



RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

B. Sc. GENERAL (SEMESTER PATTERN)

B. Sc. SECOND YEAR

MICROBIOLOGY – CURRICULUM

UNDER ACADEMIC AUTONOMOUS STATUS 2013 -2018

(MCQ + Theory Pattern)

w. e. f. JUNE, 2016

INTRODUCTION

Microbiology has been at the forefront of research in industry, environment, agriculture, food, dairy, medicine and biology. It is one of the rapidly growing and applied areas of the science. There many job opportunities available for student in this stream. Industrial production and management are some of the areas in which trained manpower is needed.

Microbiology is one of the optional subjects for B.Sc. degree course of three years. I, II, &III. Students passed 10+2 are eligible for admission. Language of Medium is English.

The pattern of question paper, standard of passing is as per norms given by BOE of Rajarshi Shahu Mahavidhyalaya, Latur (Autonomous)

The admission procedure for course is as per college norms.

Teacher's qualifications are as per UGC norms.

The list of laboratory Equipments and Instruments is given

GENERAL OBJECTIVES OF THE COURSE

- The syllabus of course is designed to provide knowledge which is useful for making carrier in related fields.
- To promote students for self employment.
- To provide basic knowledge and skills to promote students in research and social scientific awareness.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Dept. of Microbiology

B. Sc. GENERAL (SEMESTER PATTERN)

**B. Sc. SECOND YEAR
MICROBIOLOGY – CURRICULUM
(MCQ Pattern + Theory Pattern)**

| Semester | Paper No. & Title, Course code | Lectures / practical | Marks | | |
|--------------|---|----------------------|--------------------|---------------------|-------|
| | | | In Sem. Evaluation | End Sem. Evaluation | Total |
| Semester III | Theory Paper-V: Applied Microbiology (U-MIB-359) | 45 | 20 | 30 | 50 |
| | Theory Paper-VI: Fundamentals of immunology (U-MIB 360) | 45 | 20 | 30 | 50 |
| | Lab Course-MB-III: Practical's based on theory papers-V | 12 | ---- | --- | 50 |
| | Lab Course-MB-IV: Practical's based on theory papers-VI | 12 | ---- | --- | 50 |
| Semester IV | Theory Paper-VII: Environmental Microbiology (U-MIB- 459) | 45 | 20 | 30 | 50 |
| | Theory Paper-VIII: Medical microbiology(U-MIB-460) | 45 | 20 | 30 | 50 |
| | Lab Course-MB-V: Practical's based on theory papers –VII | 12 | ---- | --- | 50 |
| | Lab Course-MB-VI: Practical's based on theory papers –VIII | 12 | ---- | --- | 50 |

Note: B.Sc. I, II, III year practical's includes Studies of growth and life activities of microorganisms.

These Studies needs two consecutive days for completion of practical

Workload:

1. Theory: Per paper per week three periods

2. Practical: Per batch per week one practical (Four periods) for two consecutive days (04+04= 08 periods)

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

B. Sc. Second year (Semester -III)

MICROBIOLOGY

Course Code:U-MIB-359

Maximum Marks: 50

Lectures: 45

PAPER V – Applied microbiology

Course Objectives:

Students will learn importance of microorganisms in day to day life.

Students will know techniques to control microbial contamination in air, water and food.

Course Outcomes: Completing third semester, the Microbiology students will be able to:

Describe the importance of existence, beneficial and harmful role of microorganisms in air, water, food and waste. Understand and describe various methods of microbiological analysis and controlling microbial growth and activities for making these life governing factors safe

.....

