Tikka Disease of Groundnut, Fusarial Wilt in Cotton, Leaf rust of coffee. Viral - Mosaic Disease in Tobacco. Parasite- root knot nematode in tomato. Prevention and Control of Plant Diseases.

UNIT V:

15 hrs

Soil fertility - Definition and Soil Requirement for Agriculture. Production, Application and Uses of Biofertilizers - VAM, Rhizobium, Azotobacter Azospirillum and Cyanobacteria. Biopesticides- Bacterial, Fungal and Viral.

Learning Outcome:

- Students understand about soil structure and microbial processes in soil.
- A thorough knowledge is acquired about the fertility of soil.

RECOMMENDED TEXTBOOKS:

1. SubbaRao.N.S. (2004), Soil Microorganisms and Plant Growth, Oxford and IBH Publishing Pvt Ltd
2. Atlas, R.M., and Bartha, R. (1998), Microbial Ecology Fundamentals and Applications, 3rd edn. Benjamin Cummings. Redwood City. C. A.
3. Vijaya R K, (2004). Environmental Microbiology. 1st edn, MJP Publishers, Chennai.

REFERENCES:

1. SubbaRao.N.S.(1995), Biofertilizers in Agriculture and Forestry, 3rd edn. Oxford and IBH Publishing co. Pvt Ltd.
2. Paul, E.A. and Clark, F.E, (1989), Soil Microbiology and Biochemistry. Academic Press, London.
3. Alexander, M, (1991), Introduction to Soil Microbiology. John Wiley and Sons, New York.
4. Butler, E.J, (1987), Fungi and Disease in plants. Thacker Spink and Co., Calcutta.
5. Agrios, G.N, (2004), Plant Pathology, 2nd edn Press, New York.

WEBSITES

<http://www.studentsguide.in>
<http://www.en.wikipedia.org>
<https://www.scribd.com>
<http://www.freebookcentre.net>
<http://www.microbiology procedure.com>
<https://www.scribd.com>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER V
MEDICAL PARASITOLOGY

Teaching Hours: 75 Hours
Course code: MB18/5C/MPL

Credits: 4
LT P: 3 2 0

OBJECTIVES:

This paper focuses on

- Types of Protozoan's and their impact on human health
- Clinical manifestations and diagnostic approach of Parasitic Infections
- Methods of Prevention and Management of Parasitic Infections

COURSE CONTENT:

UNIT I:

20 hours

Introduction to Medical Parasitology. Classification of Protozoa. Collection, Transport and Processing of Specimen. Examination of parasitic ova/ cyst by direct wet mount and iodine wet mount. Concentration techniques- Saturated salt solution, Zinc sulphate and Formol Ether method. Blood smear preparation- thick and thin. Cultivation of Parasites.

UNIT II:

10 hours

Lifecycle, Pathogenesis, Lab diagnosis and Control of intestinal Protozoans - *Entamoeba and Balantidium*, Genito-Urinal Protozoans - *Giardia and Trichomonas*.

UNIT III:

20 hours

Protozoology - Lifecycle, Pathogenesis, Lab diagnosis and Control of Blood and Tissue Protozoans - *Plasmodium, Leishmania, Trypanosoma and Toxoplasma*.

UNIT IV:

10 hours

Helminthology - Platyhelminthes - General characters of Cestodes - Lifecycle, Clinical features, Lab diagnosis and Control of *Taenia, Echinococcus*. General characters of Trematodes – *Fasciola, Schistosoma, Paragonimus*.

UNIT V:

15 hours

Nemathelminthes - General characters of Nematodes - Lifecycle, Clinical features, Lab diagnosis and Control of *Ascaris lumbricoides, Ancylostoma duodenale, Trichinella spiralis, Enterobius vermicularis, Wuchereria bancrofti and Dracunculus medinensis*.

Learning Outcome:

- Insight on the identification of medically important parasites by studying structure, life cycle and its pathogenesis.
- Theoretical knowledge in diagnosing infections

RECOMMENDED TEXT BOOKS

- 1.Chatterjee (2009). Medical Parasitology. CBS Publishers, New Delhi.
- 2.Arora.D.R. and Brij Bala Arora(2014),Medical Parasitology. CBS Publishers, New Delhi.

REFERENCE BOOKS

1. Parija S. C. (1996). Text Book of Medical Parasitology. Orient Longman.
2. Levanthal, R. and Cheadle, R.S. (2012). Medical Parasitology. 6th edn. S.A.Davies Co., Philadelphia.
3. Walter Beck, J. and Davies, J.E. (1976). Medical Parasitology. 2nd edn. C.V.Mosby Company, St. Louis.
4. P.L.Choidini ,A.H.Moody, D.W.Manser.(2001). Atlas of Medical Helminthology and Parasitology. Churchill living stone.
5. Schmidt G.Dand Roberts L.S. (1981). Foundations of Parasitology, 2nd edn, Mosby, St. Louis.

