# DEPARTMENT OF BIOTECHNOLOGY

**RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)**

**Rathinam Techzone, Pollachi Road, Eachanari,Coimbatore – 641021**

Celebrate life

RATHINAM

# Syllabus for

# B.Sc. BIOTECHNOLOGY

# (I - VI Semester)

## 2024 – 2025 Batch onwards

## Vision and Mission of the Institution:

### VISION

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsters who can accelerate the overall development of India.

### MISSION

To provide quality education at affordable cost, build academic and research excellence, maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India.

## Vision and Mission of the Department:

### Vision

To Create a top-tier Biotechnology department by blending academic excellence with industry expertise, aiming for recognition through scholarly achievements and research contributions, attracting top students and faculty to advance national progress.

### Mission

To cultivate a premier Biotechnology department by fostering a dynamic environment that integrates rigorous academic pursuits with practical industry knowledge. We are dedicated to achieving scholarly excellence, driving impactful research and nurturing talent to propel national advancement in the field of Biotechnology.

## Program Educational Objectives (PEO)

| | | |
|---|---|---|
| **PEO1** | **:** | Pursue a career as a globally competent and universally employable professional in core and related fields in diverse sectors who accelerates the overall development of India. |
| **PEO2** | **:** | Pursue lifelong learning opportunities including graduate degrees to improve and expand domain specific and professional skills. |
| **PEO3** | **:** | Advance personally and professionally by accepting professional and societal responsibilities, and pursuing leadership roles. |

## Mapping of Institute's Mission to PEO

| Institute's Mission | PEO's |
|---|---|
| To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and | PEO1, PEO2 |
| To create a team of well qualified faculty who can build global competency and employability among the youth of India. | PEO2, PEO3 |

## Mapping of Department Mission to PEO

| Department Mission | PEO's |
|---|---|
| Imparting critical thinking | PEO 1, PEO 2 |
| Enhancing research skills | PEO 1, PEO 2 |
| Developing professionalism | PEO 2, PEO 3, |
| Viable technical knowledge and core competency | PEO 1. PEO 3 |

## Program Outcomes (PO):

| | | |
|---|---|---|
| **PO1** | **:** | Demonstrate knowledge competency in core discipline |
| **PO2** | **:** | Apply the appropriate knowledge and suitable skills in solving the complex problems |
| **PO3** | **:** | Conduct investigations of complex problems through various scientific approaches |
| **PO4** | **:** | Design solutions for complex and open ended real-life or real-time problems |
| **PO5** | **:** | Use appropriate and advanced tools for wide range of practices with an understanding on its associated limitations |
| **PO6** | **:** | Work effectively and responsibly as a member or a leader in a team |
| **PO7** | **:** | Express complex concepts within the profession and with society at large |
| **PO8** | **:** | Understand the professional roles and responsibilities |
| **PO9** | **:** | Analyze social and environmental aspects of the professional practices |
| **PO10** | **:** | Practice higher moral and ethical standards during the discharge of professional duties |
| **PO11** | **:** | Incorporate finer finance and business practices in all professional engagements |
| **PO12** | **:** | Identify and address their professional development through lifelong learning |

**Program Specific Outcomes (PSO):**

| | |
|---|---|
| PSO1 | Stay abreast of emerging trends and advancements in biotechnology and provide opportunities for students to engage in cutting edge research and innovation in the field. |
| PSO2 | Encourage innovation and creativity in students by supporting entrepreneurship and the development of novel biotechnological solutions. |
| PSO3 | Foster interdisciplinary collaboration and critical thinking skills to address complex challenges in Biotechnology. |
| PSO4 | Promote ethical and responsible conduct in biotechnological research and practice, emphasizing the importance of sustainability and social impact. |

## Correlation between the PO/PSO and the PEOs

| Program Outcomes | | PEO 1 | PEO 2 | PEO 3 |
|---|---|---|---|---|
| **PO 1** | : | 3 | 1 | 3 |
| **PO 2** | : | 3 | 2 | 3 |
| **PO 3** | : | 1 | 2 | 3 |
| **PO 4** | : | 3 | 1 | 3 |
| **PO 5** | : | 3 | 3 | 2 |
| **PO 6** | : | 2 | 3 | 3 |
| **PO 7** | : | 2 | 3 | 1 |
| **PO 8** | : | 3 | 2 | 1 |
| **PO 9** | : | 2 | 2 | 3 |
| **PO 10** | : | 3 | 2 | 1 |
| **PO 11** | : | 2 | 1 | 1 |
| **PO 12** | : | 3 | 2 | 2 |
| **PSO 1** | : | 2 | 3 | 1 |
| **PSO 2** | : | 3 | 2 | 2 |
| **PSO 3** | : | 2 | 3 | 3 |
| **PSO 4** | : | 3 | 2 | 2 |

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

## Components considered for Course Delivery is listed below:

a. Class room Lecture
b. Laboratory class and demo
c. Assignments
d. Mini Project
e. Project
f. Online Course
g. External Participation
h. Seminar
i. Internship

**Mapping of POs with Course Delivery:**

| Program Outcome | Course Delivery | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** |
| PO1 | 3 | 3 | 1 | 1 | 2 | 1 | 3 | 3 | 1 |
| PO2 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 2 | 3 |
| PO3 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 3 |
| PO4 | 2 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 1 |
| PO5 | 3 | 2 | 1 | 3 | 1 | 3 | 3 | 3 | 3 |
| PO6 | 2 | 3 | 1 | 3 | 3 | 1 | 2 | 3 | 3 |
| PO7 | 2 | 3 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| PO8 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 3 | 3 |
| PO9 | 1 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| PO10 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 |
| PO11 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| PO12 | 1 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 |
| PSO1 | 2 | 3 | 1 | 3 | 2 | 3 | 1 | 3 | 3 |
| PSO2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |
| PSO3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 |
| PSO4 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 2 |

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

**___BSc Biotechnology_ Curriculum Structure - Regulation - 2024**

| S.No. | Sem | Part | Sub Type | Course Code | Course Name | Credit | Hours | INT | EXT | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | L1 | | Language - I | 3 | 5 | 50 | 50 | 100 |
| 2 | 1 | 2 | L2 | | English - I | 3 | 5 | 50 | 50 | 100 |
| 3 | 1 | 3 | Core | | Core Course – I Cell Biology | 4 | 5 | 50 | 50 | 100 |
| 4 | 1 | 3 | Core | | Core Course – II Lab in Cell Biology | 4 | 4 | 50 | 50 | 100 |
| 5 | 1 | 3 | Allied | | Allied- Applied Chemistry | 4 | 5 | 50 | 50 | 100 |
| 6 | 1 | 4 | SEC | | Skill Enhancement Courses – I Bioinstrumentation | 4 | 4 | 50 | 50 | 100 |
| 7 | 1 | 4 | AEC | | Ability Enhancement Course I Environmental Studies **or** Universal Human Values & Professional Ethics | 2 | 2 | 50 | 0 | 50 |
| | | | | | | **24** | **30** | **350** | **300** | **650** |
| | | | | | | | | | | |
| 1 | 2 | 1 | L1 | | Language - II | 3 | 5 | 50 | 50 | 100 |
| 2 | 2 | 2 | L2 | | English - II | 3 | 5 | 50 | 50 | 100 |
| 3 | 2 | 3 | Core | | Core Course – III Fundamentals of Microbiology | 4 | 5 | 50 | 50 | 100 |
| 4 | 2 | 3 | Core | | Core Course – IV Lab in Microbiology | 4 | 4 | 50 | 50 | 100 |
| 5 | 2 | 3 | Elective | | Elective - I Entreprenuership Development | 4 | 4 | 50 | 50 | 100 |
| 6 | 2 | 3 | Allied | | Allied-II Human Anatomy and Physiology | 4 | 5 | 50 | 50 | 100 |
| 7 | 2 | 4 | AEC | | Ability Enhancement Course II Design Thinking | 2 | 2 | 50 | 0 | 50 |
| 8 | 2 | 5 | Ext | | Extension Activity - I (NASA) | 1 | 0 | 25 | 0 | 25 |
| | | | | | | **25** | **30** | **375** | **300** | **675** |
| | | | | | | | | | | |
| 1 | 3 | 1 | L1 | | Language - III | 3 | 4 | 50 | 50 | 100 |
| 2 | 3 | 2 | L2 | | English - III | 3 | 4 | 50 | 50 | 100 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | Core | | Core Course – V Plant Biotechnology | 4 | 6 | 50 | 50 | 100 |
| 4 | 3 | 3 | Core | | Core Course – VI Lab In Plant Biotechnology & Biochemistry | 4 | 4 | 50 | 50 | 100 |
| 5 | 3 | 3 | Allied | | Allied-III - Biochemistry | 4 | 5 | 50 | 50 | 100 |
| 6 | 3 | 4 | SEC | | Skill Enhancement Courses – II Applications of Bioinformatics | 4 | 5 | 50 | 50 | 100 |
| 7 | 3 | 4 | AEC | | Ability Enhancement Course III Soft Skill-1 | 2 | 2 | 50 | 0 | 50 |
| 8 | 3 | 3 | ITR | | Internship / Industrial Training (Summer vacation at the end of II semester activity) | 2 | 0 | 50 | 0 | 50 |
| 9 | 3 | 5 | Ext | | Extension Activity - II (NASA) | 1 | 0 | 25 | 0 | 25 |
| | | | | | | **27** | **30** | **425** | **300** | **725** |
| | | | | | | | | | | |
| 1 | 4 | 1 | L1 | | Language - IV | 3 | 4 | 50 | 50 | 100 |
| 2 | 4 | 2 | L2 | | English - IV | 3 | 4 | 50 | 50 | 100 |
| 3 | 4 | 3 | Core | | Core Course – VII Immunology and Animal Biotechnology | 4 | 6 | 50 | 50 | 100 |
| 4 | 4 | 3 | Core | | Core Course – VIII Lab in Animal Biotechnology & Immunology | 4 | 4 | 50 | 50 | 100 |
| 5 | 4 | 3 | Allied | | Allied-IV Biostatistics & Computer Application | 4 | 5 | 50 | 50 | 100 |
| 8 | 4 | 3 | Elective | | Elective - II | 4 | 5 | 50 | 50 | 100 |
| 7 | 4 | 4 | AEC | | Ability Enhancement Course IV Soft Skill-2 | 2 | 2 | 50 | 0 | 50 |
| 8 | 4 | 5 | Ext | | Extension Activity - III (NASA) | 1 | 0 | 25 | 0 | 25 |
| | | | | | | **25** | **30** | **375** | **300** | **675** |
| | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 3 | Core | | Core Course – IX Molecular Biology & Genetics | 4 | 6 | 50 | 50 | 100 |
| 2 | 5 | 3 | Core | | Core Course – X Lab in Molecular Biology & Genetics | 4 | 6 | 50 | 50 | 100 |
| 3 | 5 | 3 | Elective | | Elective - III | 4 | 6 | 50 | 50 | 100 |
| | 5 | 3 | PRJ | | Project | 0 | 6 | 0 | 0 | 0 |
| 4 | 5 | 4 | SEC | | Skill Enhancement Courses – III Practical /Genetic Engineering | 4 | 6 | 50 | 50 | 100 |
| 5 | 5 | 3 | ITR | | Internship / Industrial Training (Summer vacation at the end of IV semester activity) | 2 | 0 | 50 | 0 | 50 |
| 6 | 5 | 5 | Ext | | Extension Activity - IV (NASA) | 1 | 0 | 25 | 0 | 25 |
| | | | | | | **19** | **30** | **275** | **200** | **475** |
| | | | | | | | | | | |
| 1 | 6 | 3 | Core | | Core Course – XI Environmental Biotechnology | 4 | 6 | 50 | 50 | 100 |
| 2 | 6 | 3 | Core | | Core Course – XII Lab in Environmental Biotechnology | 4 | 4 | 50 | 50 | 100 |
| 3 | 6 | 3 | Elective | | Elective – IV | 4 | 6 | 50 | 50 | 100 |
| 4 | 6 | 3 | PRJ | | Core Project | 8 | 8 | 100 | 100 | 200 |
| 5 | 6 | 4 | SEC | | Skill Enhancement Courses – IV Nanoscience & Nanotechnology | 4 | 6 | 50 | 50 | 100 |
| | | | | | | **24** | **30** | **300** | **300** | **600** |
| | | | | | **Total credit** | **144** | **180** | **2100** | **1700** | **3800** |

| **Additional Credits** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **S.No.** | **Sem** | **Part** | **Sub Type** | **Course Code** | **Course Name** | **Credit** | **Hours** | **INT** | **EXT** | **Total** |
| 1 | 2 | 6 | VAC | | VAC - Microsoft CoE Course / NPTEL | 2 | 2 | 50 | 0 | 50 |
| 3 | 4 | 6 | IDC | | VAC - Microsoft CoE Course / NPTEL | 2 | 2 | 50 | 0 | 50 |
| 4 | 5 | 6 | VAC | | VAC - Microsoft CoE Course / NPTEL | 2 | 2 | 50 | 0 | 50 |

| Certificate on Minor Discipline | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **S.No.** | **Sem** | **Part** | **Sub Type** | **Course Code** | **Course Name** | **Credit** | **Hours** | **INT** | **EXT** | **Total** |
| 1 | 2 | 6 | MD | | Course - I | 5 | 2 | 0 | 100 | 100 |
| 2 | 3 | 6 | MD | | Course - II | 5 | 2 | 0 | 100 | 100 |
| 3 | 4 | 6 | MD | | Course - III | 5 | 2 | 0 | 100 | 100 |
| 4 | 5 | 6 | MD | | Course - IV | 5 | 2 | 0 | 100 | 100 |