UNIT I: Air Microbiology

10L

- 1.1 Definition, composition and quality of air.
- 1.2 Sources of microorganisms in air: Intramural Aerobiology, Extramural Aerobiology, Importance of state of suspension- Bioaerosols: droplet, droplet nuclei and droplet infection
- 1.3 Significance of microorganisms present in air: With respect to human, animal, plant health (list of air borne diseases), environment and industry
- 1.4 Microbiological Analysis of Air: Impaction, liquid impingement, filtration, Anderson air sampler
- 1.5 Control of microorganisms in air: Dust control, UV radiation, laminar airflow system, masks, Bactericidal vapours.
- 1.6 Bioterrorism: List of microbial warfare agents, Brief idea of their detection and control measures

UNIT II: Aquatic Microbiology

12L

- 2.1 Natural waters: Atmospheric, surface, stored and ground water.
Definitions: Fresh water (ponds, lakes, streams) and Marine water (estuaries, the sea).
- 2.2 Aquatic environment: Temperature, hydrostatic pressure, light, salinity, turbidity, Planktons and other microorganisms
- 2.3 Domestic water: water borne diseases, nuisance microorganisms
- 2.4 Bacteriological evidence of pollution: Fecal pollution, significance of index organisms
- 2.5 Microbiological examination of water: Membrane filter technique, Tests for presence of coliforms (quantitative and qualitative), IMVC test, Elevated temperature test.
- 2.6 Safety of drinking water: Boiling, chlorination, radiation and ozonization

UNIT III: Waste water microbiology

08L

- 3.1 Definition, Composition and strength of sewage: BOD, COD, Eutrofication
- 3.2 Sewage treatment: domestic sewage treatment, municipal sewage treatment, industrial waste treatment (physical, biological and chemical Oxidation ponds, solids processing, Composting.)

UNIT IV: Food and milk microbiology

15L

- 4.1 Sources of microorganisms in foods and milk
- 4.2 Milk as a nutrient medium for microbial growth
- 4.3 Common food borne bacteria-List
- 4.4 Microbiological examination of food: DMC, SPC, Differential enumeration, MBRT, Resazurin test, Milk ring test for brucellosis and tests for mastitis
- 4.5 Food Spoilage: Classification of foods depending upon ease of spoilage, Different types of spoilages with suitable examples, biochemical types of microorganisms in milk (including starter cultures)
- 4.6 Principles and applications of food Preservation techniques: Aepsis, use of high temperatures (milk pasteurization and phosphatase test, canning), freezing, dehydration, radiation (UV and Gamma rays), osmotic pressure; use of chemicals- Vinegar, Benzoic acid
- 4.7 Microbial food poisoning: Staphylococcal poisoning, Aflatoxin and Salmonellosis (organism, foods involved and type of toxin)

References:

- 1) Fundamental principles of bacteriology. A.J. Salle. TATA MCGRAW- HILL
- 2) Fundamentals of Microbiology. Martin Frobisher.
- 3) Food microbiology. Fourth edition. Willium Frazier, Dennis Westhoff. TATA McGraw- Hill
- 4) General microbiology Vol. II by Power C.H and H.F. Dagainawala. Himalaya Publishing House
- 5) Microbiology. Pelczar, Chan and Crieg. TATA McGraw- Hill
- 6) Text book of applied microbiology. Dr. B.M Sandikar, Himalaya Publishing House
- 7) Microbial biotechnology: fundamentals of applied microbiology. Alexander Glazer, Hiroshi Nikaido. Cambridge university press
- 8) Environmental microbiology. Ralph Mitchell, Ji-Dong Gu. Wiley-Blackwell
- 9) Modern Food Microbiology 4th edition. Jay,J.M. Van Nostra and Rainhokdd Co.
- 10) Food Microbiology. Adams. M. R and M. D Moss. New Age International limited.

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

B. Sc. Second year (Semester -III)

MICROBIOLOGY

Course Code:U-MIB-360

Maximum Marks: 50

Lectures: 45

PAPER VI – FUNDAMENTALS OF IMMUNOLOGY

OVERALL COURSE OBJECTIVES

- To understand basic principles of immunology.
- To gain knowledge about microbial interactions with relationship.
- To understand antigen, antibody and complement system.
- Get an overview of Immunity and immune responses.
To understand basic principles and concepts of immunization.
- Knowledge of antigen antibody reaction and their applications.