WEBSITES:

- <https://www.amsocparasit.org/human-parasite-medical-links>
- <http://medicalppt.blogspot.com/2012/03/parasitology-lecture-notes.html>.
- https://www.oxbridgenotes.co.uk/revision_notes/veterinary-medicine-university-of-nottinghamcardiorespiratory-system/samples/parasitology.
- <http://medicalppt.blogspot.com/2012/03/parasitology-lecture-notes.html>.
- http://www.phsource.us/PH/PARA/Chapter_6.htm
- <http://nematode.unl.edu/Wormgen.htm>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER V
FOOD MICROBIOLOGY

Teaching Hours: 60 Hours
Course code: MB18/5E/FMB

Credits: 5
LT P: 3 1 0

OBJECTIVES:

- Students will gain an understanding of spoilage microorganisms and how their effects on food.
- Students will be able to think critically about problems and issues concerning beneficial and harmful microorganisms in foods.

COURSE CONTENT:

UNIT I:

10 hrs

Introduction to Food Microbiology – Scope of food microbiology. Factors (Extrinsic and Intrinsic) affecting Microbial Growth in food. Microorganisms in Food - Bacteria and Fungi. Principles of Preservation - Asepsis, High Temperature, Low Temperature, Drying, irradiation and Food Additives.

UNIT II:

10 hrs

Spoilage of Food: Fruits, Vegetables, Fresh meat, Processed meat , poultry, Fish and sea foods, Canned foods. Culture, Microscopic, and Sampling Method for detecting microbes, Physical, Chemical methods, Immunological methods.

UNIT III:

15 hrs

Food Borne Infections and Food Poisoning - *Bacillus*, *Clostridium*, *Escherichia*, *Salmonella*, *Shigella*, *Staphylococcus*, *Vibrio*, Nematodes, Protozoa, Algae, Fungi and Viruses. Food borne outbreaks in India.

UNIT IV:

10 hrs

Microbiology of Milk-Microbes in Milk, Milk borne Infections. Fermentation of Milk-Souring, Lactic Acid Fermentation, Colour and flavours, Gassy fermentation and proteolysis. Quality Control Tests – Phosphatase, Resazurin and Reductase Tests. Microbiology of Fermented Milk products - Production of Cheese, Yogurt, Buttermilk, Kumis, Kefir, Acidophilus milk and Probiotics.

UNIT V:

15 hrs

Good Hygiene Practices, Sanitation in manufacture and retail trade; Food control agencies and their regulations, Hazard analysis and critical control points (HACCP); GMP, Plant sanitation-employees'

health standard, waste treatment, disposal, quality control. Bureau of Indian standards. Food laws and standards in India (FSS). Recent trends and development in food technologies in India.

Learning Outcome:

- Understanding the growth requirements of common food borne pathogens.
- Evaluating microbial safety of food products.

RECOMMENDED TEXT BOOKS:

1. Frazier, W.C., & West off, D.C. (1988). Food Microbiology 4thedn. Tata McGraw Hill Publishing Company Ltd. New York
2. Jay J.M. (2005). Modern Food Microbiology, CBS Publishers and Distributors., New Delhi
3. Prescott and Dunn, (1982), Industrial Microbiology, CBS Publishers and Distributors.

REFERENCES:

1. Robinson R. K. (2000). Dairy Microbiology, Elsevier Applied Science, London.
2. Adams M.R, and Moss M.D, (2005). Food Microbiology, New Age International Pvt. Ltd., Publishers. First edition.
3. Banwarst. G.J. (2003). Basic Food Microbiology, CBS Publishers and distributors.
4. Hobbs, B.C. and Roberts, D, (1968), Food Poisoning and Food Hygiene. Edward Arnold: London.
5. Vijaya R K, (2004). Food Microbiology. MJP Publishers, Chennai. First edition.

WEBSITES

http://www.fda.gov/food/food_safety.html
http://www.microbiology_procedure.com
<http://www.vm.cfsan.fda.gov/-Ird/haccp.html>
<http://www.nal.usda.gov/fnic/foodborne/foodborn.htm>
<http://www.dfst.csiro.au/icmsf.htm>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER V BIOTECHNOLOGY

Teaching Hours: 75 Hours
Course code: MB18/5E/BIO

Credits: 5
LT P: 3 2 0

OBJECTIVES:

This Paper provides Knowledge in

- Basics of Biotechnology
- Applications of Biotechnology in Human Welfare

UNIT-I

15 hrs

Introduction- Historical and recent developments in Biotechnology- Immobilization of cells and enzymes and its applications. Social and ethical aspects of Biotechnology- Intellectual Property Rights (IPR) -Definition and types - Patents and trademarks.

