# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**

**688**

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Programme Educational Objectives of the B.Sc. in Microbiology Programme at Sourashtra College, Madurai are given below and are numbered from PEO1 to PEO5.

| | |
|---|---|
| **PEO 1** | To provide in–depth knowledge about core areas of biosciences such as biotechnology, biochemistry and microbiology. |
| **PEO 2** | To make students competent in the field of biosciences and allied areas by providing them hands on experience in basic tools and techniques |
| **PEO 3** | To instil the ability for research and entrepreneurship in the students along with strong ethics and communication skills |
| **PEO 4** | To inculcate, facilitate, motivate and promote knowledge technical skills in core areas of biological sciences including advanced tools and techniques like genomics, proteomics and transcriptomics to young aspirants and to equip and motivate the students to pursue higher education and research in reputed institutes at national and international level in the field Science |
| **PEO 5** | To develop trained human resource in the field of advanced translational research and to develop graduates with a strong professional ethics and moral duties that will positively affect their profession, community, society and Nation at large |

## POSTGRADUATE (PG) PROGRAMME OUTCOMES (POs)

Postgraduate (M.A., **M.Sc.,** M.Com., M. Com (CA)., M.B.A., M.C.A., etc.,) is a two year degree Programme with 4 semesters consisting the following Programme Outcomes (POs) under various criteria including critical thinking, problem solving, effective communication, societal/ citizenship/ ethical credibility, sustainable growth and employable abilities.

| | |
|---|---|
| **PO 1** | **Critical Thinking**: Intellectual exploration of knowledge towards actions in clear and rational manner by understanding the logical connections between ideas and decisions. |
| **PO 2** | **Problem Solving**: Understanding the task/ problem followed by planning and narrow execution strategy that effectively provides the solution. |
| **PO 3** | **Effective Communication**: Knowledge dissemination by oral and verbal mechanisms to the various components of our society. |
| **PO 4** | **Societal/ Citizenship/ Ethical Credibility**: Realization of various value systems/ moral dimensions and demonstrate the empathetic social concern as well as equity in all the decisions, executions and actions. |
| **PO 5** | **Environmental Concern and Sustainable Growth**: Understanding the emerging environmental challenges and provide the possible contribution in sustainable development that integrates environment, economy and employment. |
| **PO 6** | **Skill Development and Employable Abilities**: Adequate training in relevant skill sector and creating employable abilities among the PG. |

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## PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of **M.Sc. Microbiology** Programme, the students are expected to

| | |
|---|---|
| **PSO 1** | **Placement** – Prepare the students in varied disciplines like agriculture, industry–medical, pharma, dairy, hotel, food and food processing, immunological, cosmetics, vermitechnology and water treatment for effective and respectful placement. |
| **PSO 2** | **Critical Thinking** – Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively |
| **PSO 3** | **Analytical & Scientific Reasoning** – Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models. |
| **PSO 4** | **Entrepreneurship** – To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. |
| **PSO 5** | **Research and Development** – Design and implement HR systems that comply with good laboratory, practices, following ethical values, leading the organization towards growth and development. |
| **PSO 6** | **Contribution to Society** – To contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level. |

## DISTRIBUTION OF CREDITS (PG PROGRAMME)

| Semester | Courses | Number of Courses | Hours | Credits | Total Credits |
|---|---|---|---|---|---|
| I – IV | Core | 14 | 5 – 6 | 4 – 5 | 58 |
| I – IV | Elective | 5 | 5 – 6 | 3 – 5 | 17 |
| III | Non Major Elective (NME) | 1 | 4 | 3 | 3 |
| II-IV | SEC (Skill Enhancement Course) | 2 | 3-4 | 2-3 | 5 |
| IV | Project | 1 | 10 | 7 | 7 |
| III | Internship | 1 | - | 1 | 2 |
| | TOTAL CREDITS | | | | 92 |

**Extra credits may be earned through SWAYAM Courses/other online courses**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

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## M.Sc. MICROBIOLOGY – I YEAR

## COURSE STRUCTURE – SEMESTER – I

| S. No | Course Code | Course Title | Hrs./ Week | Exam (Hrs.) | CA | SE | Total | Credits |
|---|---|---|---|---|---|---|---|---|
| 1. | 24PMBC11 | **Core – 1:** General Microbiology and Microbial Physiology | 5 | 3 | 25 | 75 | 100 | 4 |
| 2. | 24PMBC12 | **Core – 2:** Molecular Biology and Microbial Genetics | 5 | 3 | 25 | 75 | 100 | 4 |
| 3. | 24PMBC13 | **Core – 3:** Bioprocess Technology | 4 | 3 | 25 | 75 | 100 | 4 |
| 4. | 24PMBCP1 | **Core – 4: Core Practical – I:** Lab in General Microbiology | 6 | 3 | 40 | 60 | 100 | 4 |
| 5. | 24PMBCP2 | **Core – 5: Core Practical – II:** Lab in Molecular Biology and Microbial Genetics | 6 | 3 | 40 | 60 | 100 | 4 |
| 6. | 24PMBE11 | **Elective – 1: *** Microbial Biochemistry | 4 | 3 | 25 | 75 | 100 | 3 |
| | 24PMBE12 | Biophysics and Bioinstrumentation | | | | | | |
| | 24PMBE13 | Nano Biotechnology | | | | | | |
| | | **TOTAL** | **30** | | | | | **23** |

***One elective course to be chosen from THREE courses**

## SEMESTER – II

| S. No | Course Code | Course Title | Hrs./ Week | Exam (Hrs.) | CA | SE | Total | Credits |
|---|---|---|---|---|---|---|---|---|
| 1. | 24PMBC21 | **Core – 6:** Medical Bacteriology and Mycology | 5 | 3 | 25 | 75 | 100 | 4 |
| 2. | 24PMBC22 | **Core – 7:** Medical Virology and Parasitology | 5 | 3 | 25 | 75 | 100 | 4 |
| 3. | 24PMBCP3 | **Core – 8: Core Practical – III:** Medical Microbiology | 6 | 3 | 40 | 60 | 100 | 4 |
| 4. | 24PMBE21 | **Elective – 2:*** Epidemiology | 5 | 3 | 25 | 75 | 100 | 4 |
| | 24PMBE22 | Clinical Diagnostic Microbiology | | | | | | |
| | 24PMBE23 | Bioremediation | | | | | | |
| 5. | 24PMBE24 | **Elective – 3:*** Bioinformatics | 5 | 3 | 25 | 75 | 100 | 4 |
| | 24PMBE25 | Biosafety, Bioethics and IPR | | | | | | |
| | 24PMBE26 | Clinical Research and Clinical Trials | | | | | | |
| 6. | 24PMBS21 | **SEC:** Vermitechnology | 4 | 3 | 25 | 75 | 100 | 3 |
| 7. | | Internship | – | – | – | – | – | – |
| | | **TOTAL** | **30** | | | | | **23** |

***One elective course to be chosen from THREE courses**

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## M.Sc. MICROBIOLOGY – II YEAR

## COURSE STRUCTURE – SEMESTER – III

| S. No. | Course Code | Course Title | Hrs. / Week | Exam (Hrs.) | CA | SE | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| 1 | 24PMBC31 | **Core – 9:** Immunology and Microbial Genetics | 6 | 3 | 25 | 75 | 100 | 4 |
| 2 | 24PMBC32 | **Core – 10:** Molecular Biology and Recombinant DNA Technology | 6 | 3 | 25 | 75 | 100 | 4 |
| 3 | 24PMBCP4 | **Core –11:**<br>**Core Practical – IV:** Immunology, Microbial Genetics and Molecular Biology | 5 | 3 | 40 | 60 | 100 | 4 |
| 4 | 24PMBC33 | **Core – 12:** Fermentation Technology | 6 | 3 | 25 | 75 | 100 | 4 |
| 5 | 24PMBE31 | **Elective – 4:** Bioinstrumentation | 3 | 3 | 25 | 75 | 100 | 3 |
| 6 | 24PMBN31 | **SEC: NME:** Organic Farming and Biofertilizer | 4 | 3 | 25 | 75 | 100 | 3 |
| 7 | 24PMBP31 | Internship | – | – | – | – | – | 2 |
| | | **TOTAL** | **30** | | | | **700** | **24** |

