**St. Aloysius' College (Auto.), Jabalpur**
**Department of Microbiology**
**M.Sc. Microbiology**
**III Semester**
**Choice Based Credit System**
**Session 2025-26**

| (A) Continuous evaluation, Theory, Practical | | Credits | Maximum Marks | | Total |
|---|---|---|---|---|---|
| | | | Continuous Evaluation | End Semester Exam | |
| Course Code | Course Title | | | | |
| **I Core courses** | | | | | |
| P I | Environmental Microbiology | **4** | **10** | **40** | **50** |
| P II | Medical Microbiology | **4** | **10** | **40** | 50 |
| P III | Agricultural Microbiology | **4** | 10 | 40 | 50 |
| | Practical based on PI & PII | **4** | | | 50 |
| | Practical based on PIII & P IV/ PV | **4** | | | 50 |
| **II Electives courses (Any one to choose)** | | **4** | **10** | **40** | **50** |
| P IV | Bioprocess Engineering and Technology | | | | |
| V | Biotechnology | | | | |
| **III Skill Development course** | | | | | |
| | Skill Development | **1** | **Grade Point will be provided by Skill Development Centre** | | |
| Total valid credits | | **25** | | | |

| | | M.Marks |
|---|---|---|
| **(B) Seminar and viva voce** | **2** | **25** |

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# ST. ALOYSIUS COLLEGE(AUTONOMOUS), JABALPUR

*Reaccredited 'A++ 'Grade by NAAC(CGPA:3.58/4.00)*
*College with Potential for Excellence by UGC*
*DST-FIST Supported & STAR College Scheme by DBT*
*SESSION 2025-26*

# Faculty of Science

**Master of Science (M.Sc.)**

**SUBJECT: MICROBIOLOGY**

**M.Sc. III Semester**

**Core Paper-I**

**Environmental Microbiology**

## Course Outcomes

| CO.No. | Course Outcomes | Cognitive Level |
|---|---|---|
| CO1 | Students will get acquainted about microbes associated with different natural habitat, microbial interactions, and applications of microbes in pollution control | U, Analyze |
| CO2 | Students will get equipped with methods of isolating microbes from varied environments, assaying presence of microbes in polluted water, soil and air. | U, Analyze |
| CO3 | They will get content thus, finds its application in becoming an entrepreneur in eco-friendly products and controlling environmental pollution, the most wanted field of the present scenario at global level.. | U,A |

## Credit and Marking Scheme

| | Credits | Marks | | Total Marks |
|---|---|---|---|---|
| | | Internal | External | |
| **Theory** | 4 | 10 | 40 (Minimum Passing marks 14) | **50** |
| **Practical** | 2 | 5 | 20 | **25** |
| **Total** | **6** | | | |

## Evaluation Scheme

| | Marks | |
|---|---|---|
| | **Internal** | **External** |
| **Theory** | 1 Internal Exams of 10 Marks | 1 External Exams (At the End of Semester) |
| **Practical** | Continuous Evaluation (5 marks) | 1 External Exams (At the End of Semester) |

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## Content of the Course
## Theory

**No. of Lectures (in hours per week):** 5 Hrs. per week
**Total No. of Lectures:** 60 Hrs.

**Maximum Marks:** 40

| Units | Topics | No. of Lectures |
|---|---|---|
| I | Environment: Basic concepts and issues; environmental pollution: types and methods for the measurement; methodology of environmental management-problem solving approach, its limitations; air pollution and its control through biotechnology, air sampling techniques; biodiversity: conservation and management. | 12 |
| II | Water pollution and its control: Water as a scarce natural resource, need for water management, sources and measurement of water pollution, waste water treatment-physical, chemical and biological treatment processes; Algal blooms and human health. | 12 |
| III | Microbiology of waste water treatment: Aerobic process-activated sludge, oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds; anaerobic processes-anaerobic digestion, anaerobic filters, upflow anaerobic sludge blanket reactors; treatment schemes for waste waters of dairy, distillery, tannery industries; biotechnological application of microbes form extreme environment. | 12 |
| IV | Microbial degradation of xenobiotics in the environment- ecological considerations, decay behavior & degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides; bioaccumulation of metals and radio-nucleids and detoxification; bioremediation. | 12 |
| V | Biological N2 fixation, H2 production, biofertilizers and biopesticides; solid wastes; sources and management (composting, vermiculture and methane production). Single cell protein (Spirulina, yeast, mushroom); global environmental problems-ozone depletion, UV-B greenhouse effect and acid rain, their impact and biotechnology approaches for management. | 12 |

**List of Recommended Books**


- Wastewater Engineering- Treatment, disposal and Reuse. Metcalf and Eddy, Inc,.Tata McGraw Hill, New Delhi.