UNIT-II

15 hrs

Plant biotechnology - media and equipment for plant tissue culture- explant culture- micropropagation-somatic hybridization, Ti plasmid – structure and strategies of gene transfer using Ti plasmid in plants – cointegrate vector, binary vector and its applications. Transgenic plants - insect resistant plants - golden rice

UNIT-III

15 hrs

Animal biotechnology- principles of animal cell culture, media and equipment for animal cell culture - primary and secondary cultures- Cell lines- types, establishment and maintenance of cell lines. Transgenic animals – mice and sheep. Production of insulin, interferons, factor VII- Human gene therapy- Germline and somatic cell therapy

UNIT IV

15 hrs

History of rDNA technology- Steps involved in gene cloning. Isolation of bacterial, phage and plasmid DNA. Enzymes involved in genetic engineering - restriction endonucleases, ligases, reverse transcriptase, DNA polymerase- use of linkers and adapters.

UNIT V:

15 hrs

Cloning vectors – structure, uses, methods of cloning and selection of recombinants using pBR 322, pUC, cosmids, lambda phage based vectors, shuttle vectors, YAC. Artificial methods of transformation- transfection . Molecular Techniques - southern blotting, northern blotting, western blotting, PCR, Microarray-DNA sequencing methods- Sanger's and automated methods.

Learning Outcome:

- Students will understand the benefits of gene transfer in plants and animals for human race.
- The techniques used in genetic engineering and the ethical issues about GMOs

RECOMMENDED TEXT BOOKS

1. Glick B.K. and Pasternak, J.J, (1994) Molecular Biotechnology. Principles and Applications of Recombinant DNA. ASM Press, Washington, DC.
2. Crichton. M. (2014). Essentials of Biotechnology. Scientific international Pvt Ltd.New Delhi.
3. Tandon. N. (2014). Tissue Science Technology. Random Publications, New Delhi
4. Freifelder D, (2008). Molecular Biology . Narosa Publishing house, New Delhi
5. Desmond S.T. Nicholl. (2002). An Introduction to Genetic Engineering. Cambridge press
6. B.D. Singh. (2014). Biotechnology Kalyani Publishers

REFERENCES:

1. Brown, T.A. (2001). Gene Cloning and DNA Analysis – An Introduction, 4thedn, Blackwell. Science Ltd.Oxford.
2. Old R. W. and Primrose S. B., (1985), Principles of Gene Manipulation. 4th edn. Black well Scientific Publications, London.
3. Dubey and Maheshwari. (2007). A textbook of Biotechnology, S.Chand and company.
4. Lee Yuan Kun (2003). Microbial Biotechnology- Principles and Applications- 2nd Edition World Scientific
5. V. Kumaresan.(2015). Biotechnology Saras Publication.

WEBSITES

<http://www.reddit.com>
<http://www.microbiology procedure.com>
<http://www.gmac.gov.sg>
<http://textbook of bacteriology.net>
<http://www.microbiologyonline.org>
<http://www.iprlawindia.org>.
<http://www.nptel.ac.in>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
 10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
 5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

**SEMESTER VI
MEDICAL MYCOLOGY**

Teaching Hours: 90 Hours
Course code: MB18/6C/MML

Credits: 4
LT P: 4 2 0

OBJECTIVES:

This paper focuses on

- Emphasizing the medically important fungi in human health.
- Mechanisms of fungal infections.
- Methods of prevention and management of fungal infections.

COURSE CONTENT:

UNIT I: **15 hours**
General Mycology - morphology, taxonomy and classification of medically important fungi-
Mycotoxins and antifungal agents-cultivation of fungi.

UNIT II: **20 hours**
Superficial Mycoses - Pathogenesis, laboratory diagnosis and treatment of *Pityriasis versicolor*,
Tinea nigra, *Piedra* and dermatophytoses. Subcutaneous mycoses - pathogenesis, laboratory
diagnosis and treatment of mycetoma and sporotrichosis.

UNIT III: **20 hours**
Systemic Mycoses - Pathogenesis, Laboratory diagnosis and Treatment of Histoplasmosis,
Blastomycosis, Coccidioidomycosis and Paracoccidioidomycosis.

UNIT IV: **20 hours**
Opportunistic Mycoses - Pathogenesis, Laboratory diagnosis and Treatment of Cryptococcosis,
Candidiasis, Aspergillosis and Zygomycosis.

UNIT V: **15 hours**
Clinical Mycology - Collection, transport and storage of fungal specimens. Recent diagnostic
techniques in mycological infections.

Learning Outcome:

- Knowing about different type of mycoses and their clinical importance in the human health
- Updating the recent techniques along with the traditional methods

RECOMMENDED TEXT BOOKS

1. Jagdish Chander. (1996). A Text book of Medical Mycology, New Delhi.
2. Arora.D.R. and Brij Bala Arora (2014).Medical Mycology, CBS Publishers, New Delhi.