## SEMESTER – IV

| S. No. | Course Code | Course Title | Hrs. / Week | Exam (Hrs.) | CA | SE | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| 1 | 24PMBC41 | **Core – 13:** Food and Environmental Microbiology | 6 | 3 | 25 | 75 | 100 | 5 |
| 2 | 24PMBCP5 | **Core – 14:**<br>**Core Practical – V:** Applied Microbiology | 6 | 3 | 40 | 60 | 100 | 5 |
| 3 | 24PMBCV1 | **Core – 15:** Project with Viva – Voice | 10 | 3 | 40 | 60 | 100 | 7 |
| 4 | 24PMBE41 | **Elective – 5:** Research Methodology and Biostatistics | 4 | 3 | 25 | 75 | 100 | 3 |
| 5 | 24PMBS41 | **SEC or Professional Competency Skill –** Life Science for Competitive Examinations | 4 | 3 | 25 | 75 | 100 | 2 |
| | | **TOTAL** | **30** | | | | **500** | **22** |

**Credits: 23+23+24+22 = 92**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

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## COURSE STRUCTURE – SEMESTER – III

| S. No. | Course Code | Course Title | Hrs. / Week | Exam (Hrs.) | CA | SE | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| 1 | 24PMBC31 | **Core – 9:** Immunology and Microbial Genetics | 6 | 3 | 25 | 75 | 100 | 4 |
| 2 | 24PMBC32 | **Core – 10:** Molecular Biology and Recombinant DNA Technology | 6 | 3 | 25 | 75 | 100 | 4 |
| 3 | 24PMBCP4 | **Core –11:** **Core Practical – IV:** Immunology, Microbial Genetics and Molecular Biology | 5 | 3 | 40 | 60 | 100 | 4 |
| 4 | 24PMBC33 | **Core – 12:** Fermentation Technology | 6 | 3 | 25 | 75 | 100 | 4 |
| 5 | 24PMBE31 | **Elective – 4:** Bioinstrumentation | 3 | 3 | 25 | 75 | 100 | 3 |
| 6 | 24PMBN31 | **SEC: NME:** Organic Farming and Biofertilizer | 4 | 3 | 25 | 75 | 100 | 3 |
| 7 | 24PMBP31 | Internship | – | – | – | – | – | 2 |
| | | **TOTAL** | **30** | | | | **700** | **24** |

**CA – Class Assessment (Internal)**

**SE – Summative Examination**

**SEC – Skill Enhancement Course**

**NME – Non – Major Elective**

**T – Theory**

**P – Practical**

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| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBC31 | IMMUNOLOGY, IMMUNOTECHNOLOGY AND MICROBIAL GENETICS | CORE – 9 | 6 | - | 4 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | III | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | ✓ | Skill Oriented | | ✓ | Entrepreneurship | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | ✓ | Gender | | Environment and Sustainability | | Human Values | ✓ | Other Values | | |

**COURSE DESCRIPTION:**

The course introduces students to a wide range of topics in immunology starting from cells of immune system, innate and adaptive immune systems, humoral immunity, antibody structure and function, basic immunological techniques, autoimmunity, hypersensitivity and vaccine production

**COURSE OBJECTIVES:**

- discuss immunity, organs and cells involved in immunity and ompare the types of antigens and their properties and describe immunoglobulin and its types. Categorize MHC and understand its significance.
- elucidate the mechanisms of different hypersensitivity reactions and list out the Vaccines and discuss their development and acquire knowledge the structure DNA in prokaryotes and eukaryotes and explain out gene transfer studies in microbes.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | categorize the immune response to a variety of antigens. Identify different immune cells involved in immunity. | Upto K5 |
| CO 2 | justify the significance of MHC molecules in immune response and antibody production. | Upto K5 |
| CO 3 | design antibodies and evaluate immunological assays in patient samples | Upto K5 |
| CO 4 | analyze genomic DNA of prokaryotes and eukaryotes. | Upto K5 |
| CO 5 | summarize gene transfer mechanisms for experimental study. | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## IMMUNOLOGY, IMMUNOTECHNOLO GY AND MICROBIAL GENETICS

**UNIT – I:**

Introduction to biology of the immune system – Cells and organs of Immune System. T and B lymphocytes – Origin, development, differentiation, lymphocyte subpopulation in humans. Innate immunity– Complement, Toll–like receptors and other components. Acquired immunity – Active and Passive immunity. Antigens – features associated with antigenicity and immunogenicity. Basis of antigen specificity. MHC genes and products, Structure of MHC molecules, Genetics of HLA Systems – Antigens and HLA typing. Antigen processing and presentation to Tlymphocytes.

**UNIT– II:**

Immunoglobulins. Theories of antibody production. Class switching and generation of antibody diversity. Monoclonal and polyclonal antibodies. Complement system – mode of activation– Classical, Alternate and Lectin pathways, biological functions. Antigen recognition – TCR, Diversity of TCR, T cell surface alloantigens, lymphocyte activation, clonal proliferation and differentiation. Physiology of acquired immune response – various phases of HI, CMI – Cell mediated cytotoxicity, DTH response.

**UNIT– III:**

Hypersensitivity – Types and mechanisms, Autoimmunity, Tumor Immunity and Transplantation immunology. Immunodeficiency–Primary immunodeficiency and Secondary immunodeficiencies. Genetics of Immunohematology – Genetic basis and significance of ABO and other minor blood groups in humans, Bombay blood group, Secretors and Non–secretors, Rh System and genetic basis of D– antigens. Diagnostic Immunology – Precipitation reaction, Immunodiffusion methods – SRID, ODD. Immunoelectrophoresis – Rocket and Counter current electrophoresis. Agglutination – Hemagglutination – Hemagglutination inhibition. Labeled AssayImmunofluorescence assay, Radio immunoassay, FISH, ELISA. Flow cytometry. Immune regulation mechanisms – immuno–induction, immuno– suppression, immunotolerance, immuno–potentiation, Immunomodulation. Role of cytokines, lymphokines and chemokines. Introduction to Vaccines and Adjuvants – Types of vaccines. Development of vaccines and antibodies in plants. Immunomics – Introduction and Applications. Antigen engineering for better immunogenicity and use for vaccine development–multiepitope vaccines. Reverse vaccinology

**UNIT– IV:**

Structural of prokaryotic and eukaryotic genome. Introduction to prokaryotic genomic structure, Eukaryotic Genome – Structure of chromatin, chromosome, centromere, telomere, nucleosome. Modifications– methylation, acetylation, phosphorylation and its effect on structure and function of chromatin, DNA methylation and gene imprinting, organelle genome.

**UNIT– V:**

Gene Transfer Mechanisms– Conjugation and its uses. Transduction, Generalized and Specialized, Transformation– Natural Competence and Transformation. Transposition and Types of Transposition reactions. Insertion sequences, complex and compound transposons – T10, T5, and Retroposon. Mechanism – Transposons of E. coli, Bacteriophage and Yeast. Importance of transposable elements in horizontal transfer of genes and evolution.

**TEXT BOOKS:**


1. Coico R., Sunshine G. and Benjamini E. (2003). ***Immunology – A Short Course.*** (5th Edition). Wiley–Blackwell, New York.
2. Owen J. A., Punt J., Stranford S. A. and Kuby J. (2013). ***Immunology***, (7th Edition). W. H. Freeman and Company, New York.
3. Abbas A. K., Lichtman A. H. and Pillai S. (2021). ***Cellular and Molecular Immunology***. (10th Edition). Elsevier.
4. Malacinski G.M. (2008). ***Freifelder's Essentials of Molecular Biology***. (4th Edition). Narosa Publishing House, New Delhi.
5. Gardner E. J. Simmons M. J. and Snusted D.P. (2006). ***Principles of Genetics.*** (8th Edition). Wiley India Pvt. Ltd.


