# Dr. Babasaheb Ambedkar Marathwada University

## Chhatrapati Sambhajinagar- 431001

# Course Structure and Syllabus for B. Sc. Microbiology

# (Second year)

**( AS PER NEP-2020 )**

## BSc Second Year: 3rd Semester

| Course Type | Course Code | Examination Code ( To be given by respective BoS) | Course Name | Teaching Scheme ( Hrs / Week) | | Credits Assigned | | Total Credits |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical | Theory | Practical | |
| Major ( Core) Mandatory DSC | MIC/DSC/T/200 | SAC00122003T | Bacterial Cytology and Basic Biochemistry | 2 | | 2 | | 2+2+2+2 = 08 |
| | MIC/DSC/T/201 | SAC00122013T | Immunology | 2 | | 2 | | |
| | MIC /DSC/P/226 | SAC00122263P | Practical based on MIC/DSC/T/200 | | 4 | | 2 | |
| | MIC/DSC/P/227 | SAC00122273P | Practical based on MIC/DSC/T/201 | | 4 | | 2 | |
| Minor (Choose any two from the pool of courses) **It is from different disciplines of the same faculty** | MIC/Mn/T/200 | SCC00122003T | To be chosen from other disciplines of the same faculty | 2 | | 2 | | 2+2 = 04 |
| | MIC/Mn/T/201 | SCC00122013T | To be chosen from other disciplines of the same faculty | 2 | | 2 | | |
| Generic / Open Elective ( GE/OE) (Choose any one from the pool of courses) **It should be chosen compulsorily from the faculty other than that of the Major** | MIC/GE/OE/T/200 | SDC00122003T | To be chosen from other faculty | 2 | | 2 | | 02 |
| **VSC** ( Vocational Skill Courses) (Choose any one from SUB/VSC/T/ 200 and SUB/VSC/T/ 201) and corresponding Practical | MIC/VSC/T/200 | SEC00122003T | Microbial Diagnostic | 1 | | 1 | | 1+1 =02 |
| | MIC/VSC/T/201 | SEC00122013T | Biosensor | 1 | | 1 | | |
| | MIC/VSC/P/226 | SEC00122263P | Practical based on MIC/VSC/T/ 200 | | 2 | | 1 | |
| | MIC/VSC/P/227 | SEC00122273P | Practical based on MIC/VSC/T/ 201 | | 2 | | 1 | |
| AEC, VEC, IKS | MIC/AEC/T/200 | | **English** ( Common for all the faculty) | 2 | | 2 | | 2 + 2 = 04 |
| | MIC/VEC/T/201 | | Environmental Studies | 2 | | 2 | | |
| OJT/ FP/CEP/CC/RP | MIC/CC/P/226 | | Cultural Activity / NSS, NCC ( Common for all the faculty) | | 4 | | 2 | 02 |
| | | | | **15** | **14** | **15** | **07** | **22** |

**Minor Courses for Other Discipline**

MIC/Mn/T/ 200 : This is a 2-credit theory course to be designed for other disciplines **(Pharmaceutical Microbiology)**

MIC/Mn/T/ 201 : This is a 2 credit theory course to be designed for other disciplines **(Microbial Diseases)**

Generic /Open Elective Courses for other faculty

mic/GE/OE/T/200 : This is a 2 credit theory course to be designed for other faculty **(Public Health)**

**SAC00122003T**

**MIC/DSC/T/200 : Bacterial Cytology and Basic Biochemistry**

**Total Credits :02**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives of the Course:**

i) To understand prokaryotic cell structure
ii) To know the details of the external structure of bacterial cell
iii)To know the details of the internal structure of bacterial cell
iv) To understand cell-to-cell interaction
v) To compare pro and eukaryotic cell structure
vi)To understand basic biochemistry

**Course Outcomes ( COs) :**

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

i) Understand procaryotic cell structure
ii) Study procaryotic cytoplasmic inclusions
iii)Understand cell-to-cell interaction
iv)Difference between pro and eucaryotic cell structure
v) Understand the structure, properties and significance of macromolecules

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Bacterial morphology and Ultrastructure of outer cell layers**<br>• Morphology- size and arrangement of bacterial cell<br>• Structure, chemical composition, and functions of :<br>i. Flagella- structure, chemical composition, flagellar arrangements, mechanism of flagellar movement, chemotaxis, phototaxis, magnetotaxis<br>ii. Cell membrane- Unit membrane, structure, chemical composition and functions<br>• Bacterial endospore- Structure, spore formation and germination<br>• Reserve food materials- Nitrogenous and non nitrogenous – Metachromatic granules, starch granules, glycogen granules, Poly beta hydroxy butarategranules,( Chemical composition and functions, examples of bacteria having granules )<br>• Nuclear material<br>• Mesosomes<br>• Ribosomes<br>• Bacterial cell division- binary fission<br>iii. Difference between pro and eucaryotic cell structure | **12 Hrs** |
| II | **Bacterial cell-to-cell interaction,**<br>**Quorum sensing –** | **6 Hrs** |

| | | |
|---|---|---|
| | Quorum sensing molecules-<br>Acylhomoserine lectone,<br>autoinducer peptides,<br>Autoinducer-2<br>Significance of the molecules<br>• Mating interactions- Transfomation, conjugation<br>• Developmental interactions- Myxobacteria<br>• Ecological / colonization interaction- Rhizobium- legume symbosis<br>• Predator- prey interaction-Bedllovibrio | |
| III | **Microbial Biochemistry:**<br>• **Carbohydrates:** Definition, Classification with examples, properties, Structure of glucose- ring structure, pyranose, furanose, isomers and mutarotation, Disaccharides – glycosidic linkages, lactose, maltose and sucrose, polysaccharides- homo and hetero polysaccharides with examples , biological significance<br>• **Proteins:** Definition, properties, structure- Primary, secondary , tertiary and quaternary, peptide bond, biological importance<br>• **Nucleic acids:**<br>• **DNA-** Properties, types of DNA<br>• **RNA-** Properties, types of RNA- mRNA, rRNA and tRNA | **12 Hrs** |

***Text Books:***


1. General Microbiology- R.Y.Stayner
2. Fundamentlas of Microbiology by Crabtree and Martin Frobisher
3. Fundamentals of Bacteriology- A.J.Salle
4. A Text of Microbiology – Dubey and Maheshwari D.K.
5. Microbiology by Pelczar T.R., M.J.Chan and Kreig N.R.
6. Microbiology by Prescott L.M., J.P.Harley and D.A. Klein
7. Introduction to Microbiology by Ingraham and Ingraham
8. Microbial cell –cell interaction – Edited by Martin Dworkin
9. Biochemiostry by Lehninger
10. Biochemistry by Stainer
11. Biochemistry by Rastogi
12. Biochemistry by Cohn and Stumph 13. Biochemistry by Satynarayan

**SAC00122013T**
**Course Code: MIC/DSC/T/201 : Immunology**

**Total Credits :02**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives of the Course:**

- Comprehend the fundamental principles of immunity and differentiate between its major components
- Analyze the nature and function of antigens and antibodies
- Evaluate the principles and types of vaccines and their production methods
- Explain the mechanisms and general features of antigen-antibody reactions
- Apply knowledge of antigen-antibody reactions to understand and interpret various immunological techniques

**Course Outcomes ( COs) :**

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

i) Define and classify immune system components antibodies, and vaccines and explain the functions of physiological barriers, normal flora, and lymphoid organs.
ii) Differentiate cellular and humoral immunity, describe antibody structure and function, and explain various vaccine.
iii) Analyse antigenicity factors (size, chemical nature, enzyme susceptibility, foreignness, specificity)
iv) Compare primary and secondary immune responses.
v) Explain antigen-antibody reaction mechanisms and the significance of immunological reactions.
vi) Describe monoclonal antibody.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **I** | **Immune system**<br>i. Immunity: Definition and classification with examples<br>ii. Defensive mechanisms of host<br>iii. Normal flora of the human body and its significance<br>iv. Difference between Cellular and Humoral immunity<br>v. Organs involved in immunity: Primary and Secondary lymphoid organs | **10 Hrs** |

| | | |
|---|---|---|
| | vi. Cells involved in immunity: Types and functions in brief<br>**vii.** Aggressive mechanisms of pathogens/ pathogenicity | |
| **II** | **Antigen, Antibody, Vaccines**<br><br>**Antigen:**<br>i. Definition, introduction, and example: Antigen, Exogenous antigen, Auto antigens, Species-specific, Heterogenous antigen<br>ii. Antigen in relation to bacterial cells.<br>iii. Determinants of antigenity: a) size, b) chemical, nature, c) susceptibility to tissue enzymes, foreignness, specificity of antigen.<br>**Antibody:**<br>i. Definition, Structure of antibody<br>ii. Classes and functions of antibody<br>iii. Introduction to Monoclonal antibodies<br>**Vaccines**<br>i. Definition and types of vaccines Live-attenuated, Inactivated vaccine, Toxoids, Combination vaccine, and Recombinant vaccines<br>**ii.** Introduction to (in brief): OPV, BCG, TAB, TT, DPT, CoViD-19 | **10 Hrs** |
| **III** | **Antigen- Antibody Reactions**<br>i. General features of Antigen-Antibody reactions<br>ii. Mechanism of Antigen-Antibody reactions<br>iii. Methods and significance of<br>a. Precipitation<br>b. Agglutination<br>iv. Introduction to<br>a. Complement fixation<br>b. ELISA<br>c. Neutralization<br>d. Immunofluorescence | **10 Hrs** |

Text Books:

1. 1. A Textbook of Microbiology. Chakraborty P. (2013). 3rd edition. New Central Book Agency. India. ISBN-13: 978-8173818769.
2. Textbook of Microbiology. Kanungo Reba. (2017). Ananthanarayan and Paniker's 10th edition. The Orient Blackswan Publisher. ISBN-13: 978-9386235251..
3. Basic Immunology-Functions and Disorders of Immune System.Abbas A. K. and Lichtman A. H. (2004). 2nd Ed. Saunders. Elsevier Inc. PA. USA.
4. Immunology Essential and Fundamental. Pathak S. S. and Palan V. (1997) Pareen Publications Bombay.
5. Handbook of Immunology, Talwar G. P. (1983). Vikas Publishing Pvt. Ltd. New Delhi.