Course Outcomes: Completing third semester, the Microbiology students will be able to understand the body defence mechanisms and describe the immunological concepts with reference to infection, immunity, immunological reactions and importance of immunization

.....
UNIT I: Microbial interactions with humans

10 L

- 1.1 Definition –contamination, infection and disease, pathogen, pathogenacity and virulence.
- 1.2 Overview of human microbial interactions.
- 1.3 Virulence factors of pathogen.
- 1.4 Normal (indigenous) micro flora.
- 1.5 Host factors in infection.

UNIT II: Antigen and Antibody and Complement

12 L

Antigen

- 2.1 Definition, Immunogenicity versus antigenicity
- 2.2 General properties of antigen.
- 2.3 Antigen specificity.
- 2.4 Bacterial antigens with special reference to antigens of *Sal.typhi*.

Antibody

- 2.4 Definition, basic structure of immunoglobulin.
- 2.5 Immunoglobulin classes, properties of immunoglobulin classes

Complement system-General properties.

UNIT III: Immunity and Immunization

11 L

3.1 Definition, cells and organs of the immune system.

3.2 Classification of immunity with suitable examples.

3.3 Immune response: Humoral and cellular

3.4 Theories of antibody production

Immunization

3.5 Active and passive immunization

3.6 Designing vaccines for active immunization

a. Live attenuated vaccines.

b. Inactivated or killed vaccine.

c. Subunit vaccine.

d. Toxoid.

e. DNA vaccine

3.7 Immunesera

UNIT IV: Antigen antibody reaction

12L

4.1 General features of antigen antibody reactions

4.2 Mechanism and applications of the following reaction

a. Precipitation

b. Immunodiffusion

c. Immunoelectrophoresis

d. Agglutination.

e. Complement fixation.

f. Neutralization: toxin and virus neutralization

g. Enzyme linked immunosorbent assay.

h. Western blotting

References:

- 1) Kuby's Immunology. 6th edition. Goldsby RA, Kindt TJ, Osborne BA. W.H. Freeman and Company, New York.
- 2) Textbook of Microbiology. 7th edition (edited by Paniker CKJ). Ananthanarayan R and Paniker CKJ. University Press Publication.
- 3) Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. Brooks GF, Carroll KC, Butel JS and Morse SA. McGraw Hill Publication.
- 4) Roitt's Essential Immunology. 11th edition Delves P, Martin S, Burton D, Roitt IM. Wiley-Blackwell Scientific Publication, Oxford.
- 5) Basic Immunology. Joshi and Osarano. Agrobotanical publishers Ltd. Bikaner.
- 6) Elementary microbiology Vol.I and II. Dr. A.H Modi. Akta Prakashan. Nadiad.
- 7) Medical Microbiology. N.C.Dey and T.K. Dey.
- 8) Allied agency, Calcutta.
- 9) Microbiology. Davis, Dulbecco, Eisen Harper and Row Maryland.
- 10) Molecular biology. David freidfelder, marosa Publishing house, New Delhi.
- 11) Text book of immunology. B.S.Nagoba and D.V.Vedpathak. BI publications, New Delhi

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR
B. Sc. Second Year (Semester -IV)
MICROBIOLOGY
Course Code:U-MIB-459

Maximum Marks: 50

Lectures: 45

PAPER VII – Environmental microbiology

Course Objectives:

- Students will gain knowledge of the interrelationship and influence of microorganisms on each other and on environment.
- Students will be aware of eco-friendly and sustainable microbial techniques to resolve agro-environmental problems

Course Outcomes:

- i. Completing fourth semester, the Microbiology students will be able to: Explain why microorganisms are *ubiquitous in nature*; the influence of interactions among different microorganisms and with environment; and on development of an ecosystem.
- ii. Demonstrate that microorganisms have an *indispensable role* in turnover of elements in the environment. Understand and advocate the role of microorganisms in plant growth promotion and plant disease management