**REFERENCE BOOKS:**


1. Travers J. (1997). ***Immunobiology – The Immune System in Health and Disease***. (3rd Edition). Current Biology Ltd. New York.
2. Delves P.J., Martin S., Burton D. R. and Roitt I. M. (2006). ***Roitt's Essential Immunology.*** (11th Edition). Wiley–Blackwell.
3. Hay F. C. and Westwood O. M. R. (2002). ***Practical Immunology*** (4th Edition). Wiley–Blackwell.
4. Glick B. R. and Patten C.L. (2018). ***Molecular Biotechnology – Principles and Applications of Recombinant DNA.*** (5th Edition). ASM Press.
5. Russell P.J. (2010). ***Genetics – A Molecular Approach***. (3rd Edition). Pearson New International Edition.


**DIGITAL TOOLS:**

- https://www.ncbi.nlm.nih.gov/books/NBK279395/
- https://med.stanford.edu/immunol/phd–program/ebook.html
- https://ocw.mit.edu/courses/hst–176–cellular–and–molecular–immunologyfall–2005/pages/lecture–notes/

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 3 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 1 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

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**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBC32 | MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY | CORE–10 | 6 | - | 4 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | III | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | | Skill Oriented | ✓ | | Entrepreneurship | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | ✓ | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

Students will gain an insight to the chemical and molecular processes that occur in the cells. The theoretical and practical application of recombinant DNA technology includes. understanding and analyzing genomics, proteomics, genetic engineering of microbes, animal and plant cells and their protein expression.

**COURSE OBJECTIVES:**

- Provide knowledge on the structure, replication and repair mechanisms of DNA. Illustrate the structure, functions and significance of RNA.
- Discuss the gene regulatory mechanisms in prokaryotes and eukaryotes and importance of mutations.
- Provide in depth knowledge about artificial gene transfer mechanisms and selection of Recombinants
- Impart knowledge on various molecular techniques and their importance in biotechnology
- Explain the applications of genetic engineering in various fields.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | analyze, demonstrate and appreciate DNA replication and protein synthesis. | Upto K5 |
| CO 2 | investigate the types of mutation and its impact on microbes. Illustrate various strategies on gene cloning | Upto K5 |
| CO 3 | analyze, modify and characterize DNA modifying enzymes. | Upto K5 |
| CO 4 | illustratively assess the molecular techniques for DNA and protein analysis. | Upto K5 |
| CO 5 | adopt the applications of Genetic Engineering in the field of agriculture and medicine towards scientific research. | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY**
**K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY

**UNIT – I:**

DNA replication – modes and enzymes involved. Detailed mechanism of semi–conservative replication. Prokaryotic and eukaryotic transcription. Structure and processing of m–RNA, rRNA and t–RNA. Ribosomes. Genetic Code and Wobble hypothesis, Translation in prokaryotes and eukaryotes, post translational modifications.

**UNIT– II:**

Gene regulation and expression – Lac operon, arabinose and tryptophan operons. Gene regulation in eukaryotic systems – repetitive DNA, gene rearrangement, promoters, enhancer elements. Molecular basis of gene mutation – Types of mutations – base substitutions, frame shift, deletion insertion, duplication, inversion. Silent, conditional and lethal mutation. Chemical mutagenesis. Repair of DNA damage. Photoreactivation. SOS repair mechanism. Base excision repair. Nucleotide excision repair. Detection and analysis of mutations (Replica plating, Antibiotic enrichment, Ames test).

**UNIT– III:**

Tools and methods in gene cloning. Restriction endonucleases – nomenclature, classification and characteristics – DNA methylases, DNA polymerases, Ligases. Adapters, linkers and homopolymer tailing. Artificial gene transfer techniques – electroporation, microinjection, protoplast fusion and microparticle bombardment. Screening for recombinants. Gene cloning vectors for prokaryotes and eukaryotes – cloning properties and types of plasmids vectors (pBR322 and derivatives, pUC vectors and pGEM3Z) – Phage Vectors(M13 and Lambda), cosmids, phasmids, phagemids and BACs – Eukaryotic vectors – Yeast vectors – Animal and plant vectors – expression vectors. Shuttle vectors – Expression of foreign genes in bacteria, animal, plant, algae and fungi – merits and demerits.

**UNIT– IV:**

Genomic DNA and cDNA library – Construction and Screening. Substrative hybridization for tissue specific DNA libraries. Techniques in genetic engineering Characterization of cloned DNA: Hybrid arrested translation (HAT) – Restriction mapping – restriction fragment length polymorphism (RFLP) – Polymerase chain reaction (PCR) – Principles, types and their applications. DNA sequencing – Primer walking, Sanger's method and automated sequencing methods. Pyrosequencing – DNA chips and micro array. Protein engineering and techniques Site directed mutagenesis – methods – Design and construction of novel proteins and enzymes, Basic concepts in enzyme engineering, engineering for kinetic properties of enzymes. protein folding, protein sequencing, protein crystallization. Applications of protein engineering

**UNIT– V:**

Plant biotechnology – constituents and concepts of sterilization – preparation, isolation and selection of explant. Suspension cell culture, callus culture, protoplast isolation, culture & fusion. Anther and pollen culture for production. Animal biotechnology – equipment and media used for animal cell culture technology. Primary and established cell line culture and culture media. Applications of animal cell cultures. Serum protein media viability and cytotoxicity. Applications of Genetic Engineering – transgenic animals, Recombinant Cytokines and their use in the treatment of animal infections. Monoclonal Antibodies in Therapy– Vaccines and their Applications in Animal Infections – Human Gene Therapy – Germline and Somatic Cell Therapy – Exvivo Gene Therapy. In–vivoGene Therapy. Vectors in Gene Therapy–Viral and Non–Viral Vectors. Transgenic Plants.

**TEXT BOOKS:**


1. Malacinski G.M. (2008). ***Freifelder's Essentials of Molecular Biology***. (4th Edition). Narosa Publishing House, New Delhi.
2. Snusted D.P. and Simmons M. J. (2019). ***Principles of Genetics***. (7th Edition). John Wiley and Soms, Inc.
3. Dale J. W., Schantz M.V. and Plant N. (2012). ***From Gene to Genomes – Concepts and Applications of DNA Technology***. (3rd Edition). John Wileys and Sons Ltd.
4. Primrose S.B. and Twyman R. M. (2006). ***Principles of Gene Manipulation and Genomics.*** (7th Edition). Blackwell Publishing.
5. Maloy S. R. Cronan J.E. Jr. and Freifelder D. (2011). ***Microbial Genetics***. (2nd Edition). Narosa Publishing House Pvt. Ltd


**REFERENCE BOOKS:**


1. Brown T. A. (2016). ***Gene Cloning and DNA Analysis– An Introduction***. (7th Edition). John Wiley and Sons, Ltd.
2. Glick B. R. and Patten C.L. (2018). ***Molecular Biotechnology – Principles and Applications of Recombinant DNA***. (5th Edition). ASM Press.
3. Russell P.J. (2010). Genetics – A Molecular Approach. (3rd Edition). Pearson New International Edition.
4. Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). ***Molecular Genetics of Bacteria***. (4th Edition). ASM Press Washington–D.C. ASM Press.
5. Dale J. W., Schantz M.V. and Plant N. (2012). ***From Gene to Genomes – Concepts and Applications of DNA Technology***. (3rd Edition). John Wileys and Sons Ltd.


**DIGITAL TOOLS:**

- https://microbenotes.com/gene–cloning–requirements–principle–steps–applications/
- https://geneticeducation.co.in/what–is–transcriptomics
- https://www.molbiotools.com/usefullinks.html
- https://geneticeducation.co.in/what–is–transcriptomics
- https://courses.lumenlearning.com/boundless–biology/chapter/dna–replication/

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 3 | 1 | 1 | 3 |
| CO2 | 2 | 1 | 1 | 3 | 1 | 3 |
| CO3 | 3 | 3 | 1 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

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## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**

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| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBCP4 | CORE PRACTICAL – IMMUNOLOGY, MICROBIAL GENETICS AND MOLECULAR BIOLOGY | CORE–11 PRACTICAL – III | - | 6 | 4 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | III | 40 | 60 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | ✓ | Skill Oriented | ✓ | Entrepreneurship | | | | | | |
| | National | ✓ | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | ✓ | Human Values | ✓ | Other Values | | |

**COURSE DESCRIPTION:**

This course is intended to apply the knowledge to understand the microbial physiology, regulation of biochemical pathway and possible modifications for improved control over microorganisms for microbial product synthesis.