Reference Books:

1. Medical Bacteriology Including Medical Mycology and AIDS. Dey N. C., Dey T. K. and Sinha D. (2013). 17th Edition. New Central Book Agency (P) Ltd (Publisher). India...
2. Textbook of Microbiology. Kanungo Reba. (2017). Ananthanarayan and Paniker's 10th edition. The Orient Blackswan Publisher.
3. Microbiology: An introduction. Tortora G. J., Funke B. R. and Case C. L. (2016). 12th Edition, Pearson. ISBN-13: 9780321929150.
4. Medical Microbiology and Immunology. Goering R., Dockrell H., Zuckerman M., Roitt I, and Chiodini P. L. (2018). Mims' 6th Edition. Elsevier. ISBN: 9780702071546.
5. Immunology. Kuby J. (1996) 3rd Ed. W. H. Freeman and Co, New York.

**SAC00122263P**
**MIC/DSC/P/226 : Practical**
**Based on Bacterial cytology and Basic Biochemistry**

**Total Credits :02**

**Total Contact Hours : 60 Hrs** **Maximum Marks :50**

Learning Objectives of the Course:

- To study the external structure of a bacterial cell
- To study the reserve food material of a bacterial cell
- To understand cell-cell interaction
- To understand the macromolecules

Course Outcomes ( COs) :

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

- Study bacterial structures with special staining techniques
- Study reserve food materials in prokaryotes
- Understand cell-to-cell interaction
- Study properties of macromolecules

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | Structural staining :<br>• Nuclear staining- Giemsa's method<br>Reserve food material staining:<br>• Lipid granule staining- Burdon's method<br>• Metachromatic granules- Albert's method | 24 Hrs |
| II | • Demonstration of transformation<br>• Demonstration of conjugation | 12 Hrs |
| III | • Quantitative test for carbohydrates by Benedict's method<br>• Quantitative test for proteins- Folin Lowery's method<br>• Quantitative test for DNA by Diphenyl amine method<br>• Quantitative test for RNA by Rosen's method | 24 Hrs |

Reference Books:


1. Experiments in Microbiology- Aneja K.R.
2. Handbook of Media, stain, and reagents in Microbiology by A.M.Deshmukh

3. Practical Microbiology –R.C.Dubey and D.K.Maheshwari S.Chand and company Limited Reprint 2024
4. Practical Manual of Biochemistry - Dr. G. Sattanathan, , Dr. S.S. Padmapriya, , Dr. B. Balamuralikrishnan, ,
5. Laboratory Manual of Biochemistry – J.Jayraman

**SAC00122273P**
**Course Code: MIC/DSC/P/227: Immunology - Practical**
**Total Credits :02**

**Total Contact Hours : 60 Hrs** **Maximum Marks :50**

**Learning Objectives of the Course:**

To make students competent

i) To perform differential blood staining techniques to identify and differentiate various white blood cells.
ii) To apply aseptic techniques to isolate the normal microbial flora present in different regions of the human body.
iii) Execution of principles tests such as RPR and Immunodiffusion to characterize antigen-antibody reactions.
iv) Execution of agglutination tests, such as Blood Grouping and Widal to characterize antigen-antibody reactions.
v) To compare and contrast the principles and applications of immunological tests

**Course Outcomes ( COs) :**

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

i) Perform and Interpret differential blood staining and normal flora isolation.
ii) Understand and perform Precipitation and Agglutination Tests
iii) Interpret Precipitation and Agglutination Tests.
iv) Relate Laboratory Observations to Clinical Applications

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **I** | 1. Differential Blood Staining<br>2. Isolation of normal flora of the human body | **20 Hrs** |
| **II** | 3. Precipitation test: Demonstration<br>a) RPR Test<br>b) Immunodiffusion | **20 Hrs** |
| **III** | **4.** Agglutination tests: (slide tests)<br>a) Blood grouping | **20 Hrs** |

| | | |
|---|---|---|
| | b) Widal test<br>**5.** Visit to pathological laboratory to observe antigen-antibody reactions | |

Reference Books:


1 A Textbook of Microbiology, Chakraborty P. (2013). 3rd edition. New Central Book Agency. India.

2. Textbook of Microbiology. Kanungo Reba. (2017). Ananthanarayan and Paniker's 10th edition. The Orient Blackswan.

3. Basic Immunology-Functions and Disorders of Immune System, Abbas A.K. and Lichtman A.H., Churchill Livingstone, (2023), 7th edition, Churchill Livingstone;

4. Immunology Essential and Fundamental. Pathak S. S. and Palan V. (2005), 2nd edition, Pareen Publications Bombay.

5. A Handbook of Practical and Clinical Immunology, Talwar G.P. (2017). 2nd edition, CBS Publishers.

**SCC00122003T**

MIC/Mn/T/200 : **Pharmaceutical Microbiology**

(This course is designed for students from other disciplines)

**Total Credits: 02**

**Total Contact Hours: 30 Hrs** **Maximum Marks: 50**

Learning Objectives of the Course

i) To introduce students to the fundamentals of microbiology relevant to Pharmaceutical industries.

ii) To understand the significance of microbial contamination and its control in Pharmaceutical processes.

iii) To familiarize the students with the concepts of microbial safety, microbial load, MLD, LD50

iv) To impart knowledge about good manufacturing practices (GMP) and quality control measures.

Course Outcomes ( COs) :

After successful completion of the course, students will be able to -

i) Understand the basic concepts of microbiology and microbial contamination.

ii) Explain the microbial load and its control

iii) Interpret MLd and LD 50in the context of pharmaceutical toxicology and microbial potency.

iv) Apply knowledge of GMP in maintaining microbiological quality in pharmaceutical manufacturing

i)

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | a)Principles of chemotherapy –General properties of antimicrobial agents,<br>b) Methods of Sterilisation, Sterilisation in industry, Sterility testing<br>c) choice of drug, dosage, route of administration, combined/mixed multi-drug therapy,<br>control of antibiotic/drug usage, sensitivity testing<br>d) Introduction to pharmacopeia—British and Indian | **10 Hrs** |
| II | a) History of chemotherapy – plants and arsenicals as therapeutics, Paul Ehrlich and his<br>contributions, | **10 Hrs** |

| | | |
|---|---|---|
| | c) Selective toxicity and target sites of drug action in microbes.<br>b ) Over view of development of synthetic drugs.<br>Antibiotics - The origin, development and definition of antibiotics as drugs, types of antibiotics<br>and their classification.<br>d) Introduction to cell culture technology and its applications in pharmaceutical industries. | |
| III | Good Manufacturing practices ( GMP)<br>Introduction<br>a ) Overview of GMP and its importance in the pharmaceutical and healthcare industries<br>b ) History and evolution of GMP regulations and guidelines<br>c ) Regulatory agencies and their roles in GMP compliance<br>d ) Quality Management systems and quality assurance in GMP | **10 Hrs** |

***Text Books:***


1.Pharmaceutical Manufacturing Handbook: Regulations and quality by Shayne Cox Gad

2. Pharmaceutical Qaulity assurance by Prof. Avinash Ade

3. Pharmaceutical Qaulity assurance and GMP by Dr.S.S Agrawal

4. Good manufacturing practices in Pharmaceutical industries. By DR. S.J.H.Shokri

5. Good manufacturing practices in Pharmaceuticals by Manohar A. Potdar

**SCC00122013T**

**MIC/Mn/T/201: Microbial Diseases**

(This course is designed for the students from other discipline)

**Total Credits: 02**

**Total Contact Hours: 30 Hrs** **Maximum Marks: 50**

**Learning Objectives of the Course:**

-To introduce the basic concepts of probiotics, prebiotics, and fermented foods in the context of traditional Indian diets and public health.

-To develop awareness about the role of probiotics in maintaining gut health, immunity, and prevention of lifestyle-related diseases.

-To enable students to identify probiotic-rich foods and understand their preparation, safety, and potential applications in daily life and community health.

**Course Outcomes (CO's)**

After successful completion of this course, students are expected to:

**i.** Explain the fundamental concepts of probiotics, prebiotics, and their role in human health using non-technical language.

**ii.** Identify various traditional Indian fermented foods that act as natural probiotics and describe their health benefits.

**iii.** Apply the knowledge of probiotic foods in promoting personal and community well-being, aligned with holistic and preventive healthcare principles of NEP 2020.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Introduction:** Diseases and Disorders<br>**Definitions:** Pathogen, Antigen, Antibody, Vaccines, Antisera<br>**Infection:** Definition, Modes of Infection, Routes of infection | **10 Hrs** |
| II | **Plant & Animal Diseases**<br>Causative Agent, Transmission, Symptoms, Treatment, Prophylaxis,<br>Impact. wrt Late Blight of Potato, Bacterial Blight of Rice, Anthrax and FMD (Foot & Mouth Disease) | **10 Hrs** |
| III | **Human Diseases**<br>Causative Agent, Transmission, Symptoms, Treatment, Prophylaxis, Impact.<br>wrt Tuberculosis, HIV, Cadidiasis & Malaria | **10 Hrs** |

**Reading Materials:**

1. Baveja, C. P. – Textbook of Microbiology
2.Dubey, R. C. – A Textbook of Microbiology
3. Pelczar, M. J. – Microbiology: Applications and Disease

**SDC00122003T**

**MIC/GE/OE/200 : Public Health**

(This course is designed for the students from other faculty)

**Total Credits : 02**

**Total Contact Hours : 30 Hrs** **Maximum Marks : 50**

**Learning Objectives of the Course:**

Introduce the basic concepts and scope of public health, including its historical evolution. Familiarize students with the structure and functioning of the healthcare system in India. Highlight the importance of preventive healthcare, nutrition, sanitation, and hygiene in community health. Develop awareness about major communicable and non-communicable diseases affecting public health in India.