**Core - Theory**

| S.No. | Sem | Pre-requesite | Course Code | Course Name | Offering Department | Type Theory / Practical |
|---|---|---|---|---|---|---|
| 1 | 1 | No | | Cell Biology | **Biotechnology** | **Theory** |
| 2 | 2 | No | | Fundamentals of Microbiology | **Biotechnology** | **Theory** |
| 3 | 3 | No | | Plant Biotechnology | **Biotechnology** | **Theory** |
| 4 | 4 | No | | Immunology & Animal Biotechnology | **Biotechnology** | **Theory** |
| 5 | 5 | No | | Molecular Biology & Genetics | **Biotechnology** | **Theory** |
| 6 | 6 | No | | Environmental Biotechnology | **Biotechnology** | **Theory** |

**Core - Theory / Practical**

| S.No. | Sem | Pre-requesite | Course Code | Course Name | Offering Department | Type Theory / Practical |
|---|---|---|---|---|---|---|
| 1 | 1 | No | | Lab in Cell Biology | **Biotechnology** | **Practical** |
| 2 | 2 | No | | Lab in Microbiology | **Biotechnology** | **Practical** |
| 3 | 3 | No | | Lab in Plant Biotechnology & Biochemistry | **Biotechnology** | **Practical** |
| 4 | 4 | No | | Lab in Animal Biotechnology & Immunology | **Biotechnology** | **Practical** |
| 5 | 5 | No | | Lab in Molecular Biology & Genetics | **Biotechnology** | **Practical** |
| 6 | 6 | No | | Lab in Environmental Biotechnology | **Biotechnology** | **Practical** |

| S.No. | Sem | Pre-requesite | Course Code | Course Name | Offering Department | Type Theory / Practical |
|---|---|---|---|---|---|---|
| 1 | 1 | No | | Applied Chemistry | **Physics** | **Theory** |
| 2 | 2 | No | | Human Anatomy & Physiology | **Biotechnology** | **Theory** |
| 3 | 3 | No | | Principles of Biochemistry | **Biotechnology** | **Theory** |
| 4 | 4 | No | | Biostatistics & Computer Application | **Biotechnology** | **Theory** |
| | | | | | | |

**Skill Enhancement Course**

| S.No. | Sem | Pre-requesite | Course Code | Course Name | Offering Department | Type Practical / Training |
|---|---|---|---|---|---|---|
| 1 | 1 | No | | Bioinstrumentation Principles & Application | **Physics** | **Training** |
| 2 | 3 | No | | Applications of Bioinformatics | **Microbiology** | **Training** |
| 3 | 5 | No | | Genetic Engineering | **Computer Science** | **Training** |
| 4 | 6 | No | | Nanoscience & Nanotechnology | **Biotechnology** | **Training** |
| | | | | | | |

**Elective**

| S.No. | Sem | Pre-requesite | Course Code | Course Name | Offering Department | Type Practical / Training |
|---|---|---|---|---|---|---|
| 1 | 2 | No | | Entrepreneurship Development Program | **Biotechnology** | **Theory** |
| 2 | 2 | No | | Bioethics, Biosafety & GLP | **Biotechnology** | **Theory** |
| 3 | 4 | No | | Medical Biotechnology | **Biotechnology** | **Theory** |
| 4 | 4 | No | | Pharmaceutical Biotechnology | **Biotechnology** | **Theory** |
| 5 | 5 | No | | Ecology & Biodiversity | **Biotechnology** | **Theory** |
| 6 | 5 | No | | Agriculture Biotechnology | **Biotechnology** | **Theory** |
| 7 | 6 | No | | Industrial Biotechnology | **Biotechnology** | **Theory** |
| 8 | 6 | No | | Food Biotechnology | **Biotechnology** | **Theory** |

| Parts | Sem I | Sem II | Sem III | Sem IV | Sem V | Sem VI | Total Credits |
|---|---|---|---|---|---|---|---|
| **Part I** | 3 | 3 | 3 | 3 | | | 12 |
| **Part II** | 3 | 3 | 3 | 3 | | | 12 |
| **Part III** | 12 | 16 | 15 | 16 | 15 | 20 | 94 |
| **Part IV** | 6 | 2 | 6 | 2 | 4 | 4 | 24 |
| **Part V** | | 1 | 1 | 1 | 1 | | 4 |
| **Total** | **24** | **25** | **28** | **25** | **20** | **24** | **146** |

| Subject Code | Subject Title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **22BGE11T** | Part I Tamil | **3** | **6** | **1** | **0** | **Theory / Practical** |

**Introduction: பகுதி முதல் பாடமாக அமையும், தமிழ்ப்பாடம் கவிதைகள், இலக்கணம், இலக்கியவரலாறு ஆகியவைகள் கொண்டு அமைந்து உள்ளது. ஐந்து அலகுகளாக பகுக்கப்பட்டுள்ளது.**

**Course Outcome:**

CO1 : பாரதியார், பாரதிதாசன், சிற்பி, சுரதா ஆகிய மரபு மற்றும் புதுக்கவிதைகளின் விளக்கத்தை மாணவர்கள் அறிந்து கொள்ளுவதால், தன்னம்பிக்கையை வெளிக்கொணரும் வகையில் உள்ளது.

CO2 : இக்காலக்கவிதைகள்- பெண் கவிஞர்களின் படைப்பு கவிதையை அறிவதன் மூலம் வாழ்வியல் சிந்தனைகள், வாழ்வியல் செய்திகள், யதார்த்த நிலைகள் ஆகியவற்றை அறிய உதவுகிறது.

CO3 : கவிஞர் கவிதாசனின் -எண்ணங்களே ஏணிப்படிகள் -வாழ்வில் வெற்றி பெற வேண்டுமானால் எண்ணங்களை வளர்த்துக் கொள்ள வேண்டும். சிந்தனையில் மூழ்கினால் தெளிவு கிடைக்கும் என்ற கருத்துக்களை அறியும் வகையில் அமைந்துள்ளது.

CO4 : படைப்புத்திறனை வெளிப்படும் விதமாகவும், பயிற்சி அளித்தல் தொடர்பாகவும் மற்றும் இலக்கணத்தை அறிய பயனுள்ளதாக அமைகிறது.

CO5 : இலக்கியவரலாறு பற்றியச் செய்திகளைக் கொண்டு அதன் கருத்துக்கள், வளர்ச்சி நிலையை அறிவும் வகையில் உள்ளது.

**Unit I: மரபுக்கவிதைகள், புதுக்கவிதைகள் :** [12 Periods]

பாரதியார் - பெண் விடுதலை, பாரதிதாசன் - அழகின் சிரிப்பு- சிற்றூர்- சிற்பி - நிலவுப்பூ சுரதா - நாடு ஆகியவற்றின் விளக்கம் தருதல் மற்றும் நடைமுறைகளை அறிதல்.

**Unit II: இக்கால கவிதைகள்** [12 Periods]

பெண்கவிஞர்களின் கவிதைகள்- தாமரை - தொலைந்துபோனேன், அ. வெண்ணிலா - நீரிலையும் முகம் மாலதி மைத்ரி - கன்னியாகுமரி, க்ருஷாங்கினி - புன்னை மரம் ஆகிய பெண் கவிதைகளின் செய்திகளை அறிவதால் வாழ்க்கையின் புரிதலையும், பழக்கங்கள் அறிதல் மற்றும் வாழ்வியல் சூழலையும், யாதர்த்த நிலையையும் விளக்குதல்.

**Unit III: வாழ்வியல் கட்டுரைகள்** [12 Periods]

சிந்தனைக்கவிஞர் கவிதாசனின் -வாழிவியல் கட்டுரை- எண்ணங்களே ஏணிப்படிகள்- தெளிவான இலக்கு- ஆற்றல் நதி பெருகட்டும்- அறிவை விரிவு படுத்துக்கள்- முன்னேற்றப் படிகள்- வெற்றிச் சிகரம்- எப்பொழுதும் வெற்றி ஆகியவைகள் வாழ்வின் முன்னேற்றதுக்கான செய்திகள் அறியப் பயன்படும்

**Unit IV:** [12 Periods]

**இலக்கணம்** : பெயர் சொல், வினைச்சொல், இடைச்சொல், உரிச்சொல், -இலக்கணத்திற்கு விளக்கம் அளித்தல்- எழுத்துக்களை அறிந்து கொள்ளல். படைப்பிலக்கியப் பயிற்சி, கவிதை எழுதல் வானொலித் தமிழ், தொலைக்காட்சித் தமிழ் பயன்பாட்டுத்தமிழ், இலக்கண நோக்கில் பயிற்றுவித்தல் எழுதுதல் கவிதைவானொலி பேச்சுத்திறன் வளர்த்தல். ஆகியவைகள் கொண்டு திறன் வளர்க்க உதவுதல்.

**Unit V:** [12 Periods]

**இலக்கியவரலாறு** : இலக்கியவரலாறு பற்றியச் செய்திகள் மற்றும் புதுக்கவிதைகளின் தோற்றங்கள், வளர்ச்சிகள் மற்றும் அறிவும் வகையில் உள்ளது. ஹைக்கூ,. குக்கூ, சென்ட்ரியூ, கஜல். ஆகியவற்றுக்கு விளக்கம் தருதல்.

*Approved in the BOS Meeting held on 25-04-2024*

**Textbook:**

**பாடநூல்கள்**

1. பாரதியார் கவிதைகள்
2. பாரதிதாசன் கவிதைகள்
3. சுரதா கவிதைகள்
4. சிற்பி கவிதைகள்
5. அ. வெண்ணிலா

**பார்வை நூல்கள்** :

1 இலக்கியவரலாறு – பாக்கியமேரி,
2. இலக்கண நூல்,
3. மு.வ. -தமிழ் இலக்கிய வரலாறு

## முதற்பருவம்

**(கவிதை, கட்டுரை, இலக்கணம், படைப்பிலக்கியம், இலக்கியவரலாறு)**

**அலகு 1 மரபக்கவிதைகள், புதுக்கவிதைகள்**

1. பாரதியார் - பெண் விடுதலை
2. பாரதிதாசன் -அழகின் சிரிப்பு (சிற்றூர்)
3. சிற்பி - நிலவுப்பூ
4. சுரதா - நாடு

**அலகு 2 இக்கால கவிதைகள்**

1. தாமரை - தொலைந்துபோனேன்
2. அ.வெண்ணில - நீரிலையும் முகம்
3. மாலதி மைத்ரி - கன்னியாகுமரி
4. க்ருஷாங்கினி - புன்னை மரம்

**அலகு 3 உரைநடை**

1.எண்ணங்களே ஏணிப்படிகள் - சிந்தனைக் கவிஞர்-கவிதாசன்
க.எண் : 2,5,9,10,12,15,

**அலகு 4 இலக்கணம்**

I பெயர் சொல், வினைச்சொல், இடைச்சொல், உரிச்சொல், எச்சம்

**படைப்பிலக்கியப் பயிற்சி** - 1. கவிதை எழுதல்
2. வானொலித் தமிழ்
3. தொலைக்காட்சித் தமிழ்

**பயன்பாட்டுத்தமிழ்** :

**இலக்கண நோக்கில் பயிற்றுவித்தல்**

1. எழுதுதல்- கவிதைவானொலி
2. பேச்சுத்திறன் வளர்த்தல்

**அலகு 5 இலக்கிய வரலாறு**

**நவீனக் கவிதை இலக்கிய வடிவங்கள்**

1. ஹைக்கூ 2. குக்கூ 3. சென்ட்ரியூ 4. கஜல்..
2. கணினித் தமிழ் - கலைச்சொற்கள்

**பயிற்சிக்குரியன**

**பாடநூல்கள்**

1. பாரதியார் கவிதைகள்
2. பாரதிதாசன் கவிதைகள்
3. சுரதா கவிதைகள்
4. சிற்பி கவிதைகள்

5. அ. வெண்ணிலா
6. சிந்தனைக் கவிஞர் கவிதாசன்

**பார்வை நூல்கள்** :

1. இலக்கியவரலாறு – பாக்கியமேரி,
2. இலக்கண நூல்,
3. மு.வ.-தமிழ் இலக்கிய வரலாறு

**PART – I – FRENCH**
**SEMESTER I**
**PAPER I**

**French I**

1. Topics & Vocabulary:
   i. Greetings
   ii. Alphabet + letters combination
   iii. Nationalities and countries
   iv. Jobs
   v. Numbers
   vi. Giving personal details (address, telephone number, email, age)
   vii. Filling a form
   viii. Food and drinks
   ix. Holidays in France and abroad
   x. Describing a city (jobs and places)
   xi. Using a dictionary
2. Grammar:
   i. Nouns – feminine, masculine, singular, plural
   ii. The verbs 'être', 'avoir' in the present tense
   iii. Articles – definite and indefinite
   iv. Verbs in 'ER'
   v. Etre and Avoir
   vi. Prepositions of place
   vii. Il y a + Il n'y a pas
   viii. Word order: sentence/question
   ix. Key prepositions – à, dans, en, au, etc.
   x. Yes/no questions
3. Cultural Content:
   i. Paris
   ii. Cities of France
   iii. French speaking countries
   iv. French names
   v. Map of France

4. Skills Work:
   i. Lots of speaking/active practice
   ii. Role-plays
   iii. Lots of listening
   iv. Pronunciation – key sounds
   v. Letter writing

**Part I – Hindi Language**
**FIRST SEMESTER – Paper I**

**I PROSE:**

NUTHAN GADYA SANGRAH

Lesson 1 – Bharathiya Sanskurthi - Dr.Rajendra Prsad

Lesson 2 – Rashtrapitha Mahathma Gandhi - Mukthibodh

II NON DETAILED TEXT SHORT STORIES:

**II KAHANI KUNJ**

1. Pareksha – Premchand
2. Mamtha - Jayashankar Prasad
3. Apna paraya – Jaynendrakumar

**III GRAMMAR:**

SHABDHA VICHAR ONLY (NOUN, PRONOUN, ADJECTIVE, VERB, TENSE, CASE ENDINGS)

**IV TRANSLATION:**

English – Hindi only.