**COURSE OBJECTIVES:**

- Acquire adequate skills to perform blood grouping and serological reactions.
- Provide fundamental skills in preparation, separation and purification of immunoglobulin.
- Illustrate the significance of artificial transformation and mutations.
- Familiarize with routine molecular biological techniques.
- Discuss blotting techniques and PCR.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | perform and evaluate immunological reactions to aid diagnosis. | Upto K5 |
| CO 2 | assess the level of lymphocytes in a blood sample and purify immunoglobulin employing appropriate techniques. | Upto K5 |
| CO 3 | perform DNA extraction and gene transfer mechanisms, analyze and identify by gel electrophoresis | Upto K5 |
| CO 4 | utilize various molecular techniques for gene manipulation and detection of mutants. | Upto K5 |
| CO 5 | undertake novel research with techniques like PCR and blotting analysis. | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY**
**K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## CORE PRACTICAL – IMMUNOLOGY, MICROBIAL GENETICS AND MOLECULAR BIOLOGY

**UNIT – I:**

Hematological reactions – Blood Grouping – forward and reverse, Rh Typing Identification of various immune cells by morphology – Leishman staining, Giemsa staining. Agglutination Reactions– Latex Agglutination reactions– RF, ASO, CRP. Detection of HBs Ag by ELISA. Precipitation reactions in gels– Ouchterlony double immunodiffusion (ODD) and Mancini's single radial immunodiffusion (SRID) Immuno–electrophoresis and staining of precipitin lines Rocket immuno electrophoresis and counter current immuno electrophoresis

**UNIT– II:**

Preparation of lymphocytes from peripheral blood by density gradient centrifugation. Purification of immunoglobulin– Ammonium Sulphate Precipitation. Separation of IgG by chromatography using DEAE cellulose or Sephadex

**UNIT– III:**

Artificial Transformation Detection of Antibiotic resistant mutants Identification of mutants by replica plating method

**UNIT– IV:**

Isolation of genomic DNA from E. coli and analysis by agarose gel electrophoresis Separation of proteins by polyacrylamide gel electrophoresis (SDS–PAGE) Plasmid DNA isolation from E.coli.

**UNIT– V:**

Amplification of DNA by PCR Western blotting – Demonstration Southern blotting – Demonstration

**TEXT BOOKS:**


1. Roitt R.I.M (2001). ***Essential Immunology***. 10th Edn. Blackwell Scientific Publishers.
2. Glick B. R. and Patten C. L. (2018). ***Molecular Biotechnology – Principles and Applications of Recombinant DNA*** (5th Edition). ASM Press.
3. Gunasekaran P. (2007). ***Laboratory Manual in Microbiology***. New Age International.
4. James G Cappucino and Natalie Sherman. (2016). ***Microbiology – A Laboratory Manual***. (5th Edition). The Benjamin publishing company. New York.
5. Russell P. J. (2019). ***Genetics – A Molecular Approach*** (3rd Edition). Pearson Education, Inc.

**REFERENCE BOOKS:**


1. Stites D.P., Abba I. Terr, Parslow T.G.(1997). ***Medical Immunology***. 9th edn, Prentice Hall Inc.
2. Tizard, R.I. (2000) ***Immunology – An Introduction.*** 4thedn. Saunders College Publishing, Philadelphia.
3. Dale J. W., Schantz M. V. and Plant N. (2012). ***From Gene to Genomes – Concepts and Applications of DNA Technology***. (3rd Edition). John Wileys and Sons Ltd.
4. Sambrook J. and Russell D.W. (2001). ***Molecular Cloning: A Laboratory Manual***. (7th Edition). Cold Spring Harbor, N.Y: Cold Spring Harbor Laboratory Press.
5. Brown T.A. (2016). ***Gene Cloning and DNA Analysis***. (7th Edition). John Wiley and Jones, Ltd.


**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| **CO1** | **1** | **1** | **2** | **2** | **1** | **2** |
| **CO2** | **3** | **3** | **2** | **1** | **3** | **3** |
| **CO3** | **2** | **2** | **2** | **2** | **1** | **2** |
| **CO4** | **3** | **3** | **1** | **3** | **3** | **3** |
| **CO5** | **2** | **2** | **2** | **2** | **2** | **2** |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBC33 | FERMENTATION TECHNOLOGY | CORE–12 | 6 | - | 4 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | III | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | | Skill Oriented | ✓ | Entrepreneurship | | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | ✓ | Gender | | Environment and Sustainability | ✓ | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

This course covers the basic principles of fermentation and technologies of upstream and Downstream Processing. The students will learn overview of pharmaceutical microbiology and Production of pharmaceutical products

**COURSE OBJECTIVES:**

- Discuss fermentation and its types, sensitize on methods of strain development for improved yield.
- Impart knowledge on the fermenter design and types.
- Provide knowledge on the effective recovery and purification of the products.
- Explain the importance of pharmaceutical microbiology.
- Illustrate methods for production products using microorganisms and their quality control.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | develop microbial strains, carry out fermentation and recover the products of the process | Upto K5 |
| CO 2 | design fermenters according to needs for various products. | Upto K5 |
| CO 3 | recover the end products of the fermentation process economically | Upto K5 |
| CO 4 | utilize the knowledge on pharmaceutical microbiology for industrial production of products. | Upto K5 |
| CO 5 | produce therapeutic products from microbes employing technology and analyze the quality the products | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY**
**K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## FERMENTATION TECHNOLOGY

**UNIT – I:**

Bioprocesses – concepts and design. Industrially important microorganisms – Isolation, primary and secondary screening, preservation and improvement of industrially important strains. Upstream processing – Development of inoculums for fermentation process. Media for industrial fermentation – Formulation, optimization. Sterilization. Stages of upstream – Growth of inoculums, fermenter preculture and production fermentation. Types of fermentation – Batch, continuous, dual or multiple, surface, submerged, aerobic and anaerobic.

**UNIT– II:**

Fermenter – Design, types and construction, Instrumentation and control. Productivity. Yield coefficients. Heat production. Aeration and agitation. Gas exchange and mass transfer. Computer Applications in fermentation technology. Fermentation Economics

**UNIT– III:**

Downstream Processing – Recovery and purification of intracellular and extracellular products. Biomass separation by centrifugation, filtration, flocculation and other recent developments. Cell disintegration – Physical, chemical and enzymatic methods. Extraction – Solvent, two phase, liquid extraction, whole broth, aqueous multiphase extraction. Purification by different methods. Concentration by precipitation, ultra–filtration, reverse osmosis. Drying and crystallization.

**UNIT– IV:**

Overview of pharmaceutical microbiology – Ecology of microorganisms – Atmosphere, water, skin, respiratory flora of workers, raw materials, packaging, building equipment and their control measures. Design and layout of sterile manufacturing unit. Contamination and Spoilage of Pharmaceutical products – sterile injectable and noninjectable, ophthalmologic preparation, implants

**UNIT– V:**

Production of pharmaceutical products and quality assurance – Vaccines, immunodiagnostics, immuno–sera, immunoglobulin. Antibiotics – Penicillin, Griseofulvin, Metronidazole. Enzymes – Streptokinase, Streptodornase. Quality assurance and quality management in pharmaceuticals – In–Process, Final–Product Control and sterility tests. Regulatory aspects – BIS (IS), ISI, ISO, WHO and US certification

**TEXT BOOKS:**


1. Patel A. H. (2016). ***Industrial Microbiology***. (2nd Edition). Laxmi Publications, New Delhi.
2. Casida L. E. J. R. (2019). ***Industrial Microbiology***. New Age International Publishers. Sathyanarayana U. (2005). ***Biotechnology***. (1st Edition). Books and Allied (P) Ltd.
3. Reed G. (2004). ***Prescott and Dunn's Industrial Microbiology***. (4th Edition). CBS Publishers & Distributors.
4. Waites M. J., Morgan N. L., Rockey J. S. and Higton G. (2013). ***Industrial Microbiology: An Introduction.*** Wiley Blackwell Publishers.

