



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)

PALLAVARAM - CHENNAI

ACCREDITED BY NAAC WITH 'A' GRADE

*Marching Beyond 30 Years Successfully*

INSTITUTION WITH UGC 12B STATUS

## **UNDERGRADUATE DEGREE PROGRAMME**

**B.Sc., Microbiology**

**Three Years /**

**B.Sc., (Hons) Microbiology**

**Four Years**

### **CURRICULUM & SYLLABUS**

**REGULATION 2024**

**Choice Based Credit System (CBCS)**

**&**

**Learning Outcomes Based Curriculum Framework (LOCF)**

**Effective from the Academic Year**

**2024 -2025**

**Department of Microbiology**

**School of Life Sciences**



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## DEPARTMENT OF MICROBIOLOGY

### VISION OF THE DEPARTMENT

To produce graduates with relevant education descriptors and hands-on skills in microbiology and related areas of life sciences plus holistic development of individuals that makes them responsible citizens of society.

### MISSION OF THE DEPARTMENT

|           |   |
|-----------|---|
| <b>M1</b> | Imparting relevant knowledge and creating an atmosphere to develop innovative and critical thinking.  |
| <b>M2</b> | Skill enhancement through hands-on training and value-added courses plus add on courses.  |
| <b>M3</b> | Sustained focus on original high-quality research encouraging scientific thinking and approach.   |
| <b>M4</b> | Creating an environment for holistic development of individuals with emphasis on spirit of integrity, equity, professional ethics and social harmony through the exposure and participation in co-curricular, extracurricular and extension activities. |

### PROGRAMME EDUCATIONAL OUTCOMES (PEO)

|             |   |
|-------------|---|
| <b>PEO1</b> | To provide the graduates with knowledge in microbiology and an overview of the processes that employ or deal with microbes that enables them to handle the safe and efficient use of microbiological applications with development of competence on par with global standards and helps the graduates for life-long learning.   |
| <b>PEO2</b> | To prepare graduates by imparting skills to use technological developments related to current and advanced areas involving molecular diagnostics, immunotechnology, mass cultivation of microbes, downstream processing and nanotechnology with scope for upskilling in all potential future technologies so as to contribute effectively for Research & Development leading to patenting and publishing. |
| <b>PEO3</b> | To train graduates to choose a decent career option either as Entrepreneur or having a high degree of employability; or pursue higher education – by empowering students with basic interpersonal skills, ability to handle critical situations allowing them to be good team members as well as training to excel in competitive examinations.   |
| <b>PEO4</b> | To impart a strong sense of social responsibility with awareness of professional and societal ethical values and scope to develop leadership capabilities.  |
| <b>PEO5</b> | To establish an environment that accentuates the requirement to fulfil life-long learning for the overall development of self and society at large.   |

### PROGRAMME OUTCOMES (PO)

|            |   |
|------------|---|
| <b>PO1</b> | <b>Microbiology knowledge:</b> Graduates will acquire microbiology specific knowledge including molecular biology, immunology and rDNA technology coupled with hands-on skills and leadership skills for a successful career. |
| <b>PO2</b> | <b>Problem analysis:</b> Graduates will be able to analyse, solve and troubleshoot problems in implementation of microbiological protocols.   |
| <b>PO3</b> | <b>Design/development of solutions:</b> Graduates will develop creative thinking and cooperate with each other to solve problems in the field of microbiology.  |
| <b>PO4</b> | <b>Conduct investigations of complex problems:</b> Graduates will acquire practical skills  |

|            |  |
|------------|--|
|            | – which help in planning and designing protocols to validate hypothesis and execute experimental techniques independently as well as assimilate, analyse and interpret subsequent data.  |
| <b>PO5</b> | <b>Modern tool usage and communication:</b> Graduates will effectively be able to manage resources and time using ICT and computer enabled devices and accomplish ability to understand and communicate all ideas effectively.   |
| <b>PO6</b> | <b>Environment sustainability and Ethics:</b> Graduates will get adequate knowledge to use information and implement solutions for environmental protection and remediation. Graduates will be aware of their role and responsibility in handling and use of microbes including genetically modified microorganisms. |
| <b>PO7</b> | <b>Lifelong learning:</b> Graduates will carry on to learn and adapt in a world of constantly evolving technology.   |

### **PROGRAMME SPECIFIC OUTCOMES (PSO)**

|             |  |
|-------------|--|
| <b>PSO1</b> | <b>Microbiology skills:</b> The ability to understand the basic concepts related to the relevant fields of microbiology which will enable them to analyse and develop solutions to microbiology related problems.  |
| <b>PSO2</b> | <b>Microbiology related employability skills:</b> The ability to use the acquired hands-on skills in microbiology, molecular biology, immunology, medical microbiology and screening for useful biomolecules within employment areas.  |
| <b>PSO3</b> | <b>Successful Career and Entrepreneurship:</b> The ability to gainfully become an entrepreneur by using microorganisms to produce biofertilizers, mushrooms and pharmaceutically important biomolecules as well as using practical hands-on training to become employed in diagnostic, industrial, pharmaceutical, food and research and development laboratories. |

## BOARD OF STUDIES

### List of Members

#### Department of Microbiology

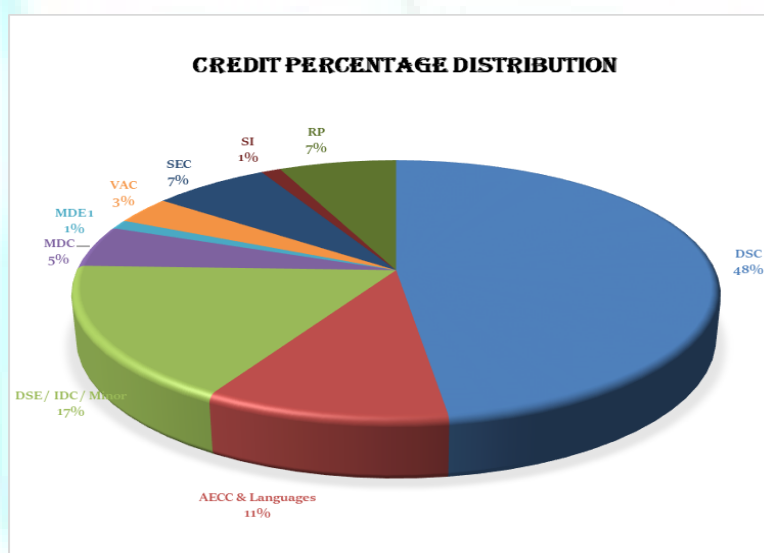
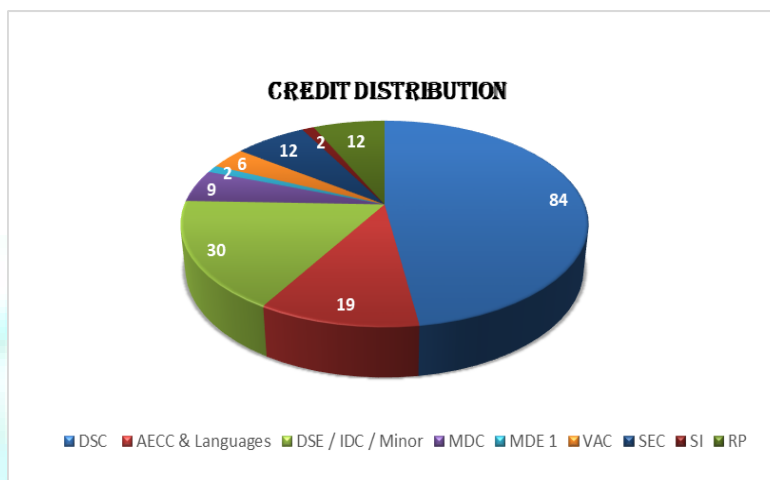
| S. No | Name & Designation   | Address  | Role   |
|-------|--|--|--|
| 1     | <b>Dr.G.Gayathri</b><br>Associate Professor and Head<br>I/c Department of<br>Microbiology, VISTAS.<br>Chennai. | Associate Professor and Head<br>I/c Department of<br>Microbiology, VISTAS.<br>Chennai.   | <b>Chairperson</b>                                     |
| 2     | <b>Dr. A.K.Kathiresan</b><br>Professor & Director, School<br>of Life Sciences, VISTAS,<br>Chennai.             | Professor & Director<br>School of Life Sciences,<br>VISTAS.<br>Chennai.  | <b>Member</b>  |
| 3     | <b>Dr.Suresh Dhanaraj</b><br>Associate Professor<br>Department of Microbiology,<br>VISTAS.<br>Chennai.         | Associate Professor<br>Department of Microbiology,<br>VISTAS.<br>Chennai.  | <b>Member</b>  |
| 4     | <b>Dr.S.B.Prabha</b><br>Assistant Professor<br>Department of Microbiology,<br>VISTAS.<br>Chennai.              | Assistant Professor<br>Department of Microbiology,<br>VISTAS.<br>Chennai.  | <b>Member</b>  |
| 5     | <b>Dr.S.V.Rajyoganandh</b><br>Assistant Professor<br>Department of Microbiology,<br>VISTAS.<br>Chennai.        | Assistant Professor<br>Department of Microbiology,<br>VISTAS.<br>Chennai.  | <b>Member</b>  |
| 6     | <b>Dr. K.Mahalakshmi</b><br>Professor and Head   | Director – Research lab for<br>Oral and Systemic Health,<br>Department of Microbiology,<br>Sree Balaji Dental College and<br>Hospital, Pallikaranai, Bharath<br>University, Chennai. | <b>Academic<br/>Expert<br/>(External<br/>Member)</b>   |
| 7     | <b>Dr.Babu Sarangan</b><br>Managing Director,<br>Mahathi Biotech.  | Mahathi Biotech<br>K.K Nagar, Chennai –<br>78.   | <b>Industrial<br/>Expert<br/>(External<br/>Member)</b> |
| 8     | <b>Thiru Siraj Kareem</b><br>Managing Director<br>Inlead Management  | Inlead Management Services,<br>Mangadu, Chennai.   | <b>Alumini<br/>(External<br/>Member)</b>               |

## CREDIT DISTRIBUTION

**B.Sc., (Hons) in Microbiology**  
**Minimum credits to be earned: 176**

**B.Sc., Microbiology**  
**Minimum credits to be earned: 132**

| <b>Component</b>            | <b>I Sem</b> | <b>II Sem</b> | <b>III Sem</b> | <b>IV Sem</b> | <b>V Sem</b> | <b>VI Sem</b> | <b>3 Yrs. Total Credits</b> | <b>VII Sem</b> | <b>VIII Sem</b> | <b>4 Yrs Total Credits</b> |
|-----------------------------|--------------|---------------|----------------|---------------|--------------|---------------|-----------------------------|----------------|-----------------|----------------------------|
| <b>DSC</b>                  | 8            | 8             | 8              | 8             | 12           | 16            | 60                          | 12             | 12              | 84                         |
| <b>AECC &amp; Languages</b> | 4            | 4             | 4              | 7             | -            | -             | 19                          | -              | -               | 19                         |
| <b>DSE / IDC / Minor</b>    | 4            | 4             | 3              | 4             | 4            | 3             | 22                          | 4              | 4               | 30                         |
| <b>MDC</b>                  | 3            | 3             | 3              | -             | -            | -             | 9                           | -              | -               | 9                          |
| <b>MDE 1</b>                | -            | -             | 2              | -             | -            | -             | 2                           | -              | -               | 2                          |
| <b>VAC</b>                  | 1            | 2             | -              | 1             | 2            | -             | 6                           | -              | -               | 6                          |
| <b>SEC</b>                  | 2            | 2             | 2              | 2             | 2            | 2             | 12                          | -              | -               | 12                         |
| <b>SI</b>                   | -            | -             | 1              | -             | 1            | -             | 2                           | -              | -               | 2                          |
| <b>RP</b>                   | -            | -             | -              | -             | -            | -             | -                           | 6              | 6               | 12                         |
| <b>Total Credits</b>        | 22           | 23            | 23             | 22            | 21           | 21            | 132                         | 22             | 22              | 176                        |



## ABBREVIATIONS

|             |  |
|-------------|--|
| <b>DSC</b>  | Disciplinary Specific Core             |
| <b>AECC</b> | Ability Enhancement Compulsory Courses |
| <b>DSE</b>  | Disciplinary Specific Elective         |
| <b>IDC</b>  | Interdisciplinary / Minor Courses      |
| <b>MDC</b>  | Multidisciplinary Courses              |
| <b>VAC</b>  | Value Added Courses                    |
| <b>SEC</b>  | Skill Enhancement Courses              |
| <b>SI</b>   | Summer Internship                      |
| <b>RP</b>   | Research Project                       |

## CURRICULUM STURCTURE

B.Sc., Microbiology Three Years

/

B.Sc., (Hons) in Microbiology Four Years

**Total number of Credits: 176**

| B.Sc., Microbiology (Hons) Minimum Credits to be earned :176 |                                    |   |           |          |          |          |           |          |          |          |
|--|------------------------------------|---|-----------|----------|----------|----------|-----------|----------|----------|----------|
| B.Sc., Microbiology Minimum Credits to be earned: 132        |                                    |   |           |          |          |          |           |          |          |          |
| SEMESTER 1   |                                    |   |           |          |          |          |           |          |          |          |
| Hours/Week   |                                    |   |           |          |          |          |           |          |          |          |
| Maximum Marks  |                                    |   |           |          |          |          |           |          |          |          |
| Category   | Code                               | Course  | L         | T        | P        | O        | C         | CIA      | SEE      | Total    |
| <b>LANG 1</b>  | 24LTAM11/2<br>4LHIN11/<br>24LFRE11 | Tamil I /<br>Hindi I/<br>French I                           | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>ENG 1</b>   | 24LENG11                           | English I   | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>DSC 1</b>   | 24CBMB11                           | Basic Techniques in Microbiology                            | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSC 2</b>   | 24CBMB12                           | General Microbiology  | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| <b>MDC 1</b>   | 24MBMB11                           | Microbiology of Air and Water                               | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSE 1 /<br/>IDC 1 /<br/>Minor 1</b>                       | 24DBMB1-                           | Discipline Specific Elective - I                            | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| <b>DSC 1 (Lab)</b>   | 24PBMB11                           | Practical I - Practical in Basic Microbiological Techniques | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| <b>VAC 1</b>   | 24DVAC11                           | Universal Human Values                                      | 1         | 0        | 0        | 1        | 1         | -        | 100      | 100      |
| <b>SEC 1</b>   | 24SSKU11                           | Soft Skills I   | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>SEC 2</b>   |                                    | Orientation programme / Industrial Visit                    | -         | -        | -        | -        | -         | -        | -        | -        |
|  |                                    |   | <b>21</b> | <b>-</b> | <b>2</b> | <b>-</b> | <b>22</b> | <b>-</b> | <b>-</b> | <b>-</b> |

CIA - Continuous Internal Assessment

SEE - Semester End Examination

\*L – Lecture, \*T- Tutorial, \*P- Practical, \*O - Outside the class effort / self-study



## SEMESTER 2

| Category                               | Code      | Course   | L         | T        | P        | O        | C         | CIA      | SEE      | Total    |
|--|-----------|--|-----------|----------|----------|----------|-----------|----------|----------|----------|
| <b>LANG 2</b>                          | 24LTAM21/ | Tamil II /   |           |          |          |          |           |          |          |          |
|  | 24LHIN21/ | Hindi II /   | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
|  | 24LFRE21  | French II  |           |          |          |          |           |          |          |          |
| <b>ENG 2</b>                           | 24LENG21  | English II   | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>DSC 3</b>                           | 24CBMB21  | Microbial Genetics and Molecular Biology             | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSC 4</b>                           | 24CBMB22  | Industrial Microbiology                              | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>MDC 2</b>                           | 24MBMB21  | Bioinstrumentation                                   | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSE 2 /<br/>IDC 2 /<br/>Minor 2</b> | 24DBMB2-  | Discipline Specific Elective - II                    | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| <b>DSC 3<br/>(Lab)</b>                 | 24PBMB21  | Practical II – Practical in Molecular biology        | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| <b>DSC 4<br/>(Lab)</b>                 | 24PBMB22  | Practical III – Practical in Industrial Microbiology | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| <b>VAC 2</b>                           | 24DVAC21  | Communication Skills                                 | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>SEC 3</b>                           | 24SSKU21  | Soft Skills II                                       | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
|  |           |  | <b>21</b> | <b>-</b> | <b>4</b> | <b>-</b> | <b>23</b> | <b>-</b> | <b>-</b> | <b>-</b> |