REFERENCES

1. Alexopolus, C.J. and Mims, C.W. (1995). Introductory Mycology. 4th edn .John Wiley and Sons, New York.
2. Fisher, F. and Cook, N.B. (1998). Fundamentals of Diagnostic Mycology. W.B. Saunders Company, Pennsylvania.
3. Chander, J. (2009). A Text book of Medical Mycology. 3rd edn. Mehta publishers.
4. Topley and Wilson's. (1988). Principles of Mycology, Edward Arnold, London.
5. Errol Reiss, H. Jean Shadomy, G. Marshall Lyon(2011).Fundamental Medical Mycology. Wiley-Blackwell, 1st Edition

WEBSITES:

<http://www.mycology.adelaide.edu.au/>
www.bsम्म.org/fungal-websites/
<https://www.britmycolsoc.org.uk/library/links/>
<https://www.journals.elsevier.com/medical-mycology-case-reports/>
<https://academic.oup.com/cid/article/40/3/437/303735>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

**SEMESTER VI
ENVIRONMENTAL MICROBIOLOGY**

Teaching Hours: 90 Hours
Course code: MB18/6C/ENM

Credits: 4
LT P: 4 2 0

OBJECTIVES:

This paper provides knowledge on

- Environmental aspects of Microbiology
- Role of Microorganisms in Bioremediation and Biodegradation

COURSE CONTENT:

UNIT I:

20 hrs

Microbiology of Air - Introduction to Atmospheric Layers, Sources of Microorganism, Air Micro Flora -Indoor and Outdoor Air. Factors affecting Air Micro-flora, Enumeration of Microbes in Air- Air sanitation- Air Borne Diseases

UNIT II:

20 hrs

Microbiology of Water - Introduction, Natural waters, Distribution of Microorganisms in the Aquatic Environment, Sources and Types of Water Pollution, Biological Indicators of Water Pollution. Determination of the quality of Water - MPN Index, Membrane Filtration, Biological Oxygen Demand. Water Purification in Municipal Water Supply, Parameters of Potable Water, Water Borne Diseases.

UNIT III:

20 hrs

Microbiology of Sewage- BOD- Waste Water Treatment - Primary - Secondary - Tertiary Treatment - Disposal of Solid Wastes – Composting and Landfill.

UNIT IV:

20 hrs

Biofuel Production – Ethanol, Methane and Hydrogen. Biodegradation – Lignin. Xenobiotics – Halocarbons, PCB and Synthetic polymers. Microbial Leaching of ores.

UNIT V:

10 hrs

Biodeterioration of Paper, Leather and Wood. Microbial enhanced Oil recovery. Vermicomposting – Pit and windrow method

Learning Outcome :

- Students acquire an in depth knowledge about the role of microbes in water and sewage treatment
- They learn about the microbial role in biodegradation and fuel production processes.

RECOMMENDED TEXT BOOKS:

1. Atlas R. M and Bartha R. (1998). Microbial Ecology Fundamentals and Applications 3rd edn. Benjamin Cummings. Redwood City .CA
2. Daniel. C.J., (1999). Environmental aspects of Microbiology, Bright Sun Publications
3. Vijaya R K, (2004). Environmental Microbiology. MJP Publishers, Chennai. First edition.

REFERENCES:

1. Mitchell.R.,(1999). Introduction to Environmental Microbiology. Prentice- Hall Inc. Englewood Chiffs-New Jersey.
2. Rheinheimer .G, (2007). Aquatic Microbiology. 2nd edn. John Wiley And Son, London.
3. Lynch, J.M. and Poole, N.J.(1980). Microbial Ecology: A. Conceptual Approach. Blackwell Scientific Publications, London
4. Gregory, P.H. and Monteth, (1980). Airborne Microbes. Cambridge University Press, Cambridge, UK.
5. Scragg, A, (2005). Environmental Biotechnology. Pearson Education Ltd., England.

WEBSITES

[http:// www.en.wikipedia.org](http://www.en.wikipedia.org)
<http://www.eplantscience.com>
[http:// www.microbiology procedure.com](http://www.microbiology procedure.com)
<http://www.ttu.ee/public/k/Keemia>
[http:// www.freebookcentre.net](http://www.freebookcentre.net)

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER VI

VIROLOGY

Teaching Hours: 90 Hours
Course code: MB18/6C/VIR

Credits: 4
LT P: 4 2 0

OBJECTIVES:

This paper focuses on

- Understanding the pathogenesis and disease manifestations of viral infections
- Knowledge to prevent and manage the infections

COURSE CONTENT

UNIT I:

10 hrs

History and principles of virology, virus taxonomy, introduction to virus replication strategies. Structure, morphology and general properties of viruses. Cultivation of viruses – inoculation in animals, embryonated eggs and tissue culture.