Equip students with knowledge about national health programs, policies, and public health interventions. Encourage critical thinking about health disparities, environmental factors, and the role of social determinants in health.

## Course Outcomes (CO's)

After successful completion of this course, students are expected to:

- Define key public health terms and explain the role of public health in improving community well-being.
- Analyze the causes, prevention, and control measures for major health issues in India.
- Apply basic public health principles to real-life situations, including health education, disease prevention, and health promotion.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Understanding Public Health**<br>i. Public Health: Concept, Significance<br>ii. Importance of Public Health<br>iii. Everyday Factors That Affect Health (Food, Exercise, Cleanliness)<br>iv. Terminologies related to Public Health: Epidemic, Pandemic, contagious/communicable infections, Carrier, Vector | **10 Hrs** |
| II | **Health and Society**<br>i. Common Illnesses and Their Prevention<br>ii. Importance of Clean Water, Good Food, and Exercise<br>iii. How Public Health Helps in Communities<br>**iv.** Role of Hospitals and Government in Public Health | **10 Hrs** |
| III | **Public Health in Daily Life**<br>i. Care of Own Health<br>ii. Helping Others Stay Healthy<br>iii. Role of Media in Spreading Health Awareness<br>iv. Simple Public Health Campaigns That Work | **10 Hrs** |

**Reading Materials:**

1."Foundations of Community Medicine" – D. K. Taneja
2. "Textbook of Public Health and Community Medicine" – B. S. Garg
3. "Public Health in India: Concern, Action and the Way Forward" – Edited by R. Srinivasan
4. "Health and Development" – M. M. Sury
5. "सार्वजनिक आरोग्य शास्त्र" – *डॉ. एन. डी. देशपांडे*
6. "समाज आणि आरोग्य" – *डॉ. संजय सावंत*
7. "समाजमाध्यमे आणि आरोग्य जागृती" – *डॉ. उज्वला गवळी*
8. "सामुदायिक आरोग्य परिचय" – *डॉ. वसंत पाटील*

**SDC00122003T**

## MIC/GE/OE/200 : सार्वजनिक आरोग्य

**एकूण क्रेडिट्स** : 02

**एकूण संपर्क तास** : 30 तास **कमाल गुण** : 50

## अभ्यासक्रमाची उद्दिष्टे:

- सार्वजनिक आरोग्याच्या मूलभूत संकल्पना व व्याप्ती यांची ओळख करून देणे, तसेच त्याचा ऐतिहासिक विकास समजावणे.
- भारतातील आरोग्यसेवा व्यवस्थेची रचना व कार्यपद्धती समजावणे.
- प्रतिबंधात्मक आरोग्यसेवा, पोषण, स्वच्छता आणि आरोग्यविषयक सवयींचे महत्त्व अधोरेखित करणे.
- भारतात सार्वजनिक आरोग्यावर प्रभाव टाकणाऱ्या प्रमुख संसर्गजन्य व असंसर्गजन्य रोगांविषयी जागरूकता निर्माण करणे.
- राष्ट्रीय आरोग्य कार्यक्रम, धोरणे आणि सार्वजनिक आरोग्य हस्तक्षेप याविषयी माहिती देणे.
- आरोग्यविषयक विषमता, पर्यावरणीय घटक, आणि सामाजिक निर्धारक )Social Determinants) यांचा आरोग्यावरील प्रभाव यावर चिंतन करायला उद्युक्त करणे.

## Course Outcomes (CO's)

**CO1:** सार्वजनिक आरोग्याशी संबंधित प्रमुख संज्ञा समजावून सांगता येतील आणि समाजाच्या आरोग्यवृद्धीसाठी सार्वजनिक आरोग्याची भूमिका स्पष्ट करता येईल.
**CO2:** भारतातील प्रमुख आरोग्य समस्यांची कारणे, प्रतिबंध व नियंत्रण उपाय विश्लेषित करता येतील.
**CO3:** आरोग्य शिक्षण, रोग प्रतिबंध व आरोग्यवर्धन यासह वास्तव जीवनातील परिस्थितींमध्ये सार्वजनिक आरोग्य तत्त्वे लागू करता येतील.

| घटक क्र | विषय अभ्यासाचे तपशील / | संपर्क तास |
|---|---|---|
| I | **सार्वजनिक आरोग्याची समज**<br>• सार्वजनिक आरोग्य :संकल्पना व महत्त्व<br>• सार्वजनिक आरोग्याचे महत्त्व<br>• दैनंदिन जीवनातील आरोग्यावर परिणाम करणारे घटक अन्न), व्यायाम, स्वच्छता( | **10 Hrs** |

| | | |
|---|---|---|
| | • सार्वजनिक आरोग्याशी संबंधित संज्ञासाथी :, महामारी, संसर्गजन्य रोग, वाहक, विषाणूवाहन/) | |
| **II** | **आरोग्य आणि समाज**<br>• सामान्य आजार व त्यांची प्रतिबंधात्मक उपाय<br>• स्वच्छ पाणी, पोषक आहार आणि व्यायामाचे महत्त्व<br>• सार्वजनिक आरोग्याचा समाजातील उपयोग<br>• रुग्णालये व शासनाची सार्वजनिक आरोग्यातील भूमिका | **10 Hrs** |
| **III** | **दैनंदिन जीवनातील सार्वजनिक आरोग्य**<br>• स्वतःच्या आरोग्याची काळजी<br>• इतरांच्या आरोग्याची मदत<br>• आरोग्य जनजागृतीसाठी माध्यमांची भूमिका<br>• प्रभावी सार्वजनिक आरोग्य मोहिमा | **10 Hrs** |

**Reading Materials:**


1. "Foundations of Community Medicine" – D. K. Taneja
2. "Textbook of Public Health and Community Medicine" – B. S. Garg
3. "Public Health in India: Concern, Action and the Way Forward" – Edited by R. Srinivasan
4. "Health and Development" – M. M. Sury
5. "सार्वजनिक आरोग्य शास्त्र" – *डॉ. एन. डी. देशपांडे*
6. "समाज आणि आरोग्य" – *डॉ. संजय सावंत*
7. "समाजमाध्यमे आणि आरोग्य जागृती" – *डॉ. उज्वला गवळी*
8. "सामुदायिक आरोग्य परिचय" – *डॉ. वसंत पाटील*

**SEC00122003T**

**MIC/VSC/T/ 200: Microbial Diagnostics**

**Total Credits: 01**

**Total Contact Hours: 15 Hrs** **Maximum Marks: 50**

**Learning Objective:** The course aims to provide an advanced understanding of the core principles and topics of clinical microbiology

**Course Outcome:**

- Learn the basics of infection and the epidemiology of infectious diseases.
- Understand the morphology, pathogenicity, and laboratory diagnosis of Gram-positive and negative organisms.
- Study the morphology, pathogenicity, and laboratory diagnosis of acid-fast bacteria.
- Acquire basic knowledge about the pathogenicity and laboratory diagnosis of fungal and protozoan pathogens.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Importance of Diagnosis of Diseases and Collection of Clinical Samples**<br>Bacterial, Viral, Fungal, and Protozoan Diseases of various human body systems, Disease-associated clinical samples for diagnosis.<br>Collection of clinical samples (oral cavity, throat, skin, Blood, CSF, urine, and feces) and precautions required. Method of transport of clinical samples to laboratory and storage. | **5Hrs** |
| II | **Microscopic Examination and preparation of media -**<br>Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria, Lactophenol cotton blue staining for fungi<br>Preparation and use of culture media – Nutrient agar, MacConkey agar, Blood agar, Sabouraud agar, Lowenstein-Jensen medium, Wilson and Blair's medium, Distinct colony properties of various microbial pathogens.<br>Biochemical characteristics | **5 Hrs** |

| | | |
|---|---|---|
| **III** | **Serological and Molecular Methods, Kits for rapid Detection of Pathogens, Testing for Antibiotic Sensitivity in Bacteria**<br><br>**Serological Methods** - Agglutination, Precipitation, ELISA, immunofluorescence,<br><br>Nucleic acid based methods - PCR, Nucleic acid probes<br><br>**Kits for rapid Detection of Pathogens: -**<br><br>Typhoid, Dengue, HIV, Covid-19, Swine flu, malaria<br><br>**Testing for Antibiotic Sensitivity in Bacteria:**<br><br>Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method. | **5 Hrs** |

**Reading Materials:**


1.Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.

2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd

4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby

5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier.

**SEC00122013T**

**MIC/VSC/T/ 201: Biosensors**

**Total Credits: 01**

**Total Contact Hours: 15 Hrs** **Maximum Marks: 50**

**Learning objectives**

These are designed to ensure that students gain a solid understanding of the core principles, technologies, applications, and challenges associated with biosensors. The goals aim to equip students with both theoretical knowledge and practical skills in the field of biosensor technology.

**Course Outcome: -**

The Course Outcome (CO) for a course on Biosensors outlines the specific skills, knowledge, and abilities that students are expected to have gained upon completing the course.