UNIT I: Microbial Ecology and interactions

11L

- 1.1 Microbial ecology: Ecosystem, Synecology, Autecology, population, community (Autochthonous, Allochthonous), Dispersal (Center, Active, Passive), Community succession (Pioneer, Successive, Climax), Adaptation (Phenotypic, Genotypic)
- 1.2 Symbiosis: Definition and functions
Types of symbiosis: neutralism, Commensalism, Mutualism (Lichens, Mycorrhiza) Competition, Antibiosis, Synergism, and Parasitism. (Definition and example of each)

UNIT II: Plant growth promoting rhizobacteria

11L

- 2.1 Rhizosphere
- 2.2 Direct plant growth promotion:
 - i) Releasing plant growth promoting substances: Indoleacetic acid, gibberellic acid, cytokines, ethylene and ACC deaminase

- ii) Decreasing heavy metal toxicity.
- 2.2 Indirect plant growth promotion –Biocontrol:
 - i) Competition for an ecological niche,
 - ii) Suppression of growth of soil-born phytopathogens by producing allelochemicals
 - iii) Induction of systemic resistance (ISR)

UNIT III: The cycles of matter 13 L

- 3.1 Soil as growth medium for microorganisms: Physical and chemical considerations, Organic fraction of soil
- 3.2 Carbon cycle: Cycle, Mineralization- cellulose, Starch (Microbiology and enzymology), Carbon assimilation
- 3.3 Nitrogen cycle: Cycle, Nitrogen fixation(Symbiotic, Non symbiotic, Nitrogenase), Mineralization of proteins, Ammonification, Nitrification, Denitrification
- 3.4 Sulfur cycle
- 3.5 Phosphorus cycle.

UNIT IV: Soil contamination and Bioremediation 10L

- 4.1 Soil contamination- Xenobiotics
- 4.2 Bioremediation: Definition and principles
- 4.3 Microbial Populations for Bioremediation Processes
- 4.4 Types of Bioremediation: *In situ* bioremediation, *Ex situ* bioremediation
- 4.5 Advantages and disadvantages of Bioremediation

References:

- 1) Introduction to soil Microbiology, Alexander Martin, John Wiley and Sons. N.Y.
- 2) Soil Micro organisms and plant growth, Subba Rao N.S, Oxford and IBH publishing Co. Pvt. Ltd.
- 3) Microbiology. Pelczar, Chan and Crieg. TATA MCGRAW- HILL
- 4) Text book of applied microbiology. Dr. B.M Sandikar, Himalaya Publishing House
- 5) Microbial biotechnology: fundamentals of applied microbiology. Alexander Glazer, Hiroshi Nikaido. Cambridge university press
- 6) Review on Bioremediation of Polluted Environment: A Management Tool: Kumar.A, Bisht.B.S, Joshi.V.D, Dhewa.T. International journal of environmental sciences. Volume 1, No 6, 2011
- 7) Environmental microbiology. Ralph Mitchell, Ji-Dong Gu. Wiley-Blackwell

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

**B. Sc. Second year (Semester- IV)
Microbiology**

Course Code: U-MIB-460

Maximum Marks: 50

Lectures: 45

PAPER VIII- Medical Microbiology

Course objectives:

- To gain knowledge about disease process and kinds of diseases
- To study reservoirs of infection and modes of transmission of infections. To study diseases caused by bacterial, viral pathogens and parasites

Course outcomes:

Completing fourth semester, the Microbiology students will be able to:
Explain an *integral role* of microorganisms in causation of diseases;
antimicrobial, immunological and diagnostic methodologies used in
disease treatment and prevention.

UNIT I : Disease process and kinds of diseases 08 L

- 1.1 Kinds of diseases –terms used to describe infections.
- 1.2 Disease process, signs, symptoms and syndrome.
- 1.3 Epidemiology-epidemic, endemic, pandemic, sporadic
- 1.4 Reservoirs of infection.
- 1.5 Modes of disease transmission, carriers and their types.