ANUVADH ABHYAS – III (1-15 lessons only)

**V COMPREHENSION**:

1 Passage from ANUVADH ABHYAS–III (16-30)

**Text Book**:

1. Nuthan gadya sangrah, 2009, editor : Jayaprakash, publisher
2. Kahani kunj, 2011, Editor :V.P. Amithab.Publisher

**Part I –Malayalam Language**
**FIRST SEMESTER – Paper I**

**Malayalam - First Semester**

Unit I & II Autobiography of C Keshavan ( Jeevidhasamaram)

Unit III,IV & V Travelogue

Unit III,IV & V Aalahayude Penmakkal

**Text Books prescribed:**

1. C Keshavan - Jeevidhasamaram (D.C.Books)
2. Sarah Joseph - Aalahayude Penmakkal (D.C.Books)

**Reference books:**

1. C Keshavan - Jeevidhasamaram
2. Sarah Joseph - Aalahayude Penmakkal
3. Balkan Diary- Baiju N Nai

**PART I – ARABIC LANGUAGE FOR UG DEGREE COURSES**

**I SEMESTER**

**PAPER-I: PROSE AND GRAMMAR–I**

**Books Prescribed: 1. Duroos Al-Lugha Al-Arabiyya Part-I (Lesson 1 to 12)** By Dr. V. Abdur Rahim, IFT, Perambur, Chennai-12.

**2. An-Nahwu Al-Wadeh Part-I (Al-Ibtidaiyyah - Selected Lessons)** By Ali Alijarim and Mustafa Ameen, Al-Huda Book Stall, Calicut, Kerala

(Lessons: Al-Jumlah Al-Mufeedha, Ajza Al-Jumlah, Al-Fi'l al-Madhi, Al-Fi'l-al-Mudhari', Fi'l al-Amr, Al-Fa'il, Al-Maf'uool, Al-Mubthdha Wal- Khabar)

**Part – I Language - URDU**
**SYLLABUS -- UNDER CBCS**
**I SEMESTER**
**PROSE, GRAMMER & TRANSLATION**

Book Prescribed: **Faizan-e-Adab** - Edited by Dr.K.Habeeb Ahmed
[Published by Ansaar Educational & Welfare Society,
Melvisharam- Contact No.9994965700,9443818785]

[a] Prose:
The following lessons only

1. SAIR PAHLAY DARWESH KI - Meer Amman Dehalvi
2. UMEED KI KHUSHI – Sir Syed
3. MIRZA GHALIB KE AKHLAQ WA ADAT – Moulana hali
4. ZUBAIDA KHATOON – Abdul Haleem Sharar
5. NOOR JHAN – Mohamed Hussain Azad
6. MARHOOM DI YAAD MEIN – PATRAS BUKHARI
7. SIR SYED MARHOOM AUR URDU LITERATURE – Shibi
8. KHAJA MOHINUDEEN SHITHI- Shabaz Hussain

[b] Grammar: 1. ISM AUR USKI KHISMEIN
2. ZAMEER AUR USKI KHISMIEN
3. SIFAT AUR USKI KHIMEIN
4. FE'L AUR USKI KHIMEIN
5. LAWAZIM-E-ISM
6. ALAMAT-E-FAEL "NAY" AUR ALAMAT-E-MAFO'OL "KO" KE QUAIDE BOOK FOR REFERENCE Urdu Grammar by Yaqoob Aslam

[c] TRANSLATION: A GENERAL PASSAGE FOR TRANSLATION FROM ENGLISH TO URDU

**Semester-I**

| Subject Code | Subject title | Lecture | Tutorial | Practical | Credit | Type |
|---|---|---|---|---|---|---|
| | General English | 4 | 0 | 0 | 4 | Theory |

**Introduction**

To encourage students to inculcate and use effective communication skills in their day-to-day lives. To develop the LSRW skills to enhance the culture and thoughts through language

**Course Outcome:**

| | |
|---|---|
| CO1 | Develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking, and Writing |
| CO2 | Understand the total content and underlying meaning in the context |
| CO3 | Form the habit of reading for pleasure and for information |
| CO4 | Comprehend material other than the prescribed text |
| CO5 | Develop the linguistic competence that enables them, in the future, to present the culture and civilization of their nation. |

**Unit I:** **[12 Periods]**

1.1 A Patch of Land -Subramania Bharathi.
1.2 JRD-Harish Bhat
1.3 The Faltering Pendulum- Bhabani Bhattacharya
1.4 Listening for General and Specific Information
1.5 Vocabulary: Synonyms, Antonyms, Word Formation

**Unit II:** **[12 Periods]**

2.1 The Sparrow-Paul Lawrence Dunbar
2.2 Us and Them-David Sedaris (From Dress your Family in Corduroy and Denium}
2.3 How I taught my grandmother to read-Sudha Murthy
2.4 Appropriate use of /articles and Parts of Speech
2.5 Listening to Giving Instructions/Directions

**Unit II** **[12 Periods]**

3.1 A Nation's Strength- Ralph Waldo Emerson
3.2 Uncle Podger Hangs a Picture-Jerome K.Jerome
3.3 Self-Introduction, Greeting, Introducing Others.
3.4 Error Detection

**Unit IV:** **[12 Periods]**

4.1 Love Cycle
4.2 The Gold Frame-R.K Laxman
4.3 Communication and its types
4.4 Close Reading
4.5 Paragraph Writing

**Unit V:** **[12 Periods]**

**5.1** Translation
5.2 Conversation
5.3 Free Writing
5.4 Sentence Types

**Text Books:**

1. Steel Hawk and other stories by Bhattacharya, Bhabani, New Delhi Sahitya Akademi 1967

2. How I Taught my Grandmother to Read and Other Stories, Murthy, Sudha, Penguin Books, India, 2004

**Reference Books:**

1. English in use - A textbook for College Students (English, Paperback, - T.Vijay Kumar, K Durga Bhavani, YL Srinivas

2. Practical English Usage - 4th Edition By Michael Swan

3. The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace -Margaret Shepherd, Penny Carter, (Illustrator), Sharon Hogan, 2005.

**Mapping of Course Outcomes with Program**

**Outcomes:**

| Course Outcomes | Program Outcomes | | | | | | | | | | Program Specific Outcomes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P01 | PO2 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| | **Core : Cell Biology** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective**

Students can able to know about cell and cellular function, reproduction mechanisms.

**Course outcome:**

CO1: Students will be able to accurately describe the structure and function of major cellular organelles.

CO2: Students will demonstrate proficiency in basic laboratory techniques used in cell biology and microscopy observation.

CO3: Students will effectively communicate scientific concepts and experimental findings through written assignment and oral presentation.

CO4: Students will be able to discuss the societal implications of cell biology research and consideration of ethical.

CO5: Students will demonstrate the ability to apply concepts and principles from cell biology to real world problems and scenarios.

Unit I 12hrs

History and overview of cell Biology – Discovery of Cell, Cell theory, Protoplasm theory, Organismal theory. Cytology & cytochemical Techniques: Cytological study of Living cells, cytological study of dead cells, cytochemical staining.

Unit II 12hrs

Cell: Viruses; History & Structure, Classification. Classification of cells of cellular organisms; Prokaryotic cell and types; Eukaryotic cell ; shape, size, cytoplasm, cell organelle and functions.

Unit III 12hrs

Cellular organelle – Cytoplasm; Plasma membrane and cell wall; cytoplasmic vascular system; Endoplasmic reticulum; golgi complex; Lysosomes; Mitochondria; Plastids; Microbodies; microtubules; centrioles; cilia and flagella; Ribosomes; Nucleus.

Unit IV 12hrs

Cell division: Types of cell division; amitosis; mitosis and cell cycle; cytokinesis; Meiosis and reproductive cycle; kinds of meiosis, process of meiosis, significance of meiosis; comparison between mitosis and meiosis.

Unit V 12hrs

Reproduction: Asexual reproduction; sexual reproduction; Gametogenesis; oogenesis, difference between spermatogenesis and oogenesis; Fertilization; Parthenogenesis; cell growth and aging.

Text Book:

1. Cell Biology by P S Verma and V K Agarwal, 2016

2. Cell Biology- cytology, Biomolecules and Molecular Biology by P S Verma, V K Agarwal, 2020.

References:

1.Cell and molecular biology, 3rd edition, Philip Sheeler, Donal E Bianchi, John Wiley

2. Molecular biology of cell, Albert et al

3. Molecular cell biology, Lodish, Baltimore, Scientific American books, 1994

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| Skilled : | Bioinstrumentation | 4 | 5 | 0 | 0 | Theory |

**Objectives:** This course presents the various instrumentation Principle, operation and applications.

**Course Outcome**

CO1: Able to understand the principles of spectroscopy.

CO2: Analyze the application of chromatography techniques.

CO3: Apply the techniques for biomolecule separation process.

CO4: Evaluate the DNA and protein through Electrophoresis techniques.

CO5: Know the techniques for Gene amplification and sequencing.

Unit I 12hrs

Principles and applications of Autoclave – Hot air oven – Incubator, Laminar air flow chamber / Biosafety cabinets, BOD Incubator, Lyophilizer.

Unit II 12hrs

Microscopy: Basic principles in microscopy - Types of microscopes, light, dark, phase contrast, fluorescent. Electron microscope- TEM & SEM.

Unit III 12hrs

Spectroscopy- UV Visible spectroscopy- – Beer – Lambert law Applications – Instrumentation, Applications. Vibrational spectroscopy - infrared Absorption spectroscopy, Raman spectroscopy –,instrumentation, applications. Fluorescence spectroscopy instrumentation – Applications.

Unit IV 12hrs

Separation technique – chromatography – column chromatography, Thinlayer chromatography – paper chromatography – ion exchange chromatography, exclution chromatography - Reversed phase chromatography. Affinity chromatography – HPLC, Equipment, Application. Advanced chromatography techniques.

Unit V 12hrs

Electrophoresis – polyacrylamide gel electrophoresis applications - SDS PAGE. Agarose Gel Electrophoresis – pulsed field gel electrophoresis. 2D gel electrophoresis. Polymerase chain reaction – DNA synthesis in PCR – Variations of the basic PCR methods. Quantitative PCR – Nested PCR – Reverse transcription PCR- Inverse PCR.