1: Understanding the Fundamentals of Biosensors

2: In-depth Knowledge of Bioreceptors and Transducers

3: Design and Fabrication of Biosensors:

4: Evaluating and Optimizing Biosensor Performance

5: Application of Biosensors in Various Fields:

6: Understanding Challenges and Limitations

7: Emerging Trends and Future Directions in Biosensors:

8: Practical Skills and Hands-on Experience

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Introduction to Biosensors**<br>Definition, concept, and importance of biosensors<br>• Components of a Biosensor:<br>• Bioreceptor (Biological Element), Transducer: Signal Processor | 5Hrs |

| | | |
|---|---|---|
| | • Basic Working Principles of Biosensors | |
| **II** | **Types of Biosensors:**<br><br>• **Microbial Biosensors for Pathogen Detection**<br>  o Detection of bacterial, viral, and fungal pathogens using biosensors<br>  o Examples of microbial biosensors for clinical diagnostics<br>• **Enzyme-Based Biosensors**<br>  o Principles of enzyme-based sensors and their applications<br>  o Types of enzyme-based biosensors: Glucose sensors, lactate sensors, etc.<br>• **Immunosensors and Antibody-Based Biosensors**<br>  o Principles of immunosensors: Antigen-antibody interactions<br>  o Design and working of antibody-based biosensors<br>• **DNA and RNA-Based Biosensors**<br>  o Mechanisms of DNA-based biosensors (e.g., hybridization-based detection)<br>  o Use of molecular biology techniques in biosensor development | **5 Hrs** |
| **III** | **Applications of Biosensors:**<br><br>• Healthcare and Medical Diagnostics<br>• Environmental Monitoring<br>• Food and Agriculture<br>• Industrial Applications | **5 Hrs** |

**Text / Reference books**


1) Biosensors: Principles and Applications" by *R. S. Khandare & S. K. Ghosh*
2) Biosensors and Bioelectronics" by *Joaquim A. M. Oliveira and Teresa M. Fernandes*
3) Handbook of Biosensors and Biochips" edited by *John W. Gardener, G. A. Jones, and P. J. H. Gachovska*
4) Biosensors: A Practical Approach" by *Clifford A. C. Seitz and John R. G. R. Deamer*
5) Principles of Biosensors and Bioelectronics" by *C. N. R. Rao, A. K. Sood, and P. K. Jain*
6) Biosensors: Microbial and Enzymatic Applications" edited by *T. K. Gupta and S. K. Gupta*
7) Introduction to Biosensors: A Practical Guide" by John E. B. Shriver and L. D. Stokes

**SEC00122263P**

**MIC/VSC/P/ 226: Microbial diagnostics**

**Practical based on -Microbial diagnostics**

**Total Credits: 01**

**Total Contact Hours: 30 Hrs** **Maximum Marks: 50**

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | • Collection of clinical samples (oral cavity, throat, skin, Blood, CSF, urine, and faeces)<br>• Method of transport of clinical samples to laboratory and storage<br>• Gram staining of bacterial samples | 10Hrs |
| II | • Ziehl-Neelson staining for tuberculosis<br>• Giemsa staining of thin blood film for malaria<br>• Lactophenol cotton blue staining for fungi | 10 Hrs |
| III | • Prparation of Nutrient agar, MacConkey agar, Blood agar, Sabouraud agar, Lowenstein-Jensen medium, Wilson and Blair's medium and study of distinct colony properties of various microbial pathogens.<br>• Diagnosis of Typhoid, Dengue, HIV, Covid-19, Swine flu, malaria by using rapid diagnosis kits<br>• Determination of resistance/sensitivity of bacteria using disc diffusion method / Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method. | 10 Hrs |

**Text / Reference Books:**


1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.

2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd

4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby

5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier.

**SEC00122273P**

**MIC/VSC/P/ 227: - Biosensors**

**Practical based on - Biosensors**

**Total Credits: 01**

**Total Contact Hours: 30 Hrs** **Maximum Marks: 50**

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | • Design and Fabrication of Biosensors<br>• Investigate an electrochemical biosensor Glucometer for detecting the blood sugar level of different persons | 10Hrs |
| II | • Colorimetric Biosensor Experiment – Determination of concentration of product produced by adding enzyme which produces colour ( Determination of reducing sugar by Summner's method by using enzyme amylase)<br>• Determination of concentration of DNA by using spectrophotometric biosensor<br>• | 10 Hrs |
| III | • Degradation of pesticides by using microorganisms and Detection of change in pH by pH meter.<br>• Degradation of dye by using microorganisms and Detection of change in colour by colorimeter.<br>• | 10 Hrs |

**Text / Reference books**

8) Biosensors: Principles and Applications" by *R. S. Khandare & S. K. Ghosh*
*9)* Biosensors and Bioelectronics" by *Joaquim A. M. Oliveira and Teresa M. Fernandes*
*10)* Handbook of Biosensors and Biochips" edited by *John W. Gardener, G. A. Jones, and P. J. H. Gachovska*
*11)* Biosensors: A Practical Approach" by *Clifford A. C. Seitz and John R. G. R. Deamer*
*12)* Principles of Biosensors and Bioelectronics" by *C. N. R. Rao, A. K. Sood, and P. K. Jain*
*13)* Biosensors: Microbial and Enzymatic Applications" edited by *T. K. Gupta and S. K. Gupta*
14) Introduction to Biosensors: A Practical Guide" by John E. B. Shriver and L. D. Stokes

## BSc Second Year: 4th Semester

| Course Type | Course Code | Examination Code ( To be given by respective BoS) | Course Name | Teaching Scheme ( Hrs / Week) | | Credits Assigned | | Total Credits |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical | Theory | Practical | |
| Major ( Core) Mandatory DSC | MIC/DSC/T/250 | SAC00122504T | Environmental Microbiology | 2 | | 2 | | 2+2+2+2 = 08 |
| | MIC/DSC/T/251 | SAC00122514T | Medical Microbiology | 2 | | 2 | | |
| | MIC/DSC/P/276 | SAC00122764P | Practical based on MIC/DSC/T/250 | | 4 | | 2 | |
| | MIC/DSC/P/277 | SAC00122774P | Practical based on MIC/DSC/T/ 251 | | 4 | | 2 | |
| Minor (Choose any two from the pool of courses) **It is from different disciplines of the same faculty** | MIC/Mn/T/250 | SCC00122504T | To be chosen from other disciplines of the same faculty | 2 | | 2 | | 2+2 = 04 |
| | MIC/Mn/T/251 | SCC00122514T | To be chosen from other disciplines of the same faculty | 2 | | 2 | | |
| Generic / Open Elective ( GE/OE) (Choose any one from the pool of courses) **It should be chosen compulsorily from the faculty other than that of the Major** | MIC/GE/OE/T/250 | SDC00122504T | To be chosen from other faculty | 2 | | 2 | | 02 |
| **SEC** ( Skill Enhancement Courses) (Choose any one from SUB/SEC/T/250and SUB/SEC/T/ 251) and corresponding Practicals | MIC/SEC/T/250 | SEC00122504T | Standardization and Calibration of Laboratory Equipment | 1 | | 1 | | 1+1 =02 |
| | MIC/SEC/T/251 | SEC00122514T | Microbiological analysis of food and soil | 1 | | 1 | | |
| | MIC/SEC/P/276 | SEC00122764P | Practical based on MIC/SEC/T/250 | | 2 | | 1 | |
| | MIC/SEC/P/277 | SEC00122774P | Practical based on MIC/SEC/T/ 251 | | 2 | | 1 | |
| AEC, VEC, IKS | MIC/AEC/T/250 | | Modern Indian Language (MIL-2) ( Choose any one from the pool of language courses ) | 2 | | 2 | | 02 |
| OJT/ FP/CEP/CC/RP | MIC/FP/P/276 | | Field Project | | 4 | | 2 | 2+2= 04 |
| | MIC/CC/P/277 | | (Fine/ Applied/ Visual/ Performing Arts) ( Common for all the faculty) | | 4 | | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **13** | **18** | **13** | **09** | **22** |
| **Exit Option: Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course ( related to major/minor) / Internship during summer vacation OR Continue with Major and Minor** | | | | | | | | |

**Minor Courses for Other Discipline**

MIC/Mn/T/ 250 : This is a 2 credit theory course to be designed for other disciplines

- **( Microbiology of Indian Traditional Foods )**

MIC/Mn/T/ 251: This is a 2 credit theory course to be designed for other disciplines

- **(Microbiology of Beverages)**

**Generic /Open Elective Courses for other faculty**

MIC/GE/OE/T/250 : This is a 2 credit theory course to be designed for other faculty

- **( Probiotics: Health and Applications )**

**SAC00122504T**
**MIC/DSC/T/250: Environmental Microbiology**
**Total Credits :02**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives:**

The candidate will gain knowledge about microbes in the air, air sanitation, and quality assessment. Types of water ecosystems and water-borne diseases. Effluent treatment and parameters – BOD, COD. Extremophiles in the environment.