**REFERENCE BOOKS:**


1. Stanbury P. T. and Whitaker. (2016). ***Principles of Fermentation Technology***. (3rd Edition). Pergamon Press. NY.
2. Handa S. S. and Kapoor V. K. (2022). ***Pharamcognosy***, (4th Edition). Vallabh Prakashan Publishers, New Delhi.
3. Kokate C. K., Durohit A. P. and Gokhale S. R. ***Pharmacognosy***. (2002). (12th Edition). Nirali Prakasham Publishers, Pune.
4. Hugo W. B. and Russell A. D. (2004). ***Pharmaceutical Microbiology***. (7th Edition). Blackwell Scientific Publication, Oxford.
5. Wallis, T.E. (2005). ***Text book of Pharmacognosy***. (5th Edition). CBS publishers and distributors, New Delhi.


**DIGITAL TOOLS:**

- https://ib.bioninja.com.au/options/untitled/b1–microbiology organisms/fermenters.html
- https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/penicillin.html
- https://www.sciencedirect.com/topics/biochemistry–genetics–andmolecularbiology/ethanol–fermentation
- https://www.usp.org/sites/default/files/usp/document/harmonization/genmethod/q05b_pf_ira_34_6_2008.pdf
- http://www.simbhq.org/

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 1 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**

705

| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBE31 | BIOINSTRUMENTATION | ELECTIVE–4 | 3 | - | 3 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | III | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | ✓ | Skill Oriented | | ✓ | Entrepreneurship | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | ✓ | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

Bioinstrumentation is an interdisciplinary field requiring knowledge of the basic principles in several areas including digital electronic systems, control systems, detection systems, and material biocompatibility.

**COURSE OBJECTIVES:**

- Explain the principles and working mechanisms of laboratory instruments.
- Discuss chromatography techniques and molecular biology techniques.
- Illustrate molecular techniques in biological applications.
- Acquire knowledge on spectroscopic techniques
- Demonstrate the use of radio isotopes in various techniques.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | make use of the laboratory instruments– laminar air flow, pH meter, centrifugation methods, biosafety cabinets following SOP | Upto K5 |
| CO 2 | apply chromatography techniques in the separation of biomolecules. | Upto K5 |
| CO 3 | perform molecular techniques like mutagenesis and their detection. | Upto K5 |
| CO 4 | estimate molecules in biological samples by adopting UV spectroscopic techniques | Upto K5 |
| CO 5 | cultivate organisms anaerobically | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY K4–ANALYSE, K5–EVALUATE**

## BIOINSTRUMENTATION

**UNIT – I:**

Basic laboratory Instruments. Aerobic and anaerobic incubator – Biosafety Cabinets – Fume Hood, pH meter, Lyophilizer, Flow cytometry. Centrifugation techniques: Basic principles of centrifugation – Standard sedimentation coefficient – measurement of sedimentation co–efficient; Principles, methodology and applications of differential, rate zonal and density gradient centrifugation – Applications in determination of molecular weight.

**UNIT– II:**

General principles of chromatography – Chromatographic Performance parameters; Types– Thin layer chromatography, Paper Chromatography, Liquid chromatography (LPLC &HPLC), Adsorption, ion exchange, Gel filtration, affinity, Gas liquid (GLC). Flash Chromatography and Ultra Performance convergence chromatography. Two dimensional chromatography. Stimulated moving bed chromatography (SEC).

**UNIT– III:**

Electrophoresis: Principle and applications – paper electrophoresis, Serum electrophoresis, starch gel electrophoresis, Disc gel, Agarose gel, SDS – PAGE, Immuno electrophoresis. Blotting techniques –Southern, northern and western blotting

**UNIT– IV:**

Spectroscopic techniques: Principle, simple theory of absorption of light by molecules, electromagnetic spectrum, instrumentation and application of UV– visible, FTIR spectrophotometer, Atomic Absorption Spectrophotometer, Flame spectrophotometer, NMR, ESR, Emission Flame Photometry and GC–MS. Detection of molecules in living cells – FISH and GISH. Biophysical methods: Analysis of biomolecules by Spectroscopy UV/visible.

**UNIT– V:**

Radioisotopic techniques: Principle and applications of tracer techniques in biology. Radioactive isotopes – radioactive decay; Detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger– Muller and Scintillation counters, auto radiography and its applications. Commonly used isotopes in biology, labeling procedures and safety aspects.

**TEXT BOOKS:**


1. Sharma B. K. (2014). ***Instrumental Method of Chemical Analysis***. Krishna Prakashan Media (P) Ltd.
2. Chatwal G. R and Anand S. K. (2014.) ***Instrumental Methods of Chemical Analysis.*** Himalaya Publishing House.
3. Mitchell G. H. (2017). ***Gel Electrophoresis: Types, Applications and Research***. Nova Science Publishers Inc.
4. Holme D. Peck H. (1998). ***Analytical Biochemistry***. (3rd Edition). Prentice Hall.
5. Jayaraman J. (2011). ***Laboratory Manual in Biochemistry***. (2nd Edition). Wiley Eastrn Ltd., New Delhi.

**REFERENCE BOOKS:**


1. Pavia D. L. (2012) ***Spectroscopy*** (4th Edition). Cengage.
2. Skoog A. and West M. (2014). ***Principles of Instrumental Analysis***. (14th Edition). W.B.Saunders Co., Philadephia.
3. Miller J. M. (2007***). Chromatography: Concepts and Contrasts*** (2nd Edition) WileyBlackwell.
4. Gurumani N. (2006). ***Research Methodology for Biological Sciences.*** (1st Edition) MJP Publishers.
5. Ponmurugan P. and Gangathara P. B. (2012). ***Biotechniques.*** (1st Edition). MJP Publishers.


**DIGITAL TOOLS:**

- https://norcaloa.com/BMIA
- http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction–types–uses–and–other–details–with–diagram/12489
- https://www.watelectrical.com/biosensors–types–its–working–and–applications.
- http://www.wikiscales.com/articles/electronic–analytical–balance /
- https://study.com/academy/lesson/what–is–chromatography–definition–types–uses.

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| **CO1** | **1** | **1** | **1** | **2** | **1** | **3** |
| **CO2** | **2** | **3** | **1** | **2** | **2** | **3** |
| **CO3** | **3** | **3** | **2** | **1** | **3** | **1** |
| **CO4** | **2** | **1** | **3** | **2** | **1** | **2** |
| **CO5** | **1** | **3** | **2** | **3** | **2** | **2** |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBN31 | ORGANIC FARMING AND BIOFERTILIZER TECHNOLOGY | NME | 3 | - | 2 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | III | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | | Skill Oriented | ✓ | | Entrepreneurship | ✓ | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | ✓ | |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | ✓ | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

This course is designed to develop critical understanding on various aspects of agronomy, plant nutrition, cropping methods and crop rotation.