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**2025-26**

# Faculty of Science

**Master of Science (M.Sc.)**
**SUBJECT: MICROBIOLOGY**
**M.Sc. III Semester**
**Paper-II**
**Core Paper**
**Medical Microbiology**

## Course Outcomes

| CO. No. | Course Outcomes | Cognitive Level |
|---|---|---|
| CO1 | Students are imparted with the concepts in medical microbiology including: Pathogenic microorganisms and the mechanisms by which they cause disease in the human body, Preventive measures for diseases, factors that limit microbial growth and survival in diseases, diagnostics strategies | U, K |
| CO2 | Students can define role of the human body's normal microflora and key concepts in immunology and immunization. | U, K |
| CO3 | Students will be enriched to serve the society with intense knowledge of disease causing microbes | U, A |

## Credit and Marking Scheme

| | Credits | Marks | | Total Marks |
|---|---|---|---|---|
| | | Internal | External | |
| **Theory** | 4 | 10 | 40 (Minimum Passing marks : 14) | **50** |
| **Practical** | 2 | 5 | 20 | **25** |
| **Total** | **6** | | 75 | |

## Evaluation Scheme

| | Marks | |
|---|---|---|
| | **Internal** | **External** |
| **Theory** | 1 Internal Exams of 10 Marks | 1 External Exams (At the End of Semester) |
| **Practical** | Continuous Evaluation (5 marks) | 1 External Exams (At the End of Semester) |

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## Content of the Course

## Theory

**No. of Lectures (in hours per week):** 5 Hrs. per week
**Total No. of Lectures:** 60 Hrs. **Maximum Marks:** 40

| Units | Topics | No. of Lectures |
|---|---|---|
| I | Early discovery of pathogenic microorganisms; development of bacteriology as scientific disciplines; contribution made by eminent scientists. Normal microbial flora and the human host; role of resident flora; classification of medically important microorganisms, dermatophytes, dimorphic fungi, opportunistic fungal pathogens, laboratory diagnosis of pathogenic fungi. | 12 |
| II | Mechanism of pathogenicity, virulence and protection, organs and cells involved in immune system and immune response; antigens, antigenic specificity, antigenic determinants, cellular and humoral basis of immunity: immunoglobulins, antigen and antibody reactions, immunological | 12 |
| III | Classification of pathogenic bacteria- *Staphylococcus, Streptococcus, Pneumococcus, Corynebacteria, Bacillus, Clostridium,* non-sporing anaerobes, organisms belonging to *Enterobacteriaceae. Vibrios*, non-fermenting bacilli, *Yersinia, Haemophilus, Bordetella, Brucella, Mycobacteria, Spirochaetes,* Actinomycetes, *Ricketisae, Chlamydiae.* | 12 |
| IV | Important RNA and DNA viral pathogens; virus host interactions; pox viruses, adenoviruses, picornaviruses, orthomyxoviruses, paramyxoviruses, arboviruses, rhabdoviruses; general properties of pathogenic protozoans and diseases caused by them, slow virus disease. | 12 |
| V | Laboratory control of antimicrobial therapy; strategies/ approaches (conventional and modern) in the diagnosis of important disease/ syndrome; meningitis, urinary tract infection, sexually transmitted diseases, pyrexia of unknown origin, wound infection etc. | 12 |

**List of Recommended Books**


1. Mims CA (2004). Medical Microbiology, 3rd ed, Mosby
2. Carter JB & Saunders VA (2007) Virology-Principles and Applications, John Wiley and Sons
3. Paniker CKJ (2007). Ananthanarayan and Paniker's Textbook of Microbiology, Orient Longman Pvt. Limited, India.
4. Greenwood D, Slack RCB & Peutherer JF (2006). Medical Microbiology, A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis & Control, Churchill Livingstone, Elsevier, India.

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# Faculty of Science

**Master of Science (M.Sc.)**

**SUBJECT: MICROBIOLOGY**

**M.Sc. III Semester**

**Paper-III**

**AGRICULTURE MICROBIOLOGY**

**2025-26**

## Course Outcomes

| CO. No. | Course Outcomes | Cognitive Level |
|---|---|---|
| On completion of this course, the learners - | | |
| CO 1 | learns plant microbe interactions for the applications in biofertilizer production and gene protection etc. | U, A |
| CO 2 | will also familiarize with the concept of microbes involved in diseases of economically significant crops, integrated pest management and disease control measures, | U, A, |
| CO 3 | attains knowledge of techniques to access and improve soil quality for increased crop production. | U,A |

## Credit and Marking Scheme

| | Credits | Marks | | Total Marks |
|---|---|---|---|---|
| | | Internal | External | |
| **Theory** | 4 | 10 | 40 (Minimum Passing marks 14) | **50** |
| **Practical** | 2 | 5 | 20 | **25** |
| **Total** | **6** | | | |

## Evaluation Scheme

| | Marks | |
|---|---|---|
| | **Internal** | **External** |
| **Theory** | 1 Internal Exams of 10 Marks | 1 External Exams (At the End of Semester) |
| **Practical** | Sessional (5 marks) | 1 External Exams (At the End of Semester) |

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## Content of the Course
## Theory