**Course Outcomes ( COs) :**

**1**: Gain knowledge on the role and infections caused by microbes in air.

**2**: Obtain detailed information on aquatic ecosystems and Assimilate knowledge on Water-borne diseases.

**3**: Get detailed knowledge of Wastewater treatment and its different methods.

**4**: Basic understanding of different types of microbes present in the environment and their uses.

**5**: Acquire knowledge on Biodegradation, of xenobiotic compounds and Understand Biomagnification and Bioremediation.

| ModuleNo. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Air Microbiology**<br>1. Air flora –<br>i.Transient nature of air flora<br>ii. Droplet, droplet nuclei, and aerosols<br>iii. Transmission of air-borne pathogens<br>2. Air pollution: Chemical pollutants, their sources in the air, and effects on human health<br>3. Principles of air sampling for microbial load<br>i. Impaction on solids- Any two methods<br>ii. Impingement in liquid- Any two methods<br>iii. Sedimentation<br>4. Air sanitation: Physical and chemical methods | **10 Hrs** |

| | | |
|---|---|---|
| II | **Microbiology of water**<br>**1.** Types of Water<br>2. Sources of microbes in water.<br>3.Determining sanitary quality of water indicators of fecal pollution:Fecal and non fecal coliforms (IMVIC&elevated temperature tests).<br>4.Bacteriological examination of water: Presumptive ,confirmed ,completed test, SPC, MPN and Membrane filter technique.<br>5.Water purification methods : Disinfection of potable water supplies. | **10 Hrs** |
| III | **Sewage and Waste Water Microbiology**<br>1.Analysis of waste water – Physico- chemical parameters: pH, temperature, total solids, suspended solids, Chemical Oxygen Demand (C.O.D.); Biological parameters: B.O.D.<br>2.Industrial water pollutants, their ecological effects and health hazards (Biomagnification and eutrophication)<br>3.Methods of effluent treatment – Primary, secondary, tertiary treatment methods<br>4.Recycling and reuse of waste water<br>Treatment of sludge – sludge thickening and dewatering and its disposal; biochemical mechanisms of Biomethanation, Types of anaerobic digesters, Applications of biogas (Methane) | **10 Hrs.** |

## Reference Books:


1. Environmental Pollution by Chemicals Walker, Hulchiason.
2. Biochemistry and Microbiology of Pollution - Higgins and Burns.
3. Environmental Pollution - Laurent Hodge, Holt.
4. Waste Water Treatment - Datta and Rao (Oxford and IBH)5.Sewage and waste treatment - Hammer
6. Pollution - Kudesia, PragatiPrakashanMeerat.
7. Environment Chemical Hazards - Ram Kumar (Swarup and Sons, New Delhi).
8. Environment and Metal Pollution - Khan (ABD Pub. Jaipur).
9. Environment Pollution - Timmy Katyal (SatkeAnmol Pub. New Delhi).
10. Ecology of Polluted Water - Vol. II - Anand Kumar (Aph Pub. Co. New Delhi),
11. Microbial Techniques - Pathade and Goel (ABD Pub, Jaipur).

12. Current Topics in Environmental Sciences - Tripathi and Pandey (ABD Pub. Jaipur).
13. Environmental Impact Assessment - R. K. Trivedy
14. Microbial Limit and Bioburden Tests, 2nd edition - Lucia Clontz (CRC Press)
15. Introduction to Biodeterioration by Dennis Allsopp and Kenneth J.Seal, ELBS
16. Environmental Pollution by Chemicals by Walker C
17. Food Industry wastes: Disposal and recovery by Herzika and Booth (editors) 1980, Allied Science Publishers.
18. Water Pollution Vol. I and II by R. Mitchell
19. Microbiology of the Atmosphere by P. H. Gregory 2nd edition Leonard Hill
20. Air Pollution Control Theory by Crawford M
21. Basic Microbiology with applications by Brock and Brock
22. Evans, G.G. & Furlong, J. 2010. Environmental Biotechnology: Theory and Application (2edition). Wiley-Blackwell Publications.
23. Scagg, A H 2005 Environmental Biotechnology. Oxford University Press
24.Jordening, HJ. & Winter J. 2005 Environmental Biotechnology: Concepts andApplications.John Wiley & Sons.
25. Rittman, B.F. & McCarty, PL., 2001. Environmental Biotechnology.Principles andApplications. McGraw-Hill, New York.
26. Snustad, D.P. & Simmons, MJ. 2011. Principles of Genetics (6th edition). John Wiley &Sons

**SAC00122514T**
**MIC/DSC/T/251: Medical Microbiology**

**Total Credits :02**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives of the Course:**

- Explain the role of bacteria, viruses, fungi, protozoa, and rickettsiae in causing human diseases.
- Compare and contrast the pathogenesis and laboratory diagnosis of key bacterial, viral, fungal, protozoal, and rickettsial diseases.
- Analyze the morphological, cultural, and biochemical characteristics of bacterial pathogens and relate them to diagnostic procedures.
- Evaluate the epidemiological factors and prophylactic measures for viral diseases.
- Differentiate the antigenic structures and staining reactions of various microorganisms.

**Course Outcomes ( COs) :**

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

i) Apply Koch's postulates to analyze the etiology of microbial diseases.
ii) Comprehensively describe the representative bacterial disease w.r.t. morphology, classification, pathogenesis, laboratory diagnosis, and treatment.
iii) Analyze the virological characteristics, pathogenesis, and clinical management of viral diseases.
iv) Explain the characteristics, pathogenesis, and diagnostic approaches for fungal, protozoal, and rickettsial diseases, focusing on representative species.
v) Compare and contrast the epidemiological and prophylactic strategies for the prevention and control of bacterial, viral, fungal, protozoal, and rickettsial infections.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **I** | **Study of Human Diseases caused by bacteria**<br>Relevance of Koch's postulates in the study of disease caused by microorganisms<br>Study of following diseases w.r.t. Morphology, Staining reaction, Cultural & Biochemical characteristics, Antigenic profile, | **10 Hrs** |

| | | |
|---|---|---|
| | Pathogenesis, Clinical symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Treatment<br>- ***Mycobacterium tuberculosis***<br>- ***Staphylococcus aureus***<br>- ***Salmonella typhi*** | |
| **II** | **Study of Human Diseases caused by virus**<br>Study of following diseases w.r.t. Morphology, Antigenic structure, Pathogenesis, Clinical Symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Treatment.<br>**i)** HIV<br>**ii)** Hepatitis A<br>iii) Chikungunya<br>**iv)** Dengue Fever | **10 Hrs** |
| **III** | **Study of Human Diseases caused by fungi, protozoa and rickettsiae**<br>Study of following diseases w.r.t. Morphology, Pathogenesis, Clinical symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Treatment.<br>***i)*** Fungal disease: ***Candida albicans***<br>***ii)*** Protozoal disease: ***Plasmodium vivax***<br>**iii)** Rickettsial disease: ***Rickettsia typhi. Coxiella burnetii*.** | **10 Hrs** |

TextBooks:


6. A Textbook of Microbiology. Chakraborty P. (2013). 3rd edition. New Central Book Agency. India. ISBN-13: 978-8173818769.
7. Textbook of Microbiology. Kanungo Reba. (2017). Ananthanarayan and Paniker's 10th edition. The Orient Blackswan Publisher. ISBN-13: 978-9386235251..
8. Basic Immunology-Functions and Disorders of Immune System.Abbas A. K. and Lichtman A. H. (2004). 2nd Ed. Saunders. Elsevier Inc. PA. USA.
9. Immunology Essential and Fundamental. Pathak S. S. and Palan V. (1997) Pareen Publications Bombay.
10. Handbook of Immunology, Talwar G. P. (1983). Vikas Publishing Pvt. Ltd. New Delhi.

**SAC00122764P**
**MIC/DSC/P/276: Practical - Environmental Microbiology**
**Practical – Based on - Environmental Microbiology**

**Total Credits :02**

**Total Contact Hours : 60 Hrs** **Maximum Marks :50**

Learning Objectives of the Course:

- To study the variety of microorganisms present in air and its impact on human health
- To study the bioburden of the outdoor and indoor air
- To understand the bacteriological analysis of water and its significance in portability
- To study the types of pathogens present in water & wastewater
- To study the pollution parameters

Course Outcomes ( COs) :
After completion of the course, students will be able to –

- Study various types of microorganisms present in the air
- Study microbial load of indoor and outdoor air
- Study the potability of water
- Study pollution parameters of water and wastewater

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | • Enumeration of microbes from: Indoor and outdoor environments<br>• Dust Fall Jar: Construction and analysis of pollution trend in the selected area. | 12 Hrs |
| II | • Bacteriological examination of drinking water:MPN, SPC<br>• Qualitative analysis of water: Presumptive, Confirmed,Completed test<br>• Demonstration of Automated water testing methods (The growth direct by Rapid micro biosystem, Bioburden testing)<br>• Isolation of E.coli and identification by IMVIC | 24 Hrs |
| III | • Testing of (water& domestic sewage) for parameters like chlorine, phosphate, nitrate, and BOD and COD.<br>• Isolation of coliphages from sewage | 24 Hrs |

| | | |
|---|---|---|
| | • Isolation of enteric pathogens from domestic sewage salmonella and shigella spp | |

Reference Books:


11. Experiments in Microbiology- Aneja K.R.

12. Handbook of Media, stain and reagents in Microbiology by A.M.Deshmukh

3. Practical Microbiology –R.C.Dubey and D.K.Maheshwari S.Chand and company Limited Reprint 2024

4. Microbial Limit and Bioburden Tests, 2nd edition - Lucia Clontz (CRC Press)

5. Microbial Techniques - Pathade and Goel (ABD Pub, Jaipur).

6. Waste Water Treatment - Datta and Rao (Oxford and IBH)

7. APHA (2023) Standard Methods for the examination of water wastewater 24th Edition, Greenberg, Washington D.C. USA

**SAC00122774P**
**MIC/DSC/P/277: Practical - Medical Microbiology**
**Practical based on- Medical Microbiology**

**Total Credits : 02**

**Total Contact Hours : 60 Hrs** **Maximum Marks : 50**

**Learning Objectives of the Course:**

To develop abilities among students for

i) Accuracy in preparation and utilization of selective and differential media for cultivation of and differentiation of pathogens
ii) Proficiency in performing and interpreting studies to characterize bacterial pathogens.
iii) Effective employment and interpretation of immunological assays to detect specific pathogens.
iv) Identification and analysis of pathogens through microscopic observation and rapid diagnostic tests, demonstrating an understanding of fungal and protozoal pathogens.
v) Study of antibiotic resistance patterns using and gain practical insights into PCR-based pathogen identification..