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### SEMESTER 3

| Category                               | Code      | Course  | L         | T        | P        | O        | C         | CIA      | SEE      | Total    |
|--|-----------|---|-----------|----------|----------|----------|-----------|----------|----------|----------|
| <b>LANG 3</b>                          | 24LTAM31/ | Tamil III /   |           |          |          |          |           |          |          |          |
|  | 24LHIN31/ | Hindi III /   | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
|  | 24LFRE31  | French III  |           |          |          |          |           |          |          |          |
| <b>ENG 3</b>                           | 24LENG31  | English III   | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>DSC 5</b>                           | 24CBMB31  | Basic Concepts in Immunology                          | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSC 6</b>                           | 24CBMB32  | Environmental Microbiology                            | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>MDC 3</b>                           | 24MBMB31  | Microbial Biotechnology                               | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSE 3 /<br/>IDC 3 /<br/>Minor 3</b> | 24DBMB3-  | Discipline Specific Elective - II                     | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSC 5<br/>(Lab)</b>                 | 24PBMB31  | Practical IV – Practical in Immunology                | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| <b>DSC 6<br/>(Lab)</b>                 | 24PBMB32  | Practical V – Practical in Environmental Microbiology | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| <b>MDE 1</b>                           | -         | Indian Knowledge System                               | 1         | 1        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>SEC 4</b>                           | 24SSKU31  | Soft Skills III                                       | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| <b>SI 1</b>                            | 24IBMB31  | Internship I  | 0         | 0        | 2        | 1        | 1         | -        | 100      | 100      |
|  |           |   | <b>19</b> | <b>1</b> | <b>6</b> | <b>-</b> | <b>23</b> | <b>-</b> | <b>-</b> | <b>-</b> |

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**SEMESTER 4**

| <b>Category</b>                        | <b>Code</b>                        | <b>Course</b>  | <b>L</b>  | <b>T</b> | <b>P</b> | <b>O</b> | <b>C</b>  | <b>CIA</b> | <b>SEE</b> | <b>Total</b> |
|--|------------------------------------|--|-----------|----------|----------|----------|-----------|------------|------------|--------------|
| <b>LANG 4</b>                          | 24LTAM41/<br>24LHIN41/<br>24LFRE41 | Tamil IV /<br>Hindi IV /<br>French IV                          | 2         | 0        | 0        | 1        | 2         | 40         | 60         | 100          |
| <b>ENG 4</b>                           | 24LENG41                           | English IV   | 2         | 0        | 0        | 1        | 2         | 40         | 60         | 100          |
| <b>AECC 1</b>                          | 24EVS031                           | Environmental<br>Studies                                       | 3         | 0        | 0        | 2        | 3         | 40         | 60         | 100          |
| <b>DSC 7</b>                           | 24CBMB41                           | Medical Mycology<br>and Parasitology                           | 3         | 0        | 0        | 2        | 3         | 40         | 60         | 100          |
| <b>DSC 8</b>                           | 24CBMB42                           | Medical<br>Bacteriology  | 3         | 0        | 0        | 2        | 3         | 40         | 60         | 100          |
| <b>DSE 4 /<br/>IDC 4 /<br/>Minor 4</b> | 24DBMB4-                           | Discipline Specific<br>Elective - IV                           | 4         | 0        | 0        | 2        | 4         | 40         | 60         | 100          |
| <b>DSC 7<br/>(Lab)</b>                 | 24PBMB41                           | Practical VI –<br>Practical in<br>Mycology and<br>Parasitology | 0         | 0        | 2        | 1        | 1         | 40         | 60         | 100          |
| <b>DSC 8<br/>(Lab)</b>                 | 24PBMB42                           | Practical VII –<br>Practical in<br>Bacteriology                | 0         | 0        | 2        | 1        | 1         | 40         | 60         | 100          |
| <b>SEC 5</b>                           | 24SBMB41                           | Industry Oriented<br>Employability skills                      | 1         | 0        | 2        | 1        | 2         | 40         | 60         | 100          |
| <b>VAC 3</b>                           | 24DVAC41                           | Yoga Education /<br>NSS / NCC                                  | 0         | 0        | 2        | 1        | 1         | -          | 100        | 100          |
| <b>SEC 6</b>                           |                                    | In-plant Training/<br>Industrial Tour/<br>Summer Term          | -         | -        | -        | -        | -         | -          | -          | -            |
|  |                                    |  | <b>18</b> | <b>-</b> | <b>8</b> | <b>-</b> | <b>22</b> | <b>-</b>   | <b>-</b>   | <b>-</b>     |

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### SEMESTER 5

| Category                      | Code     | Course   | L         | T        | P        | O        | C         | CIA      | SEE      | Total    |
|-------------------------------|----------|--|-----------|----------|----------|----------|-----------|----------|----------|----------|
| DSC 9                         | 24CBMB51 | Soil & Agricultural Microbiology   | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| DSC 10                        | 24CBMB52 | Food Microbiology  | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| DSC 11                        | 24CBMB53 | Basics of Pharmaceutical Microbiology  | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| DSE 5 /<br>IDC 5 /<br>Minor 5 | 24DBMB5- | Discipline Specific Elective - V   | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| DSC 9<br>(Lab)                | 24PBMB51 | Practical VIII – Practical in Soil and Agricultural Microbiology                                   | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| DSC 10<br>(Lab)               | 24PBMB52 | Practical IX - Practical in Food and Pharmaceutical Microbiology                                   | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| SEC 7                         | 24SBMB51 | Entrepreneurial Development  | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| VAC 4                         | 24DVAC51 | Spirulina Cultivation  | 2         | 0        | 0        | 1        | 2         | 40       | 60       | 100      |
| SI 2                          | 24IBMB51 | Internship II  | 0         | 0        | 2        | 1        | 1         | -        | 100      | 100      |
| SEC 8                         |          | Skill Enhancement Training / Student Club Activities/<br>Institution Innovation Council Activities | -         | -        | -        | -        | -         | -        | -        | -        |
|                               |          |  | <b>18</b> | <b>-</b> | <b>6</b> | <b>-</b> | <b>21</b> | <b>-</b> | <b>-</b> | <b>-</b> |

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### SEMESTER 6

| Category                               | Code     | Course  | L         | T        | P        | O        | C         | CIA      | SEE      | Total    |
|--|----------|---|-----------|----------|----------|----------|-----------|----------|----------|----------|
| <b>DSC 12</b>                          | 24CBMB61 | Basics of Genetic Engineering                     | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSC 13</b>                          | 24CBMB62 | Quality Assurance in Microbiology                 | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| <b>DSC 14</b>                          | 24CBMB63 | Biofertilizers Technology                         | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| <b>DSC 15</b>                          | 24CBMB64 | Mushroom Technology                               | 4         | 0        | 0        | 2        | 4         | 40       | 60       | 100      |
| <b>DSE 6 /<br/>IDC 6 /<br/>Minor 6</b> | 24DBMB6- | Discipline Specific Elective - II                 | 3         | 0        | 0        | 2        | 3         | 40       | 60       | 100      |
| <b>DSC 12<br/>(Lab)</b>                | 24PBMB61 | Practical X –<br>Practical in Genetic Engineering | 0         | 0        | 2        | 1        | 1         | 40       | 60       | 100      |
| <b>SEC 9</b>                           | 24SBMB61 | Mini Project                                      | 0         | 0        | 4        | 1        | 2         | -        | 100      | 100      |
| <b>SEC 10</b>                          |          | On Job Training /<br>Apprenticeship /<br>Startup  | -         | -        | -        | -        | -         | -        | -        | -        |
|  |          |   | <b>18</b> | <b>-</b> | <b>6</b> | <b>-</b> | <b>21</b> | <b>-</b> | <b>-</b> | <b>-</b> |

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### SEMESTER 7

| Category                      | Code     | Course   | L  | T | P  | O | C  | CIA | SEE | Total |
|-------------------------------|----------|--|----|---|----|---|----|-----|-----|-------|
| DSC 16                        | 24CBMB71 | Microbial Enzymology and Metabolism              | 3  | 0 | 0  | 2 | 3  | 40  | 60  | 100   |
| DSC 17                        | 24CBMB72 | Microbes and Sustainable Development             | 4  | 0 | 0  | 2 | 4  | 40  | 60  | 100   |
| DSC 18                        | 24CBMB73 | Research Methodology                             | 4  | 0 | 0  | 2 | 4  | 40  | 60  | 100   |
| DSE 7 /<br>IDC 7 /<br>Minor 7 | 24DBMB7- | Discipline Specific Elective - II                | 4  | 0 | 0  | 2 | 4  | 40  | 60  | 100   |
| DSC 16<br>(Lab)               | 24PBMB71 | Practical XI – Practical in Microbial Enzymology | 0  | 0 | 2  | 1 | 1  | 40  | 60  | 100   |
| RP 1                          | 24RBMB71 | Research Project I                               | 0  | 0 | 12 | 4 | 6  | 40  | 60  | 100   |
|                               |          |  | 15 | - | 14 | - | 22 | -   | -   | -     |

CIA - Continuous Internal Assessment                      SEE - Semester End Examination

\*L – Lecture, \*T- Tutorial, \*P- Practical, \*O - Outside the class effort / self-study

### SEMESTER 8

| Category                      | Code     | Course  | L  | T | P  | O | C  | CIA | SEE | Total |
|-------------------------------|----------|---|----|---|----|---|----|-----|-----|-------|
| DSC 19                        | 24CBMB81 | Algal Biotechnology                               | 3  | 0 | 0  | 2 | 3  | 40  | 60  | 100   |
| DSC 20                        | 24CBMB82 | Marine Microbiology                               | 3  | 0 | 0  | 2 | 3  | 40  | 60  | 100   |
| DSC 21                        | 24CBMB83 | Microbial Entrepreneurship                        | 4  | 0 | 0  | 2 | 4  | 40  | 60  | 100   |
| DSE 8 /<br>IDC 8 /<br>Minor 8 | 24DBMB8- | Discipline Specific Elective - II                 | 4  | 0 | 0  | 2 | 4  | 40  | 60  | 100   |
| DSC 19<br>(Lab)               | 24PBMB81 | Practical XII – Practical in Algal Biotechnology  | 0  | 0 | 2  | 1 | 1  | 40  | 60  | 100   |
| DSC 20<br>(Lab)               | 24PBMB82 | Practical XIII – Practical in Marine Microbiology | 0  | 0 | 2  | 1 | 1  | 40  | 60  | 100   |
| RP 2                          | 24RBMB81 | Research Project II                               | 0  | 0 | 12 | 4 | 6  | -   | 60  | 100   |
|                               |          |   | 14 | - | 16 | - | 22 | -   | -   | -     |

CIA - Continuous Internal Assessment                      SEE - Semester End Examination

\*L – Lecture, \*T- Tutorial, \*P- Practical, \*O - Outside the class effort / self-study

### DISCIPLINE SPECIFIC CORE COURSES

| Category    | Code     | Course  | L | T | P | O | C |
|-------------|----------|---|---|---|---|---|---|
| DSC 1       | 24CBMB11 | Basic Techniques in Microbiology                            | 3 | 0 | 0 | 2 | 3 |
| DSC 2       | 24CBMB12 | General Microbiology  | 4 | 0 | 0 | 2 | 4 |
| DSC 1 (Lab) | 24PBMB11 | Practical I - Practical in Basic Microbiological Techniques | 0 | 0 | 2 | 1 | 1 |
| DSC 3       | 24CBMB21 | Microbial Genetics and Molecular Biology                    | 3 | 0 | 0 | 2 | 3 |
| DSC 4       | 24CBMB22 | Industrial Microbiology                                     | 3 | 0 | 0 | 2 | 3 |
| DSC 3 (Lab) | 24PBMB21 | Practical II – Practical in Molecular biology               | 0 | 0 | 2 | 1 | 1 |
| DSC 4 (Lab) | 24PBMB22 | Practical III – Practical in Industrial Microbiology        | 0 | 0 | 2 | 1 | 1 |
| DSC 5       | 24CBMB31 | Basic Concepts in Immunology                                | 3 | 0 | 0 | 2 | 3 |
| DSC 6       | 24CBMB32 | Environmental Microbiology                                  | 3 | 0 | 0 | 2 | 3 |
| DSC 5 (Lab) | 24PBMB31 | Practical IV – Practical in Immunology                      | 0 | 0 | 2 | 1 | 1 |
| DSC 6 (Lab) | 24PBMB32 | Practical V – Practical in Environmental Microbiology       | 0 | 0 | 2 | 1 | 1 |
| DSC 7       | 24CBMB41 | Medical Mycology and Parasitology                           | 3 | 0 | 0 | 2 | 3 |
| DSC 8       | 24CBMB42 | Medical Bacteriology & Virology                             | 3 | 0 | 0 | 2 | 3 |
| DSC 7       | 24PBMB41 | Practical VI –  | 0 | 0 | 2 | 1 | 1 |

|                     |          |   |   |   |   |   |   |
|---------------------|----------|---|---|---|---|---|---|
| <b>(Lab)</b>        |          | Practical in Mycology and Parasitology                              |   |   |   |   |   |
| <b>DSC 8 (Lab)</b>  | 24PBMB42 | Practical VII –<br>Practical in Bacteriology                        | 0 | 0 | 2 | 1 | 1 |
| <b>DSC 9</b>        | 24CBMB51 | Soil & Agricultural Microbiology                                    | 3 | 0 | 0 | 2 | 3 |
| <b>DSC 10</b>       | 24CBMB52 | Food Microbiology   | 3 | 0 | 0 | 2 | 3 |
| <b>DSC 11</b>       | 24CBMB53 | Basics of Pharmaceutical Microbiology                               | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 9 (Lab)</b>  | 24PBMB51 | Practical VIII –<br>Practical in Soil and Agricultural Microbiology | 0 | 0 | 2 | 1 | 1 |
| <b>DSC 10 (Lab)</b> | 24PBMB52 | Practical IX -<br>Practical in Food and Pharmaceutical Microbiology | 0 | 0 | 2 | 1 | 1 |
| <b>DSC 12</b>       | 24CBMB61 | Basics of Genetic Engineering                                       | 3 | 0 | 0 | 2 | 3 |
| <b>DSC 13</b>       | 24CBMB62 | Quality Assurance in Microbiology                                   | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 14</b>       | 24CBMB63 | Biofertilizers Technology   | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 15</b>       | 24CBMB64 | Mushroom Technology   | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 12 (Lab)</b> | 24PBMB61 | Practical X –<br>Practical in Genetic Engineering                   | 0 | 0 | 2 | 1 | 1 |
| <b>DSC 16</b>       | 24CBMB71 | Microbial Enzymology and  | 3 | 0 | 0 | 2 | 3 |



|                     |          |   |   |   |   |   |   |
|---------------------|----------|---|---|---|---|---|---|
|                     |          | Metabolism  |   |   |   |   |   |
| <b>DSC 17</b>       | 24CBMB72 | Microbes and Sustainable Development              | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 18</b>       | 24CBMB73 | Research Methodology                              | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 16 (Lab)</b> | 24PBMB71 | Practical XI – Practical in Microbial Enzymology  | 0 | 0 | 2 | 1 | 1 |
| <b>DSC 19</b>       | 24CBMB81 | Algal Biotechnology                               | 3 | 0 | 0 | 2 | 3 |
| <b>DSC 20</b>       | 24CBMB82 | Marine Microbiology                               | 3 | 0 | 0 | 2 | 3 |
| <b>DSC 21</b>       | 24CBMB83 | Microbial Entrepreneurship                        | 4 | 0 | 0 | 2 | 4 |
| <b>DSC 19 (Lab)</b> | 24PBMB81 | Practical XII – Practical in Algal Biotechnology  | 0 | 0 | 2 | 1 | 1 |
| <b>DSC 20 (Lab)</b> | 24PBMB82 | Practical XIII – Practical in Marine Microbiology | 0 | 0 | 2 | 1 | 1 |