**Reference:**

1. Bioanalytical techniques by Sekhar Tallar (2009)- IK International Publishing House Pvt Ltd.

2. Biophysical Chemistry- Avinash Upadhyay, Nirmalendu Nath, Kakoli Upadhyay, (2014), Himalaya publishing House

3. Practical Biochemistry- Wilson & Walker – Vth edition (2009)Cambridge University Press

4. Practical Biochemistry- David Plummer- Tata McGraw Hill 3rd edition.

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Allied : Applied Chemistry** | | **4** | **5** | **0** | **0** | **Theory** |

**Course Objectives:**

The main objectives of this course are to:

1. To imbibe the knowledge of silicones, fuel gases, dyes, and their industrial applications
2. Show the importance of fertilizers and the unavoidability of insecticides in agriculture.
3. To inculcate the chemistry behind day to day used items like toiletries, detergents etc.
4. To understand the role of polymers and rubbers to mankind.
5. Appreciate the need for paints and explosives.

| **Expected Course Outcomes:** | | |
|---|---|---|
| On the successful completion of the course, student will be able to: | | |
| CO1 | Understand about silicones fuels gases and their industrial applications. The theory behind colours and dyes, their preparation and dyeing | K2-K4, K6 |
| CO2 | Appreciate the need for fertilizers and insecticides in the Agricultural sector | K2-K5 |
| CO3 | Explain the chemistry behind toiletries and cleaning agents | K2-K5 |
| CO4 | Understand the importance of polymers and rubbers in our day-to-day life | K1-K4 |
| CO5 | Understand about the importance of paints and the need for explosives as well as the bad face of war. | K2-K5 |
| K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create | | |

**UNIT I – Industrial and Dye Chemistry 12hrs**

1. **Industrial Chemistry:** Synthesis, properties, and uses of silicones. Fuel gases: composition and uses of natural gas, water gas, semi water gas, carbureted water gas, producer gas, oil gas.
2. **Dye Chemistry:** Terms: Chromophore – auxochrome - bathochromic shift – hypsochromic shift - hyperchromic effect - hypsochromic effect - Dyes: Azo and triphyenyl methane dyes - Preparation of Methyl Orange and Malachite green.

**UNIT II - Agricultural Chemistry – Fertilizers and Insecticides 12hrs**

1. Fertilizers: Classification of fertilizers- Preparation and uses of Urea, DAP, NPK, SSP, TSP and bio-fertilizers (vermicompost, coircompost, panchakavia) – types and advantages of biofertilizers
2. Insecticides: Classification of insecticides – Structure and effects of dinitro phenols, DDT, methoxychlor and BHC – comparison of artificial pesticides and bio-pesticide.

**UNIT III - Chemistry of Toiletries and Cleaning Agents 12hrs**

1. Toiletries: Bath soap – shower gel - water softeners - tooth pastes-ingredients – their characteristic functions-mouth washes-shaving creams-after shave preparations.
2. Cleaning Agents: Detergents - classification - formulation-cleansing action-optical brighteners-bleachers-phenoyls - hand sanitizer.

**UNIT IV - Polymers and Rubbers** **12hrs**

1. **Polymers:** Types of Polymerizations. Thermoplastics & thermosetting polymers. Preparation, properties and applications of the Polyethylene, Teflon, PVC, Nylon, Polypropylene, Polystyrene and PTFE.
2. **Rubbers:** Natural and synthetic rubbers: Constitution of natural rubber, Butyl, Buna-N, Neoprene, Thiokol, Polyurethane, Silicone rubbers, Vulcanization of rubber & Synthetic rubber.

**UNIT V - Paints and Explosives** **12hrs**

1. **Paints:** classification – constituents – Pigment Volume Concentration – Distemper – Varnishes – Lacquers - Pigments – name and formula of different coloured pigments and their uses – Toners – Nano paints
2. **Explosives:** classification – characteristics – chemistry of Nitrocellulose – nitroglycerine – gun powder - RDX – mustard gas – phosgene - nerve gas – Screening smokes.

**Text Books:**

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, S.Chand & Co.
3. Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons.

**Reference Books:**

1. Perfumes, Cosmetics and Soaps, W.A.Poucher (Vol.3), 9th Edition, Springer Science Business Media, 1993.
2. Handbook of Cosmetic Science and Technology, Barel, A.O.; Paye, M.; Maibach, H.I.(2014), CRC Press.
3. Pharmaceutics and Cosmetics, Gupta, P.K.; Gupta, S.K.(2011), Pragati Prakashan
4. Chemical Process Industries, R. Norris Shreve and Joseph A.Brink,Jr.,4 th Edition, McGraw Hill, 1977.
5. Environmental Chemistry, A.K.De, 6th Edition, New Age International, New Delhi, 2006.
6. History of fertilizer chemistry by T.P. Hignett, SPRINGER ,1985
7. A Text Book of Environmental Chemistry and Pollution Control, S.S. Dara–S. Chand Publication 2012.

| **Mapping with Programme Outcomes** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
| **CO1** | S | S | S | S | S | M | S |
| **CO2** | S | S | S | M | S | M | S |
| **CO3** | S | S | S | S | M | M | S |
| **CO4** | S | M | S | S | S | S | M |
| **CO5** | S | S | S | M | S | M | S |

***S-Strong; M-Medium; L-Low***

Semester I

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Core I–** | **Lab in Cell Biology** | **2** | **0** | **0** | **4** | **Practical** |

Course Objective: This practical session students able to know the cell divisions and various stages 1. 1.

Course Focus on: Skill Development & Employability

1. Mitosis in onion (*Allium cepa)* Root tip
2. Meiosis in Flower Buds of *Allium cepa*
3. Buccal Epithelial Smear and Barr Body
4. Differential Staining of Blood
5. Determination of Blood group and Rh Factor

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **DSC-** | **Lab in Bioinstrumentation** | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Microscopy
2. Spectrophotometer - Protein Quantification
3. Electrophoresis – Age & Page (Demo)
4. Column Chromatography (Demo)
5. Polymerase Chain Reaction – PCR (Demo)

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal
S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

| Subject Code | Subject Title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **22BGE21T** | Part I Tamil | **3** | **6** | **1** | **0** | **Theory / Practical** |

**Introduction:** இரண்டாம் பருவப்பாடத்திட்டம் அற இலக்கியம், சிற்றிலக்கியம், சிறுகதைகள், இலக்கணம், இலக்கிய வரலாறு ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

**Course Outcome:**

CO1 : அறஇலக்கியத்தில் -நீதிநெறி கருத்துக்களை அறிந்து கொள்ளுவதால், வாழ்க்கையில் பண்புகளை பின்பற்றவும், அறநெறிவோடு வாழவும் கருத்துக்கள் உள்ளடங்கி இருப்பதால் பயனுள்ளதாக அமையும்.

CO2 : சிற்றிலக்கியத்தின் செய்திகளான அறம், விருந்தோம்பல் போன்றவற்றை மாணவர்கள் தெளிவாக அறிந்துகொள்ளுவது, அன்பின் மேன்மை, பண்பு ஆகியவைகளும் அறிந்து கொள்ள முடிகிறது.

CO3 : அணி இலக்கணம் அறிவதால் இலக்கணத்தின் சிறப்பையும் முக்கியக்கியத்துவத்தையும் அறியலாம்.

CO4 : சிறுகதைகளில் உள்ள கதைகளில் உள்ள மையக்கருத்துகளைத் தெரிந்து கொள்ளுவது சமுதாயச் சிந்தனையையும், விழிப்புணர்வும் உருவாக்க உதவுகிறது.

CO5 : தன்னம்பிக்கை கட்டுரை- தன்னம்பிக்கையே வெற்றி – சிந்தனைகளை தூண்டி செயலாக்கும் நுட்பங்களை அறிந்தல், தானாக வளர்வதற்கான வழிகாட்டி, வெற்றிக்கு வழிகாட்டுவதாக அமைகிறது.

**Unit I:** [12 Periods]

அற இலக்கியம் : திருக்குறள், அன்புடைமை, அறிவுடைமை, நாலடியார், பழமொழி நானூறு-ஆகியவைகள் நீதியின் கருத்துக்களைக் கொண்டு பாடமாக உள்ளது.

**Unit II:** [12 Periods]

சிற்றிலக்கியம்: நந்திக்கலம்பகம், சிற்றிலக்கிய உறுப்புகள்- குற்றலாக் குறவஞ்சி – மலைவளம், கலிங்கத்துப்பரணி, காடு பாடியது, அழகர் கிள்ளை விடு தூது, கலிங்கத்துப்பரணி– கோயில் பாடியது, கிள்ளை வயடட தூது ஆகிய சிற்றிலக்கியங்களின் கருத்துக்களைத் தெளிவாக எடுத்துரைத்தல்.

**Unit III:** [12 Periods]

ஆணி இலக்கணம் - சிலேடை அணி, பரியாய அணி, விபாவனை அணி, அதிசய அணி, இலக்கணம் - விளக்கத்துடன் கற்பிக்கப்படும்.

**Unit IV:.** [12 Periods]

சிறுகதைகள் : தேர்ந்தெடுக்கப்பட்ட 4-சிறுகதைகள் - மாணவர்களின் தனித்திறனை வளர்க்கும் பொருட்டு எடுக்கப்படும். சமுதாய செய்திகள் மற்றும் சமுதாய நோக்குப் பற்றி விளக்கம் தருதல்.

**Unit V:** [12 Periods]

தன்னம்பிக்கை கட்டுரைகள் - தன்னம்பிக்கையே – முன்னேற்றச் சிந்தனைகள்- திட்டமிடுதல்- தன்னம்பிக்கை தரும் வெற்றிகள்- வளமூட்டும் வார்த்தைகள்- திறமை தீபம் ஏற்றுகள்- செயலினில் புதுமை செய்வோம் மாணவர்களுக்கு தன்னம்பிக்கை வளர்க்க உதவும்.

**Textbook:**
**பாடநூல்கள்**

1.பதினெண்கீழ்க்கணக்கு நூல்கள்
2.நந்திக்கலம்பகம்
3.குற்றலாக்குறவஞ்சி
4. கலிங்கத்துப்பரணி

**பார்வை நூல்கள்**

1. ஜெயகாந்தன் சிறுகதை
2. புதுமைப்பித்தன் சிறுகதை
3. சூடாமணி - சிறுகதை
4. எஸ். ராமகிருஷ்ணன்- சிறுகதை
5. மு.வ. -தமிழ் இலக்கிய வரலாறு
6. டாக்டர் கே.கே பிள்ளை – தமிழக வரலாறு மக்களும் பண்பாடும்.
7. பேரா.முனைவர் பாக்யமேரி - இலக்கணம் இலக்கிய வரலாறு மொழித்திறன்.

## இரண்டாம் பருவம்

**(அற இலக்கியம், சிற்றிலக்கியம், இலக்கணம், சிறுகதை, இலக்கிய வரலாறு)**

**அலகு I அற இலக்கியம்**

1. திருக்குறள் - 2- அதிகாரங்கள்
   1. நட்பாராய்தல் 10 குறள்கள் அதிகாரம் -8
   2. அறிவுடைமை 10 குறள்கள் அதிகாரம் -43
2. நாலடியார் - 5 பாடல்கள் (132,133,135,136,139)
3. பழமொழி நானூறு - 5 பாடல்கள் (90,91,93,95,100)

**அலகு II சிற்றிலக்கியம்**

1. நந்திக்கலம்பகம் - சிற்றிலக்கிய உறுப்புகள்
   (6 பாடல்கள் ( புயம், ஊசல், தெள்ளாறு வென்றவன்,மறம்)
2. குற்றலாக் குறவஞ்சி - மலைவளம்
3. கலிங்கத்துப்பரணி - காடு பாடியது
4. அழகர் கிள்ளை விடு தூது- 199-209

**அலகு III இலக்கணம்**

அணி இலக்கணம் - விளக்கத்துடன் கற்பித்தல்.
1.சிலேடை அணி 2. எடுத்துக்காட்டு உவமையணி 3. ஆர்வமொழியணி (உயர்வு நவிற்சியணி) 4. தீவக அணி

**அலகு IV சிறுகதைகள்**

1. ஜெயகாந்தன் - ஒரு பிரமுகர் 2. புதுமைப்பித்தன்- பூசணிக்காய் அம்பி
3. சூடாமணி - சொந்த வீடு 4. எஸ். ராமகிருஷ்ணன் -பாதம் (4 சிறுகதைகள்)

**அலகு V இலக்கிய வரலாறு**

1. தன்னம்பிக்கையே வெற்றி – சிந்தனைக் கவிஞர் கவிதாசன்
   கட்டுரைகள் 2- 9.

**பாடநூல்கள்**

1. பதினெண்கீழ்க்கணக்கு நூல்கள்
2. முக்கூடற்பள்ளு நூல்
3. குற்றலாக்குறவஞ்சி
4. கலிங்கத்துப்பரணி

**பார்வை நூல்கள்**

1. ஜெயகாந்தன் சிறுகதை
2. புதுமைப்பித்தன் சிறுகதை
3. சூடாமணி சிறுகதை
4. எஸ். ராமகிருஷ்ணன்
5. மு.வ. -தமிழ் இலக்கிய வரலாறு
6. டாக்டர் கே.கே பிள்ளை – தமிழக வரலாறும் மக்களும் பண்பாடும்.
7. பேரா.முனைவர் பாக்யமேரி - இலக்கணம் இலக்கிய வரலாறு மொழித்திறன்.
8. தன்னம்பிக்கையே வெற்றி – சிந்தனைக் கவிஞர் கவிதாசன்

**PART – I – FRENCH**
**SEMESTER II PAPER II**

**French II**

1. Topics & Vocabulary:
   - i. Review and practice level 1 vocabulary/grammar
   - ii. Talking about family, friends and celebrities
   - iii. Talking about oneself – key personal information + likes/dislikes
   - iv. Talking about hobbies
   - v. Daily life – routines, habits, free time
   - vi. Days of the week
   - vii. Animals
   - viii. Telling the time
   - ix. Consumer goods – clothes, accessories, food
   - x. Describing objects – shape, colour, size
   - xi. Talking about the weather
   - xii. Shopping
2. Grammar:
   - i. Possessive Adjective
   - ii. Possessive pronouns
   - iii. Revision 'ER' verbs
   - iv. The immediate past: 'venir de'
   - v. Negative sentences
   - vi. Key verbs: faire, aller, sortir, etc.
   - vii. Demonstrative pronouns
   - viii. Frequency adverbs
   - ix. Reflexive verbs in 'ER'
   - x. Question words (quel)
3. Cultural Content:
   - i. French speaking celebrities
   - ii. French daily routine
   - iii. French brands and products
   - iv. Bruxelles
4. Skills Work:
   - i. Lots of speaking/active practice
   - ii. Role-plays
   - iii. Lots of listening
   - iv. Pronunciation – key sounds
   - v. Essay writing

**References :**

1. Annie Monnerie-Goarin, Sylvie Schmitt, Stéphanie Saintenoy, Béatrice Szarvas, Métro Saint-Michel, CLE International, Paris, 2006.
2. Jean-Luc Penfornis, (Débutant) Méthode de français professionnel et des affaires, CLE International, VEUF-Paris, 2003.