UNIT II: Study of diseases caused by following bacterial pathogens 15L

With respect to etiology, pathogenesis, symptomatology, Laboratory diagnosis, Epidemiology, Prophylaxis and Chemotherapy

1. Salmonella.
2. *Vibrio cholerae*.
3. *Staphylococcus aureus*

UNIT III: Study of the diseases caused by following pathogens 12L

1. *Mycobacterium tuberculosis*
2. Plasmodium
3. Entamoeba
4. *Candida albicans*

UNIT IV: Study of following groups of viral pathogens

10 L

With respect to - etiology, pathogenecity, pathogenesis, symptoms, laboratory diagnosis epidemiology, prophylaxis and chemotherapy

1. Alpha virus- chickungunya
2. Dengue virus
3. Hepatitis A and Hepatitis B viruses
- 4.N1H1 (swine) influenza.

References:

- 1.Basic Immunology by Joshi and Osarano. Agrobotanical publishers Ltd. Bikaner.
- 2) Elementary Microbiology Vol.I and II Dr. A.H Modi. Akta Prakashan. Nadiad.
- 3) Medical Microbiology. N.C.Dey and T.K. Dey. Allied agency, Culcutta.
- 4) Microbiology by Davis, Dulbecco, Eisen Harper and Row Maryland.
- 5) Molecular biology by David Frifelder, Narosa Publishing house, New Delhi.
- 6) Immunology by B.S.Nagoba and D.V.Vedpathak. BI publications, New Delhi.
- 7) Text book of Microbiology by R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman, Mumbai
- 8) Tortora, G.J., Funke, B.R., Case, C.L, 1992. Microbiology: An introduction 5th Edition, Benjamin Pub. Co. NY 2. Roitt, P.I: Mims, C.J. Medical Microbiology
9. Roitt, P.I: Mims, C.J. Medical Microbiology
10. Kuby Immunology

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

B. Sc. Second year (Semester – III)

Semester Pattern effective from June -2014

Microbiology

Maximum Marks: 50

Lab Course-MB-03, Course code U-MIB-361

Course objectives:

To study methods used for bacteriological analysis of water, air, soil, food and milk.

Study of pathogens and serological tests.

Course outcomes: A student successfully completing Lab course MB03 and 04 will exhibit ability to:

Perform qualitative and quantitative microbiological analysis for quality of Air, Water, Milk and food; Perform hematological procedures for detection of blood groups: diagnosis of bacterial diseases; Observe and differentiate human blood cells.

Experiments

- 1) Microbial sampling of air for fungi by solid impingement techniques
- 2) Bacteriological examination of water for potability - Quantitative analysis: MPN
- 3) Bacteriological examination of water for potability –Qualitative: Presumptive, confirmed, completed test
- 4) Test for fecal coliforms: IMViC tests
- 5) Test for fecal coliforms: Elevated temperature tests
- 6) Bacteriological analysis of milk: Reductase test
- 7) Bacteriological analysis of milk: Milk ring test for brucellosis.

Lab Course-MB-04 , Course code U-MIB-362

Maximum Marks: 50

- 1) Isolation of normal bacterial flora of human body.
- 2) Study of virulence factors of pathogen
- 3) Determination of isoantigens on human RBC: Blood grouping
- 4) Widal test.
- 5) RPR test.
- 6) Immunodiffusion test.
- 7) Differential blood staining for WBC
- 8) Differential count of leucocytes.

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

B. Sc. Second year (Semester – IV)

Semester Pattern effective from June -2014

Microbiology

Maximum Marks: 50

Lab Course-MB-05, Course code U-MIB-461

Course Objective: To study activities of microorganisms in soil, milk

Course outcomes : A student successfully completing Lab course MB05 and 06 will exhibit

ability to:

Exercise and describe Ecological developments; isolate and exploit the plant growth promoting bacteria for agricultural and industrial purpose; identify parasitism and bacterial pathogens diseases using staining procedures, cultural methods and biochemical tests; perform antibiotic sensitivity test

- 1) Study of microbial succession in raw milk.
- 2) Study of rhizosphere effect- R: S ratio.
- 3) Isolation of rhizospheric bacteria showing biocontrol potential.
- 4) Isolation of starch degrading bacteria.
- 5) Demonstration of i) Ammonification ii) Nitrification and iii) Denitrification .
- 6) Demonstration of i) Nitrate reduction and ii) Sulfate reduction .
- 7) Isolation and study of *Rhizobium* species from root nodules of leguminous plants.
- 8) Isolation and study of *Azotobacter sp.* from soil .