KNOWLEDGE IS POWER

## DISCIPLINE SPECIFIC ELECTIVE COURSES

| Category     | Code     | Course   | L | T | P | O | C |
|--------------|----------|--|---|---|---|---|---|
| <b>DSE 1</b> | 24DBMB11 | Microbial Diversity                              | 4 | 0 | 0 | 2 | 4 |
|              | 24DBMB12 | Microbial Physiology and Metabolism              | 4 | 0 | 0 | 2 | 4 |
| <b>DSE 2</b> | 24DBMB21 | Basics of Biochemistry                           | 4 | 0 | 0 | 2 | 4 |
|              | 24DBMB22 | Biosafety and Intellectual Property Rights (IPR) | 4 | 0 | 0 | 2 | 4 |
| <b>DSE 3</b> | 24DBMB31 | Cell culture and Fermentation Technology         | 3 | 0 | 0 | 2 | 3 |
|              | 24DBMB32 | Food Fermentation Techniques                     | 3 | 0 | 0 | 2 | 3 |
| <b>DSE 4</b> | 24DBMB41 | Medical virology                                 | 4 | 0 | 0 | 2 | 4 |
|              | 24DBMB42 | Antimicrobial Agents and Resistance              | 4 | 0 | 0 | 2 | 4 |
| <b>DSE 5</b> | 24DBMB51 | Environmental Biotechnology                      | 4 | 0 | 0 | 2 | 4 |
|              | 24DBMB52 | Microbiome and Human health                      | 4 | 0 | 0 | 2 | 4 |
| <b>DSE 6</b> | 24DBMB61 | Microbiology and Public Health                   | 3 | 0 | 0 | 2 | 3 |
|              | 24DBMB62 | Bioenergetics in Microorganisms                  | 3 | 0 | 0 | 2 | 3 |
| <b>DSE 7</b> | 24DBMB71 | Recombinant DNA Technology                       | 4 | 0 | 0 | 2 | 4 |
|              | 24DBMB72 | Microbial bioremediation                         | 4 | 0 | 0 | 2 | 4 |
| <b>DSE 8</b> | 24DBMB81 | Microbial Technology for Human Welfare           | 4 | 0 | 0 | 2 | 4 |
|              | 24DBMB82 | Microbial Nanotechnology                         | 4 | 0 | 0 | 2 | 4 |

### AECC & LANGUAGES

| Category      | Code                               | Course                                   | L | T | P | O | C |
|---------------|------------------------------------|--|---|---|---|---|---|
| <b>LANG 1</b> | 24LTAM11/<br>24LHIN11/<br>24LFRE11 | Tamil I/ Hindi I/<br>French I            | 2 | 0 | 0 | 1 | 2 |
| <b>ENG 1</b>  | 24LENG11                           | English I                                | 2 | 0 | 0 | 1 | 2 |
| <b>LANG 2</b> | 24LTAM21/<br>24LHIN21/<br>24LFRE21 | Tamil II / Hindi II /<br>French II       | 2 | 0 | 0 | 1 | 2 |
| <b>ENG 2</b>  | 24LENG21                           | English II                               | 2 | 0 | 0 | 1 | 2 |
| <b>LANG 3</b> | 24LTAM31/<br>24LHIN31/<br>24LFRE31 | Tamil III /<br>Hindi III /<br>French III | 2 | 0 | 0 | 1 | 2 |
| <b>ENG 3</b>  | 24LENG31                           | English III                              | 2 | 0 | 0 | 1 | 2 |
| <b>AECC 1</b> | 24EVS031                           | Environmental<br>Studies                 | 3 | 0 | 0 | 2 | 3 |

### MULTIDISCIPLINARY COURSES

| Category     | Code     | Course                           | L | T | P | O | C |
|--------------|----------|----------------------------------|---|---|---|---|---|
| <b>MDC 1</b> | 24MBMB11 | Microbiology of Air<br>and Water | 3 | 0 | 0 | 2 | 3 |
| <b>MDC 2</b> | 24MBMB21 | Bioinstrumentation               | 3 | 0 | 0 | 2 | 3 |
| <b>MDC 3</b> | 24MBMB31 | Microbial<br>Biotechnology       | 3 | 0 | 0 | 2 | 3 |

### MULTIDISCIPLINARY ELECTIVE COURSES

| Category     | Code | Course                     | L | T | P | O | C |
|--------------|------|----------------------------|---|---|---|---|---|
| <b>MDE 1</b> | -    | Indian Knowledge<br>System | 1 | 1 | 0 | 1 | 2 |

### VALUE ADDED COURSES

| Category | Code     | Course                     | L | T | P | O | C |
|----------|----------|----------------------------|---|---|---|---|---|
| VAC 1    | 24DVAC11 | Universal Human Values     | 1 | 0 | 0 | 1 | 1 |
| VAC 2    | 24DVAC21 | Communication Skills       | 2 | 0 | 0 | 1 | 2 |
| VAC 3    | 24DVAC41 | Yoga Education / NSS / NCC | 0 | 0 | 2 | 1 | 1 |
| VAC 4    | 24DVAC51 | Spirulina Cultivation      | 2 | 0 | 0 | 1 | 2 |

### SKILL ENHANCEMENT COURSES

| Category | Code     | Course  | L | T | P | O | C |
|----------|----------|---|---|---|---|---|---|
| SEC 1    | 24SSKU11 | Soft Skills I   | 2 | 0 | 0 | 1 | 2 |
| SEC 2    |          | Orientation Programme / Industrial Visit  | - | - | - | - | - |
| SEC 3    | 24SSKU21 | Soft Skills II  | 2 | 0 | 0 | 1 | 2 |
| SEC 4    | 24SSKU31 | Soft Skills III   | 2 | 0 | 0 | 1 | 2 |
| SEC 5    | 24SBMB41 | Industry Oriented Employability skills  | 1 | 0 | 2 | 1 | 2 |
| SEC 6    |          | In-plant Training/ Industrial Tour/ Summer Term   | - | - | - | - | - |
| SEC 7    | 24SBMB51 | Entrepreneurial Development   | 2 | 0 | 0 | 1 | 2 |
| SEC 8    |          | Skill Enhancement Training / Student Club Activities/ Institution Innovation Council Activities | - | - | - | - | - |
| SEC 9    | 24SBMB61 | Mini Project  | 0 | 0 | 4 | 1 | 2 |
| SEC 10   |          | On Job Training / Apprenticeship / Startup  | - | - | - | - | - |

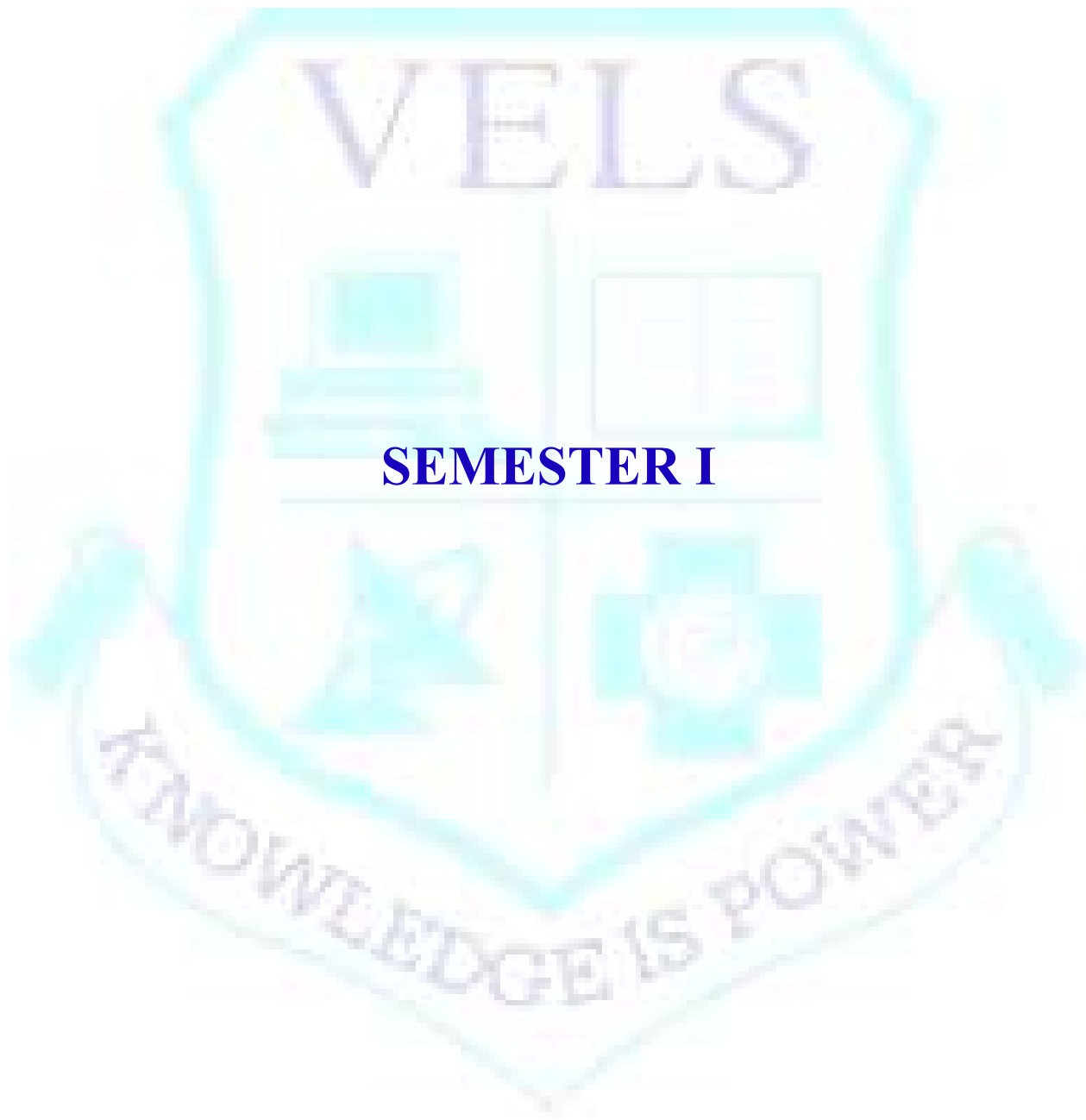
### SUMMER INTERNSHIP

| Category | Code     | Course        | L | T | P | O | C |
|----------|----------|---------------|---|---|---|---|---|
| SI 1     | 24IBMB31 | Internship I  | 0 | 0 | 2 | 1 | 1 |
| SI 2     | 24IBMB51 | Internship II | 0 | 0 | 2 | 1 | 1 |

### RESEARCH PROJECT

| Category | Code     | Course              | L | T | P  | O | C |
|----------|----------|---------------------|---|---|----|---|---|
| RP 1     | 24RBMB71 | Research Project I  | 0 | 0 | 12 | 4 | 6 |
| RP 2     | 24RBMB81 | Research Project II | 0 | 0 | 12 | 4 | 6 |





**SEMESTER I**

**24LTAM11 மொழிவரலாறு – சங்க இலக்கியம் – அற இலக்கியம் –  
மொழித்திறன்**

|   |   |   |   |   |
|---|---|---|---|---|
| L | T | P | O | C |
| 2 | 0 | 0 | 1 | 2 |

பருவம்-1, தமிழ்மொழிப்பாடம்-1, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப்  
பாட நேரம்: 2.

தாள்-1

**பாடத்திட்ட நோக்கம்:**

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், தற்கால தமிழ் இலக்கிய வகைமைகளான மரபுக்கவிதை, புதுக்கவிதை, உரைநடை ஆகியவற்றை அறிமுகப்படுத்துதல், தமிழர்தம் வாழ்வியல் நெறிகளையும் பண்பாட்டுச் செழுமைகளையும் இன்றைய தலைமுறையினர் அறியச் செய்தல், மாணவர்களுக்குத் தமிழைத் தவறின்றி எழுதுவதற்குத் தேவையான பயிற்சி அளித்து அவர்களின் மொழித்திறனை மேம்படுத்துதல், செய்யுளின் நலத்தைப் பாராட்டும் முறைமையை அறியச் செய்து அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களுக்கு வேலைவாய்ப்பை உருவாக்குவதும் இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

**அலகு - 1: தமிழ் மொழி வரலாறு**

**08 மணி நேரம்**

மொழிக்குடும்பம் - இந்திய மொழிக்குடும்பங்கள் - இந்திய ஆட்சி மொழிகள் - திராவிட மொழிக்குடும்பங்கள் - திராவிட மொழிகளின் வகைகள் - திராவிட மொழிகளின் சிறப்புகள் - திராவிட மொழிகளின் வழங்கிடங்கள் - திராவிட மொழிகளுள் தமிழின் இடம் - தமிழ்மொழியின் சிறப்புகள் - தமிழ் பிறமொழித் தொடர்புகள்.

**அலகு -2**

**08 மணி நேரம்**

புறநானூறு- பாடல் எண்: , 182, 183, - இரண்டு பாடல்கள்.  
குறுந்தொகை- பாடல் எண்: 2, 167, - இரண்டு பாடல்கள்  
பரிபாடல் - முருகன். வையை - இரண்டு பாடல்கள்

**அலகு -3 அற இலக்கியங்கள்**

**07 மணி நேரம்**

திருக்குறள்- வான்சிறப்பு (அறம்), பெருமை (பொருள்), பிரிவாற்றாமை (இன்பம்), மூன்று அதிகாரங்கள் முழுமையும் நாலடியார் - இரண்டு பாடல்கள். (2, 3 ) மூதுரை - இரண்டு பாடல்கள். (2, 8 )

பிழை நீக்கி எழுதுதல் - ஒற்றுப்பிழை நீக்கி எழுதுதல் - தொடர்பிழை நீக்கி எழுதுதல் - ஒற்று மிகும் இடங்கள் - ஒற்று மிகா இடங்கள் - பிற மொழிச் சொற்களை நீக்கி எழுதுதல் - பயிற்சிகள்.

**மொத்தம்: 30 மணி நேரம்**

***பார்வை நூல்கள்***

தமிழர் நாகரிகமும் பண்பாடும், டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.

தவறின்றித் தமிழ் எழுதுவோம், மா. நன்னன், ஏகம் பதிப்பகம், 1999.

தவறின்றித் தமிழ் எழுத - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.

தமிழ் இலக்கிய வரலாறு, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.

புதிய தமிழ் இலக்கிய வரலாறு, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.