UNIT II:

20hrs

DNA viruses - Structure, replication, pathogenesis, diagnosis and treatment of Pox virus (Small pox and Molluscum contagiosum), Herpes Virus (Varicella, HSV, Cytomegalovirus, Epstein Barr Virus) Human Hepatitis B virus and Adenovirus .

UNIT III:

20hrs

RNA viruses - Structure, replication, pathogenesis, diagnosis and treatment of Picorna Virus- Polio Virus, Rhabdovirus- Rabies, Orthomyxovirus- Influenza virus, Paramyxovirus- Mumps and Measles, Corona- SARS virus. Retro Virus- Human Immunodeficiency virus. Hepatitis virus- HAV and HCV

UNIT IV:

20hrs

Arthropod borne virus- dengue, chikungunya and Mosquito borne encephalitis. Oncogenic viruses- Human papilloma virus, HCV and Herpes viruses. Virioids, virusoids and Prions.

UNIT V:

20hrs

Clinical Virology - Collection, handling and processing of specimens for detection by Immuno histochemistry, electron microscopy, serological and molecular method- introduction to Reverse transcriptase analysers for mutagenic viruses- PCR. Viral vaccines, Interferons and antiviral drugs.

Learning Outcome:

- Students will learn the essential concepts of virology which include the structure, pathogenesis and disease control

RECOMMENDED TEXT BOOKS:

1. Jawetz, E., Melnick, J.L. and Adelberg, E.A., (1991), Review of Medical Microbiology 19th edn. Lange Medical Publications, USA.
2. Luria, S.E., Darnel, J.E., Jr., Baltimore, D. and Campbell, A., (1978), General Virology, 3rd edn. John Wiley & Sons, New York.
3. Greenwood, D., Slack, R.B., and Peutherer, J.F., (1993), Medical Microbiology 14th edn. Churchill Livingstone London

REFERENCES:

1. Morag, and Timbury, M.C., (1994) Medical Virology 10th edn. Churchill Livingstone.
2. Dimmock, N.J., and Primrose, S.B., (1994) Introduction to Modern Virology 4th edn. Blackwell Scientific Publications, Oxford.
3. Fenner, F. and White, D.O., (1994) Medical Virology. Academic Press, New York.
4. Conrat, H.F., Kimball, P.C. and Levy, J.A., (1994), Virology, 3rd edn. Prentice Hall, New Jersey.
5. S.J. Flint. (2009). Principles of Virology. Vol I: Molecular Biology, Vol. II: Pathogenesis and Control. Third edn, ASM Press

WEBSITES

<http://www.CDC.GOV/>
<http://www.virology.net/>
<http://www.vaccineinformation.org/>
<http://www.asm.org/>
<http://www.microbiologyonline.org.uk/>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

**SEMESTER VI
INDUSTRIAL MICROBIOLOGY**

Teaching Hours: 90 Hours
Course code: MB18/6E/INM

Credits: 5
LT P: 4 2 0

OBJECTIVES:

This Paper provides Knowledge in

- Basics of Fermentation Technology
- Exploitation of Microorganisms for Human Welfare

COURSE CONTENT:

UNIT I:

10 hrs

Introduction to Fermentation Processes - Components of Fermentation Process. Types of Fermentation Processes - Batch, Continuous, Surface, Submerged, Solid Substrate Industrially Important Microorganisms.

UNIT II:

20 hrs

Strain Development and Media Formulation - Industrially Important Microorganisms - Isolation, Preservation and Improvement of Strains. Media Formulation- Crude Media Components, Antifoam agents, Buffering Agents. Sterilization -Batch and Continuous Process.

UNIT III:

20 hrs

Inoculum Development and Design of Fermentor - Development of Inoculum for various Fermentation Processes. Process Parameters - Aeration, Agitation, Temperature Regulation, Foam Regulation and pH Regulation. Fermentor: Basic Structure, Construction and Types - Typical Stirred Aerated fermentor, Tower fermentor, Airlift Fermentor.

UNIT IV:

20 hrs

Downstream Processing - Choice of recovery process, biomass separation from fermentation media- Precipitation, filtration, centrifugation, Cell disruption for intracellular products, solvent extraction and recovery, chromatography, membrane processes, drying, crystallization and whole broth processing. Industrial effluent treatment and quality assurance - GMP, QC of raw materials and Microbiological assays.

UNIT V:**20 hrs**

Industrial Production - Antibiotics- Penicillin and Streptomyces, Amino acids - Glutamic acid and Lysine, Vitamins - Cyanocobalamine, Enzymes – Amylase -Alcoholic Beverages - Wine and Beer, Vinegar production, SCP - Bakers yeast.