**No. of Lectures (in hours per week):** 5 Hrs. per week
**Total No. of Lectures:** 60 Hrs.
**Maximum Marks:** 40

| Units | Topics | No. of Lectures |
|---|---|---|
| I | History, scope and development of agricultural microbiology, rhizosphere and phyllosphere: concept, importance, factors affecting microbial diversity. | 10 |
| II | Soil health: crop residues, humus, mineralization, immobilization, soil-sickness, composting, vermicomposting, green manure. Effect of crop residues on plant growth; biodegradation of pesticides and pollutants; biodegradation fate, bioavailability, acceleration, bioremediation. Biofertilizers: types, production, formulation and constraints. | 15 |
| III | General idea about major agricultural pests: Plant diseases- late blight potato. downy mildew of pea, stem gall of coriander, powdery mildew / rust / smut, rust of linseed, Ergot of bajara, Anthracnose of soybean, Tikka disease of groundnut, wilt of arhar, bacterial blight of paddy, citrus canker, leaf curl of papaya, little left of brinjal. Insects: gram, soybean. Weeds: *Parthenium, Xanthium, Waterhyacinth, Cyperus, Phalaris.* | 15 |
| IV | Post harvest losses of agricultural products: causes, problems and management recent trends in pest management: strategies, mass production, formulation and application technology, achievements, constraints | 10 |
| V | Biotechnology in agriculture: the new green revolution, transgenic crops, gene protection technology, frost control technology, resistant varieties. Bioconversion futurology: exploitation of agricultural wastes for food / feed and fuel | 10 |

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# Faculty of Science

**Master of Science (M.Sc.)**

**SUBJECT: MICROBIOLOGY**

***SESSION 2025-26***

**M.Sc. III Semester**

**Paper-IV (ELECTIVE)**

**Bioprocess Engineering and Technology**

## Course Outcomes

| CO. No. | Course Outcomes | Cognitive Level |
|---|---|---|
| On completion of this course, the learners - | | |
| CO 1 | acquires theoretical and experimental knowledge of strain improvement of microbes for mass production of microbial products like ethanol, antibiotics vitamins, enzymes etc. | U, A |
| CO 2 | will acquire the skill entangled in microbial examination of dairy products as well as production of fermented food and microbial protein. | U, A |

## Credit and Marking Scheme

| | Credits | Marks | | Total Marks |
|---|---|---|---|---|
| | | Internal | External | |
| **Theory** | 4 | 10 | 40 | **50** |
| **Practical** | 2 | 5 | 20 | **25** |
| **Total** | 6 | | | |

## Evaluation Scheme

| | Marks | |
|---|---|---|
| | **Internal** | **External** |
| **Theory** | 1 Internal Exams of 10 Marks | 1 External Exams (At the End of Semester) |
| **Practical** | Sessional (5 marks) | 1 External Exams (At the End of Semester) |

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# Content of the Course

## Theory

**No. of Lectures (in hours per week):** 2 Hrs. per week
**Total No. of Lectures:** 60 Hrs.

**Maximum Marks:** 60

| Units | Topics | No. of Lectures |
|---|---|---|
| I | Biofermentation: designing and application, principles of biofermentation, monitoring and control of parameters (pH, oxygen, agitation, temperature, foam etc.), batch & continuous; production medium, raw materials, isolations; maintenance, preservation & improvement of industrial strains, computer control of fermentation processes. | 10 |
| II | Downstream processing: Filtration of fermentation broths, ultra-centrifugation, recovery of biological products by distillation, superficial fluid extraction. | 10 |
| III | Industrial production of solvents: Ethyl alcohol, citric and acetic acids; enzymes; amylases, proteases, cellulases; vitamins: vitamin B12, vitamin C, antibiotics (penicillin, streptomycin, tetracycline and griseofulvin). Microbes in petroleum industry (oil recovery); immobilized cells & enzymes. | 10 |
| IV | Microbiology of food: sources and types of microorganisms in food, food borne pathogens, microbiological examination of food, spoilage of food, food preservation, fermented foods, microbial proteins. | 10 |
| V | Dairy microbiology: sources and types of microorganisms in milk, microbial examination of milk, pasteurization and phosphatase test, sterilization of milk, grades of milk, dairy products, fermented milk, butter & cheese. | 10 |

**List of Recommended Books:**


1. Biochemical Engineering, Aiba, S., Humphrey, A.E. and Millis, N.F. Univ of Tokyo Press, Tokyo.
2. Biochemical Reactors, Atkinson, B: Pion Ltd. London.
3. Biochemical Engineering Fundamentals, Baily, J.E. and Ollis, D.F. McGraw-Hill Book Co. New York.
4. Bioprocess Technology: Fundamental and Application, KTH, Stockholm.
5. Process Engineering in Biotechnology, Jackson, A.T., Prentice Hall, Engelwood Cliffs.
6. Bioprocess Engineering: Basic Concepts, Shuler, M.L. and Kargi, F., Prentice Hall, Engelwood Cliffs.
7. Principles of Fermentation Technology, Stanbury, P.F. and Whitaker, A. Pergamon Press, Oxford.
8. Bioreaction Engineering principles, Nielson, J. and Billadsen, J. Plenum Press.


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