**Part I – Hindi Language**
**SECOND SEMESTER – Paper II**

**SECOND SEMESTER – PAPER II**

**I MODERN POETRY**

PANCHVATI by MYTHLI SHARAN GUPT 18

**II ONE ACT PLAY**

EKANIKI PIYUSH

1. Owrangjeb ki aakirirath– Ramkumar varma
2. Ek din - Lakshminarayan Misra
3. Vapasi - Vishnuprabhakar

**III LETTER WRITING**

(Leave Letter, Job Application, Ordering Books, Letter to Publisher, Personal Letter)

**IV CONVERSATION**

(Doctor & Patient, Teacher & Student, Storekeeper & Buyer, Two Friends, Booking Clerk & Passenger at Railway Station, Auto rickshaw driver and Passenger)

**V TRANSLATION**

HINDI-ENGLISH ONLY Lessons – 1-15 only ANUVADH ABYAS-III

**Text Book:**

1. Panchvati, Mythili sharan Gupt, 2015, Rajkamal Prakashan
2. Ekaniki piyush ,Srimathi Usha mehra.

## Part I –Malayalam Language
## SECOND SEMESTER – Paper II

### SECOND SEMESTER – PAPER II

Unit I & II Autobiography of Kamla Surayya

Unit III,IV & V Travelogue

Unit III, IV & V Alkoottathil Thaniyae

**Text Books prescribed:**

1. Unit I & II Autobiography of Kamla Surayya
   (D.C.Books, Kottayam)

2. M.T Vasudhevan Nair
   (D.C.Books, Kottayam)

**Reference books:**

1. Athmakathasahithyam Malayalathil-Dr.Vijayalam Jayakumar (N.B.S.Kottayam)
2. Sancharasahithyam Malayalathil –Prof.Ramesh chandran. V,(Kerala Bhasha Institute, Trivandrum)

### II SEMESTER

### PAPER-II: COMMUNICATIVE ARABIC

**Books Prescribed:** 1. **Arabic Conversation Book (Lesson 1 to 19)**

By Mohd. Harun Rashid and Khalid Perwez, Published by Good word Books

**II SEMESTER**
**POETRY, GHAZALITH & LETTER WRITING**
**Urudu Language**

Book Prescribed: **Faizan-e-Adab** - Edited by Dr.K.Habeeb Ahmed
[Published by Ansaar Educational & Welfare Society,
Melvisharam- Contact No.9994965700,9443818785]
Part- I Urudu Language (Colleges) 2014-15

Annexure : **13F** Page 2 of 4 SCAA DT. : 6-2-2014

[a] MANZOOMATH

1. BARQ-E-KALESA – AKBAR ALLAHBADI
2. SHIKWA – ALLAMA IQBAL

(Selected four stanzas from each of the above)

3. JAWAB-E-SHIKWA – ALLAMA IQBAL

(Selected four stanzas from each of the above)

4. SUBH-E-AZADI – FAIZ AHMED FAIZ
5. TAJ MAHAL – SAHIR LUDHYANWI

[b] GHAZALITH:

1. MEER TAQI MEER
2. KHAJA MEER DARD
3. SHAIK IBRAHIM ZAUQ
4. MIRZA GHALIB
5. MOMIN KHAN MOMIN
6. JIGAR MURADABADE
7. HASRATH MOHANI
8. FANI BADAYUNI
9. DANISH FARAZI
10. SHAKIR NAITHI

[c] LETTER WRITING:

1. LETTER TO THE PRINCIPAL SEEKING LEAVE
2. LETTER TO THE MANAGER OF A FIRM SEEKING EMPLOYMENT
3. LETTER TO A PUBLISHER OT BOOK SELLER PLACING ORDER FOR BOOKS
4. LETTER TO THE MUNICIPAL COMMISSIONER DRAWING HIS ATTENTION
5. LETTER TO THE FATHER / GUARDIAN ASKING MONEY FOR PAYMENT OF COLLEGE FEES
6. LETTER TO A FRIEND INVITING HIM TO YOUR SISTER'S MARRIAGE

**Semester-II**

| Subject Code | Subject title | Lecture | Tutorial | Practical | Credit | Type |
|---|---|---|---|---|---|---|
| 23BGE22E | English for Communication-I1 | 4 | 0 | 0 | 4 | Theory |

**Introduction**

To encourage students to inculcate and use effective communication skills in their day-to-day life. To develop the LSRW skills to enhance the culture and thoughts through language

**Course Outcome:**

| | |
|---|---|
| CO1 | Learn to introduce themselves and talk about everyday activities confidently |
| CO2 | Be able to write short paragraphs on people, places, and events |
| CO3 | Identify the purpose of using various tenses and effectively employ them in speaking and writing |
| CO4 | Gain knowledge to write subjective and objective descriptions |
| CO5 | Identify and use their skills effectively in formal contexts. |

**Unit I:**
**[12 Periods]**

1.1 Very Indian Poem in Indian English -Nissim Ezekiel
1.2 If you Are Wrong Admit it-Dale Carnegie
1.3 Reading for General and Specific Information (Charts, tables schedules, graphs, etc.)
1.4 Homonyms, Homophones, Homographs

**Unit II:**
**[12 Periods]**

2.1 Still I Rise- Maya Angelou
2.2 Kindly Adjust Please- Shashi Tharoor
2.3 Verbs and Tenses
2.4 Subject Verb Agreement

**Unit III:**
**[12 Periods]**

3.1 Alchemist-Paulo Coelho

**Unit IV:**
**[12 Periods]**

4.1 The Flower- Tennyson
4.2 The Spoon-Fed Age. W.R. Inge
4.3 Paragraph Writing
4.4 Error detection

**Unit V:**
**[12 Periods]**

**5.1** On Killing a Tree- Gieve Patel

5.2 Taking and Note Making
5.3 Reading news and weather reports
5.4 Precis Writing.

**Text Books:**

1. The Alchemist - Paulo Coelho
Harper - 2005

**Reference Books:**

1 Advanced English Grammar. Martin Hewings. Cambridge University Press, 2000
2. Descriptive English. SP Bakshi, Richa Sharma · 2019, Arihant Publications (India) Ltd.
3. The Reading Book: A Complete Guide to Teaching Reading. Sheena Cameron, Louise Dempsey, S & L. Publishing, 2019.
4. Skimming and Scanning Techniques, Barbara Sherman, Liberty University Press, 2014
5 Brilliant Speed Reading: Whatever you need to read, however ...Phil Chambers,

**Mapping of Course Outcomes with Program Outcomes:**

| Course Outcomes | Program Specific Outcomes | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P01 | PO2 | P03 | P04 | P05 | P06 | P07 | P08 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |

| Subject Code | 24BBT2CA | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|---|
| Core : | | Fundamentals of Microbiology | 4 | 5 | 0 | 0 | Theory |

**Course Objective:** To provide students with a comprehensive understanding of the principles and applications of microbiology in various fields, including medicine, industry, and research.

**Course Outcomes:**

**CO1:** Students will be able to explain the fundamental concepts of microbiology.

**CO2:** Students will demonstrate proficiency in basic microbiological techniques.

**CO3:** Students will be able to apply microbiological principles to real-world scenarios.

**CO4:** Students will understand the role of microorganisms in environmental and industrial processes.

**CO5:** Students will be aware of the ethical considerations in microbiological research.

**Unit I: Introduction to Microbiology** **12hrs**

Introduction to Microorganisms, History of Microbiology, Scope and Branches of Microbiology, Microbial Nomenclature, Morphology and Structure of Microorganisms, Microbial Classification, Microbial Growth and Nutrition, Microbial Metabolism (Aerobic and Anaerobic Respiration, Fermentation), Methods in Microbiology: Microscopy – Basic, Advanced Techniques and SEM(Scanning electron microscopy), Staining, and Culture Techniques.

**Unit II: Microbial Physiology and Genetics** **12hrs**

Microbial Growth Kinetics, Factors Influencing Growth, Bacterial Cell Structure and Function, Bacterial Genetics (Plasmids, Transposons, Bacteriophages), Mechanisms of Genetic Variation (Mutation, Recombination).

**Unit III: Microbial Diversity and Ecology** **12hrs**

Classification of Microorganisms, Bacteria, Archaea, Fungi, Algae, Protozoa, Viruses, Viroids, Prions, Role of Microbes in Nature, Symbiotic Associations, Microbial Ecology, Microbial Interactions (Competition, Predation, Mutualism), Microbial Habitats: Soil, Water, Air, Extreme Environments.

**Unit IV: Media Preparation** **12hrs**

Classification of culture media (synthetic, complex, selective, differential, enriched).Principles of media formulation and sterilization techniques (autoclaving, filtration).Preparation of media for specific organisms (anaerobic, fungal, bacterial). Ensuring sterility, pH adjustment, and storage conditions of prepared media.

**Unit V: Applied Microbiology and Biotechnology** **12hrs**

Industrial Microbiology Techniques: Fermentation Process, Bioreactor Operation. Food Microbiology Techniques: Food Safety Testing, Food Preservation Methods. Environmental Microbiology Techniques: Water and Soil Quality Testing. Agricultural Microbiology Techniques: Plant-Microbe Interactions and Biofertilizers. Medical Microbiology Techniques: Diagnostic Microbiology (Culture, Staining, Serological Tests- Salmonella and COVID-19), Vaccine Production, Antimicrobial Susceptibility Testing, Ethical and Legal Issues in Microbiology.

**Textbooks:**

1. "Prescott's Microbiology" by Joanne Willey, Kathleen Sandman, and Dorothy Wood - 12th Edition (2023)
2. "Microbiology: An Introduction" by Gerard J. Tortora, Berdell R. Funke, and Christine L. Case - 13th Edition (2022).

**References:**

1. "Brock Biology of Microorganisms" by Michael T. Madigan, John M. Martinko, et al. - 17th Edition (2023).
2. "Microbiology: Principles and Explorations" by Jacquelyn G. Black - 10th Edition (2021).
3. "Microbial Physiology" by Moat, John Setlow, and Michael Madigan - 5th Edition (2022).

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject | Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|---|
| Core : | | Human Anatomy and Physiology | 4 | 5 | 0 | 0 | Theory |

**Course Objective:**

To provide students with a comprehensive understanding of the structure and function of the human body, including the major organ systems and their interactions.

**Course Outcomes:**

Upon completion of this course, students will be able to:

**CO1:** Describe the anatomical structures of the human body, including organs, tissues, and cells.
**CO2:** Explain the physiological processes that occur in the human body, including homeostasis and metabolism.
**CO3:** Identify the major organ systems of the human body and their functions.
**CO4:** Demonstrate an understanding of the interrelationships between different organ systems.
**CO5:** Apply anatomical and physiological concepts to real-world scenarios and health-related issues.

**Unit I: Introduction to Anatomy and Physiology** **12hrs**

Overview of Human anatomy and physiology. Basic anatomical terminology. Levels of organization in the human body. Introduction to cells and tissues.

**Unit II: Skeletal and Muscular Systems** **12hrs**

Structure and function of bones. Types of bones and their characteristics. Bone development and growth. Structure and function of muscles. Types of muscles and their functions. Muscle contraction and movement.

**Unit III: Nervous System** **12hrs**

Structure and function of the nervous system. Neurons and nerve impulses. Central nervous system (CNS) and peripheral nervous system (PNS). Brain anatomy and functions. Spinal cord anatomy and functions. Nervous system disorders.

**Unit IV: Cardiovascular and Respiratory Systems** **12hrs**

Structure and function of the heart. Blood vessels and circulation. Blood composition and functions. Regulation of blood pressure and flow. Respiratory system anatomy and functions. Gas exchange in the lungs. Disorders of the cardiovascular and respiratory systems.