செம்மொழி தமிழின் சிறப்பியல்புகள் - முனைவர் மறைமலை இலக்குவனார்;  
<https://www.youtube.com/watch?v=HHZnmJb4jSY>

***பாட நூல் தேடலுக்கான இணையம் - <https://archive.org/>***





|   |   |   |   |   |
|---|---|---|---|---|
| L | T | P | O | C |
| 2 | 0 | 0 | 1 | 2 |

वर्ष I – सत्र I (गद्य, पत्र लेखन & व्यावहारिक हिन्दी)

I Year-Sem I (Prose, Letter Writing & Functional Words)

**Course Objectives :**

- To understand the rural life style, social responsibilities and social values
- To create awareness about the importance of varied culture
- To enable the students to develop communication skill in Hindi and to use Azhagi, Azhagi+ fonts

- UNIT I :** पं.श्रीराम शर्मा कृत 'स्मृति' (कहानी)  
'Smruti' (Kahani) by Pandit Sriram Sharma. 6hrs.
- UNIT II :** शरद जोशी कृत 'अतिथि तुम कब जावोगे' (व्यंग्य)  
'Athiti tum kab jaaoge' (Vyangy) by Sharad Joshi. 6hrs.
- UNIT III:** राहुल सांस्कृतयायन कृत 'अथातो घुमक्कड़ जिज्ञासा' (यात्रा वृत्तान्त)  
'Atatho Ghumakkad Jigyasa' (Yatra Vruthanth) by 6hrs.  
Rahul Sanskritayan.
- UNIT IV:** व्यावहारिक हिन्दी- पत्र लेखन में प्रयुक्त वाक्यांश, कौशल विकास  
– भाव एक भाषा अनेक 6hrs.  
Functional Hindi-Phrases used in Letter Writing.  
Skill development - Bhav Ek Bhasha Anek
- UNIT V :** पत्र लेखन – परिचय व प्रकार, 3 अनौपचारिक पत्र  
अलगी, अलगी + फ्रॉन्ट का परिचय 6hrs.  
Letter Writing- Intro. & Types & 3 Personal Letters  
Introduction to Azhagi, Azhagi + fonts

**Total: 30hrs.**

**Course Outcome:**

At the end of this course Students will be able to

- CO1** Gain knowledge about the rural life style  
**CO2** Understand social values  
**CO3** Understand importance of varied culture  
**CO4** Journalise in Functional Hindi  
**CO5** Use Azhagi, Azhagi+ fonts

**Text Books:**

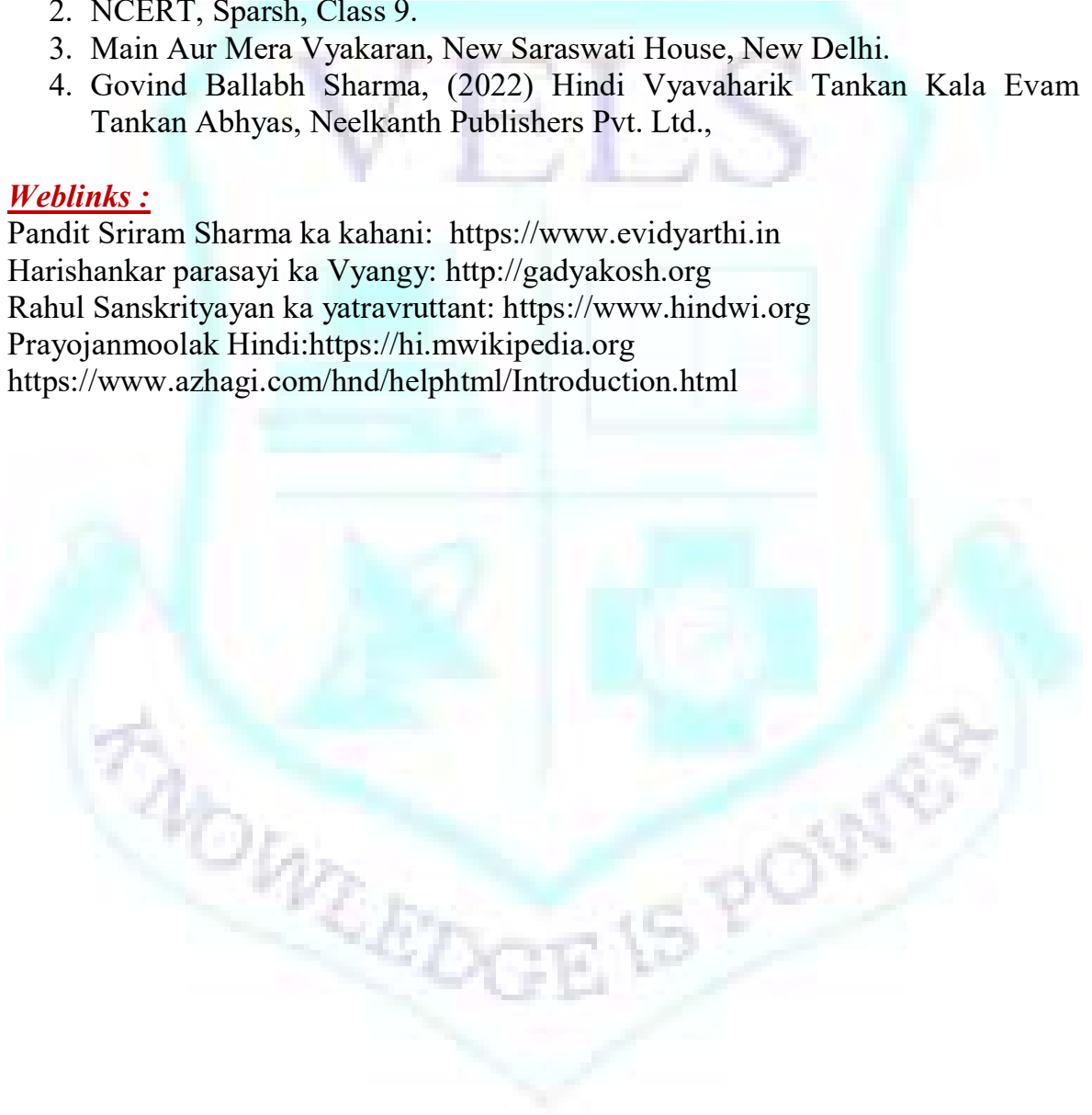
1. Pandit Shriram Sharma, Shikaar, (1932) Sahitya Sadan.
2. Sharad Joshi, Yatha Sambhav, (2014) Bharatiya Gyanpeet.
3. Rahul Sanskritayan, Ghumakkad Shastra, (1949) Rajkamal Prakashan.

**Reference Book:**

1. Kendriya Hindi Sansthan, (2012) Banking Hindi Patyakram.
2. NCERT, Sparsh, Class 9.
3. Main Aur Mera Vyakaran, New Saraswati House, New Delhi.
4. Govind Ballabh Sharma, (2022) Hindi Vyavaharik Tankan Kala Evam Tankan Abhyas, Neelkanth Publishers Pvt. Ltd.,

**Weblinks :**

Pandit Sriram Sharma ka kahani: <https://www.evidyarthi.in>  
Harishankar parasayi ka Vyangy: <http://gadyakosh.org>  
Rahul Sanskritayan ka yatravruttant: <https://www.hindwi.org>  
Prayojanmoolak Hindi: <https://hi.m.wikipedia.org>  
<https://www.azhagi.com/hnd/helphtml/Introduction.html>



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### Course Objectives

The lessons are being chosen:

- 1) to greet, to express excuse and to introduce oneself
- 2) to introduce another person
- 3) to express his/her ideas, opinions and weekend projects
- 4) to request someone to do something, polite manners
- 5) to accept, refuse, enquire and indicate the time and date
- 6) to express himself / herself in positive and negative manner

### UNITS

#### 1) Salut

les nombres, Les jours de la semaine et du mois, La nationalité 4 hours

#### 2) Enchanté

Les verbes Etre, Avoir, Aller, Regular ER verbes, Present tense. 6 hours

#### 3) J'Adore

La negation, l'adjectif possessif, le futur proche 4 hours

#### 4) Tu veux bien

Les articles de finis/indéfinis, Les pronoms après une préposition (avec lui, chez moi), Le passé composé 7 hours

#### 5) On se voit quand

Les pronoms compléments directs me, te, nous, vous, L'interrogation avec est-ce que, L'heure et la date. 5 hours

#### 6) Bonne idée

Les articles partitifs, Le masculin et le féminin des adjectifs, Les pronoms compléments directs le, la, les, La négation : ne... pas de. 4 hours

Total no. of hours - 30 hours

### Course Outcome :

- 1) The students would be able to greet, to excuse and to introduce himself
- 2) The students would be able to introduce someone
- 3) The students would be able to express his ideas, opinions and weekend projects
- 4) The students would be able to ask someone to do something, polite manner
- 5) The students would be able to accept, refuse enquire and indicate the time and date
- 6) The students would be able to express himself in positive and negative manner

### Text / Reference Book:

Prescribed book: LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

Reference book: SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

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**COURSE OBJECTIVES:**

- To enable students to develop their communication skills effectively.
- To make students familiar with usage skills in the English Language.
- To enrich their vocabulary in English.
- To develop communicative competence.

**Unit I- Prose**

- Dangers of drug abuse - Hardin B.Jones
- Tight corners - E.V.Lucas

**Credit Hours****06****Unit II -Poetry**

- Ecology - A.K.Ramanujan
- The owl and the chimpanzee - Jo Camacho

**06****Unit III - Short story**

- The Dear Departed - Stanley Houghton
- The Fool's Paradise- Isaac Bashevis Singer

**06****Unit IV -Grammar**

- Parts of speech, Articles

**06****Unit V -Grammar**

- One-word substitution, prefix, suffix, synonym, antonym.

**06****Total 30 hours****Course Outcomes:**

At the end of this course, the students would have learnt to

|            |  |
|------------|--|
| <b>CO1</b> | Understand the characteristic features of the language used in the text. |
| <b>CO2</b> | Strengthen their knowledge of basic grammar                              |
| <b>CO3</b> | Improve narrative skills after studying diverse prose and play.          |
| <b>CO4</b> | Understand to classify parts of speech and articles.                     |
| <b>CO5</b> | Develop critical writing skills in the textual content of the syllabus.  |

**References:**

- English for Communication Enrichment: by Jeya Santhi June 2015.
- Dr. M. Narayana Rao and Dr. B. G.Barki-Anu's Current English for Communication (AnuChitra). June 2012.
- Dr. Ananthan, R. Effective Communication. Ed. Chennai: Anu Chithra Pub.2010.

**24CBMB11****BASIC TECHNIQUES IN MICROBIOLOGY**

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**COURSE OBJECTIVE:**

The candidate will gain hands-on knowledge and acquire adequate skill required to sterilize media and to prepare, inoculate observe and distinguish the growth patterns in different media.

**UNIT-1 INTRODUCTION TO MODERN MICROSCOPY 9**

Bright field microscopy: Electromagnetic spectrum of light, Structure, working of and ray diagram of a compound light microscope, Types, ray diagram and functions of – condensers (Abbe and cardioid) eyepieces and objectives, Concept of aberrations in lenses - spherical, chromatic, comma and astigmatism, Principle, working and ray diagram of - Phase contrast microscope, Fluorescence Microscopy, Electron Microscopy – TEM, SEM.

**UNIT -11 STAINING TECHNIQUES 9**

Definition of Stain; Types of stains (Basic and Acidic), Properties and role of Fixatives, Mordants, Decolourisers and Accentuators, Monochrome staining and Negative (Relief) staining, Differential staining - Gram staining and Acid-fast staining, Special staining- Capsule, Cell wall, Spore, Flagella, Lipid granules, metachromatic granules.

**UNIT-111 STERILIZATION AND DISINFECTION 9**

Sterilization: Physical Agents - Heat, Radiation, Filtration, Checking of efficiency of sterilization (Dry and Moist) – Biological and Chemical Indicators, Disinfection: Chemical agents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds, Phenol and phenolic compounds, Characteristics of an ideal disinfectant, Heavy metals, Alcohol, Dyes, Detergents and Ethylene oxide, Checking of efficiency of disinfectant - Phenol Coefficient (Rideal–Walker method).

**UNIT-IV CULTIVATION OF MICROORGANISMS 9**

Nutritional requirements and nutritional classification, Design and preparation of media: Common ingredients of media and types of media, Methods for cultivating photosynthetic, extremophilic and chemo-lithotrophic bacteria, anaerobic bacteria, algae, fungi, actinomycetes and viruses, Concept of Enrichment, Pure Culture, Isolation of culture by streak plate, pour plate, spread plate, Maintenance of bacterial and fungal cultures using different techniques, Culture collection centres and their role, Requirements and guidelines of National Biodiversity Authority for culture collection centres

**UNIT-V BACTERIAL GROWTH 9**

Kinetics of bacterial growth (Exponential growth model), Growth curve and Generation time, Diauxic growth, Measurement of bacterial growth- Methods of enumeration: Microscopic methods

(Direct microscopic count, counting cells using improved Neubauer, Petroff-Hausser's chamber), Plate counts (Total viable count), Turbidometric methods (including Nephelometry), Estimation of biomass (Dry mass, Packed cell volume), Chemical methods (Cell carbon and nitrogen estimation), Factors affecting bacterial growth {pH, Temperature, Solute Concentration (Salt and Sugar)} and Heavy metals

**Total: 45 Hours**

### **Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Develop skills to observe microbes using microscopes.

**CO2:** Competently prepare and cultivate bacteria in different types of media.

**CO3:** Judge the accuracy of sterilization

**CO4:** Prepare media and grow fungi and algae in the lab

**CO5:** Evaluate the sensitivity and resistance of bacteria to antimicrobials

**CO6:** Explain the principles behind common microbiological techniques (e.g., staining methods, culturing techniques).

**CO7:** Summarize the differences between various types of microbial cultures.

### **Reference Books:**

1. T. Michael, M. Madigan, John. P. Martinko, David. Stahl, and A. David Clark (2010), Brock Biology of Microorganisms" 13<sup>th</sup> Edition. This textbook offers a detailed introduction to microbiology, including fundamental techniques and applications. It covers various microbiological methods and the principles behind them.
2. J. Gerard. Tortora, R. Berdell. Funke, and L. Christine. Case (2013). Microbiology: An Introduction" 11<sup>th</sup> Edition. This book provides a thorough introduction to microbiological techniques and concepts, including practical laboratory methods and their applications.
3. C. Karen. Carroll, C. Janice. Love, and A. Michael. P. faller (2023). Manual of Clinical Microbiology This manual is a comprehensive reference for clinical microbiology techniques, including culture methods, staining, and identification procedures.
4. Albert Balows, J. William. J. Hausler, Karl Hermann, and L. Kenneth. Herrmann (2006). Practical Handbook of Microbiology" 3<sup>rd</sup> Edition. A practical guide that covers essential microbiological techniques and protocols. It is useful for both beginners and experienced practitioners.
5. J.G. Holt, N.R. Krieg, P.H.A. Sneath, J. Staley, and S.T. Williams (2004). Microbiological Methods" 8<sup>th</sup> Edition. Description: This book provides detailed methods for microbiological laboratory techniques, including culturing, staining, and biochemical testing.

**24CBMB12**

**GENERAL MICROBIOLOGY**

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**COURSE OBJECTIVE:**

The candidate will gain knowledge about the structure of bacteria, fungi, algae, protozoa and viruses along with the basic principles of microscopy. Control of microbial growth by physical and chemical methods plus the use of antibiotics and their efficacy testing are emphasized. Cultivation of microbes and space microbiology is discussed.

**UNIT-I INTRODUCTION 12**

Historical perspective and scope of microbiology. Description of various groups of microorganisms with typical example. Cell cycle and reproduction of bacteria. Bacterial cell structure and components. Microbial classification. Tools and techniques in microbiology

**UNIT-II MICROSCOPY 12**

Microscopy–principles of microscopy-bright-field microscopy–Simple microscope, Compound microscope, PCM, FM, DFM,TEM,SEM and STEM–description, principle and use. Scanning Probe Microscopy (SPM), Applications of Microscopy, Preparing Samples for Microscopy, Modern Advances -Super-Resolution Microscopy, Cryo-Electron Microscopy (Cryo-EM)).

**UNIT-III STERILIZATION 12**

Sterilization– Principle, use and quality control of: High temperature -Dry Heat- Hot air oven, incineration, moist heat- Tyndallization, Pasteurization, inspissation, moist heat under pressure; low temperature–preservation; filtration-membrane filters, depth filters; centrifugation; radiation. Disinfection-Mode of action and Evaluation – RW test, KS Test, Use-Dilution method. Sterilization Validation (Biological Indicators, Chemical Indicators, Mechanical Indicators)

**UNIT – IV ANTIBIOTICS 12**

Antibiotics–Classification, Mode of Action, mechanism of resistance, Evaluation–Disc Diffusion; MIC– Broth dilution, agar dilution; MBC; E-test with Quality control for each method. Development of New Antibiotics -Novel Antibiotics, Teixobactin, Murepavadin, Rapid Diagnostic Techniques -Point-of-Care Testing, Genomic and Proteomic Approaches, Microbiome-Based Therapies.