Learning Outcome:

- To gain knowledge on the basics of fermentation technology and their components.
- The industrial production of various substances which benefit human race.

RECOMMENDED TEXTBOOKS:

- 1.Prescott and Dunn (2009).Industrial Microbiology, 4th edn C B S Publishers
- 2.Stanbury, P.F,Whitaker A. and Hall S.J. (1995). Principles of Fermentation Technology. 2nd edn. Pergamon press.
3. Patel A.H. Industrial Microbiology. (2011). Macmillan India Pvt Ltd

REFERENCES:

- 1.Casida L.E. (1968). Industrial Microbiology, Wiley Eastern Limited, New Delhi.
- 2.Reed, G. (1982). Industrial Microbiology. Mac Millan Publishers Ltd., Wisconsin
- 3.Patel A.H. (1985). Industrial Microbiology. Macmillan India Pvt Ltd.
- 4.Peppler H.J, and Periman D. (1979) Fermentation Technology, Vol 1 & 2, Academic Press, London
- 5.Baumberg, S., Hunter, I.S. and Rhodes, P.M. (1989). Microbial Products - New approaches. Cambridge University Press, Cambridge, UK

WEBSITES:

[http://www.yourarticlelibrary.com/micro-biology/bioreactors-fermenters-function-designs-and-types/33628/.](http://www.yourarticlelibrary.com/micro-biology/bioreactors-fermenters-function-designs-and-types/33628/)
<http://www.srmuniv.ac.in/sites/default/files/files/PENCILLIN.pdf>
[http://microbiology.blogspot.com/2014/01/scope-of-biotechnology-industrial.html.](http://microbiology.blogspot.com/2014/01/scope-of-biotechnology-industrial.html)
[https://en.wikipedia.org/wiki/Alcoholic_beverage.](https://en.wikipedia.org/wiki/Alcoholic_beverage)

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)

10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

MAJOR PRACTICAL- I MEDICAL MICROBIOLOGY

Teaching Hours: 90 Hours
Course code: MB18/6C/PR3

Credits: 4
L T P 0 0 3

OBJECTIVES:

This paper provides

- Knowledge in handling clinical specimens
- Diagnosis of organisms responsible for the infection

COURSE CONTENT BACTERIOLOGY

1. General requirements for Collection and Transport of clinical specimens.
2. Gram's staining and Motility-Hanging Drop Method
3. Metachromatic granule staining, Capsule staining, Spore staining and Acid fast staining,
4. Isolation and Identification of Bacterial Pathogens from Clinical Specimens and their Biochemical reactions.-Urine, Pus, Sputum, Throat swab.
5. Isolation and Identification of Bacterial Pathogens from Clinical Specimens and their - Biochemical reactions.-Stool, Blood
6. Antimicrobial Sensitivity Testing-
 - (i) Disk Diffusion Method
 - (ii) Broth Dilution Method

VIROLOGY

1. Isolation of Coliphage from Sewage sample.
2. Demonstration of inclusion bodies – Negri bodies. Electron Micrograph pictures of Common Viruses.
3. Demonstration of Egg inoculation-CAM and Yolk Sac

MYCOLOGY

1. Microscopic Examination of Fungi (LPCB Mount) causing Opportunistic Mycotic Infections
 - i) Candidiasis, ii) Aspergillosis, iii) Zygomycosis.
2. Slide Culture Technique for Demonstration of Fungi.

3. Microscopic Examination of Fungi causing Dermatophytosis –
Microsporum sp., *Trichophyton sp.*, *Epidermophyton sp.*,
4. Carbohydrate Assimilation and Fermentation tests for Yeast
5. Germtube test for *Candida*.

PARASITOLOGY

1. Examination of Stool specimens for Parasites by Iodine Mount Techniques.
2. Concentration Methods for Stool specimens –Floataion Techniques- Saturated Salt and ZnSO₄ Floataion Method
3. Concentration Methods for Stool specimens Sedimentation techniques- Formol Ether Method
4. Examination of Blood Smear for Malarial Parasites.
5. Examination of Permanent Slides- Scolex of *Taenia*, Proglottid of *Taenia*.

Learning Outcome:

- Students learn to identify medical important bacteria, fungi and parasites from the given sample.
- They also gain knowledge about the isolation and cultivation of viruses.

QUESTION PAPER PATTERN:

Time: 6 Hours (3 Hrs, Two days)

Max Marks: 60

Major practical : 25 marks
Minor practical : 15 marks
Spotters (5 x 2) : 10 marks
Record : 10 marks

MAJOR PRACTICAL- II APPLIED MICROBIOLOGY

Teaching Hours: 90 Hours
Course code: MB18/6C/PR4

Credits: 4
L T P 0 0 3

OBJECTIVES:

- Hands on Training on analysis of Spoiled Food
- Analysis of Air, Water and Soil samples.