**COURSE OBJECTIVES:**

- Impart knowledge on the importance, types and advantages of organic farming thereby creating awareness on conserving environment and natural resources, encouraging sustainable agriculture.
- Familiarize with the basic concepts of farm development and relate the development of organic farming in their countries to meet global trends.
- Explain the various types of biofertilizer and the scope in its production.
- Discuss biofertilizer production and its field application, promoting economy.
- Develop the skill to analyze the quality of packaging, storage, assess the shelf life and efficacy of biofertilizers

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | produce biofertilizers and distinguish between organic and conventional farming. | Upto K5 |
| CO 2 | plan a complete farm business including marketing, operation and financial outline | Upto K5 |
| CO 3 | practice the application of microbial bio–fertilizers in large scales, thereby increasing soil fertility. | Upto K5 |
| CO 4 | develop integrated farming for sustainable agriculture. | Upto K5 |
| CO 5 | promote the quality of packaging, storage, increase shelf life, accelerate the bio efficacy of bio fertilizers as per bis standards | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## ORGANIC FARMING AND BIOFERTILIZER TECHNOLOGY

**UNIT – I:**

Organic farming – Definition, relevance. Biological nutrient management – Organic manures, vermicompost, green manure, organic residue, biofertilizer soil amendments. Integrated pest and weed management – Use of biocontrol agents, bio pesticides etc. Organic and Conventional farming. Organic and Chemical farming – Comparison

**UNIT– II:**

Certification and Schemes – Certification and Schemes. Organic certification in brief. Integrated farming systemdefinition, goal, components. Factors affecting ecological balance. Land degradation. Soil health management. Models of IFS for rainfed and irrigated conditions and different categories of farmers. Government schemes – NPOF, NPOF, NHM, HMNEH, NPMSH&F and RKVY

**UNIT– III:**

Biofertilizers – Introduction, types, advantages and future perspective. Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia

**UNIT– IV:**

Cyanobacterial biofertilizers– Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers– AM mycorrhiza and ectomycorhiza. Nitrogen fixation –Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, potassium solubilization

**UNIT– V:**

Production technology – Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid bio–fertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers. Biofertilizers – Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

**TEXT BOOKS:**


1. Sharma A. K. (2001). ***Hand book of Organic Farming***. Agrobios.
2. Gaur A. C. (2006). ***Hand book of Organic Farming and Biofertilizers***. Ambika Book Agency.
3. Subba Rao N.S. (2017). ***Bio–fertilizers in Agriculture and Forestry***. (4th Edition). Med Tech publisher.
4. Subba Rao N. S. (2002). ***Soil Microbiology. Soil Microorganisms and Plant Growth.*** (4th Edition). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Sathe T.V. (2004). ***Vermiculture and Organic Farming***. Daya Publishers.


**REFERENCE BOOKS:**


1. Rakshit A. and Singh H. B. (2015). ***ABC of Organic Farming***. (1st Edition). Jain Brothers.
2. Dubey R. C. (2008). ***A Textbook of Biotechnology***. S. Chand & Co., New Delhi.
3. Bansal M. (2019). ***Basics of Organic Farming***. CBS Publisher.
4. Bhoopander G., Ram Prasad., (2019 ) ***Biofertilizer for sustainable agriculture and Environment***, Springer
5. Niir Board., ( 2012) (1st Edition ) ***Biofertiliser and organic farming***

**DIGITAL TOOLS:**

- https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html
- https://www.fao.org/organicag/oa–faq/oa–faq6/en/
- https://www.india.gov.in/topics/agriculture/organic–farming
- https://agriculture.nagaland.gov.in/bio–fertilizer/
- https://www.ccd.ngo/sustainable–agriculture.html?gclid=EAIaIQobChMI5a–KndCowIV2ZZLBR1ozQj9EAAYAiAAEgJW2_D_BwE

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



## COURSE STRUCTURE – IV SEMESTER

| S. No. | Course Code | Course Title | Hrs. / Week | Exam (Hrs.) | CA | SE | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| 1 | 24PMBC41 | **Core – 13:** Food and Environmental Microbiology | 6 | 3 | 25 | 75 | 100 | 5 |
| 2 | 24PMBCP5 | **Core – 14: Core Practical – V:** Applied Microbiology | 6 | 3 | 40 | 60 | 100 | 5 |
| 3 | 24PMBCV1 | **Core – 15:** Project with Viva – Voice | 10 | 3 | 40 | 60 | 100 | 7 |
| 4 | 24PMBE41 | **Elective – 5:** Research Methodology and Biostatistics | 4 | 3 | 25 | 75 | 100 | 3 |
| 5 | 24PMBS41 | **SEC or Professional Competency Skill –** Life Science for Competitive Examinations | 4 | 3 | 25 | 75 | 100 | 2 |
| | | **TOTAL** | **30** | | | | **500** | **22** |

**CA – Class Assessment (Internal)**

**SE – Summative Examination**

**SEC – Skill Enhancement Course**

**NME – Non –Major Elective**

**T – Theory**

**P – Practical**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBC41 | FOOD AND ENVIRONMENTAL MICROBIOLOGY | CORE–13 | 6 | - | 5 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | IV | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | ✓ | Skill Oriented | | ✓ | Entrepreneurship | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | ✓ | Gender | | Environment and Sustainability | ✓ | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

This course is designed to provide basic knowledge on application of microbiology on the area of food production and environment protection and sustainability.

**COURSE OBJECTIVES:**

- Discuss microorganisms involved in food spoilage
- Illustrate bacterial and nonbacterial food borne infections important in public health. Familiarize various national and international aspects of food safety and quality assurance
- Create awareness. about components of environment, environmental pollution, and detection methods
- Acquire in depth knowledge about solid and liquid waste treatments.
- Develop knowledge about organic matter degradation, bioremediation, and the environment risk assessment.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | utilize the knowledge on process of food contamination and spoilage to preserve food. | Upto K5 |
| CO 2 | use the knowledge on food borne disease to protect public health. | Upto K5 |
| CO 3 | explain the different types of microorganisms in water. identify the causes of water pollution and the methods for quality assessment of water and control of water borne diseases. | Upto K5 |
| CO 4 | apply knowledge about waste treatments and microbial decomposition and bio–remediation process in environmental cleanup. | Upto K5 |
| CO 5 | plan a clear approach on environmental issues. control pollution and explain protection laws to public. | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY**
**K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## FOOD AND ENVIRONMENTAL MICROBIOLOGY

**UNIT – I:**

Microorganisms of food– Scope of food Microbiology. Contamination and spoilage of food –vegetables, fruits, poultry, fish, eggs, meat and milk products and canned foods. Food Preservation – Temperature (low and high), drying, radiation and chemicals.

**UNIT– II:**

Food microbiology and public health. Food hazards. Food Bacterial infections. Nonbacterial food borne illness – Helminthes, nematodes, protozoa, toxigenic fungi and food borne virus. Microbiological quality standards for food. Government regulatory practices and policies – FDA, HACCP, BIS (IS), FSSAI–2014. Food adulteration and common food additives

**UNIT– III:**

Components of Environment: Hydrosphere, lithosphere, atmosphere, and biosphere – definitions with examples; Energy flow in the ecosystem– Carbon, Nitrogen, Sulfur and Phosphorous cycles. Physical factors affecting distribution of microorganisms in various environments. Predisposing factors for Environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases. Treatment and safety of drinking (potable) water, methods to detect potability of water samples. Space microbiology – Microbiological research in space environment.

**UNIT– IV:**

Waste management – Solid waste – Types – management – Factors affecting solid waste generation rates. Industrial effluent treatment, primary, secondary, tertiary, and advanced treatment process. Quality assessment of decontaminated matters and other biological effluents. Biological reference standards. Utilization of Solid Waste as Food, Feed and Fuel– Composting, Vermicomposting, Bio manure and Biogas production. E waste management

**UNIT– V:**

Degradation of organic matter – lignin, cellulose, hemicellulose, pectin, common pesticides– herbicides (2,4–D) and pesticides (DDT), heavy metals. Biodegradation of Xenobiotics – Recalcitrant Halocarbons, Recalcitrant TNTs, PCBs and Synthetic polymers. Biodegradation of Hydrocarbons. Biodeterioration of Textiles and Leather. Pollution Control Bodies and Environmental laws in India. Environmental impact assessment, EIA guidelines, US Environment protection Agency norms.

**TEXT BOOKS:**


1. Adams M. R. and Moss M. O. (1996). ***Food Microbiology***, New Age International (P) Limited Publishers, New Delhi.
2. Frazier W.C., Westhoff. D. C. and Vanitha K.N. (2013). ***Food Microbiology***. (6th Edition). McGraw Hill Education.
3. Jay J. M., Loessner M. J. and Golden D.A. (2006). ***Modern Food Microbiology***. (7th Edition). Springer.
4. Shrivastava A.K. (2003). ***Environment Auditing***. A. P. H. Publishing Corporation.
5. Tinsley, S. and Pillai, I. (2012). ***Environmental Management Systems – Understanding Organizational Drivers and Barriers***. Earthscan.