**UNIT- V MICROBIAL GROWTH 12**

Growth requirements of Bacteria. Microbial culture media and pure culture techniques.



Anaerobic cultivation methods. Preservation of cultures. Quantitation of microbial growth and bacterial growth curve in batch culture. Microbial Growth in Extreme Environments - Thermophiles, Space Microbiology.

**Total: 60 Hours**

### **Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Demonstrate knowledge of fundamental microbiological principles.

**CO2:** Evaluate the outcomes of various antibiotic sensitivity tests.

**CO3:** Decide the optimum media for growth of microbes.

**CO4:** Assess the outcome of sterilization and disinfection protocol.

**CO5:** Judge the suitability of microscopes to microbial cytology.

**CO6:** Choose appropriate methods for cultivation of microorganisms.

### **Text Books:**

1. J. Michael , E.C.S.Chan, Noel R.Krieg (2006), Microbiology, Tata-McGrawHill.Ed.5.

### **Reference Books:**

1. R. Ananthanarayanan & C.K.Jeyaram Paniker (2005), Textbook of Microbiology, Ed.7, 2. Orient Longman.
2. T. Michael T. Madigan, M. John Martinko (2006), Brock's Biology of Microorganisms, Ed.11 Pearson-PrenticeHall.
3. M. Ronald Atlas (1997), Principles of Microbiology, Ed. 2. WCB Publishers.
4. Y. Roger, John Stanier, L. Ingraham, L. Mark Page Wheelis, Page R. Painter (2004), General Microbiology, Ed. 5. MacMillan Press.
5. Topley & Wilson's (2002), Principles of Bacteriology, Virology&Immunology, Ed. 9, Edward Arnold.
6. M. Lansing Prescott, P. John Harley, Donald A. Klein (2005), Microbiology, McGrawHill.Ed.6.

### **Web Sources:**

1. <https://www.britannica.com/science/microbiology>
2. <https://www.slideshare.net/slideshow/lect-1-introduction/34565343>
3. <https://www.slideshare.net/slideshow/introduction-to-microbiology-67925181/67925181>



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**COURSE OBJECTIVE:**

The candidates will gain comprehension of microbial interactions with the environment, specifically in the realms of air and water, as well as their correlation with diseases. The students will also understand the significance of microorganisms as indicators of pollution. The purpose of this syllabus is to give students a thorough comprehension of the microbial ecology of air and water, with a focus on both theoretical understanding and practical implementation in the fields of environmental and public health.

**UNIT- I INTRODUCTION TO MICROBIOLOGY OF AIR AND WATER 9**

Bio aerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens. Brief account of air borne water borne transmission of harmful microbes.

**UNIT-II AIR SAMPLE COLLECTION AND ANALYSIS NO OF HOURS 9**

Bio aerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and Fungi, Identification characteristics. Microbial diversity in air and water. Method of air sampling and types of air samplers; Impaction on solids, Impingement in liquid, Sedimentation and Centrifugation. Air sanitation: Physical and chemical methods.

**UNIT-III WATER MICROBIOLOGY 9**

Types of water: surface, ground, stored, distilled, mineral and demineralized water. Recommended Bacteriological standards of Water Quality, Tamil Nadu pollution control board (TNPCB). Main Functions of TNPCB. Water quality standards for best designated usages, Central pollution control board, (CPCB), Main Functions of CPCB.

**UNIT – IV WATER TREATMENT AND PURIFICATION 9**

Water purification methods. Water borne Infections; Indicators of faecal pollution, *Escherichia coli*, *Bifidobacterium*, *Streptococcus faecalis*, *Clostridium perfringens*. New indicators: Campylobacter and Pseudomonas. Environmental Factors Affecting Microbial Populations; BIS and WHO.

**UNIT– V APPLIED MICROBIOLOGY OF AIR AND WATER 9**

Microbial bioremediation of air and water pollutants, Role of microbes in sustainable environmental practices. Control Measures; Precipitation, chemical disinfection, filtration, high temperature and UV light.

**Total: 45 Hours**

## **Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Understand the fundamental principles of microbiology as they apply to air and water environments.

**CO2:** Identify and classify the types of microbes present in air and water and their ecological roles.

**CO3:** Evaluate the impact of environmental factors on microbial populations in air and water.

**CO4:** Analyze the significance of microbes in the context of public health and environmental sustainability.

**CO5:** Apply knowledge of microbiological principles to solve real-world problems related to air and water quality.

**CO6:** Perform techniques for the isolation and identification of microorganisms from air and water samples.

### **Text Books:**

1. A Martin (1961), Introduction to Soil Microbiology, John Wiley & Sons, New York and London Publication.
2. N. S Subba Rao (1977), Soil Microbiology, 4th Ed., Oxford & IBH Publishing Co. Pvt. Ltd.
3. R.C Dubey and D. K Maheswari, (2023), Textbook of Microbiology, S. Chand & Co.
4. A Martin (1977), An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
5. H.C Dube and K.S Bilgrami (1976), Text book of modern pathology. Vikas publishing house. New Delhi.
6. G Rangaswami (1979), Recent advances in biological nitrogen fixation. Oxford and IBH. New Delhi.
7. Daniel Lim (2003), Microbiology, 2nd Edition; McGraw-Hill Publication.
8. J.L Ingraham and C.A Ingraham (2004), Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.
9. M.T Madigan, J.M Martinko (2006), Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.

### **Reference Books:**

1. N da Silva, MH Taniwaki, VC Junqueira N Silveira, MS Nascimento, RAR Gomes (2012) Microbiological Examination Methods of Food and Water A Laboratory Manual, CRC Press.
2. RM Atlas and R Bartha (2000), Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA

3. RM Maier, IL Pepper and CP Gerba (2009), Environmental Microbiology. 2nd edition, Academic Press.
4. C.J. Hurst, R.L. Crawford, J.L. Garland, D.A. Lipson (2007), Manual of Environmental Microbiology, 3rd edition, ASM press.

**Web Sources:**

1. [Home - Books - NCBI \(nih.gov\)](#)
2. [Food Microbiology Notes - Microbe Notes](#)



**24DBMB11**

**MICROBIAL DIVERSITY**

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**COURSE OBJECTIVE:**

This course provides an in-depth exploration of microbial diversity, encompassing bacteria, archaea, fungi, viruses, and protists. Emphasis will be placed on understanding the ecological roles, evolutionary relationships, and applications of microorganisms in diverse environments.

**UNIT- I INTRODUCTION TO TAXONOMY 12**

Introduction to taxonomy; Taxonomical hierarchy, Binomial Nomenclature; concept of species; Major characteristics used in classification; five kingdom, six kingdom and eight kingdom concepts.

**UNIT-II CLASSIFICATION OF BACTERIA 12**

Morphological Basic classification of Bacteria and Basis for Classification of bacteria according to Bergey's Manual of Systematic Bacteriology.

**UNIT-III CLASSIFICATION OF ALGAE 12**

Classification of Algae, Structure of algal cell with example; Life-cycle patterns of Algae. Reproduction in algae. Structure of Fungi - unicellular and multicellular forms. Industrial impotent Algae

**UNIT – IV CLASSIFICATION OF VIRUSES 12**

Classification of animal and Plant viruses, Structure of Virus – Adenovirus, Retrovirus, TMV and T- phage. Replication of Viruses – RNA Viruses ssRNA, ds RNA and DNA Viruses ssDNA, dsDNA.

**UNIT– V CLASSIFICATION OF FUNGI 12**

General Characteristics of fungi; Range of thallus organization and Reproduction. Classification according to Alexopolous, Mims and Black Well. General characteristics of Fungi.

**Total: 60 Hours**

**Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Define microbial diversity and different types of microorganisms.

**CO2:** Recall key characteristics of bacteria, archaea, fungi, viruses, and protists.

**CO3:** List methods used to study microbial diversity, such as sequencing, microscopy, and culture techniques.

**CO4:** Explain the ecological roles of microorganisms in nutrient cycling, decomposition, and symbiosis.

**CO5:** Summarize the evolutionary processes that have shaped microbial diversity.

**CO6:** Interpret scientific literature on microbial diversity and ecosystems.

**CO7:** Apply knowledge of microbial diversity to analyze case studies of microbial communities in specific environments (e.g., soil, oceans, human microbiome).

**CO8:** Evaluate the effectiveness of different techniques for studying microbial diversity.

**CO9:** Assess the implications of microbial diversity research for human health, agriculture, and environmental sustainability.

**Text Books:**

1. G.J Tortora, B.R. Funke and C.L. Case (2008). Microbiology: An Introduction. 9th edition. Pearson Education
2. M.T. Madigan, J.M. Martinko P.V Dunlap D.P and Clark (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition

**Reference Books:**

1. J.Cappucino and N.Sherman (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
2. J.M.Wiley, L.M.Sherwood C.J.and Woolverton (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. R.M. Atlas (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
4. M.J. Pelczar, E.C.S Chan and Krieg N.R. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
5. R.Y. Stanier , J.L.Ingraham, M.L. Wheelis, and P.R.Painter (2005). General Microbiology. 5th edition. McMillan.

**24DBMB12**

**MICROBIAL PHYSIOLOGY AND  
METABOLISM**

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**COURSE OBJECTIVE:**

This course provides an in-depth exploration of microbial cell structure, function, and physiology. Explore the diverse metabolic pathways utilized by microorganisms for growth and energy production. Analyze the regulatory mechanisms governing microbial metabolism under different environmental conditions.

**UNIT- I MICROBIAL CELL STRUCTURE AND FUNCTION 12**

Overview of microbial cell structure: Bacteria, Archaea, and Eukaryotes. Functions of cell membranes, cell walls, and cellular organelles. Growth phases, cell division, and nutrient transport mechanisms. Energy production: ATP synthesis and electron transport chain.

**UNIT-II MICROBIAL METABOLISM – CATABOLISM 12**

Glycolysis, TCA cycle, and fermentation pathways, Anaerobic and aerobic respiration. Bioenergetics: Oxidative phosphorylation and chemiosmosis. Metabolism of carbohydrates, lipids, and proteins.

**UNIT-III MICROBIAL METABOLISM – ANABOLIC PATHWAYS 12**

Biosynthesis of amino acids, nucleotides, and fatty acids. Assimilation of nitrogen, sulfur, and phosphorus Anaplerotic reactions and glyoxylate cycle Regulation of anabolic processes

**UNIT – IV ENVIRONMENTAL INFLUENCES ON MICROBIAL PHYSIOLOGY 12**

Influence of temperature, pH, osmotic pressure, and oxygen levels on growth. Microbial stress responses: Heat shock, oxidative stress, and nutrient starvation. Adaptation to extreme environments: Thermophiles, halophiles, acidophiles. Quorum sensing and microbial communication.

**UNIT- V APPLICATIONS OF MICROBIAL PHYSIOLOGY AND METABOLISM 12**

Industrial fermentation and bioprocessing. Microbial biotechnology: Production of enzymes, antibiotics, and biofuels. Environmental applications: Bioremediation and biodegradation Use of microbial physiology in synthetic biology and metabolic engineering.

**Total: 60 Hours**

## **Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Students will demonstrate a thorough understanding of the physiological processes governing microbial growth, metabolism, and adaptation.

**CO2:** Students will be able to recognize the diversity of microorganisms and their adaptations to various environmental conditions.

**CO3:** Students will be able to classify microorganisms based on their metabolic characteristics, including chemotrophs, phototrophs, autotrophs, and heterotrophs, and their contribution to microbial diversity.

**CO4:** Students will analyse microbial interactions and community dynamics, including mutualism, commensalism, parasitism, and competition in terms of their ecological and medical significance.

**CO5:** Students will be able to appraise the role of biofilms and quorum sensing in microbial communities, as well as the physiological adaptations of extremophiles to harsh environments.

**CO6:** Students will be able to apply knowledge of microbial physiology to real-world challenges in biotechnology, medicine, environment and environmental remediation.

**CO7:** Students will be able to solve practical problems in various fields such as industry, biotechnology, medicine, and environment.

### **Text Books:**

1. Jr, M.J, Pelczar, N.R. Krieg (1986), Microbiology, 5th edn, McGraw-Hill Book Company, NY.
2. J.L Ingraham, and C.L. Ingraham, (2000), Introduction to Microbiology, 2nd edn, Brooks/Cole, Singapore.
3. J.G. Black (2002), Microbiology: Principles and Explorations, 5th edn, John Wiley and Sons, Inc. NY.

### **Reference Books:**

1. M.T. Madigan and J.M. Martinko (2014), Brock Biology of Microorganisms, 14th edition. Prentice Hall International Inc.
2. A.G. Moat and J.W. Foster (2002), Microbial Physiology, 4th edition, John Wiley & Sons.
3. S.R..Reddy and S.M.Reddy (2005), Microbial Physiology, Scientific Publishers India.
4. G.Gottschalk (1986), Bacterial Metabolism, 2nd edition, Springer Verlag.



5. R.Y. Stanier, J.I. Ingrahm, M.L. Wheelis and P.R. Painter (1987), General Microbiology, 5th edition, McMillan Press.
6. J.M. Willey, L.M. Sherwood and C.J Woolverton (2013), Prescott's Microbiology, 9th edition, McGraw Hill Higher Education.

**Web Sources:**

1. <https://spot.colorado.edu/~schmidts/Teaching/EPOB3400/microPhys.html>
2. <https://dl.icdst.org/pdfs/files3/0bc9d88695de86f1fbad48fe3fccffc9.pdf>
3. <https://nsdl.niscpr.res.in/bitstream/123456789/803/1/CarbonMetabolism.pdf>





**24PBMB11**

**PRACTICAL - I**

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**PRACTICAL IN BASIC MICROBIOLOGICAL TECHNIQUES**

**COURSE OBJECTIVE:**

The candidate will gain hands-on knowledge and acquire adequate skill required to sterilize media and to prepare, inoculate observe and distinguish the growth patterns in different media.

1. Cleaning and Sterilization of Glassware.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory
3. Preparation of culture media for bacterial cultivation
4. Preparation and growth of Bacteria in Basal Media– Nutrient Broth, Peptone Water, Nutrient Agar.
5. Preparation and growth of Bacteria in – MacConkey Agar and Cetrimide Agar.
4. Preparation and growth of Bacteria in Carbohydrate Fermentation Media.
6. Simple staining– positive and negative staining.
7. Gram staining of Bacteria (Study of different shapes of bacteria).
8. Capsule staining.
9. Spore staining.
10. Cultivation of fungi in SDA (Study of Rhizopus, Penicillium, Aspergillus) and LPCB.
12. Antibiotic sensitivity test – KirbyBauer Method.
13. Study of the following protozoans using permanent mounts/photographs: Amoeba, Entamoeba, Paramecium and Plasmodium

**Total: 45 Hours**

**Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Develop skills to observe microbes using microscopes.

**CO2:** Competently prepare and cultivate bacteria in different types of media.

**CO3:** Judge the accuracy of sterilization

**CO4:** Prepare media and grow fungi and algae in the lab

**CO5:** Evaluate the sensitivity and resistance of bacteria to antimicrobials

**CO6:** Explain the principles behind common microbiological techniques (e.g., staining methods, culturing techniques).

**CO7:** Summarize the differences between various types of microbial cultures.

**CO8:** Perform basic microbiological techniques accurately and safely in a laboratory setting.

**CO9:** Demonstrate proficiency in using microscopes and other equipment for microbiological analysis.

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**COURSE OBJECTIVE:**

The candidates will be able to appreciate the complementarity between the values and skills for sustained happiness and prosperity. To influence the students to approach the life and profession with a holistic perspective towards a value-based living in a natural way. To highlight plausible implications of holistic understanding of ethical human conduct.