**Course Outcomes ( COs) :**

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

i) Prepare and utilize selective and differential media for the cultivation and identification of pathogenic bacteria and fungi.
ii) Perform and interpret acid-fast staining, hemolysis, and coagulase tests to characterize bacterial pathogens.
iii) Demonstrate and interpret immunological assays, including ELISA and rapid tests for Chikungunya, Dengue fever, and malaria, for the detection of specific pathogens.
iv) Identify fungal (*Candida albicans*) and protozoal (*Plasmodium vivax*) pathogens through microscopic observation and rapid diagnostic methods.
**v)** Determine antibiotic resistance patterns in bacteria and understand the principles of PCR-based pathogen identification through a pathological laboratory visit.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **I** | 1) Preparation of media for cultivation of pathogenic bacteria<br>i. Mannitol Salt Agar<br>ii. Wilson and Blair's Medium | **20 Hrs** |

| | | |
|---|---|---|
| | iii. Lowenstein-Jenson's Medium<br>iv. Sabouraud Dextrose Agar<br>2) Demonstration of permanent slide of Acid Fast Staining<br>3) Study of bacterial pathogens ***Staphylococcus aureus***<br>4) Study of bacterial pathogens ***Salmonella typhi*** | |
| **II** | 1) Demonstration of ELISA<br>2) Rapid Test for Chikungunya<br>3) Rapid Test for Dengue Fever<br>4) Demonstration of haemolysis and coagulase test | **20 Hrs** |
| **III** | 1) Study of fungal pathogen ***Candida albicans***<br>2) Study of protozoal parasite ***Plasmodium vivax*:** Observation of *Plasmodium vivax* in peripheral blood smear (permanent slide)<br>3) Determination of antibiotic resistance of bacteria by Gradient Plate Technique<br>4) Visit to pathological laboratory to study PCR based identification of pathogen.<br>5) Epidemiological study of any one disease from various diseases commonly found in the region/ state/ country. | **20 Hrs** |

***Reference books:***


1. *Practical Microbiology*, Arora, D.R. and Bharati Arora, (2025), 3rd Edition, CBS Publishers & Distributors Pvt. Ltd.
2. Mahajan's Methods in Biostatistics for Medical Students and Research Workers, Bratati Banerjee, (2018), 9the Edition, Jaypee Brothers Medical Publishers.
3. *Practical Microbiology For Under Graduate Medical Students*, Subhash Chandra Parija, (2018), Ahuja Publishing House
4. *Practical Pathology*, Harsh Mohan, (2016), 4th edition, Jaypee Brothers Medical Publishers (P) Ltd.
5. *Levinson's Review of Medical Microbiology and Immunology: A Guide to Clinical Infectious Disease*, M.D. Chin-Hong *et al*, (2024), 18th Edition, McGraw-Hill.
6. *Handbook of Immunology, Talwar G. P. (1983). Vikas Publishing Pvt. Ltd. New Delhi*

**SCC00122504T**

**MIC/Mn/T/250: Microbiology of Indian Traditional foods**

(This course is designed for students from other disciplines)

**Total Credits :02**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives:**

- To understand the role and diversity of microorganisms in Indian traditional fermented foods.
- To study the process of fermentation and its effect on food quality
- To study the process of preservation of food
- To understand the cultural and ethnic importance of Indian fermented foods.

**Course Outcomes ( COs) :**

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

- To understand the microbiological basis and health benefits of Indian traditional fermented foods.
- To explore the role of microorganisms in food fermentation and preservation.
- To highlight the cultural and economic importance of Indian fermented foods.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Basics of Fermentation and Microorganisms**<br>● Definition and types of fermentation (lactic acid, alcoholic, acetic acid, alkaline).<br>● Microorganisms involved in fermentation: lactic acid bacteria, yeasts, molds.<br>● Advantages of fermentation: nutrition, preservation, flavor, and probiotic effects.<br>● Traditional methods vs. modern fermentation technologies. | **6 Hrs** |
| II | **Cereal- and Legume-Based Fermented Foods**<br>● Biochemistry, Microbiology, Fermentation, and beneficial activities involved in Fermented products: Dosa, Pickled Cucumber, Kombcha, Dhokala, Idli, Hawaijar, Jalebi, Anarsa<br>● Microflora involved: *Leuconostoc, Lactobacillus, Saccharomyces*.<br>● Changes in texture, flavor, and nutritional profile. | **12 Hrs** |

| | | |
|---|---|---|
| | ● Case studies: Fermentation process flow, pH changes, shelf-life extension. | |
| III | **Milk- and Vegetable-Based Fermented Foods**<br>● Dairy products: Dahi, Lassi, Shrikhand, Mishti Doi, Cheese,<br>● Vegetable products: Gundruk (fermented leafy greens), Kanji, Pickles (lactic fermented).<br>● Starter cultures and natural microflora.<br>● Health benefits: probiotic potential, lactose digestion, antimicrobial compounds.<br>● Food safety and quality control in traditional fermented products.<br>● Government initiatives (FSSAI, AYUSH) and entrepreneurship opportunities in fermented foods. | **12 Hrs** |

**References:**


1. Ethnic fermented food and beverages of India: Science, history and culture. Editor- Jyoti Prakash Tamang, School of Sciences, Dept. of Microbiology, Sikkim University, Gangtok, Sikkim, India.

2. Functional Properties of Microorganisms in Fermented Foods **:** Jyoti P Tamang , Dong-Hwa Shin , Su-Jin Jung , Soo-Wan Chae, Front Microbiol 2016 Apr 26;7:578. doi: 10.3389/fmicb.2016.00578

3. A Comprehensive Review on Survey on Lactic Acid Bacteria in Fermented Foods of West Bengal: Understanding Diversity and Functionality Papiya Ghorai Manna , Keshamma E , Kamal Kant Patra https://doi.org/ 10.33472/AFJBS.6.SI2.2024.103-116

4. Isolation, characterization and safety assessment of lactic acid bacterial isolates from fermented food productsPooja Thakkar, H.A.Modi and J.B.Prajapati, Int.J.Curr.Microbiol.App.Sci (2015)4(4):713-725

5. Indian Traditional Fermented Foods: The Role of Lactic Acid Bacteria by Arekal Nagaraja Roopashri, Janakiraman Savitha, M.S. Divyashree, B.S. Mamatha, K.A. Usha Rani and Ashwini Kumar, DOI: 10.5772/intechopen.110741

**SCC00122514T**

**MIC/Mn/T/ 251: Microbiology of Beverages**

(This course is designed for students from other disciplines)

**Total Credits :02**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives:**

By the course end, students will:

- Explain microbial roles in diverse beverage systems.
- Design fermentation protocols and troubleshoot spoilage.
- Evaluate beverage safety using industry-standard methods.

**Course Objectives:**

1. Understand microbial roles in beverage production, spoilage, and safety.
2. Analyse fermentation processes for alcoholic/non-alcoholic beverages.
3. Apply quality control and regulatory standards in beverage microbiology.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Introduction to Beverage Microbiology**<br>- Historical context and economic impact.<br>- Microbial diversity in beverages: yeasts, bacteria (LAB, acetic acid bacteria), molds.<br>**Microbial Physiology in Fermentation**<br>- Carbohydrate metabolism (glycolysis, ethanol production).<br>- Role of enzymes, stress responses in microbes.<br>**Quality Control & Safety**<br>- Microbiological testing (CFU counts, PCR, ATP bioluminescence).<br>- HACCP, sanitation, regulatory standards (FDA, ISO). | **6 Hrs** |

| | | |
|---|---|---|
| | - Examples of outbreaks linked to contaminated beverages. | |
| II | **Non-Alcoholic Beverages**<br>- Juices: Pasteurization, spoilage (Alicyclobacillus), safety (*E. coli*, Salmonella).<br>- Soft Drinks: Carbonated and Non-Carbonated, Preservatives, acid-tolerant microbes.<br>- Dairy-based: Kefir, yogurt drinks (Lactobacillus, Bifidobacterium).<br>-Tea: kombucha (Acetobacter, Brettanomyces).<br>Alcoholic Beverages<br>-Beer: Malting, mashing, fermentation (Saccharomyces), spoilage (lactic acid bacteria).<br>-Wine: Grape must, yeast strains (*S. cerevisiae*), MLF (*Oenococcus oeni*).<br>-Distilled Spirits: Distillation post-fermentation (whiskey, rum).<br>-Traditional: Sake (rice wines).<br>Emerging Trends<br>- Probiotic beverages, low-alcohol beers, and non-dairy alternatives.<br>- Sustainability in production (e.g., waste-to-energy microbes). | **12 Hrs** |
| III | **Preservation of Beverages**<br>1. Pasteurization<br>2. High-process processing<br>3. Hydrodynamic cavitation<br>4. Pulsed electric field (PEF)<br>5. Irradiation<br>6. Membrane filtration<br>7. Preservatives | **12 Hrs** |

**References:**

1. Brewing Microbiology (F.G. Priest).

2. Wine Microbiology (K.C. Fugelsang).

3. Food and Beverage Mycology (L.R. Beuchat).

Supplementary:

- Journal articles on probiotic trends, spoilage mechanisms.

- FDA/ISO guidelines for beverage safety.

**SDC00122504T**

**MIC/GE/OE/T/250 -: Public Health**

(This course is designed for students from other disciplines)

**Total Credits : 02**

**Total Contact Hours : 30 Hrs** **Maximum Marks : 50**

**Learning Objectives of the Course:**

Introduce the basic concepts and scope of public health, including its historical evolution. Familiarize students with the structure and functioning of the healthcare system in India. Highlight the importance of preventive healthcare, nutrition, sanitation, and hygiene in community health. Develop awareness about major communicable and non-communicable diseases affecting public health in India.

Equip students with knowledge about national health programs, policies, and public health interventions. Encourage critical thinking about health disparities, environmental factors, and the role of social determinants in health.