**REFERENCE BOOKS:**

1. Robinson R. K. (2000). ***Dairy Microbiology*** 3rd Edn, Elsevier Applied Science, London.
2. Hobbs, B.C. and Roberts, D, (1968), ***Food Poisoning and Food Hygiene*** 7th Edn. Edward Arnold: London.
3. Banwarst. G.J. (2003). ***Basic Food Microbiology*** 2nd Edn, CBS Publishers and distributors.
4. Bitton, G. (2011). ***Wastewater Microbiology***. (4th Edition). Wiley–Blackwell.
5. Bridgewater L. (2012). ***Standard Methods for the Examination of Water and Wastewater.*** American Public Health Association.

**DIGITAL TOOLS:**

- https://www.fssai.gov.in
- https://www.who.int/news–room/fact–sheets/detail/food–safety
- https://egyankosh.ac.in

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 1 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 1 | 1 | 3 |
| CO3 | 3 | 3 | 1 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBCP5 | CORE PRACTICAL – APPLIED MICROBIOLOGY | CORE–14 PRACTICAL – IV | - | 6 | 5 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | IV | 40 | 60 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | ✓ | Skill Oriented | | ✓ | Entrepreneurship | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | ✓ | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

The course gives an overview on the utilization and application of microbes in different industries that enrich human lives and environmental sustenance.

**COURSE OBJECTIVES:**

- Enumerate bacteria in milk for quality analysis
- Analyze methods for microbes from spoiled food
- Gain knowledge on microbes present in water
- Identification and characterization of nitrogen fixers.
- Gain knowledge on biofertilizer production. and field application.

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| **CO 1** | check the quality of milk | **Upto K5** |
| **CO 2** | identify bacteria and fungi in spoiled food | **Upto K5** |
| **CO 3** | analyze potability of water | **Upto K5** |
| **CO 4** | check the microbial population in air. | **Upto K5** |
| **CO 5** | prepare, apply and check the efficiency of biofertilizers. | **Upto K5** |

**K1–KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY**
**K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## PRACTICAL IV – APPLIED MICROBIOLOGY

**UNIT– I:**

Breed count, Direct microscopic count and Standard plate count of Milk, Methylene blue reductase test, Resazurin test and alkaline phosphatase test of milk

**UNIT– II:**

Isolation of bacteria, fungi and yeast from spoiled and canned food. Production and detection of aflatoxins from spoiled food.

**UNIT– III:**

Microbial Analysis of water – MPN, Membrane filtration. Chemical – BOD.

**UNIT– IV:**

Enumeration of bacteria and fungi from air – Air sampler Isolation of free–living nitrogen fixers from soil and Rhizobium from root nodules of leguminous plants. Isolation and enumeration of phosphate–solubilizing bacteria from soil

**UNIT– V:**

Preparation of Biofertilizers and testing the efficiency of prepared biofertilizers, R:S ratio of soil microbes Study of phylloplane microflora by leaf impression method Isolation of cellulose degrading bacteria Isolation of plant pathogen – Alternaria, Curvularia, Cultivation of mushroom from solid waste

**TEXT BOOKS:**


1. Ray B. and Bhunia A. (2013). ***Fundamentals of Food Microbiology***. (5th Edition). CRC Press.
2. Garg N., Garg K. and Mukerji K. G. (2013). I K. International Pvt. Ltd.
3. Pepper I., Gerba C. and Brendecke J. (2004). ***Environmental Microbiology – A Laboratory Manual***. (2nd Edition). Academic Press, Elsevier.
4. Yates M.V., Nakatsu C.H., Miller R.V. and Pillai, S.D. (2016). ***Manual of Environmental Microbiology.*** (4th Edition). Wiley.


**REFERENCE BOOKS:**


1. Hobbs, B.C. and Roberts, D, (1968), ***Food Poisoning and Food Hygiene*** 7th Edition Edward Arnold: London.
2. Vijaya R K, (2004). ***Food Microbiology*** 1st Edition. MJP Publishers, Chennai.
3. Banwarst. G.J. (2003). ***Basic Food Microbiology*** 2nd Edition, CBS Publishers and distributors.
4. James G Cappucino. and Natalie Sherman. (2016). ***Microbiology – A laboratory manual.*** (5th Edition). The Benjamin publishing company. New York.


**DIGITAL TOOLS:**

- https://www.fssai.gov.in
- https://www.who.int/news–room/fact–sheets/detail/food–safety
- https://academic.oup.com/bioscience/article/65/8/758/240222
- https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.
- https://vlab.amrita.edu/index.php?sub=3&brch=272

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBCV1 | PROJECT WITH VIVA – VOICE | CORE – 15 | 10 | - | 7 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | IV | 40 | 60 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | | Skill Oriented | ✓ | Entrepreneurship | | | | | |
| | National | ✓ | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | | Human Values | | Other Values | | |

**COURSE OBJECTIVE:**

The objective of the project work is to carry out as an independent research and to emphasis on the area of specialization of the student

**GUIDELINES**

This is an individual project assigned to students.

It is undertaken during the fourth semester, spanning the period from December to April.

Each student will be assigned a faculty member as a guide. The project must be carried out under the supervision of the assigned faculty.

After obtaining acceptance from the host organization, the student must submit a confirmation letter to the department.

Upon completion of the project, the student is required to submit a completion letter from the organization to the department.

After completing the project, the student must document the work and submit three copies of the project report:

One copy to the Controller's Office

One copy to the Department Library

One copy to the Faculty Guide

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBE41 | RESEARCH METHODOLOGY AND BIOSTATISTICS | ELECTIVE–5 | 4 | - | 3 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | IV | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | ✓ | Skill Oriented | | ✓ | Entrepreneurship | | | | |
| | National | ✓ | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | ✓ | Gender | | Environment and Sustainability | | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

This course is designed to provide an overview of research methodology including basic concepts employed in quantitative and qualitative research methods and statistical approaches used in processing biological information.

**COURSE OBJECTIVES:**

- Discuss the methods and techniques of data collection.
- Explain sampling methods, write research reports and articles.
- Discuss the basic concepts of Biostatistics.
- Describe statistical software for analysis.
- Explain the tests of significance

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | collect and present data suitable to the research design. | Upto K5 |
| CO 2 | write research manuscripts and articles for journals. | Upto K5 |
| CO 3 | recommend the utilization of biostatistics tools for analysis of biological data | Upto K5 |
| CO 4 | prove and justify hypothesis for a particular research. | Upto K5 |
| CO 5 | apply software tools for interpretation of biological data | Upto K5 |

**K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## RESEARCH METHODOLOGY AND BIOSTATISTICS

**UNIT – I:**

Introduction to Research Methodology – Meaning and importance. Statement, Constraints. Review of literature – Review and synopsis presentation. Types of research, Research tools. Methods and techniques of data collection – types of data, methods of primary data collection (observation/ experimentation/ questionnaire/ interviewing/ case/pilot study, methods), methods of secondary data collection.

**UNIT– II:**

Sampling and sampling distributions. Sampling frame, importance of probability sampling, sampling – simple random, systematic, stratified random and cluster. Variables – nominal, ordinal, discontinuous, continuous, derived. Research process, designs and Report writing – types of research reports, guidelines for writing an article and report, report format, appendices, Ethical issues related to publishing, Plagiarism and Self–Plagiarism.

**UNIT– III:**

Introduction to Biostatistics – Basic concepts, Measurement and measurement scales, Sampling and data collection, Data presentation. Measures of central tendency: Mean, Median, Mode. Measures of variability – Standard deviation, standard error, range, mean deviation and coefficient of variation. Frequency table of single discrete variable, bubble spot, computation of mean, variance and standard Deviations, t test, correlation coefficient.

**UNIT– IV:**

Correlation and regression – Positive, negative, calculation of Karl–Pearsons co–efficient of correlation. Linear regression and multiple linear regression, ANOVA, one and two way classification. Calculation of an unknown variable using regression equation. Tests of significance – Tests of significance: Small sample test (Chi–square t test, F test), large sample test (Z test) and standard error

**UNIT– V:**

Probability and distributions – Introduction to probability theory and distributions, (concept without deviation) binomial, poison and normal (only definitions and problems) Computer oriented statistical techniques. RSM: methods for process optimization set up CCD, Box Behnken, optimal RSM design, regression models FDS curves, surface contours, multi linear constraints and categoric factors to optimal design.