**UNIT-I INTRODUCTION TO VALUE EDUCATION 5**

Living a fulfilling life. Value education. Skill education. Complementarity of Values and Skills. Development of a holistic perspective. Right understanding, relationship and physical facility. Understanding the happiness and prosperity.

**UNIT-II HARMONY AT MULTIPLE LEVELS 5**

Human being as co-existence of the self and the human body. Understanding harmony in the self. Harmony in the family and understanding values in human-human relationships. Harmony in the society and understanding universal human order. Harmony in nature and understanding the interconnectedness, self-regulation and mutual fulfillment. Harmony in existence and understanding co-existence at various levels.

**UNIT-III IMPLICATIONS OF THE RIGHT UNDERSTANDING 5**

Ethical human conduct. Implications of value-based living. Right understanding of professional ethics. Humanistic education. Holistic technologies, production systems and management models. Strategies for transition towards value-based life and profession.

**Total: 15 Hours**

**Course Outcome:**

**At the end of the course learners will be able to:**

**CO1:** Develop qualities like responsibility and the ability to handle problems with sustainable solutions.

**CO2:** Appraise human values and the harmony at various levels.

**CO3:** Perceive a better critical ability.

**CO4:** Develop qualities pertaining to value-based living.

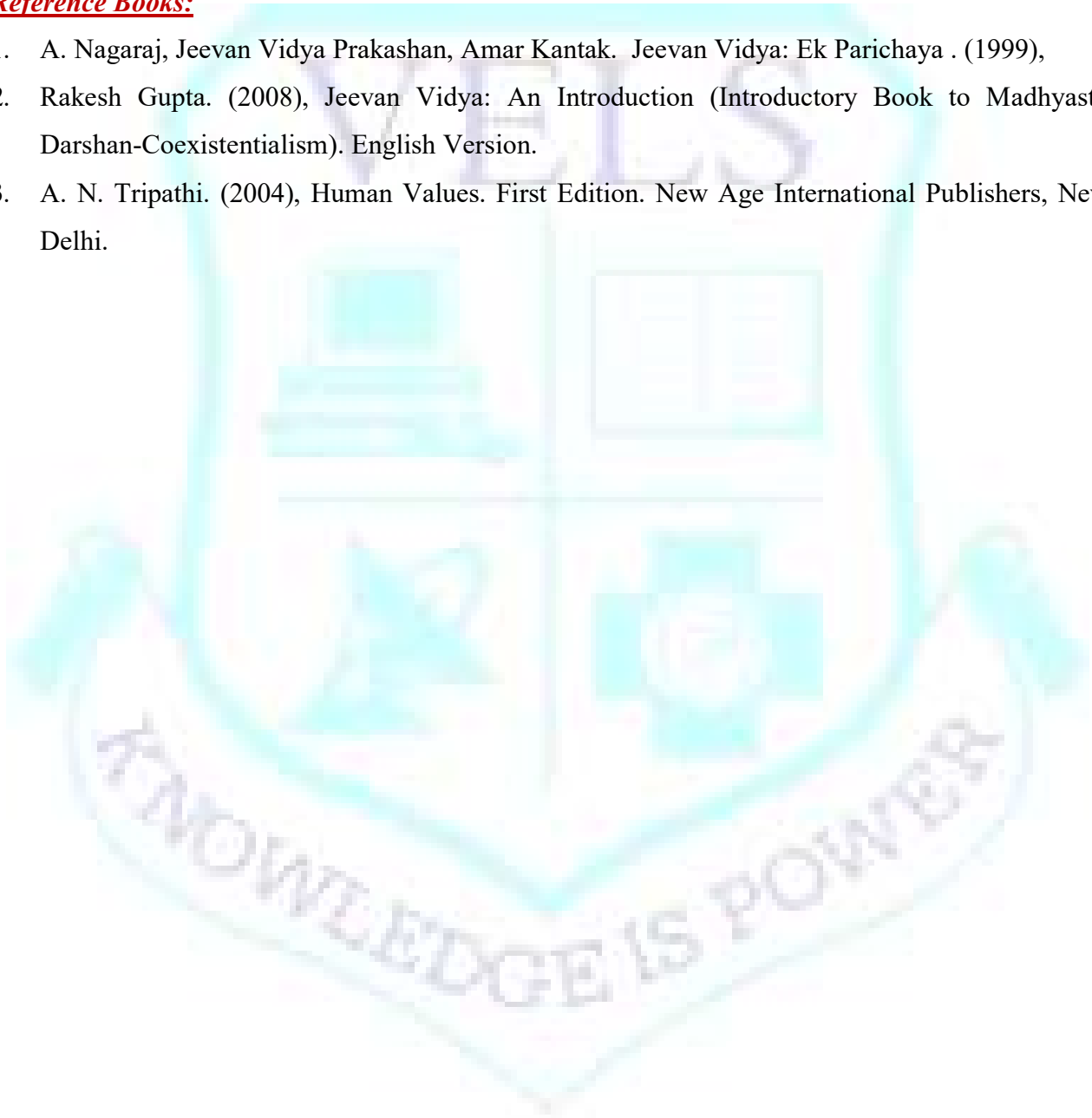
**CO5:** Apply what they have learnt to their own self in real life settings.

**Text Books:**

1. R.R. Gaur, R. Asthana, G.P. Bagaria. (2023), A Foundation Course in Human Values and Professional Ethics. 3<sup>rd</sup> Revised Edition. Excel Books, New Delhi.

**Reference Books:**

1. A. Nagaraj, Jeevan Vidya Prakashan, Amar Kantak. Jeevan Vidya: Ek Parichaya . (1999),
2. Rakesh Gupta. (2008), Jeevan Vidya: An Introduction (Introductory Book to Madhyasth Darshan-Coexistentialism). English Version.
3. A. N. Tripathi. (2004), Human Values. First Edition. New Age International Publishers, New Delhi.



**24SSKU11****SOFT SKILLS -I**

|   |   |   |   |   |
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**COURSE OBJECTIVES:**

- To learn and apply basic etiquette for personal and professional interactions.
- To develop effective stress management techniques for maintaining mental and emotional well-being.
- To enhance self-awareness for personal growth and informed decision-making.
- To gain an overview of essential 21st-century skills necessary for success in a rapidly changing world.
- To foster creativity and critical thinking skills for innovative problem-solving and adaptability.

**Credit Hours****UNIT I INTRODUCTION TO SOFT SKILLS****6**

- Soft Skills vs Hard Skills
- 15 important Soft Skills
- Communication Skills, Time Management, Leadership Skills

**UNIT II - OVERVIEW OF 21<sup>ST</sup> CENTURY SKILLS.****6**

- Lateral Thinking – Left Brain/Right Brain Functionality
- Problem solving skills

**UNIT III - SELF AWARENESS****6**

- Human Values
- Mindfulness
- SWOT Analysis
- PDCA Approach

**UNIT IV - CREATIVITY/CRITICAL THINKING****6**

- Six Thinking Traits
- Creative writing exercises
- Open mindedness

**UNIT V - PERSONAL HYGIENE AND STRESS MANAGEMENT****6**

- Basic Etiquettes
- Health and Personal Grooming
- Stress-meaning and nature, Eustress, Distress
- Stress management strategies

**Total Hours****30**

## **COURSE OUTCOMES:**

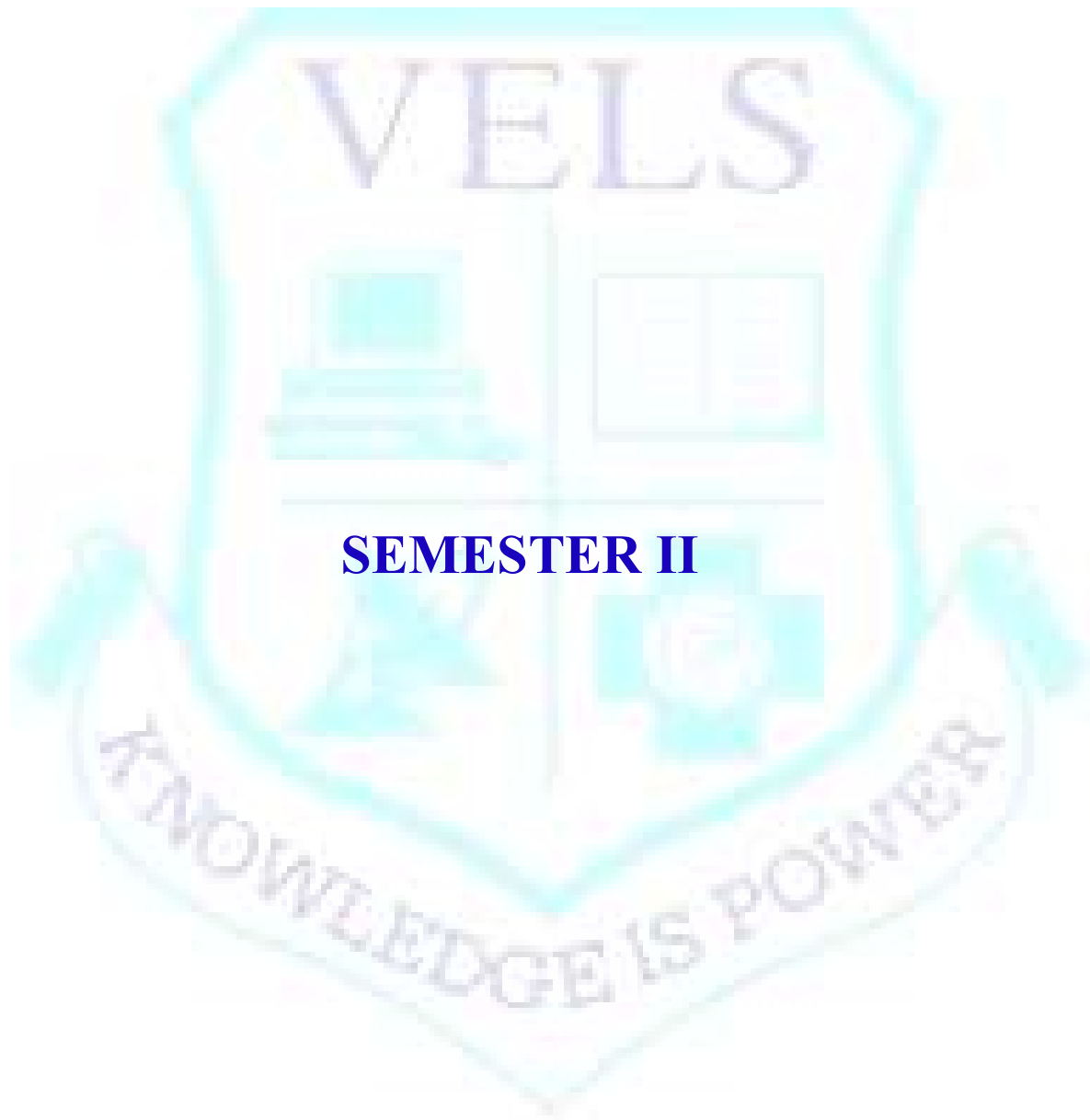
At the end of this course, the students would have learnt to

|            |  |
|------------|--|
| <b>CO1</b> | demonstrate basic etiquette in various personal and professional settings. |
| <b>CO2</b> | effectively manage stress using learned techniques.                        |
| <b>CO3</b> | show increased self-awareness and make informed decisions.                 |
| <b>CO4</b> | understand and articulate key 21st-century skills.                         |
| <b>CO5</b> | apply creativity and critical thinking to solve problems innovatively.     |

## **References:**

- K. Alex (2014). Soft Skills (1st edition) S Chand & Company
- Taylor. (2005) Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd
- Tiko, Champa& Jaya Sasikumar. (1979) Writing with a purpose. OUP New Delhi
- Nelson-Jones, R. (1992). Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.
- Tuhovsky, Ian (2019). Communication Skills Training (2nd edition) Rupa PublicationIndia.





**SEMESTER II**

24LTAM21 பருவம்-2, தமிழ்மொழிப்பாடம்-2, பகுதி-1,

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தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2.

தாள்-2

காப்பியம், பக்தி இலக்கியம், கலைகள், நாகரிகம்-பண்பாடு

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், அற இலக்கியங்கள், சிற்றிலக்கியம், சிறுகதை ஆகியவற்றை அறிமுகப்படுத்துதல், தற்காலப் பேச்சுத் தமிழ் எழுத்துத்தமிழ் ஆகியவற்றின் வளர்நிலைகளை மாணவர்களை அறியச் செய்தல், அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களின் மொழித் திறனை மேம்படுத்த அவர்களுக்குக் கடிதம் எழுதும் கலையைக் கற்றுக்கொடுத்தல், அணி இலக்கணத்தை அறியச் செய்தல் என்பன இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1 காப்பியங்கள்

08மணி நேரம்

சிலப்பதிகாரம்- கனாத்திறம் உரைத்தக் காதை முழுவதும்.

மணிமேகலை- மலர்வனம் புக்க காதை முழுவதும்.

கம்பராமாயணம் - குகப் படலம் (தேர்ந்தெடுக்கப்பட்ட ஒன்பது பாடல்கள்)

அலகு 2: பக்தி இலக்கியம்

08 மணி நேரம்

1. மாணிக்கவாசகர் - திருவாசகம் – மூன்று பாடல்கள்
  - ✓ புல்லாகி பூடாகி (சிவபுராணம்)
  - ✓ எல்லாப் பிறப்பும் (சிவபுராணம்)
  - ✓ உற்றாரை யான் வேண்டேன் (திருப்புலம்பல்)
2. ஆண்டாள் - திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)
  - ✓ மார்கழித் திங்கள் ... (பாசுரம் 1)
  - ✓ ஓங்கி உலகளந்த... (பாசுரம் 3)
  - ✓ ஆழிமழைக் கண்ணா... (பாசுரம் 4)

3. வீரமாமுனிவர் - தேம்பாவணி - வளன் செனித்தப் படலம்
4. சீறாப்புராணம்- மானுக்கு பிணை நின்ற படலம்

அலகு 3 கலைகள்

07 மணி நேரம்

சிற்பம் - ஓவியம் - இசை - கூத்து - ஒப்பனை - ஆடை அணிகலன்கள்.

அலகு 4 நாகரிகம், பண்பாடு

07மணி நேரம்

சொற்பொருள் விளக்கம் - பண்டைத் தமிழர் வாழ்வியல் - அகம் - களவு - கற்பு - குடும்பம் - விருந்தோம்பல் - உறவு முறைகள் - சடங்குகள் - நம்பிக்கைகள் - பொழுதுபோக்கு - புறம் - போர் முறைகள் - நடுகல் வழிபாடு - கொடைப்பண்பு.