COURSE CONTENT

1. Isolation and identification of microbes from spoiled fruits.
2. Isolation and identification of microbes from sea foods
3. Preparation of sauerkraut.
4. Detection of number of bacteria in milk by Breed's count
5. Detection of bacteria in milk by standard plate count method.
6. Dye reduction test - MBRT.
7. Litmus milk reaction.
8. Microbiological examination of curd - Gram staining.
9. Isolation of Lactobacilli from curd.
10. Enumeration of different bacteria, fungi, and actinomycetes from soil.
11. Isolation of *Rhizobium* from root nodules and seed inoculation with *Rhizobium*.
12. Study of *Azolla-Anabaena* relationship
13. Isolation of antibiotic producers from soil by crowded plate technique.
14. Microbiological water analysis for potability – Multiple tube test.
15. Water analysis for total bacterial population by standard plate count method.
16. Demonstration of membrane filtration technique.
17. Study of airborne microorganisms (bacteria and fungi) in different places by settle plate technique.
18. Immobilization of microorganism using gel entrapment method.

Learning Outcome:

- Students learn the techniques for identifying soil, water and food borne pathogens.
- They also learn isolation and handling of environmental related microorganisms.

QUESTION PAPER PATTERN:

Time: 6 Hours (3 Hrs, Two days)

Max Marks: 60

Major practical : 25 marks

Minor practical : 15 marks

Spotters (5 x 2) : 10 marks

Record : 10 marks

SEMESTER III

ALLIED MICROBIOLOGY- I (Offered to II BSc Biochemistry students)

Teaching Hours: 60 Hours

Credits: 4

Course Code: MB18/3A/AM1

L T P 3 1 0

OBJECTIVES:

The Focus is on

- Basic Concepts in Microbiology
- Techniques in Microbiology

COURSE CONTENT

UNIT I:

15 hrs

Introduction to Microbiology - Theories of Biogenesis and Abiogenesis. Contributions of Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Flemming, Joseph Lister. Classification of Microorganisms-Five Kingdom Concept .

UNIT II:

15 hrs

Structural Characteristics of Bacteria - Morphology, Structure of Bacterial Cells - Capsule, Flagella, Fimbriae or Pili, Cell wall, Cell membrane, Mesosomes, Cytoplasm, Cytoplasmic Inclusions, Spores.

UNIT III:**10 hrs**

Basic Microbiology Techniques - Staining techniques - Simple and Differential Staining. Cultivation of Bacteria - Types of Media.

UNIT IV:**10 hrs**

Pure Culture Techniques - Serial Dilution, Spread Plate, Pour Plate Technique, Streak Plate. Measurement of Microbial Growth (Turbidity, Biomass and Cell Count).

UNIT V:**10 hrs**

Sterilization-Physical Methods - Heat, Filtration, Chemical Methods - Alcohols, Phenols, Radiation - UV and Gamma Rays. Preservation Techniques -Mineral Oil Method, Lyophilisation.

Learning Outcome:

- Students get a broad knowledge about the history, morphology, staining cultivation and preservation of microorganisms. They also learn about various methods of sterilization

RECOMMENDED TEXT BOOKS:

1. Pelczar M.J., Chan E.C.S. and Kreig N.R.(2010). Microbiology 5th edn, McGraw-Hill, New York Publications.
2. Prescott L.M, Harley J.P and Klein D.A. (2005).Microbiology 6th edn, McGraw-Hill Publications.
3. R.C.Dubey ,D.K.Maheshwari,(2010) Microbiology 2nd edn , S.Chand and Company ltd. New Delhi.

REFERENCES:

1. Stanier R.Y, Ingraham, Wheelis M.L. Painte. (1999). General Microbiology, 5th edn, Mac Millan Press Ltd.
2. Tortora,G.J.,Funke, B.R.,Case, C.L.(2004). Microbiology- An Introduction, 8th edn, Benjamin-Cummings Pub Co.
3. Madigan M.T., Martinko J.M, Parker J. (2005). Brock - Biology of Microorganisms, 11th edn, Pearson Prentice Hall International,Inc.
4. Alcamo's Jeffrey, C.Pommerville. (2004). Fundamentals of Microbiology, 7th edn, Jones and Bartlett Publishers.
5. Ronald.M.Atlas. (1996). Principles of Microbiology, 2nd edn, Wm.C.Brown Publishers.

WEBSITES:

http://www.microbes.info/resources/general_microbiology/
<http://www.simhq.org/microbiology>
<http://www.brookscole.com/microbio>
<http://www.austincc.edu/rohde/noteref.htm>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

SEMESTER-IV

ALLIED - MICROBIOLOGY II (Offered to II BSc Biochemistry students)

Teaching Hours: 60 Hours
Course Code: MB18/4A/AM2

Credits: 4
L T P: 3 1 0

OBJECTIVES:

The Paper Focuses on different aspects of Food, Industrial, Soil, Water and Air Microbiology.