**Course Outcomes (CO's)**

After successful completion of this course, students are expected to:

**1**: Define key public health terms and explain the role of public health in improving community well-being.

**2**: Analyze the causes, prevention, and control measures for major health issues in India.

**3**: Apply basic public health principles to real-life situations, including health education, disease prevention, and health promotion.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Understanding Public Health**<br>v. Public Health: Concept, Significance<br>vi. Importance of Public Health<br>vii. Everyday Factors That Affect Health (Food, Exercise, Cleanliness)<br>viii. Terminologies related to Public Health: Epidemic, Pandemic, contagious/communicable infections, Carrier, Vector | **10 Hrs** |
| II | **Health and Society**<br>v. Common Illnesses and Their Prevention<br>vi. Importance of Clean Water, Good Food, and Exercise<br>vii. How Public Health Helps in Communities<br>**viii.** Role of Hospitals and Government in Public Health | **10 Hrs** |
| III | **Public Health in Daily Life**<br>v. Care of Own Health<br>vi. Helping Others Stay Healthy<br>vii. Role of Media in Spreading Health Awareness | **10 Hrs** |

| | | |
|---|---|---|
| | viii. Simple Public Health Campaigns That Work | |

**Reading Materials:**

13. "Foundations of Community Medicine" – *D. K. Taneja*
14. "Textbook of Public Health and Community Medicine" – *B. S. Garg*
15. "Public Health in India: Concern, Action and the Way Forward" – *Edited by R. Srinivasan*
16. "Health and Development" – *M. M. Sury*
17. "सार्वजनिक आरोग्य शास्त्र" – *डॉ. एन. डी. देशपांडे*
18. "समाज आणि आरोग्य" – *डॉ. संजय सावंत*
19. "समाजमाध्यमे आणि आरोग्य जागृती" – *डॉ. उज्वला गवळी*
20. "सामुदायिक आरोग्य परिचय" – *डॉ. वसंत पाटील*

**SDC00122504T**

**MIC/GE/OE/T/250 : सार्वजनिक आरोग्य**

**एकूण क्रेडिट्स** : 02 **एकूण संपर्क तास** : 30 तास **कमाल गुण** : 50

## अभ्यासक्रमाची उद्दिष्टे:

- सार्वजनिक आरोग्याच्या मूलभूत संकल्पना व व्याप्ती यांची ओळख करून देणे, तसेच त्याचा ऐतिहासिक विकास समजावणे.
- भारतातील आरोग्यसेवा व्यवस्थेची रचना व कार्यपद्धती समजावणे.
- प्रतिबंधात्मक आरोग्यसेवा, पोषण, स्वच्छता आणि आरोग्यविषयक सवयींचे महत्त्व अधोरेखित करणे.
- भारतात सार्वजनिक आरोग्यावर प्रभाव टाकणाऱ्या प्रमुख संसर्गजन्य व असंसर्गजन्य रोगांविषयी जागरूकता निर्माण करणे.
- राष्ट्रीय आरोग्य कार्यक्रम, धोरणे आणि सार्वजनिक आरोग्य हस्तक्षेप याविषयी माहिती देणे.
- आरोग्यविषयक विषमता, पर्यावरणीय घटक, आणि सामाजिक निर्धारक )Social Determinants) यांचा आरोग्यावरील प्रभाव यावर चिंतन करायला उद्युक्त करणे.

## Course Outcomes (CO's)

**CO1:** सार्वजनिक आरोग्याशी संबंधित प्रमुख संज्ञा समजावून सांगता येतील आणि समाजाच्या आरोग्यवृद्धीसाठी सार्वजनिक आरोग्याची भूमिका स्पष्ट करता येईल.

**CO2:** भारतातील प्रमुख आरोग्य समस्यांची कारणे, प्रतिबंध व नियंत्रण उपाय विश्लेषित करता येतील.

**CO3:** आरोग्य शिक्षण, रोग प्रतिबंध व आरोग्यवर्धन यासह वास्तव जीवनातील परिस्थितींमध्ये सार्वजनिक आरोग्य तत्त्वे लागू करता येतील.

| घटक क्र | विषय अभ्यासाचे तपशील / | संपर्क तास |
|---|---|---|
| I | **सार्वजनिक आरोग्याची समज**<br>• सार्वजनिक आरोग्य :संकल्पना व महत्त्व<br>• सार्वजनिक आरोग्याचे महत्त्व<br>• दैनंदिन जीवनातील आरोग्यावर परिणाम करणारे घटक अन्न), व्यायाम, स्वच्छता( | **10 Hrs** |

| | | |
|---|---|---|
| | • सार्वजनिक आरोग्याशी संबंधित संज्ञासाथी :, महामारी, संसर्गजन्य रोग, वाहक, विषाणूवाहन/) | |
| **II** | **आरोग्य आणि समाज**<br>• सामान्य आजार व त्यांची प्रतिबंधात्मक उपाय<br>• स्वच्छ पाणी, पोषक आहार आणि व्यायामाचे महत्त्व<br>• सार्वजनिक आरोग्याचा समाजातील उपयोग<br>• रुग्णालये व शासनाची सार्वजनिक आरोग्यातील भूमिका | **10 Hrs** |
| **III** | **दैनंदिन जीवनातील सार्वजनिक आरोग्य**<br>• स्वतःच्या आरोग्याची काळजी<br>• इतरांच्या आरोग्याची मदत<br>• आरोग्य जनजागृतीसाठी माध्यमांची भूमिका<br>• प्रभावी सार्वजनिक आरोग्य मोहिमा | **10 Hrs** |

**Reading Materials:**


21. "Foundations of Community Medicine" – *D. K. Taneja*
22. "Textbook of Public Health and Community Medicine" – *B. S. Garg*
23. "Public Health in India: Concern, Action and the Way Forward" – *Edited by R. Srinivasan*
24. "Health and Development" – *M. M. Sury*
25. "सार्वजनिक आरोग्य शास्त्र" – *डॉ. एन. डी. देशपांडे*
26. "समाज आणि आरोग्य" – *डॉ. संजय सावंत*
27. "समाजमाध्यमे आणि आरोग्य जागृती" – *डॉ. उज्वला गवळी*
28. "सामुदायिक आरोग्य परिचय" – *डॉ. वसंत पाटील*

**SEC00122504T**
**MIC/SEC/T/250:**
**Standardization and Calibration of Laboratory Equipment**

**Total Credits : 01**

**Total Contact Hours : 15 Hrs** **Maximum Marks : 50**

**Learning Objectives of the Course:**

To develop abilities among students

i) To differentiate between accuracy and precision, and apply standardization, calibration, and validation principles to laboratory equipment

ii) To perform calibration and validation procedures for Weighing Balances, Centrifuge machines, Autoclave, Hot Air Oven, and Laminar Air Flow.

iii) To standardize and validate the Colorimeter and Spectrophotometer by performing linearity, repeatability, and wavelength accuracy assessments.

iv) To explain the principles of colorimetry and spectrophotometry and apply these techniques to create standard curves and quantify substances relevant to microbiology

v) To analyze validation data statistically, document findings, and troubleshoot common issues related to laboratory equipment and sterilization procedures.

**Course Outcomes ( COs) :**

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

i) Perform calibration/ standardization and validation procedures for laboratory equipment like weighing balances and centrifuge machines.

ii) Standardize and validate Autoclave sterilization processes by pressure and temperature studies and by using biological as well as chemical indicators.

iii) Standardize and validate Hot Air Oven sterilization processes by temperature studies by using biological indicators.

iv) Apply principles of colorimetry and spectrophotometry to measure absorbance, and transmittance, and create standard curves for microbiological applications.

| | | |
|---|---|---|
| v) Undertake standardization and validation of Laminar Air Flow<br>vi) Understand and apply quality control and quality assurance concepts to laboratory equipment standardization and data analysis. | | |
| Module No. | Topics / actual contents of the syllabus | Contact Hours |
| **I** | **Introduction to Laboratory Equipment and Standardization**<br>i. Importance of accuracy and precision in microbiology,<br>ii. Concepts of standardization, calibration, and validation<br>**Weighing Balances**<br>i. Weighing balance: Types- analytical and top-loading (electronic), maintenance and care<br>ii. Standardization procedures: Calibration using standard weights.<br>iii. Linearity, repeatability checks and<br>iv. Environmental factors affecting balance accuracy.<br>**Centrifuge Machine**<br>i. Principles of sedimentation and factors affecting sedimentation rate (particle size, density, viscosity).<br>ii. Different types of centrifuges used in microbiology- benchtop, high-speed, ultracentrifuges<br>iii. Applications (cell separation, pelleting, nucleic acid precipitation, etc.).<br>iv. Importance of standardization | **5 Hrs** |
| **II** | **Autoclaves**<br>i. Principle, construction, and working<br>ii. Validation procedures: Temperature mapping<br>iii. Biological indicators- ***Geobacillus stearothermophilus*** spores and Chemical indicators- autoclave tape)<br>iv. Pressure and time validation<br>**Hot Air Ovens**<br>i. Principle, construction, and working<br>ii. Biological indicators- ***Bacillus subtilis*** spores<br>iii. Time validation<br>**Colorimeters**<br>i. Principles and Components of a colorimeter<br>ii. Standardization procedures: Calibration using standard solutions (Absorbance and transmittance measurements)<br>iii. Creating standard curves | **5 Hrs** |
| **III** | **Spectrophotometers** | **5 Hrs** |

| | | |
|---|---|---|
| | i. Principles of spectrophotometry (UV-visible)<br>ii. Components of a spectrophotometer:<br>a) Single-beam spectrophotometer<br>b) Double-beam Spectrophotometer<br>iii. Standardization using blank and standard solution<br>iv. Validation procedures: Validation with standard solutions<br>**Laminar Air Flow**<br>i. Introduction and significance<br>ii. Significance of Laminar Air Flow<br>iii. Component of LAF- Filters (pre-filter, HEPA filter), blower, pressure gauges, UV light, Visible light and understanding their function.<br>iv. Validation of Laminar Air Flow by<br>a) Microbiological analysis of airflow<br>b) Microbiological testing of interior surface contamination | |

*Reference Books:*


*1. Practical Microbiology*, R.C. Dubey, D.K. Maheshwari, (2010), S. Chand and Company Ltd.