**மொத்தம்: 30 மணி நேரம்**

**பார்வை நூல்கள்**

1. தமிழர் நாகரிகமும் பண்பாடும், டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. தவறின்றித் தமிழ் எழுதுவோம், மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. தவறின்றித் தமிழ் எழுத - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. தமிழ் இலக்கிய வரலாறு, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. புதிய தமிழ் இலக்கிய வரலாறு, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. செம்மொழி தமிழின் சிறப்பியல்புகள் - முனைவர் மறைமலை இலக்குவனார்; <https://www.youtube.com/watch?v=HHZnmJb4jSY>
7. பாடநூல் தேடலுக்கான இணையம் - <https://archive.org/>



**24LHIN21**

**HINDI**

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वर्ष I – सत्र II (गद्य, पत्र लेखन & व्यावहारिक हिन्दी)

I Year-Sem II (Prose, Official Letter Writing & Functional Hindi)

**Course Objectives :**

- To inculcate the human values, importance of patriotism and hard work
- To train students in functional Hindi
- To introduce the usage of Inscript keyboard

|                  |   |       |
|------------------|---|-------|
| <b>UNIT I :</b>  | मुंशी प्रेमचंद कृत 'बूढी काकी' (कहानी)<br>'Boodee kaki' (Kahani) by Munshi Premchand  | 6hrs. |
| <b>UNIT II :</b> | जयशंकर प्रसाद कृत 'पुरस्कार' (कहानी)<br>'Puraskar' (Kahani) by Jaishankar Prasad  | 6hrs. |
| <b>UNIT III:</b> | हरिशंकर परसाई कृत 'मैं नरक से बोल रहा हूँ' (व्यंग्य)<br>'Main Narak Se Bhol Raha Hun' (Vyangy) by<br>Harishankar Parsayi,   | 6hrs. |
| <b>UNIT IV:</b>  | व्यावहारिक हिन्दी 1 – 50 – तकनीकि शब्द, 50 – पदनाम व<br>विभागीय नाम, भाव एक भाषा अनेक<br>Functional Hindi 1 - 50-Technical Words, 50-Designation &<br>Department Names, Bhav Ek Bhasha Anek | 6hrs. |
| <b>UNIT V :</b>  | व्यावहारिक हिन्दी 2 – पत्र लेखन – 3 औपचारिक पत्र,<br>इन्स्क्रिप्ट कीबोर्ड का परिचय<br>Functional Hindi 2 -Letter Writing- 3 Official Letters.<br>Introduction to Inscript Keyboard          | 6hrs. |

**Total: 30hrs**

### **Course Outcome:**

At the end of this course Students will be able to

- CO1 Know to the human values
- CO2 Know the importance of patriotism
- CO3 Know the value of hardwork in human life
- CO4 Journalise in Functional Hindi
- CO5 Use inscript keyboard

### **Text Book:**

Ed. Subhash chandar, Boodi Kaki by Premchand (2012) Natioonal Book Trust,  
Jaishankar Prasad, Pratinidhi Kahaniyan, (2015) Raj Kamal Prakashan,  
Harishankar Parsai, Pratinidhi vyangy, (2007) Rajkamal.  
Kendriya Hindi Prashikshan Sansthan, Parangat, (2015) Bharat Sarkar.

### **Reference book:**

Kendriya Hindi Sansthan, (2012) Banking Hindi Patyakram,

### **Weblink:**

Munshi Premchand, Manasarovar, 2007, <http://gadyakosh.org>

Jaishankar Prasad/ <http://gadyakosh.org>

Harishankar Parsai/ <https://hindikahani.hindi-kavita.com>

Prayojanmoolak Hindi:<https://hi.m.wikipedia.org>

**<https://rajbhasha.gov.in/en/introduction>**

**24LFRE21****FRENCH PAPER II**

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**Course Objectives:**

The lessons are being chosen:

- 1) to express his / her where abouts and to ask seek direction
- 2) to express obligation and restriction
- 3) to describe a place
- 4) to narrate and to question
- 5) to describe someone
- 6) to express his desire and to speak about the futur

**Units:**

- 1) C'est où  
L'imperatif, Les articles contractés au, à la..., Le passé composé et l'accord du participe passé avec être. 5 hours
- 2) N'oubliez pas  
Le pronom relatif Qui, que, où, Les pronoms compléments indirects (me, te, lui, leur...) 5 hours
- 3) Belle vue sur la mer --  
Les adjectifs démonstratifs, Y- pronom complément. 4 hours
- 4) Quel beau voyage!  
Les verbes pronominaux, En- pronom complément. 4 hours
- 5) Oh ! joli  
L'imparfait, L'imparfait ou le passé composé. 5 hours
- 6) Et après ?  
Le futur simple, Le subjonctif présent. 7 hours

Total no. of hours - 30 hours

**Course Outcome:**

- 1) The students would be able to express his/her where about and to ask direction
- 2) The students would be able to express obligation and restriction
- 3) The students would be able to describe a place
- 4) The students would be able to narrate and to question
- 5) The students would be able to describe someone
- 6) The students would be able to express his desire and to speak about the futur

**Text / Reference Book:**

Prescribed book: LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

Reference book: SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

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**Course Objectives:**

- To read and understand different types of prose, poetry, and fiction.
- To think critically about texts and express ideas clearly.
- To recognize and discuss key themes and styles in literary works.
- To learn and use grammar rules correctly in writing and speaking.
- To write more effectively by applying grammar and literary techniques.

Credit Hours

**Unit I -Prose**

6

- If you are wrong, admit it- Dale Carnegie
- Words of Wisdom- Chetan Bhaghat

**Unit II - Poetry**

6

- La Belle Dame Sans Merci - John Keats
- Ozymandias- P.B.Shelley

**Unit III – Fiction**

6

- The School for Empathy - E.V. Lucas
- The Lamb to the Slaughter-Roald Dahl

**Unit IV - Grammar**

6

- Types of sentences, Concord

**Unit V - Grammar**

6

- Tenses, Voices

**Total****30 hours****Course Outcomes:**

At the end of this course, the students would have learnt to

|            |  |
|------------|--|
| <b>CO1</b> | Identify poetic expressions in the course of daily speech                            |
| <b>CO2</b> | Students will develop skills that enable them to communicate effectively in writing. |
| <b>CO3</b> | Students will develop skills that enable them to communicate effectively in writing. |
| <b>CO4</b> | Discriminate against different sensibilities in approaching life.                    |
| <b>CO5</b> | Strengthen the ability to solve life's problems, as highlighted in the selections.   |

**References:**

- Dr. M. Narayana Rao and Dr. B. G. Barki-Anu's Current English for Communication(AnuChitra). June 2012.
- General English for competitive examinations by V.Rajagopalan ( McGraw Hill Education) -2010.

**24CBMB21 MICROBIAL GENETICS AND MOLECULAR  
BIOLOGY**

| L | T | P | O | C |
|---|---|---|---|---|
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**COURSE OBJECTIVE:**

The candidate will gain knowledge about the structure, shape, and significance of DNA and RNA. They will understand the synthesis of RNA and proteins along with their regulation. The role of genes as the basic units of expression will be explored in depth.

**UNIT- I NUCLEIC ACIDS 9**

DNA as genetic material (Griffith, Avery, Hershey and Chase experiments). Nucleic acids – definition and structure. Nucleoside, nucleotide: definition and structure. DNA & RNA: Double helical structure. A-DNA, B-DNA & Z-DNA (structure and differences). General structure and types of RNA.

**UNIT-II REPLICATION 9**

Conservative, dispersive, semi-conservative, bidirectional and semi-discontinuous, Theta model of replication, Mechanism of replication-Rolling-circle model. Prokaryotic DNA replication. Enzymes and proteins associated with DNA replication. Eukaryotic DNA replication.

**UNIT-III TRANSCRIPTION 9**

Transcription–general principles, basic apparatus, RNA polymerases and steps involved. Monocistronic and polycistronic mRNAs. Processing of RNA. Genetic code. Translation overview – Prokaryotes and Eukaryotes. Post translational modifications.

**UNIT – IV GENE TRANSFER 9**

Conjugation: Discovery, F+, F- and Hfr cells and F- genetic crosses. Transformation – competent cells – mechanism, transduction – generalized and specialized. Transposition  
Regulation of gene expression – structural and functional gene, operon – inducible operon – lac operon, repression operon – Trp operon, attenuation. Ara operon.

**UNIT- V MUTATION 9**

Mutation and genetic analysis of mutants: Mutation and its types – insertion, deletion, addition, rearrangement. Genetic analysis. Mutagenesis: Types: Site directed mutagenesis, base analogue mutants, tautomerization. Physical and chemical mutagens.

**Total: 45 Hours**

## **Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Describe the flow of information from DNA to Protein and the three well-known mechanisms by which genetic material is transferred among microorganisms.

**CO2:** Explain different types of DNA replication and grasp the replication of single-stranded DNA molecules and the various features of retrovirus replication.

**CO3:** Compare the various cellular mechanisms involved in the control of prokaryotic and eukaryotic transcription.

**CO4:** Illustrate the mechanisms of gene transfer through conjugation, transformation, and transduction.

**CO5:** Identify different types of extrachromosomal elements; the nature of the transposable elements in the prokaryotic and eukaryotic cells.

**CO6:** Analyze the various mechanisms of genetic exchange, mutations, and their implications.

### **Text Books:**

1. D. Freifelder (2008), Molecular Biology. Narosa Publishing House, New Delhi.

### **Reference Books:**

1. S.R. Maloy, J.E. Cronan, D. Freifelder (1994), Microbial Genetics. Jones and Barlette publishers.
2. H. Lodish, O. Baltimore, A. Berk S.L. Zipursky, P. Matsudaira, J. Darnell (1995) Molecular Cell Biology. Scientific American Books.
3. B. Lewin (2004) Genes VIII, Oxford University Press.
4. William Haynes (1985), The Genetics of Bacteria and Their Viruses. Black well Scientific Publishers, Oxford.
5. P.B. Kaufman, W. Wu. D. Kim and L.J. Cseke, (2011) Molecular and Cellular Methods in Biology and Medicine, CRC Press, Florida.

### **Web Sources:**

1. [https://bio.libretexts.org/Bookshelves/Genetics/Genetics\\_Agriculture\\_and\\_Biotechnology\\_Suza\\_and\\_Lee/01%3A\\_Chapters/1.11%3A\\_Recombinant\\_DNA\\_Technology](https://bio.libretexts.org/Bookshelves/Genetics/Genetics_Agriculture_and_Biotechnology_Suza_and_Lee/01%3A_Chapters/1.11%3A_Recombinant_DNA_Technology)
2. <https://www.britannica.com/science/recombinant-DNA-technology>
3. <https://microbenotes.com/recombinant-dna-technology-steps-applications-and-limitations/>

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**COURSE OBJECTIVE:**

The candidate will gain insight into the significance of microbes in the production of industrially important products. They will also learn about types of bioreactors and product separation technologies. Study microbial production of diverse industrial products like antibiotics, organic acids, enzymes, and beverages.

**UNIT- I INTRODUCTION OF INDUSTRIAL MICROBIOLOGY 9**

Overview of industrial microbiology and its significance in various industries. Historical perspective: milestones and developments in industrial microbiology. Component parts of a fermentation process. Isolation, screening, improvement, preservation and handling the microbial strains.

**UNIT-II INDUSTRIAL FERMENTATION MEDIA 9**

Formulation strategies, economical means of providing energy, carbon, nitrogen, vitamin and mineral sources. Role of additional ingredients - buffers, precursors, chelators, inhibitors, inducers and antifoams. Sterilization of industrial fermentation media.

**UNIT-III UPSTREAM PROCESSING 9**

Types of fermentation processes - batch, fed-batch, continuous fermentations. Solid state fermentation and submerged fermentation. Components of a typical bio-reactor, Types of bioreactors- constantly stirred tank and air-lift fermenters, Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration.

**UNIT – IV DOWNSTREAM PROCESSING 9**

Cell disruption, filtration, centrifugation, solvent extraction, precipitation, lyophilization and spray drying, Enzyme immobilization- Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes.

**UNIT– V MICROBIAL PRODUCTION OF INDUSTRIAL PRODUCTS 9**

Microbial production of: chemotherapeutic agents - penicillin, streptomycin, tetracycline; Organic acids- Citric acid, gluconic acid; Amino acids- L-Glutamic acid, L- Tryptophan, L- Lysine; Enzymes-amylase, protease, lipase. Production of Wine, beer, ethanol and Vitamin B12.

**Total: 45 Hours**

## **Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Describe the principles governing microbial involvement in industrial processes.

**CO2:** Design and optimize fermentation media for efficient production of desired products using formulation strategies.

**CO3:** Operate various fermentation processes and bioreactor systems and its controlling key parameters.

**CO4:** Execute downstream processing techniques to extract, purify, and immobilize industrial products, demonstrating mastery in handling microbial cultures.

**CO5:** Evaluate the economic and environmental implications of microbial production processes, and propose optimizations for sustainable industrial practices..

**CO6:** Develop practical skills for handling microbial cultures, designing fermentation processes, and optimizing production techniques for industrial applications.

**CO7:** Analyze the genetic and metabolic pathways of microorganisms to enhance their productivity and stability in industrial applications.

### **Text Books:**

1. A.H. Patel (1996), Industrial Microbiology, 1st edition, Macmillan India Limited

### **Reference Books:**

1. N. Okafor (2007), Modern Industrial Microbiology and Biotechnology, 1st edition, Bios Scientific Publishers Limited. USA.
2. M.J. Waites, N.L. Morgan, J.S. Rockey, and G. Higton (2001), Industrial Microbiology: An Introduction, 1st edition, Wiley – Blackwell.
3. A.N. Glaze and H. Nikaido (1995), Microbial Biotechnology: Fundamentals of Applied Microbiology, 1st edition, W.H. Freeman and Company.
4. L.E. Casida (1991), Industrial Microbiology, 1st edition, Wiley Eastern Limited.
5. W. Crueger and A. Crueger (2000), Biotechnology: A textbook of Industrial Microbiology. 2<sup>nd</sup> edition, Panima Publishing Co. New Delhi.
6. P.F. Stanbury, A. Whitaker and S.J. Hall (2006), Principles of Fermentation Technology, 2nd Edition, Wiley-Eastern.

### **Web Sources:**

1. [https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology\\_\(Boundless\)/17%3A\\_Industrial\\_Microbiology](https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_(Boundless)/17%3A_Industrial_Microbiology)
2. [https://microbiologyclass.net/introduction-to-industrial-microbiology/#google\\_vignette](https://microbiologyclass.net/introduction-to-industrial-microbiology/#google_vignette)
3. <https://staff.run.edu.ng/oermedia/422231995398.pdf>



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**COURSE OBJECTIVE:**

Overall, a bioinstrumentation course is designed to equip students with theoretical knowledge, practical skills, and critical thinking abilities necessary for careers in biomedical engineering, healthcare technology, and related fields. These objectives ensure that students can effectively contribute to the development, implementation, and improvement of biomedical instruments and systems aimed at enhancing healthcare delivery and patient outcomes.

**UNIT- I BASIC INSTRUMENTATION AND BUFFER PREPARATION 9**

Buffers - Preparation of Buffers – Standard Buffers – Molar and Normal Solutions PH - PH meter, Principles and applications of Autoclave – Hot air oven – Incubator, Laminar air flow chamber / Biosafety cabinets, BOD Incubator, Lyophilizer

**UNIT-II CHROMATOGRAPHY 9**

Partition principle, partition coefficient, Nature of partition forces. Adsorption Chromatography - Methods of paper chromatography, Thin layer chromatography and their Applications. Column Chromatography - Basic principle, method and application of - Gel filtration, Ion-exchange, and Affinity chromatography.

**UNIT-III BIOMOLECULES 9**

PCR-principles-instrumentation-applications- primer design- Nucleic acid sequencing methods-direct PCR sequencing. Protein estimation UV-lowry method- Bradford-purification methods- cell disruption- crude extract-fractionation methods. Enzyme assays-spectrophotometric and manometric methods. Immobilization of enzymes- physical and chemical methods.

**UNIT – IV ELECTROPHORETIC TECHNIQUES 9**

Electrophoretic techniques-principles-Electrophoresis of proteins-SDS-PAGE- Native gels- Gradient gels-Isoelectric focusing gels-Two dimensional PAGE-Cellulose acetate electrophoresis. Blotting technique-Southern blotting, Northern blotting, Western blotting, Electrophoresis of Nucleic acids-Agarose gel Pulse-field gel and Capillary electrophoresis. Chromatographic techniques, principles-materials and applications.

**UNIT- V SPECTROPHOTOMETRY 9**

Concept of electromagnetic radiation, spectrum of light, Concept of chromophores, extinction coefficient, Beer's law and its deviations, Difference between spectrophotometer and colorimeter. Basic principle, Instrumentation and Application - UV and visible

Spectrophotometer, FTIR, IR Spectrophotometer and Mass spectrophotometer, NMR, Fluorescence.

**Total: 45 Hours**

**Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Demonstrate understanding of the principles and components of bioinstrumentation systems.

**CO2:** Operate and troubleshoot common bioinstrumentation devices such as biosensors, spectroscopy instruments, and imaging systems.