Experiments:

- 1) Acid fast staining.
- 2) Staining of blood for malarial parasite.
- 3) Study of biochemical reactions for identification of pathogen.
- 4) Study of morphological and cultural characteristics of *Salmonella* species.
- 5) Study of biochemical characteristics of *Salmonella* species
- 6) Study of morphological and cultural characteristics of pyogenic *Staphylococcus aureus*.
- 7) Study of biochemical characteristics of pyogenic *Staphylococcus aureus*.
- 8) Antibiotic sensitivity tests for pathogens by disc diffusion method

List of the Equipments / Instruments

| Sr.no. | Equipments / Instruments | Sr.no. | Equipments / Instruments |
|--------|--------------------------|--------|-----------------------------------|
| 1. | Shaker 24x24 (1) | 23. | Hot air oven (1) |
| 2. | VDRL shaker (1) | 24. | Electrophoresis kit (1) |
| 3. | Autoclave (3) | 25. | Magnetic stirrer (1) |
| 4. | Incubator (2) | 26. | Vortex mixture (1) |
| 5. | Water bath (1) | 27. | UV chamber (1) |
| 6. | Photocolorimeter (2) | 28. | Paper chromatography Assembly (1) |
| 7. | Spectrophotometer (1) | 29. | Refrigerator kelvinator (1) |
| 8. | Warming table (1) | 30. | pH meter (1) |
| 9. | Heating mantle (1) | 31. | Bottle washing machine (1) |
| 10. | TLC kit (1) | 32. | Soxhalet accelerator (1) |
| 11. | Rough balance (1) | 33. | Vacuum pump (1) |

| | | | |
|--------|--|--------|--|
| 12. | Fine balance (1) | 35. | Pipette washing machine (1) |
| 13. | One pan balance (1) | 36. | ESR assembly (1) |
| 14. | Distillation plant(steel) (1) | 37. | Seitz filter assembly (1) |
| 15. | Microscope with oil emulsion objective(14) | 38. | Micropipette (5) |
| 16. | Slide projector Automatic (1) | 39. | Lab research microscope (microne) (3) |
| 17. | Haemocytometer (9) | 40. | Metzes optik monocular microscope model METZ_777 (2) |
| 18. | Haemoglobinometer (9) | 41. | Digital photoelectric meter (systronics) make type 112 (1) |
| 19. | Electronics balance (1) | 42. | Drier heavy duty Philips (1) |
| 20. | Micrometer slide (2) | 43. | Vacuum cleaner.Eureks forbes make trendly model (1) |
| 21. | Hot plate (1) | 44. | Electronics balance contech model CA-124 ,0.1 mg to 120 gm (1) |
| 22. | Homogenater (1) | 45. | Distillation unit (Bhanu make) (1) |
| Sr.no. | Equipments / Instruments | Sr.no. | Equipments / Instruments |
| 46. | Godrej Refrigerator 1.Model no.280 litre (30 DY)(1) 2.Model no.230 litre (24AC)(1) | 52. | Anaerobic jar (kumar make) (1) |
| 47. | Colony counter digital (1) | 53. | Lab Fermenter 5 lit capacity make (DYNA biotech) (1) |
| 48. | Orbital shaking incubator (CIS-24)with voltage stabilizer | 54. | Air compressor with motor (Apollo) (1) |
| 49. | Cooling centrifuge (C-24 BL) with voltage stabilizer | 52. | Anaerobic jar (kumar make) (1) |
| 50. | Deluxe laboratory centrifuge (R-8C) (1) | 53 | P.C. based Binocular microscope with image processing system |
| 51. | Laminar air flow microfilt(microfilt make) (1) | 54 | Ultrasonicator probe (Lancer Make) |