**Unit V: Digestive, Endocrine, and Reproductive Systems** **12hrs**

Structure and function of the digestive system. Processes of digestion and absorption. Role of accessory organs in digestion. Endocrine system anatomy and functions. Hormones and their functions. Male and female reproductive system anatomy and functions. Reproductive cycles and processes. Fertilization and development. Disorders of the digestive, endocrine, and reproductive systems.

**Textbook:**

- "Principles of Anatomy and Physiology" by Gerard J. Tortora and Bryan H. Derrickson

**References:**

- "Essentials of Human Anatomy & Physiology" by Elaine N. Marieb and Suzanne M. Keller
- "Human Anatomy & Physiology" by Erin C. Amerman

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject | Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|---|
| **Core-** | **Lab in Microbiology** | | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Media Preparation and Sterilization
2. Isolation of microorganism from soil , water and Air
3. Pure culture Techniques
4. Selective and Differential Media Preparation
5. Measurement of Bacterial Growth
6. Staining of Microorganism
7. IMVIC test
8. Carbohydrate fermentation test
9. TSI
10. H2S production test
11. Antibiotic sensitivity test

Semester :III

| Subject Code | Subject Title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **22BGE21T** | Part I Tamil | **3** | **6** | **1** | **0** | **Theory / Practical** |

**Introduction:** மூன்றாம் பருவப் பாடத்திட்டம் சிறுகதை, வானொலி, தொலைக்காட்சி, கணிப்பொறி, மொழிப்பெயர்ப்பு ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

**Course Outcome:**

CO1 : சிறுகதை எழுதுதல்- சிறுகதையின் வடிவம் மையக்கதாபாத்திரம். பயனுள்ளதாக அமையும். சிறுகதை இலக்கணம் அறிதல், . தலைப்பு. கதைக்களம் சிறுகதையின் அமைப்பு அறிந்து கொள்ள முடிகிறது.

CO2 : வானொலியில் இடம் பெறும் நிகழ்ச்சிகள் - தமிழ் சார்ந்த பேச்சு, விவாதம், மாணவர்கள் அறிந்து கொள்ள பயன் உள்ளது.

CO3 : தொலைக்காட்சியின் இயல்பு-தொலைக்காட்சியின் நன்மைகள், நிகழ்ச்சி தயாரிக்கும் முறை- நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்ச்சி நடத்துதல். ஆகியவைகள் மாணவர்கள் தெரிந்து கொள்ளல்.

CO4 : கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள்,. கணிப்பொறி பயன்பாடுகள் ஆகியவைகள் மாணவர்களுக்கு பயனுள்ளது.

CO5 : மொழிப்பெயர்ப்பு வரலாறு, மொழிபெயர்ப்பு இயல்புகள் மற்றும் முக்கியத்துவம் பற்றித் தெளிவாக புரிந்து கொள்ள முடியும்.

**Unit I:** [12 Periods]

சிறுகதை எழுதுதல்- சிறுகதையின் வடிவம். மையக்கதாபாத்திரம். எதிர் கதாபாத்திரங்கள். சிறுகதை இலக்கணம் அறிதல். தலைப்பு கதைக்களம் சிறுகதையின் அமைப்பு சிறுகதை பயன்பாடு, சிறுகதையின் தொடக்கம் தெளிவுரையுடன் விளக்கம் கொடுத்து கற்பிக்கப்படும்.

Unit II: [12 Periods]

வானொலி வரலாறு, வானொலி பயன்பாடு, வானொலியில் இடம் பெறும் நிகழ்ச்சிகள் - தமிழ் சார்ந்த பேச்சு, விவாதம்,பட்டிமன்றம். வானொலியில் கல்வி ஒலிபரப்பு, வேலைவாய்ப்பு, வேளாண்மை நிகழ்ச்சிகள், மருத்துவக் குறிப்புகள் ஆகியவைகள் பற்றி விளக்கம் மற்றும் பேச்சுக்கலைகள் வளர்க்க கற்றுக்கொடுக்கப்படும்.

**Unit III:** [12 Periods]

தொலைக்காட்சியின் வரலாறு-தொலைக்காட்சி தன்மைகள், இயல்பு, நன்மைகள், நிகழ்ச்சி தயாரிக்கும் முறை- நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்ச்சி நடத்துதல். தொலைக்காட்சி வர்ணனைகள் - விருதுகள், நிகழ்ச்சிகள் ஆகியவைகள் பற்றி விளக்கம் தருதல்.

**Unit IV:.** [12 Periods]

கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள், கணிப்பொறி பயன்பாடுகள், மாத, நாட்காட்டி தயாரித்தல் - விளம்பரம் உருவாக்கம், மதிப்பெண் பட்டியல் தயாரித்தல், கணினி கலைச்சொல்லாக்கம் விளக்கம் கொடுத்து கற்பிக்கப்படும்.

**Unit V:** [12 Periods]

மொழிப்பெயர்ப்பு வரலாறு, இயல்புகள் பயன் ஆகியவைகள் அறிந்து கொள்ள பயிற்சிகள் கொடுத்து கற்பிக்கப்படும்.

**Textbook:**

**பாடநூல்கள்**

பார்வை நூல்கள்

1. எழுதுவது எப்படி- மகரம் வாசகர் வட்டம்
2. தமிழ் இணைய இதழ்கள் - அண்ணா கண்ணன்
3. .மொழிபெயர்ப்புக்கலை : மு.வளர்மதி,
4. மொழிபெயர்ப்பியல் : சு.சண்முக வேலாயுதம்,
5. மொழி பெயர்ப்பும், சொல்லாக்கமும் : தென்புலோலியூர், மு.கணபதிப்பிள்ளை,

## மூன்றாம் பருவம்
### (சிறுகதை, வானொலி, தொலைக்காட்சி, கணிப்பொறி, மொமிப்பெயர்ப்பு)

Unit I

1. சிறுகதை எழுதுதல்- சிறுகதையின் வடிவம், மையக்கதாபாத்திரம், எதிர் கதாபாத்திரங்கள்.
2. சிறுகதை இலக்கணம் அறிதல், தலைப்பு, கதைக்களம், சிறுகதையின் அமைப்பு.
3. சிறுகதை பயன்பாடு, சிறுகதையின் தொடக்கம்,
4. மாணவர்களின் படைப்பு, கதை அமைப்பு, கதை உருவாக்கம்,
5. குறும்படக்கதைகள் உருவாக்கம், முறைகள், வரையறைகள்.

Unit II

1. வானொலி வரலாறு, வானொலி பயன்பாடு
2. வானொலியில் இடம் பெறும் நிகழ்ச்சிகள் - தமிழ் சார்ந்த பேச்சு, விவாதம், பட்டிமன்றம்.
3. வானொலியில் கல்வி ஒலிபரப்பு, வேலைவாய்ப்பு, வேளாண்மை நிகழ்ச்சிகள், மருத்துவக் குறிப்புகள்,
4. நேர்காணல் - கலந்துரையாடல், சிறப்பு விருந்தினர்கள் உரை.
5. பண்பலை வானொலி பற்றி அறிதல்.

Unit III

1. தொலைக்காட்சியின் வரலாறு - தொலைக்காட்சி தன்மைகள்.
2. தொலைக்காட்சியின் இயல்பு - தொலைக்காட்சியின் நன்மைகள்,
3. நிகழ்ச்சி தயாரிக்கும் முறை- நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்ச்சி நடத்துதல்.
4. தொலைக்காட்சி வர்ணனைகள் - விருதுகள், நிகழ்ச்சிகள்.

Unit IV

1. கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள்
2. கணிப்பொறி பயன்பாடுகள்
3. எம்.எஸ் வேர்ட் ஆவண உருவாக்கம்
4. மாத, நாட்காட்டி தயாரித்தல் - விளம்பரம் உருவாக்கம், மதிப்பெண் பட்டியல் தயாரித்தல்
5. கணினி கலைச்சொல்லாக்கம்.

Unit V

1. மொழிப்பெயர்ப்பு வரலாறு
2. மொழிபெயர்ப்பு இயல்புகள்
3. மொழி பெயர்ப்பின் பயன்
4. மக்கள் தகவல் தொடர்பு சாதனங்களின் மொழிப்பெயர்ப்பு (பத்திரிக்கை, கணிப பொறி)

பார்வை நூல்கள்

1.எழுதுவது எப்படி- மகரம் வாசகர் வட்டம்
2.தமிழ் இணைய இதழ்கள் - அண்ணா கண்ணன்
3..மொழிபெயர்ப்புக்கலை : மு.வளர்மதி,
4.மொழிபெயர்ப்பியல் : சு.சண்முக வேலாயுதம்,
5.மொழி பெயர்ப்பும், சொல்லாக்கமும் : தென்புலோலியூர், மு.கணபதிப்பிள்ளை,

பாடத்திட்டம் பகுதி IV
தமிழ்த் தாள் I மூன்றாம் பருவம்
(12 –ம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயிலாதவர்களுக்கு)

**I. தமிழ் மொழியின் அடிப்படைக் கூறுகள்**

எழுத்துக்கள் : முதலெழுத்துகள் (உயிர் எழுத்து, மெய் எழுத்து, உயிர்மெய் எழுத்து)
சொற்கள் : வகைகள் (பெயர்ச்சொல், வினைச்சொல், இடைச்சொல், உரிச்சொல்)
தொடர் : தொடரமைப்பு (எழுவாய், செய்யப்படுபொருள், பயனிலை)
குறிப்பு எழுத்துதல் : பத்து, பதினைந்து தொடர்களில் குறிப்பு வரைதல்.
பிழைநீக்கி எழுதுதல் : (ஒற்றுப்பிழை, எழுத்துப்பிழை)

பகுதி IV : சிறப்புத் தமிழ் தாள்- I
மூன்றாம் பருவம்
(12–ம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயின்றவர்களுக்கு)

கூறு : 1 : பாரதியார் கவிதைகள்
கண்ணன் என் சேவகன்
பாரதிதாசன் - அழகின் சிரிப்பு (முழுவதும்)
மீரா கவிஞர் - குக்கூ (புதுக்கவிதை)

கூறு : 2 : மொழித் திறன்
பிழைநீக்கி எழுதுதல் : றன ர வேறுபாடு அறிந்தல்,
ளன, ழன, லன வேறுபாடு அறிதல்,
ன,ண.ந வேறுபாடு அறிதல்,
குறில் நெடில் வேறுபாடு அறிதல்.
கூறு : 3 : கடிதங்கள் எழுதுதல் : பாராட்டுக் கடிதம், நன்றிக்கடிதம்,
அழைப்புக்கடிதம், அலுவலக விண்ணப்பம்.

கூறு : 4 : சொற்களைத் தந்து தொடர்களை அமைக்கும் பயிற்சி அளித்தல்.
வல்லினம் மிகும் இடங்கள்.
கூறு : 5 : பாடத்தழுவியது வரலாறு.

**Semester-III**

| Subject Code | Subject title | | Lecture | Tutorial | Practical | Credit | Type |
|---|---|---|---|---|---|---|---|
| | English for Communication-I1 | | 4 | 0 | 0 | 4 | Theory |

**Introduction**

To encourage students to inculcate and use effective communication skills in their day-to-day lives. To develop the LSRW skills to enhance the culture and thoughts through language

**Course Outcome:**

| | | |
|---|---|---|
| CO1 | : | Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives. |
| CO2 | : | Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society |
| CO3 | : | Produce grammatically and idiomatically correct language |
| CO4 | : | Gain knowledge in writing techniques to meet academic and professional needs |
| CO5 | : | Be equipped with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career-oriented tests. |

**Unit I:**
**[12 Periods]**

1.1 The Voice of the Mountains -Mamang Dai
1.2 Romeo & Juliet- The Balcony Scene
1.3 Writing Letters and E.mails
1.4 Data Interpretation and Reporting

**Unit II:**
**[12 Periods]**

2.1 Sita- Toru Dutt
2.2 Macbeth-Banquet Scene
2.3 Writing and messaging on Social Media Platforms (blogs, Twitter, Instagram, Facebook)
2.4 Data Presentation and Analysis

**Unit III:**

3.1 A Song of Hope- Oodgeroo Noonuccal
3.2 Julius Caesar- Murder Scene
3.3 Tryst with Destiny-Jawaharlal Nehru
3.4 Learning netiquette, email etiquette

**Unit IV:**
**[12 Periods]**

4.1 In an Artist's Studio- Christina Rossetti

4.2 Yes, We Can Barack Obama
4.3 Meeting Etiquettes- Language, dress code, voice modulation.
4.4 Online Meetings- Terms and expressions used
4.5 Framing Questions

**Unit V:**

**[12 Periods]**

5.1 You've Got to Find What You Love- Steve Jobs
5.2 Group Discussion
5.3 Conducting and participating in meetings
5.4.Voices

**Text Books:**

**Arden Shakespeare Complete works by Shakespeare (Author), William (Author), Bloomsbury, 2011**

**Reference Books:**

1 The Shakespeare Book. Big Ideas Simply Explained, Stanley Wells et al. DK Publishing, 2015
2 Famous Speeches by Mahatma Gandhi, Creatingspace Independent Publishing Platform,2016
How to Build a Professional Digital Profile Kindle Edition
3 by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
4 Keys to Teaching Grammar to English Language Learners, Second Ed.: A Practical Handbook by Keith S Folse, Michigan Teacher Training, 2016
5. Role Play-Theory and Practice. Krysia M Yardley-Matwiejczuk, SAGE Publications Ltd, 1997

**Mapping of Course Outcomes with Program Outcomes:**

| Course Outcomes | Program Specific Outcomes | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P01 | PO2 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| | **Core : Plant Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with a comprehensive understanding of the principles, applications, and techniques of plant biotechnology, including genetic manipulation, tissue culture, and molecular breeding.