**TEXT BOOKS:**


1. Sharma K. R. (2002) ***Research methodology***. National Publishing House, New Delhi.
2. Daniel W.W. (2005). ***Biostatistics; A foundation for analysis in the health sciences***. (7th Edition). Jhon Wiley & sons Inc, New York.
3. Rao P. S. S. and Richard J. (2006). ***Introduction to Biostatistics & Research methods.*** Prentice–Hall, New Delhi.
4. Veerakumari L. (2015) ***Bioinstrumentation*** 1st edn. MJP Publishers.
5. Ahuja V.K. (2017) Laws Relating to Intellectual Property Rights. Lexis Nexis.


**REFERENCE BOOKS:**


1. Zar J. H. (2006). ***Biostatistical Analysis***. (4th Edition). Pearson Education Inc. New Jersey.
2. Beins B. C. and McCarthy M.A. (2011). ***Research Methods and Statistics***. Pearson Education Inc. New Jersey.
3. Adams K. A. and Lawrence E. M. K. (2014). ***Research Methods, Statistics, and Applications***. SAGE Publications, Inc., New Delhi.
4. Anderson J.B. and Poole M. (2011). ***Assignment and Thesis Writing***. 4th edn. Wiley India Private Limited
5. Kothari C.R. and Garg G (2004) ***Research Methodology: Methods and Techniques***. 2nd Edition. New Age International Publishers


**DIGITAL TOOLS:**

- https://www.studocu.com/en–ca/document/mount–royal–university/quantitativeresearch–methods–and–data–analysis/lecture–notes–all–lectures/344093
- https://www.khanacademy.org/math/statistics–probability/sampling–distributionslibrary
- https://testbook.com/learn/maths–mean–median–mode/
- https://www.cse.iitk.ac.in/users/piyush/courses/pml_fall17/material/probabilty_tuto rial.pdf

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 1 | 2 | 3 |
| CO3 | 1 | 2 | 2 | 1 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 2 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**

# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'A' grade by NAAC)

## M.Sc. MICROBIOLOGY – SYLLABUS

**(Under CBCS based on OBE)**

**(For the students admitted from the academic year 2024 – 2025 onwards)**



| COURSE CODE | COURSE TITLE | CATEGORY | T | P | CREDITS |
|---|---|---|---|---|---|
| 24PMBS41 | LIFE SCIENCE FOR COMPETITIVE EXAMINATIONS | SEC OR PROFESSIONAL COMPETENCY SKILL | 4 | - | 2 |

| YEAR | SEMESTER | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| II | IV | 25 | 75 | 100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Curriculum Design and Development** | Employability | | ✓ | Skill Oriented | | ✓ | Entrepreneurship | | | | |
| | National | | Local | ✓ | Regional | ✓ | Global | | | | ✓ |
| **Curriculum Enrichment** | Professional Ethics | | Gender | | Environment and Sustainability | | Human Values | | Other Values | | |

**COURSE DESCRIPTION:**

This course is designed to provide a comprehensive understanding of key life science topics, focusing on the concepts and skills necessary to excel in competitive examinations. It covers foundational topics in biology, biochemistry, biotechnology, ecology, genetics, evolution, physiology, and human anatomy

**COURSE OBJECTIVES:**

- Impart knowledge on structure, metabolism and function of biomolecules.
- Understand the importance of inheritance biology.
- Discuss in–depth about the different types of ecosystems and their importance.
- Outline the major drivers in biodiversity and various conservation approaches
- Introduce basic concepts of evolution and biological clock

**COURSE OUTCOMES (COs):**

**After the completion of the course, the students will be able to**

| No. | Course Outcomes | Knowledge Level (According to Bloom's Taxonomy) |
|---|---|---|
| CO 1 | define, classify and assess the structure, biological functions and interactions of biomolecules | Upto K5 |
| CO 2 | validate the knowledge of collective and progressive notions of cellular organization | Upto K5 |
| CO 3 | assess and describe the importance of inheritance biology | Upto K5 |
| CO 4 | establish acquaintance and understanding of ecology & biodiversity in a broader sense. | Upto K5 |
| CO 5 | understand the processes of evolution, relate with natural selection, adaptation and speciation. | Upto K5 |

**K1–KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY**
**K4–ANALYSE, K5–EVALUATE**

**Passed in the BoS Meeting held on 27/02/2025** **Signature of the Chairman**

## LIFE SCIENCE FOR COMPETITIVE EXAMINATIONS

**UNIT– I:**

Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Conformation of nucleic acids (helix (A, B, Z), t–RNA, microRNA). Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins. Structure of atoms, molecules and chemical bonds. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Bioenergetics.

**UNIT– II:**

Cellular Organisation, Cell division and cell cycle, Membrane structure and function, Organization of genes and chromosomes, Structural organization and function of intracellular organelles, DNA replication, repair and recombination, Protein synthesis and processing

**UNIT– III:**

Inheritance Biology, Mendelian principles– Dominance, segregation, independent assortment, Linkage and Gene mapping, Karyotyping, Extrachromosomal inheritance – Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Human genetics–Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

**UNIT– IV:**

Ecology– Habitat and Niche, biotic and abiotic interactions, Biome– biogeographical zones of India. Ecological Succession, Population Ecology– Characteristics of a population; population growth curves, Environmental pollution–global environmental change, Biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Biodiversity Management approaches. Indian case studies on Conservation/Management strategy (Project Tiger, Biosphere Reserves).

**UNIT– V:**

Evolution and Behaviour– Evolution – Theories– Darwin's, Lamarck's, Oparin Haldane. Paleontological, Embryological and Molecular evidences. Hardy Weinberg's Law. Speciation; Allopatricity and Sympatricity. Adaptive radiation and Convergent evolution; Sexual selection; Co–evolution. Altruism, Biological clocks, Migration and Parental care. Molecular Evolution– Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny.

**TEXT BOOKS:**

1. Nelson D. L. and Cox M. M. (2008). ***Lehningers Principles of Biochemistry***. (5th Edition). W.H. Freeman and Company.
2. Chapman J. L. (1998).Ecology: ***Principles and Applications***. (2nd Edition). Cambridge University Press.
3. Krishnamurthy V. K. (2003). ***Textbook of Biodiversity***. Science Publishers.
4. Rogers A. L. (2011). ***Evidence of*** **Evolution.** University of Chicago Press. Chicago.
5. Stites D.P. Abba I. Terr, Parslow T.G.(1997). ***Medical Immunology***. 9th Edn, Prentice–Hall Inc.

**REFERENCE BOOKS:**


1. Pontarotti P. (2018). ***Origin and Evolution of biodiversity***. (1st Edition). Springer.
2. Verma P. S. and Agarwal V. K. (2004). ***Cell biology, Genetics, Molecular Biology, Evolution and Ecology***. (2nd Edition). S Chand publication
3. Lewin R. and Foley R. (2004). ***Principles of Human Evolution***. (2nd Edition). Black well Publishing Company.
4. Boyer R.F. (2002) ***Modern Experimental Biochemistry*** 3rd Edition. Pearson Education.
5. Wilson K., Walker J., Clokie S and Hofmann A. (2018) ***Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology*** 8th Edition. Cambridge University Press.


**DIGITAL TOOLS:**

- https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biolog y_
- https://www.livescience.com/474–controversy–evolution–works.html..
- https://www.examrace.com/Study–Material/Life–Sciences/
- https://www.kopykitab.com/Methods–In–Biology–Life–Science–Study–Material–For–CSIRNET–Exam–by–Panel–Of–Experts
- https://www.erforum.net/2017/01/life–science–biology–handwritten–notes–for–competitiveexams.html

**Mapping of CO with PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 2 | 3 | 1 | 1 | 2 | 3 |
| CO3 | 1 | 3 | 2 | 3 | 3 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 |

**3. Advanced Application 2. Intermediate Development 1. Introductory Level**