2. *Instrumental Methods of Chemical Analysis*, Chatwal & Anand (2019), 5th Edition, Himalaya Publishing House

3. *Microbiology: A Laboratory Manual*, James G. Cappuccino, Chad Welsh, (2019), 12th editon, Pearson

4. *Good Laboratory Practices and Compliance Monitoring*, Trupti Patil-Dongare, (2021), 1st edition, PharmaMed Press / BSP Books.

5. *Handbook Of Microbiological Quality Control: Pharmaceuticals And Medical Devices*, Rosamund M. Baird, Norman A. Hodges, Stephen P. Denye, (2000), 1st edition, CRC Press

6. *Principles of Instrumental Analysis***,** Douglas A. Skoog/F. James Holler/Stanley R. Crouch, (2020), 7th Edition, Cengage India Private Limited.

**SEC00122514T**
**MIC/SEC/T/ 251: Microbiological Analysis of Food and Soil**

**Total Credits :01**

**Total Contact Hours : 15 Hrs** **Maximum Marks :50**

**Learning Objectives of the Course:**

- To learn techniques used in microbiological analysis of food and soil
- To develop skills in detecting and quantifying microbial contaminants
- To study the pathogens and their role in soil and food
- To understand possible ways of food preservation
- To report the quality of food and soil

**Course Outcomes ( COs)** :
After completion of the course, students will be able to -

- To introduce students to the principles and techniques used in microbiological analysis of food and soil.
- To develop skills in detecting and quantifying microbial contaminants.
  To understand the role of microorganisms in soil health and food safety.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Microbiological Analysis of Food**<br>1.1 Introduction to Food Microbiology<br>• Microbial flora of foods<br>• Factors influencing microbial growth in food (intrinsic and extrinsic)<br>1.2 Food Spoilage and Pathogens<br>• Spoilage of different types of food: milk, meat, fruits, vegetables<br>• Foodborne pathogens: *Salmonella, Listeria, E. coli, Clostridium botulinum, Bacillus cereus*<br>1.3 Microbiological Examination Methods<br>• Standard Plate Count (SPC)<br>• Coliform and fecal coliform testing<br>• Detection of specific pathogens (selective media, ELISA, PCR) | **5Hrs** |
| II | **Microbiological Analysis of Soil** | **5Hrs** |

| | | |
|---|---|---|
| | 2.1 Soil as a Microbial Habitat<br>● Types of soil microorganisms: bacteria, actinomycetes, fungi, algae<br>● Soil microflora and their role in nutrient cycling (N, C, P cycles)<br>2.2 Soil Sampling and Processing Techniques<br>● Soil sampling protocols<br>● Serial dilution and plating<br>● Enrichment techniques<br>2.3 Microbial Quantification in Soil<br>● Total viable count (TVC)<br>● Enumeration of specific functional groups: Nitrogen fixers (e.g., *Azotobacter*, *Rhizobium*), Phosphate solubilizers, Cellulose degraders<br>2.4 Soil Health and Microbial Indicators<br>● Microbial biomass: carbon and nitrogen<br>● Enzymatic assays (dehydrogenase, phosphatase activity) | |
| III | **Quality Control and Applications**<br>3.1 Quality Control and Good Laboratory Practices (GLP)<br>● Parameters considered in quality control of food<br>● Sterilization techniques<br>● Media preparation and quality checks<br>3.2 Applications<br>• Probiotics in food industry<br>● Biofertilizers and their microbial formulations<br>3.2 Food Safety and Standards<br>● Concept of: HACCP, ISO 22000, BRCGS, FAO, 4 C's in food safety<br>● FSSAI guidelines and food safety regulations | **5 Hrs** |

**Reference Books:**


1.Frazier, W. C., & Westhoff, D. C. (2008). Food Microbiology. McGraw Hill Education.

2.Jay, J. M., Loessner, M. J., & Golden, D. A. (2005). Modern Food Microbiology. Springer.

3.Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (1993). Microbiology: Concepts and Applications. McGraw-Hill.

4.Alexander, M. (1977). Introduction to Soil Microbiology. Wiley.

5.Subba Rao, N. S. (1999). Soil Microbiology. Oxford & IBH Publishing.

6.Tortora, G. J., Funke, B. R., & Case, C. L. (2018). Microbiology: An Introduction. Pearson.

7.FSSAI manuals and guidelines: www.fssai.gov.in

**SEC00122764P**
**MIC/SEC/P/ 276: Practical**
(Based on Standardization and Calibration of Laboratory Equipment's)

**Total Credits : 01**

**Total Contact Hours : 30 Hrs** **Maximum Marks : 50**

**Learning Objectives of the Course:**

To develop abilities among students to

1. Calibrate and validate a weighing balance by performing linearity, and repeatability tests, and documenting the data.
2. Standardization and validation of centrifuge machine.
3. Sterilization process of an autoclave by monitoring temperature, pressure, and validation using biological and chemical indicators.
4. Validate the sterilization process of a hot air oven by mapping temperature distribution and using biological indicators.
5. Standardize a colorimeter and spectrophotometer using standard solutions and validate its absorbance measurements.
6. Standardization and validation of Laminar Air Flow.

**Course Outcomes ( COs) :**

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

**i)** Calibrate and validate weighing balances by performing linearity, and repeatability tests, and documenting the data.
**ii)** Understand SOP and validate centrifuge machine.
**iii)** Standardize and validate autoclave sterilization cycles using temperature/pressure monitoring and biological/chemical indicators.
**iv)** Standardize and validate hot air oven sterilization cycles through biological indicator testing.
**v)** Standardize colorimeter and spectrophotometer using standard solutions and validate absorbance measurements by assessing wavelength absorbance accuracy and linearity.
**vi)** Standardization and validation of Laminar Air Flow.

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **I** | **Weighing Balance Calibration and Validation**<br>i. Standardization of weighing balance using standard weights<br>ii. Validation of a weighing balance by linearity and repeatability testing<br>**Centrifuge Machine**<br>i. Standard Operating Procedures (SOPs) of a Centrifuge Maching: Sample loading, balancing, setting parameters, and cleaning of centrifuge<br>ii. Validation of rotor balance by using known samples | **10 Hrs** |
| **II** | **Autoclave Validation** (4 Hours)<br>i. Standardization of Autoclave by temperature and pressure monitoring<br>ii. Validation of autoclave by sterility checks using biological indicator testing (e.g., ***Geobacillus stearothermophilus*** spores)/ Sterility checks using chemical indicator usage and interpretation and documentation<br>**Hot Air Oven Validation**<br>i. Standardization of Hot Air Oven by temperature and pressure monitoring and documentation of sterilization cycles.<br>ii. Validation of sterilization cycles using biological indicator testing (e.g., ***Bacillus subtilis*** spores and documentation | **10 Hrs** |
| **III** | **Colorimeter Standardization and Validation**<br>i. Standardization and validation of colorimeter absorbance measurements and preparation of standard curves and documentation.<br>**Spectrophotometer Validation and Standardization**<br>i. Standardization of spectrophotometer by absorbance accuracy and linearity testing,<br>ii. Validation of spectrophotometer by creating a standard curve and documentation.<br>**Laminar Air Flow**<br>i. Microbiological Air Sampling in LAF- Checking airborne microorganisms onto agar plates at different locations and enumerating the colony-forming units (CFU). | **10 Hrs** |

***Reference books:***


1. *Practical Microbiology*, R.C. Dubey, D.K. Maheshwari, (2010), S. Chand and Company Ltd.

2. *Pharmaceutical Calibration, Validation and Qualification: A Comprehensive Approach*, Shiv Shankar Shukla, Ravindra Kumar Pandey, Beena Gidwani, Gunjan Kalyani, (2023), 1st edition, Springer Verlag, Singapore

3. *Principles of Instrumental Analysis***,** Douglas A. Skoog/F. James Holler/Stanley R. Crouch, (2020), 7th Edition, Cengage India Private Limited.

4. *Autoclave Validation*, Rajesh Kumar, (2023), 1st Edition, Kindle Edition

5. *A Practical Book on Calibration of Analytical Instruments*, Suresh Jain, Vipin Saini, Dr. Naitik Trivedi, (2019), Kindle Edition, Nirali Prakashan.

6. *Practical Handbook Instrumental Methods of Analysis*, Hemant Ramchandra Badwaik; Lokesh Tukaram Thote and Tapan Kumar Giri, (2022), 1st Edition, Vallabh Prakashan

**SEC00122774P**
**MIC/SEC/P/ 277: Practical**
**(Based on Microbiological Analysis of Food and Soil)**

**Total Credits :01**

**Total Contact Hours : 30 Hrs** **Maximum Marks :50**

**Learning Objectives of the Course:**

-To study the techniques used to study microflora of food and soil
-To study pathogens in street foods
-To understand the rapid diagnostic methods for detecting pathogens
-To study media preparation
-To study sterility testing

**Course Outcomes ( COs) :**

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

-Study microbial load of food and soil
-Study types of pathogens found in street foods
-Study modern and rapid methods of diagnosis
-Study the quality of soil

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **I** | ● Enumeration of total viable bacteria in food and soil samples<br>● Isolation of pathogenic microorganisms from street foods<br>● Demonstration of Rapid methods used in the detection and diagnosis of pathogenic microorganisms from food (PCR, ELISA, Biosensors) | **10 Hrs** |
| **II** | ● Media preparation and sterility testing<br>● Detection of *E. coli* and *Salmonella* using selective media | **10 Hrs** |
| **III** | ● Isolation of phosphate-solubilizing bacteria from soil<br>● Assessment of soil dehydrogenase activity<br>● Media preparation and sterility testing | **10 Hrs** |

***Reference Books:***

1. Experiments in Microbiology- Aneja K.R.

2. Handbook of Media, stain and reagents in Microbiology by A.M.Deshmukh

3. Practical Microbiology –R.C.Dubey and D.K.Maheshwari S.Chand and company limited Reprint 2024

4. FSSAI manuals and guidelines: www.fssai.gov.in