**Course Outcome:**

**CO1:** Students will understand the historical development and scope of plant biotechnology.

**CO2:** Students will explain the principles and techniques of genetic manipulation in plants.

**CO3:** Students will demonstrate proficiency in plant tissue culture techniques.

**CO4:** Students will analyze and apply molecular breeding strategies in plant improvement.

**CO5:** Students will evaluate the ethical and regulatory aspects of plant biotechnology.

**Unit I: Introduction to Plant Biotechnology** 12hrs

Overview of historical development. Scope and importance in agriculture and allied fields. Introduction to Plant Tissue Culture (PTC): history, types of cultures, media preparation, applications in plant propagation and genetic transformation.

**Unit II: Genetic Manipulation in Plants** 12hrs

Principles and techniques of genetic manipulation. Gene cloning, vector design, gene transfer methods (Agrobacterium-mediated and biolistic methods), gene expression analysis, transgenic plant development, gene silencing, and genome editing techniques like CRISPR/Cas9.

**Unit III: Molecular Breeding and Marker-Assisted Selection** 12hrs

Principles and applications of molecular breeding. Marker-assisted selection (MAS), quantitative trait loci (QTL) mapping, genomic selection, and their applications in crop improvement. Concepts and principles of molecular farming in plants. Production of pharmaceuticals, vaccines, antibodies, and industrial enzymes in plants. Applications and benefits of molecular farming. Plant-based expression systems. Transient and stable expression of recombinant proteins in plants. Factors influencing protein expression levels and quality in plants. Case studies of successful molecular farming projects. Challenges and future prospects of molecular farming.

**Unit IV: Plant Biotechnology in Crop Improvement** 12hrs

Introduction to Transgenic Plants: Definition, history, and development of transgenic plants. Applications of transgenic plants in agriculture, medicine, and industry. Mechanisms for Developing Herbicide Resistance, Insect Resistance, Drought Resistance Plants: Other Crop Improvement Strategies: Engineering plants for improved nutritional content, disease resistance, and environmental stress tolerance. Case studies and future prospects in crop improvement through biotechnology.

**Unit V: Applications and Ethical and Regulatory Aspects of Plant Biotechnology** 12hrs

Plant genomics, metabolomics, and proteomics for the production of pharmaceutical compounds. Use of plants to remove, degrade, or contain contaminants in soil, water, and air. Genetic engineering approaches for enhancing phytoremediation capabilities.Ethical considerations and regulatory frameworks. Biosafety, environmental risk assessment, intellectual property rights (IPR) issues. Societal implications of genetically modified (GM) crops and stakeholder roles in decision-making processes.

**Textbooks:**

- Plant Biotechnology: Principles and Applications by M. Z. Abdin, Kamaluddin, Usha Kiran, Athar Ali
- Plant Biotechnology: The Genetic Manipulation of Plants by Adrian Slater, Nigel W. Scott, Mark R. Fowler
- Plant Biotechnology and Genetics: Principles, Techniques, and Applications by C. Neal Stewart Jr.

**References:**

- Plant Biotechnology by H. S. Chawla
- Principles of Plant Genetics and Breeding by George Acquaah
- Molecular Biology of the Cell by Bruce Alberts et al.

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

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- Mapping of CO's and PO's Components are:
- 3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Allied :** | **Biochemistry** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with an understanding of the biochemical principles that underpin the structure, function, and regulation of biomolecules and their relevance to biological processes and human health.

**Course Outcome:**

CO1: Students will be able to understand the structure and function of biomolecules.
CO2: Students will be able to explain the metabolic pathways and their regulation.
CO3: Students will be able to analyse the principles of enzyme action and kinetics.
CO4: Students will be able to comprehend the biochemical basis of genetic information flow.
CO5: Students will be able to evaluate the clinical applications of biochemistry in health and disease.

**Unit I: Biomolecules** 12hrs

Introduction to biomolecules: carbohydrates, lipids, proteins, and nucleic acids. Structure, classification, and function of carbohydrates, including monosaccharides, disaccharides, and polysaccharides. Structure and function of lipids: fatty acids, triglycerides, phospholipids, and steroids. Amino acids and proteins: structure, classification, levels of protein structure, and their functions. Nucleic acids: DNA and RNA structure, types, and functions.

**Unit II: Enzymes and Enzyme Kinetics** **12hrs**

Introduction to enzymes: nomenclature, classification, and general properties. Mechanism of enzyme action, enzyme-substrate complex formation, and factors affecting enzyme activity. Enzyme kinetics: Michaelis-Menten equation, Lineweaver-Burk plot, and enzyme inhibition (competitive, non-competitive, and uncompetitive inhibition). Role of cofactors and coenzymes in enzyme activity. Allosteric enzymes and regulation of enzyme activity.

**Unit III: Metabolism and Bioenergetics** **12hrs**

Overview of metabolism: anabolic and catabolic pathways. Carbohydrate metabolism: glycolysis, gluconeogenesis, citric acid cycle, and oxidative phosphorylation. Lipid metabolism: beta-oxidation of fatty acids, ketogenesis, and lipid biosynthesis. Protein metabolism: amino acid catabolism, urea cycle, and biosynthesis of amino acids. Bioenergetics: ATP production and energy transfer in biological systems.

**Unit IV: Cellular Communication and Signal Transduction** **12hrs**

Overview of cell signalling: types of signals and receptors. Signal transduction pathways: G-protein-coupled receptors, receptor tyrosine kinases, and ion channel receptors. Second messengers: cyclic AMP, calcium ions, and inositol phosphates. Mechanisms of signal transduction: phosphorylation cascades and signal amplification. Cellular responses to signals: gene expression, cell growth, and apoptosis.

**Unit V: Clinical Biochemistry** **12hrs**

Biochemical basis of disease: metabolic disorders, genetic disorders, and inborn errors of metabolism. Diagnostic enzymology: clinical significance of enzyme assays in disease diagnosis. Biochemical markers of organ function and disease: liver function tests, kidney function tests, and cardiac markers. Principles of laboratory techniques used in clinical biochemistry: spectrophotometry, electrophoresis, and chromatography.

**Textbooks:**

1. "Biochemistry" by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer
2. "Lehninger Principles of Biochemistry" by David L. Nelson and Michael M. Cox
3. "Harper's Illustrated Biochemistry" by Victor W. Rodwell, David Bender, Kathleen M. Botham, Peter J. Kennelly, and P. Anthony Weil

**References:**

1. "Biochemistry" by Donald Voet and Judith G. Voet
2. "Fundamentals of Biochemistry: Life at the Molecular Level" by Donald Voet, Judith G. Voet, and Charlotte W. Pratt
3. "Textbook of Biochemistry with Clinical Correlations" by Thomas M. Devlin

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO’s and PO’s Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Skilled:** | **Applications of Bioinformatics** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To equip students with practical knowledge and skills in bioinformatics, focusing on the application of computational tools and techniques to solve biological problems.

**Course Outcome:**

CO1: Students will be able to understand the basic concepts and tools in bioinformatics.

CO2: Students will be able to perform sequence alignment and analysis.

CO3: Students will be able to analyze and interpret genomic and proteomic data.

CO4: Students will be able to utilize bioinformatics tools for molecular modeling and drug discovery.

CO5: Students will be able to apply bioinformatics techniques to real-world biological problems.

**Unit I: Introduction to Bioinformatics** **12hrs**

Overview of bioinformatics: definition, history, and applications. Introduction to biological databases: types of databases, primary and secondary databases, and sequence databases (NCBI, EMBL, DDBJ). Data retrieval tools: Entrez, SRS, and DBGET. Introduction to bioinformatics tools: BLAST, FASTA, and sequence alignment tools. Basic concepts of data mining and data visualization in bioinformatics.

**Unit II: Sequence Alignment and Analysis** **12hrs**

Principles of sequence alignment: global and local alignment, pairwise and multiple sequence alignment. Algorithms for sequence alignment: Needleman-Wunsch, Smith-Waterman, and dynamic programming. Tools for sequence alignment: BLAST, ClustalW, and MUSCLE. Scoring matrices: PAM and BLOSUM. Phylogenetic analysis: construction of phylogenetic trees, methods (UPGMA, NJ, Maximum Likelihood), and interpretation of results.

**Unit III: Genomics and Proteomics** **12hrs**

Introduction to genomics: genome sequencing projects, next-generation sequencing (NGS) technologies, and genome annotation. Comparative genomics: identification of conserved sequences and comparative analysis of genomes. Proteomics: principles and applications, protein identification, and analysis using mass spectrometry. Protein structure prediction: primary, secondary, tertiary, and quaternary structures. Functional genomics: gene expression analysis, microarrays, and RNA-Seq.

**Unit IV: Molecular Modelling and Drug Discovery** **12hrs**

Introduction to molecular modeling: concepts and applications. Structure-based drug design: molecular docking, virtual screening, and quantitative structure-activity relationship (QSAR) analysis. Homology modeling: steps involved, model validation, and refinement. Computational tools for drug discovery: AutoDock, PyMOL, and Schrodinger. Case studies in molecular modeling and drug discovery.

**Unit V: Applications in Biotechnology and Medicine** **12hrs**

Applications of bioinformatics in biotechnology: genetic engineering, metabolic pathway analysis, and synthetic biology. Bioinformatics in medicine: personalized medicine,

pharmacogenomics, and biomarker discovery. Systems biology: integration of omics data, network analysis, and modeling of biological systems. Ethical and legal issues in bioinformatics: data privacy, intellectual property, and ethical considerations in genetic research.

**Textbooks:**

1. "Bioinformatics: Sequence and Genome Analysis" by David W. Mount
2. "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins" by Andreas D. Baxevanis and B. F. Francis Ouellette
3. "Fundamentals of Bioinformatics" by S. Harisha

**References:**

1. "Introduction to Bioinformatics" by Arthur Lesk
2. "Bioinformatics for Dummies" by Jean-Michel Claverie and Cedric Notredame
3. "Essential Bioinformatics" by Jin Xiong

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

**Semester :III**

| Subject Type | Code | Subject title | Credit | Lecture | Tutorial | | Practical |
|---|---|---|---|---|---|---|---|
| **Core-** | | **Lab in Plant Biotechnology** | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

Introduction: This course presents the Basic and advanced plant tissue culture techniques and enhance the plant based product.

1. Extraction of plant materials
2. Preparation of complex nutrient medium (Murashige & Skoog's medium).
3. To selection, Prune, sterilize and prepare explants for culture.
4. Significance of growth hormones in culture medium.
5. Callus induction and regeneration of plant.

| Subject Type | Code | Subject title | Credit | Lecture | Tutorial | | Practical |
|---|---|---|---|---|---|---|---|
| **Core-** | | **Lab in Biochemistry** | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Quantification of carbohydrates and proteins.
2. Quantification of Sugar by DNS method.
3. Phytochemical analysis.
4. Antioxidant properties.
5. Partial purification of protease enzyme.
6. Compound separation from TLC.
7. Protein separation from SDS PAGE.
8. Identification of plant compounds using GCMS.

References:

1. Plant Tissue Culture Theory and Practicals 2nd edition, T.Pullaiah, M.V. Subba Rao and E.Sreedevi, Scientific publishing

2. Plant tissue culture by K. Lindsey, 1997, Springer, Dordrecht

Semester :IV

| Subject Code | Subject Title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **22BGE21T** | Part I Tamil | **3** | **6** | **1** | **0** | **Theory / Practical** |

**Introduction:** நான்காம் புதுக்கவிதை, தகவல்தொடர்பு, ஓரங்க நாடகம், இதழியல்பு, நூல் மதிப்புரை ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

**Course Outcome:**

CO1 : புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்,.கவிதையின் அமைப்பு முறை, புதுக்கவிதை, மரபுக்கவிதை, புதுக்கவிதை, மரபுக்கவிதை வேறுபாடுகள், கரு, வடிவம், உத்திகள் மாணவர்களுக்கு படைப்புத்திறன் வளர்வதற்கு பயன் உள்ளது.

CO2 : தகவல் தொடர்பின் அடிப்படைகள்- பண்புகள்- சிறப்புகள், பயன்பாடுகள் ஆகியவைகள் குறித்து மாணவர்களுக்கு விளக்கம் தருதல்.