COURSE CONTENT

UNIT I:

15 hrs

Food Microbiology-Microbial Spoilage of Food - Fruits, Vegetables, Cereals. General Preservation Techniques - High Temperature, Low Temperature. Microbiology of Milk - Microbes in Milk and their Sources. Pasteurization, Phosphatase test. Fermented milk products – Curd, Butter Milk, Cheese.

UNIT II:

15 hrs

Soil Microbiology - Microbes in Soil - Bacteria, Fungi, Actinomycetes, Algae and Viruses, Rhizosphere. Nitrogen Cycle, Carbon Cycle. Biofertilizers – *Rhizobium*

UNIT III:

10 hrs

Water Microbiology - Sources of Water, Potable Water, Municipal Purification of Water, Water Borne Diseases.

UNIT IV:

10 hrs

Air Microbiology - Composition of Air, Microbes in Air, Enumeration of Microorganisms in Air, Air Sanitation, Air Borne Diseases.

UNIT V:**10 hrs**

Industrial Microbiology Microbes in the production of Organic acids – Citric acid, Antibiotics – Penicillin, Alcoholic Beverages - Wine and Beer. Regulatory bodies for Environment Pollution.

Learning Outcome:

- Students gain a wide spread insight about various branches of microbiology like food, environmental and industrial microbiology.

RECOMMENDED TEXT BOOKS:

1. Pelczar M.J., Chan E.C.S. and Kreig N.R.(2010). Microbiology, 5th edn, McGraw-Hill New York Publications.
2. Prescott L.M, Harley J.P and Klein D.A. (2005).Microbiology 6th edn, McGraw-Hill Publications.
3. R.C.Dubey ,D.K.Maheshwari.(2010). Microbiology 2nd edn , S.Chand and Company ltd.

REFERENCES:

1. Stanier R.Y, Ingraham, Wheelis M.L. Painter. (1999). General Microbiology, 5th edn, Mac Millan PressLtd.
2. Tortora,G.J.,Funke, B.R.,Case, C.L.(2004). Microbiology-An Introduction, 8th edn, Benjamin-Cummings Pub Co.
3. Madigan M.T., Martinko J.M, Parker J. (2005). Brock - Biology of Microorganisms, 11th edn, Pearson, Prentice Hall International,Inc.
4. Alcamo's Jeffrey, C.Pommerville. (2004). Fundamentals of Microbiology, 7th edn, Jones and Bartlett Publishers.
5. Ronald.M.Atlas. (1996). Principles of Microbiology, 2nd edn, Wm.C.Brown Publishers.

WEBSITES:

http://www.microbes.info/resources/general_microbiology/
<http://www.simhq.org/microbiology>
<http://www.jbc.org>
<http://www.science.jrank.org>pages>Water-Microbiology>
<http://www.nptel.ac.in> courses>

QUESTION PAPER PATTERN

Time: 3Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all 5 Units)

10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all 5 Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions will be given covering any 4 units)
2 x 20 marks = 40 marks

ALLIED PRACTICAL
ALLIED MICROBIOLOGY
(Offered to II BSc Biochemistry students)

Teaching Hours: 60 Hours

Credits: 2

Course Code: MB18/4A/PR2

L T P 0 0 2

OBJECTIVES:

Students learn

- Basic Microbiological Techniques.
- Staining Techniques.

COURSE CONTENT

1. Cleaning and preparation of Glassware.
2. Instrumentation- Incubator, Water Bath and Micropipette
3. Microscopy - Compound Microscope - Principle, Operation, Uses and Maintenance
4. Sterilization Techniques by Moist Heat and Dry heat method.
5. Simple staining
6. Gram staining
7. Capsule Staining
8. Preparation of Liquid and solid Media – Nutrient Broth & Nutrient agar
9. Demonstration of bacterial motility by Hanging drop method.
10. Enumeration of Bacteria from Air Samples- Standard Plate Count
11. Enumeration of Bacteria from Soil Samples- Standard Plate Count
12. Pure Culture Technique- Streak Plate technique
13. Methylene Blue Reduction test.
14. Observation of Pond Water for the Presence of Microorganisms- *Volvox*, *Nostoc*,

Oscillatoria.

15. Identification of Organisms that spoil bread by LPCB mount technique
16. Antibiotic Sensitivity testing - Disc Diffusion method.

Learning Outcome:

- Students acquire knowledge about the principles of basic microbial techniques
- They also learn the differentiating features of bacteria, fungi and algae.

QUESTION PAPER PATTERN

(Time-3hrs, One day)

Max Marks-60

Major practical : 30 marks
Minor practical : 20 marks
Record : 10 marks