**CO3:** Apply calibration and validation procedures to ensure accuracy and reliability of bioinstrumentation measurements.

**CO4:** Interpret experimental results to draw conclusions about biological phenomena or conditions being studied.

**CO5:** Understand the interface between bioinstrumentation and biological systems.

**CO6:** Apply bioinstrumentation techniques to study physiological parameters, biomolecular interactions, or cellular processes.

**CO7:** Demonstrate awareness of regulatory requirements and standards relevant to bioinstrumentation development and usage.

**Text Books:**

1. J. Jayaraman (2011), Laboratory Manual in Biochemistry, 2<sup>nd</sup> Edition, Wiley Eastern Ltd., New Delhi.
2. P. Ponnuragan and P.B Gangathara (2012), Biotechniques, 1<sup>st</sup> Edition, MJP publishers.
3. L. Veerakumari (2009), Bioinstrumentation- 5<sup>th</sup> Edition, MJP publishers.
4. Upadhyay, Upadhyay and Nath (2002), Biophysical chemistry – Principles and techniques 3<sup>rd</sup> Edition, Himalaya publishing home.

**Reference Books:**

1. Rodney.F.Boyer (2000), Modern Experimental Biochemistry, 3<sup>rd</sup> Edition, Pearson Publication.
2. A. Skoog, M. West (2014), Principles of Instrumental Analysis, 14<sup>th</sup> Edition, W.B.Saunders Co. Philadelphia.
3. N.Gurumani. (2006), Research Methodology for biological sciences, 1<sup>st</sup> Edition, MJP Publishers.
4. J.G. Webster (2004), Bioinstrumentation, 4<sup>th</sup> Edition, John Wiley & Sons (Asia) Pvt.Ltd, Singapore.

| L | T | P | O | C |
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### COURSE OBJECTIVES

The candidate will gain knowledge about the structure, properties and functions of carbohydrates, proteins, lipids and nucleic acids. Basic biochemical techniques are also dealt with chromatography, centrifugation, and electrophoresis, providing a comprehensive understanding of essential metabolic pathways and analytical methods in biochemistry.

#### UNIT I CARBOHYDATES 12

Carbohydrates – Classification, structure of mono, oligo and polysaccharides. Glycolysis, TCA cycle. Disorders of Carbohydrate Metabolism: Diabetes mellitus.

#### UNIT II PROTEINS 12

Protein – Classification, amino acid – structure and classification. Biological role of proteins and structural organization of protein. Transamination, deamination and urea cycle and its regulation. Disorders of amino acid metabolism.

#### UNIT III LIPIDS 12

Lipids – Classification, Saturated and Unsaturated fatty acids. Biological functions of lipids. Biosynthesis and oxidation of fatty acids. Disorders of lipid metabolism.

#### UNIT IV NUCLEIC ACIDS 12

Nucleic acid – Nucleosides, Nucleotides, Structure of DNA and RNA – various types of RNA. Biosynthesis of purine and pyrimidine. Disorders of nucleic acid metabolism.

#### UNIT V CHROMATOGRAPHY 12

Chromatography – gel filtration, affinity, HPLC. Centrifugation – differential centrifugation. Electrophoresis – SDS-PAGE, Agarose gel electrophoresis.

**Total: 60hrs**

#### Course Outcome

At the end of the course, learners will be able to:

**CO1:** Recall and identify the structure and classification of carbohydrates, proteins, lipids, and nucleic acids.

**CO2:** Explain the metabolic pathways such as glycolysis, TCA cycle, transamination, deamination, the urea cycle, and fatty acid metabolism.

**CO3:** Apply biochemical techniques like chromatography, centrifugation, and electrophoresis to separate and analyze biomolecules.

**CO4:** Analyze the regulation of biochemical processes and the interconnectivity of metabolic pathways in various disorders.

**CO5:** Design biochemical experiments to investigate the functions and interactions of biomolecules and interpret experimental data.

**CO6:** Evaluate the disorders of metabolism by means of various case study.

**CO7:** Gain the knowledge on different chromatographic methods.

**Textbook:**

1. J.L. Jain (2006), Fundamentals of Biochemistry, Chand Publications.

**Reference books:**

1. K. Robert (2005), Harper's Biochemistry, 26<sup>th</sup> edition, Murray Lance International Publication.
2. M.N. Chatterjee (2006), Text Book of Medical Biochemistry, 6<sup>th</sup> edition, Jaypee Publication.
3. U. Sathyanarayana (2006), Biochemistry, 3<sup>rd</sup> edition, Books and Allied (P) Ltd.



**24DBMB22**

**BIOSAFETY AND INTELLECTUAL  
PROPERTY RIGHTS (IPR)**

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**COURSE OBJECTIVE:**

The course aims to provide a comprehensive understanding of biosafety and risk assessment for handling biological agents safely. Familiarize with national and international biosafety regulations and the role of organizations like WHO and CDC. Explore the fundamentals of intellectual property rights (IPR) and their significance in biotechnology.

**UNIT- I BIOSAFETY: INTRODUCTION AND GUIDELINES 12**

Introduction, biosafety issues; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms. Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture;

**UNIT-II RISK ANALYSIS AND GUIDELINES 12**

Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. Use of Animals in Research and Testing, and Alternatives for Animals in Research, Animal Cloning, Human Cloning and their Ethical Aspects. Testing of Drugs on Human Volunteers Public and Non-Governmental Organizations (NGOs) Participation in Biosafety and Protection of Biodiversity.

**UNIT-III INTRODUCTION TO INTELLECTUAL PROPERTY 12**

Introduction to Intellectual Property and History. Patents, Trademarks, Copyright, Trade secrets, Industrial Design and Rights, Traditional Knowledge, Geographical Indications - importance of IPR – patentable and non patentable – patenting life – legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO), Ethics, Pros and Cons of IP protection.

**UNIT – IV GRANT OF PATENT, PATENTING AUTHORITIES AND TREATIES 12**

Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner. Agreements and Treaties: GATT, TRIPS Agreements; WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV & Brene conventions;

**UNIT– V BIOSAFETY IN BIOTECHNOLOGY AND ETHICAL**

Definition and importance of biosafety in biotechnological research. Types of Biological Risks. Pathogenic microorganisms, genetically modified organisms (GMOs), and biohazards. Risk assessment strategies in biotechnology.

**Total: 60 Hours**

**Course Outcome:**

**At the end of the course, learners will be able to:**

**CO1:** Demonstrate a thorough understanding of the principles and practices of biosafety in biotechnology against the biological risks.

**CO2:** Analyze the ethical implications of using genetically modified organisms (GMOs) and other biotechnological innovations, considering their impact on human health and the environment.

**CO3:** Critically assess case studies related to biosafety incidents and improvements to current biosafety practices and regulations.

**CO4:** Develop effective communication strategies to engage with the public and address concerns regarding biotechnology and its implications for health and safety.

**CO5:** Explain the regulatory and ethical frameworks governing biotechnology, including national and international guidelines.

**CO6:** Collaborate effectively with peers and professionals from various disciplines to address biosafety challenges and ethical considerations in biotechnological research.

**CO7:** Evaluate emerging trends in biotechnology and their potential impact on biosafety regulations, ethical standards, and public policy.

**Text Books:**

4. . Shomini Parashar, Deepa Goel (2013), IPR, Biosafety and Bioethics Pearson India

**Reference Books:**

1. R. J. M. A. Van den Borne, J. A. H. Van der Linde, and G. M. J. L. Thewessen (2018), Biosafety in Microbiological and Biomedical Laboratories, 5th edn, U.S. Department of Health and Human Services, Washington, D.C.
2. B. J. Campbell, L. L. K. Trivett, and C. E. Redman (2017), Biotechnology and Biosafety: A Practical Guide, 1st edn, Wiley-Blackwell, Hoboken, NJ.

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**PRACTICAL IN MOLECULAR BIOLOGY****COURSE OBJECTIVE:**

The candidate will gain hands-on knowledge and acquire adequate skill required to separate and observe chromosomal DNA, RNA, amino acids, lipids as well as estimate nucleic acids.

1. Isolation of Antibiotic Resistant bacteria from soil samples.
2. Isolation of plasmid DNA and its demonstration by agarose gel electrophoresis.
3. Study survival curve of bacteria after exposure to ultraviolet (UV) light
4. Study the effect of chemical and physical (UV) mutagens on bacterial cells
5. Isolation of plasmid DNA and its demonstration by agarose gel electrophoresis.
6. Isolation of bacterial chromosomal DNA and demonstration.
7. Quantitation of DNA and RNA by chemical methods-Dinitrophenol, orcinol, physical method – UV adsorption (Estimation of DNA by chemical method).
8. Estimation of proteins – Lowry method; Bradford method
9. Electrophoretic methods – PAGE native PAGE.
10. Separation of amino acids by paper chromatography.
11. TLC – Plant pigments, amino acids, lipids and vitamins. Protein separation by aqueous two phase partitioning.

**Total: 45 Hours**

**Course Outcome:**

**At the end of this course students will be able to:**

**CO1:** Explain the principles of chromatography and electrophoresis techniques.

**CO2:** Perform gel electrophoresis and HPLC experiments using proper techniques and safety protocols.

**CO3:** Analyze experimental data from molecular separation experiments.

**CO4:** Evaluate the reliability of chromatographic separations for different types of molecules.

**CO5:** Design a protocol for a novel molecular separation experiment to separate specific biomolecules.

**CO6:** Design a protocol for a novel molecular separation experiment to address a specific research question or problem.

**CO7:** List different types of molecular separation methods and their basic components.



**24PBMB22**

**PRACTICAL III**

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**PRACTICAL IN INDUSTRIAL MICROBIOLOGY**

**COURSE OBJECTIVE:**

Develop skills in isolating and identifying soil bacteria producing amylase, protease, lipase, organic acids, and antibiotics; understand their industrial applications. Learn about fermenter design, components, sterilization, and control mechanisms; observe industrial fermenters and downstream processing. Master techniques for yeast immobilization, isolate lactic acid bacteria from curd, and produce wine, gaining insights into microbial roles and biochemical changes in fermentation processes.

1. Study of the different parts of fermenter
2. Screening for amylase producing bacteria from soil.
3. Screening for protease producing bacteria from soil.
4. Screening for lipase producing bacteria from soil.
5. Screening for organic acid producers (acetic acid/lactic acid)
6. Screening for antibiotic producers.
7. Immobilization of yeast.
8. Isolation of lactic acid bacteria from curd.
9. Wine Production.
10. A visit to any industry to see an industrial fermenter, and other downstream processing operations.

**Total: 45 Hours**

**Course Outcome:**

At the end of the course, learners will be able to:

**CO1:** Identify the different components of a fermenter and their respective roles in the fermentation process.

**CO2:** Employ methods to identify microorganisms capable of producing specific enzymes such as amylase and protease, and understand the principles behind these screening processes.

**CO3:** Screen microorganisms for their ability to produce organic acids such as acetic acid and lactic acid, and interpret results to select potential industrial strains.

**CO4:** Conduct assays to identify microorganisms with antibiotic-producing capabilities.

**CO5:** Understand various methods used for immobilizing yeast cells and their applications in industrial processes, and be able to perform basic immobilization procedures.



**CO6:** Analyze data obtained from fermentation experiments to optimize production conditions and improve yield.

**CO7:** Gain practical insights into industrial fermentation and downstream processing through industry visits.

**Reference Books:**

1. T.C.K. Sugitha, P. Raja, R. Rajesh, U. Sivakumar (2019), Practical manual cum Work Book “Industrial Microbiology”
2. Basanta Kumar Rai, Dil Kumar Subba (2016), Basic Practical Manual on Industrial Microbiology First Edition.

**Web Sources:**

1. [file:///C:/Users/Suresh/Downloads/IMPracticalManual2020%20\(1\).pdf](file:///C:/Users/Suresh/Downloads/IMPracticalManual2020%20(1).pdf)



**24DVAC21**

**COMMUNICATION SKILLS**

| L | T | P | O | C |
|---|---|---|---|---|
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**Course Objectives:**

- To develop effective verbal and non-verbal communication techniques for various contexts.
- To enhance listening skills for better comprehension and engagement in conversations.
- To improve written communication abilities, focusing on clarity, coherence, and style.
- To build confidence in public speaking through practice and constructive feedback.
- To cultivate interpersonal skills for successful collaboration and professional interactions.

Credit Hours

**Unit I –Introduction to Communication Skills** **6**

- Fundamentals of Communications
- Elements of Communication, Types of Communication

**Unit II - Practical English** **6**

- Importance of the language - Word Usage and Jargon
- Tenses and the effectiveness - Basics of grammar (Noun/Verb/Adverb/Conjunction)

**Unit III - Effective Communication** **6**

- LSRW (Listening, Speaking, Reading & Writing)
- Pronunciation - Vocabulary Building
- Intonations & its importance

**Unit IV - Workplace Communication** **6**

- Basics of telephone etiquette
- E-Mail writing
- Presentation Skills
- Interpersonal Skills
- Business English

**Unit V - Quantitative Ability** **6**

- Verbal Ability - Verbal Analogy
- Debating Skills - Public Speaking

**Total**

**30 Hours**

### Course Outcomes:

At the end of this course, the students would have learnt to

|            |   |
|------------|---|
| <b>CO1</b> | enhance participants' business communication skills                 |
| <b>CO2</b> | enhance LSRW Skills (LSRW – Listening, Speaking, Reading & Writing) |
| <b>CO3</b> | express opinions at free will in social/ personal gathering         |
| <b>CO4</b> | impact leadership qualities among participants                      |
| <b>CO5</b> | engage in conversation with others to exchange ideas                |

### References:

- Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
- Personality development and soft skills, Barun K Mitra, 1 stEdition, Oxford Press,2011
- Elizabeth Harren, 7 April 2022, last updated: 16 November, 2023
- Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler (McGraw-Hill)
- Ethan Beute and Stephen Pacinelli (Greenleaf)
- Soft skills and professional communication, Francis Peters SJ, 1stEdition, McGraw Hill Education, 2011

**24SSKU21****SOFT SKILLS II**

| L | T | P | O | C |
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**Course Objectives:**

- To develop strategies to enhance teamwork and collaboration in professional settings.
- To cultivate a positive attitude and mindset to foster constructive relationships and productivity.
- To develop leadership, decision-making and team bonding skills

**Credit Hours****Unit I - PROFESSIONAL BEHAVIOUR****6**

- Team Building – Team Bonding
- Inter-Personal Relationship– Intra-Personal Relationship

**Unit II - PERSONALITY DEVELOPMENT****6**

- Types of Personality
- Self-Confidence - Confidence Building
- Attitude (Positive/Negative)

**Unit III - TELEPHONE ETIQUETTE****6**

- Basics of telephone etiquette
- Giving clear and concise information
- Tone & rate of speech
- Intonations & its Importance
- Whatsapp Communications

**Unit IV - DECISION MAKING****6**

- Types of Decisions – planned-unplanned, individual-group, major-minor
- Types of Leadership styles – Autocratic, democratic, lesse-faire, participative, beurocratic

**Unit V - PROFESSIONAL ETIQUETTE****6**

- Respect – Salutations
- Official Behaviour

**Total****30 Hours**

### Course Outcomes:

At the end of this course, the students will be able to,

|            |   |
|------------|---|
| <b>CO1</b> | understand the principles of effective team building and apply strategies to foster team bonding and cohesion in professional settings. |
| <b>CO2</b> | become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills.                     |
| <b>CO3</b> | practice techniques for effective communication in telephone conversations.   |
| <b>CO4</b> | evaluate decision-making processes and their implications in professional settings.   |
| <b>CO5</b> | exhibit professional conduct and demeanour in various professional situations.  |

### References:

- Language Service, Universitat Oberta de Catalunya
- Taylor. Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd 2005
- Tiko, Champa& Jaya Sasikumar. Writing with a purpose. OUP New Delhi 1979
- Alex, Dr. K. (2014). Soft Skills (1st edition) S Chand & Company.
- Nelson-Jones, R. (1992). Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.