CO3 : தொலைக்காட்சியின் இயல்பு-தொலைக்காட்சியின் நன்மைகள், நிகழ்ச்சி தயாரிக்கும் முறை- நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்ச்சி நடத்துதல். ஆகியவைகள் மாணவர்கள் தெரிந்து கொள்ளல்.

CO4 : கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள்,. கணிப்பொறி பயன்பாடுகள் ஆகியவைகள் மாணவர்களுக்கு பயனுள்ளது.

CO5 : மொழிப்பெயர்ப்பு வரலாறு, மொழிபெயர்ப்பு இயல்புகள் பற்றி தெளிவாக புரிந்து கொள்ள முடியும்.

**Unit I:** [12 Periods]

சிறுகதை எழுதுதல்- சிறுகதையின் வடிவம், மையக்கதாபாத்திரம்., எதிர் கதாபாத்திரங்கள். சிறுகதை இலக்கணம் அறிதல், தலைப்பு, கதைக்களம், சிறுகதையின் அமைப்பு சிறுகதை பயன்பாடு, சிறுகதையின் தொடக்கம் தெளிவுரையுடன் விளக்கம் கொடுத்து கற்பிக்கப்படும்.

**Unit II:** [12 Periods]

வானொலி வரலாறு, வானொலி பயன்பாடு, வானொலியில் இடம் பெறும் நிகழ்ச்சிகள் - தமிழ் சார்ந்த பேச்சு, விவாதம், பட்டிமன்றம். வானொலியில் கல்வி ஒலிபரப்பு, வேலைவாய்ப்பு, வேளாண்மை நிகழ்ச்சிகள், மருத்துவக் குறிப்புகள் ஆகியவைகள் பற்றி விளக்கம் மற்றும் பேச்சுக்கலைகள் வளர்க்க கற்றுக்கொடுக்கப்படும்.

**Unit III:** [12 Periods]

நாடகம் - விளக்கம் - ஓரங்க நாடகம் வரலாறு-நடகத்தின் தோற்றம்-வளர்ச்சி-ஓரங்க நாடகம் எழுதுதல்,- கதை அமைப்பு- அடிப்படைக்கூறுகள்- வானொலி அல்லது தொலைக்காட்சி மற்றும் திரைப்படத்துக்கு ஓரங்க நாடகம் எழுதுதல்- கற்றுக்கொடுத்து எழுதவைக்கப்படும்.

**Unit IV:.** [12 Periods]

இதழியல் விளக்கம், பத்திரிக்கை நிர்வாக அமைப்பு -இதழியல் ஆசிரியர்கள்-. தமிழ் நாளிதழ்கள் செய்கள்- தினமணி- தினமலர்-தினத்தந்தி-தினகரன் - விளக்கம் மற்றும் பயிற்சி அளிதல்.

**Unit V:** [12 Periods]

நூல் மதிப்புரை - திறனாய்வு செய்தல்- கடிதம் - விண்ணப்பம் எழுதுதல்- கட்டுரை தலைப்பு, கட்டுரை அமைப்பு- விளக்கம் தருதல்.

**Textbook:**

**பாடநூல்கள்**

பார்வை நூல்கள்

1. எழுதுவது எப்படி- மகரம் வாசகர் வட்டம்
2. தமிழ் இணைய இதழ்கள் - அண்ணா கண்ணன்
3. .மொழிபெயர்ப்புக்கலை : மு.வளர்மதி,
4. மொழிபெயர்ப்பியல் : சு.சண்முக வேலாயுதம்,
5. மொழி பெயர்ப்பும், சொல்லாக்கமும் : தென்புலோலியூர், மு.கணபதிப்பிள்ளை,

# நான்காம் - பருவம்

**(புதுக்கவிதை, தகவல்தொடர்பு, ஓரங்க நாடகம், இதழியல் நூல், மதிப்புரை)**

Unit I

1.புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்
2.கவிதையின் அமைப்பு முறை, புதுக்கவிதை, மரபுக்கவிதை
3.புதுக்கவிதை, மரபுக்கவிதை வேறுபாடுகள், கரு, வடிவம், உத்திகள்
4..கவிதை எழுதுவதின் நோக்கம், எழுதும் முறைகள், வரிகள் வரையறை
5.கவிதை உருவாக்கம் -தலைப்பு தேர்வுசெய்யும் முறைகள்,

Unit II

1.தகவல் தொடர்பின் அடிப்படைகள்- பண்புகள்- சிறப்புகள், பயன்பாடுகள்
2.தகவல் தொடர்பு சாதனங்களின் பணிகள்.
3.தகவல் தொடர்பில் ஏற்படும் தடைகள், தகவலை ஏற்பவரின் தகுதிகள்.
4.பொதுமக்களும் தகவல் தொடர்பு சாதனங்களும்.

Unit III

1. ஓரங்க நாடகம் வரலாறு, நடகத்தின் தோற்றமும், வளர்ச்சியும்.
2.ஓரங்க நாடகம் எழுதுதல், கதை அமைப்பு, அடிப்படைக்கூறுகள்
3.வானொலி அல்லது தொலைக்காட்சி மற்றும் திரைப்படத்துக்கு ஓரங்க நாடகம் எழுதுதல்.

Unit IV

1.இதழியல் விளக்கம்,
2.பத்திரிக்கை நிர்வாக அமைப்பு மற்றும் ஆசிரியர்கள்
3.இன்றைய தமிழ் நாளிதழ்கள் பற்றிய செய்கள் (தினமணி, தினமலர், தினத்தந்தி, தினகரன்)

Unit V

1.நூல் மதிப்புரை - திறனாய்வு செய்தல்
2.கடிதம் மற்றும் விண்ணப்பம் எழுதுதல்
3.கட்டுரை திறனை வளர்த்தல்- கட்டுரை தலைப்பு, கட்டுரை அமைப்பு முறைகள்

பார்வை நூல்கள்

1.புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் வல்லிக்கண்ணன்
2. மக்கள் தகவல் தொடர்பியல்- முனைவர் கி.இராசா
3..கலைச்சொல்லாக்கம் : இராதா செல்லப்பன்
4 .இதழியல் கலை : டாக்டர் மா.பா.குருசாமி

**பாடத்திட்டம் பகுதி IV**

**தமிழ்த்தாள் 2 நான்காம் பருவம்**

**(12 –ம் வகுப்பு வரை மொழிப்பாடம் பயிலாதவர்களுக்கு)**

1. நீதி நூல்கள் : ஆத்திச்சூடி

   (முதல் 12 (அறம் செய விரும்பு,"முதல் "ஒளவியம் பேசேல்) வரை

   கொன்றை வேந்தன் - "அன்னையும் பிதாவும் முன்னறி தெய்வம்" முதல் எண்ணும் எழுத்தும் எண்ணெத்தகும்" வரை(7)

2. திருக்குறள் (5) 1. அகர முதல் … (1)
   2. செயற்கரிய--- (26)
   3. மனத்துக் கண் --(34)
   4. கற்க கசடறக்….(39)
   5. எப்பொருள் யார் யார்…(423)

   எளிய நிதிக் கதைகள் : (தெனாலிராமன் கதைகள், பீர்பால் கதைகள், கீராமியக் கதைகள், ஈசாப் கதைகள்.)

3. தமிழ் இலக்கியங்கள் வரலாறு –குறிப்பு- அறிமுகம்

   எடுத்துக்காட்டு : குறள் பற்றி எளிய தொடர்களில் அறிமுகம்.

   தமிழகம் - உணவுமுறை, விழாக்கள், கலைகள் பற்றியக் குறிப்புகள்.

**பகுதி : IV :சிறப்புத் தமிழ் தாள் -I**
**நான்காம் பருவம்**

**(12 –ம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயின்றவர்களுக்கு)**

கூறு : 1 : திருக்குறள் - ஒழிபியலில் முதல் 5 அதிகாரங்கள் மட்டும்

கூறு : 2 : கட்டுரை – அறம் எனப்படுவது – 2 கட்டுரை

கூறு : 3 :எழுத்துப்பிழை நீக்க வழிகள் - பிழையும் திருத்தமும்

சொற்களைச் சரியாகப் பயன்படுத்தும் பாங்கு – வினைச்சொற்கள் துணைவினைகள் (எடுத்துக்காட்டுகளுடன் விளக்குதல்)

கூறு : 4 வழக்கறிதல் : மரபு வழக்கு இயல்பு வழக்கு –தகுதி வழக்கு அறிதல்

கூறு : 5 படைப்பாற்றல் பயிற்சி

கூறு : 6 கட்டுரை எழுதுதல்

**Semester-IV**

| Subject Code | Subject title | | Lecture | Tutorial | Practical | Credit | Type |
|---|---|---|---|---|---|---|---|
| | English for Communication-I1 | | 4 | 0 | 0 | 4 | Theory |

**Introduction**

To encourage students to inculcate and use effective communication skills in their day-to-day lives. To develop the LSRW skills to enhance the culture and thoughts through language and Literature

**Course Outcome:**

| | | |
|---|---|---|
| CO1 | : | Learn to communicate effectively and appropriately in real-life situation |
| CO2 | : | Use English effectively for study purposes across the curriculum |
| CO3 | : | Develop interest in and appreciation of Literature |
| CO4 | : | Develop and integrate the use of the four language skills |
| CO5 | : | Enhance their language skills, especially in the areas of grammar and pronunciation |

**Unit I:**
**[12 Periods]**

1.1 I am Malala -Malala Yousafzai- Chapter1
1.2 Nelson Mandela's Interview with Larry King
1.3 Job Applications: Cover Letters, CV/Resume
1.4 Refuting, Discussion & Debating

**Unit II:**
**[12 Periods]**

2.1 The Zoo Story- Edward Albee
2.2 Rakesh Sharma's Interview with Indira Gandhi from Space
2.3 Making Suggestions& Responding to Suggestions, Asking for and Giving Advice or Help
2.4 Creating a digital profile-LinkedIn

**Unit III:**

3.1 My Inventions-Nikola Tesla- Chapter 2
3.2 Lionel Messi with Sid Love-(Print)
3.3 Body Language-Practical Skills for Interviews
3.4 Interviews (face-to-face, telephone, and video conferencing)

**Unit IV:**
**[12 Periods]**

4.1 The Proposal- Anton Chekhov
4.2. Filling forms(Online & Manual) creation of account, railway reservation, ATM, Credit/ Debit card
4.3. Speaking in a Formal situation (welcome address, Vote of the thanks

**Unit V:**
**[12 Periods]**

5.1 Public Speaking
5.2 Chicago Address-Swami Vivekananda
5.3 SWOT Analysis

**Text Books:**

1 Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban by Malala Yousafzai, Christina Lamb, Little Brown, 2013

2. My Inventions by Nikola Tesla
Ingram Short title, 2011 Edition

**Reference Books:**

1. Writing Your Life: A guide to writing Autobiographies, Mary Borg Taylor Francis, 2021.
2. One-act Plays for Acting Students: An Anthology of Short
Norman A. Bert · 1987
3. The One-Act Play Companion: A Guide to plays, playwrights ...
Colin Dolley, Rex Walford · 2015
4. How to Build a Professional Digital Profile Kindle Edition
by Jeanne Kelly Bernish,Bernish Communications Associates, LLC; 1st edition (May

**Mapping of Course Outcomes with Program Outcomes:**

| Course Outcomes | Program Specific Outcomes | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P01 | PO2 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Core:** | **Immunology and Animal Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with a comprehensive understanding of the principles and applications of immunology and animal biotechnology, with a focus on the molecular and cellular mechanisms of the immune system and the biotechnological methods used in animal research and production.

**Course Outcome:**

**CO1:** Students will be able to understand the basic principles and components of the immune system.

**CO2:** Students will be able to explain the mechanisms of immune responses and their regulation.

**CO3:** Students will be able to demonstrate proficiency in techniques used in immunology and animal biotechnology.

**CO4:** Students will be able to analyze and apply biotechnological methods in animal research and production.

**CO5:** Students will be able to evaluate the ethical and regulatory aspects of animal biotechnology.

**Unit I: Introduction to Immunology**

Overview of the immune system: innate and adaptive immunity. Components of the immune system: cells, tissues, and organs. Antigens and antibodies: structure and function. Major histocompatibility complex (MHC): types, structure, and function. Antigen presentation and processing: pathways and significance. Overview of immunological techniques: ELISA, flow cytometry, immunohistochemistry, and western blotting.

**Unit II: Immune Responses and Regulation**

Mechanisms of innate immune response: pattern recognition receptors, phagocytosis, inflammation, and complement system. Adaptive immune response: T-cell and B-cell activation, differentiation, and function. Cell-mediated and humoral immunity: mechanisms and significance. Regulation of immune responses: cytokines, chemokines, and immune checkpoints. Immunological memory and vaccination: principles and applications. Autoimmunity and hypersensitivity: mechanisms and examples.

**Unit III: Techniques in Immunology and Animal Biotechnology**

Monoclonal and polyclonal antibody production: methods and applications. Hybridoma technology: principles and applications. Animal cell culture: primary culture, cell lines, and culture techniques. Transgenic animals: methods of gene transfer, applications in research and biotechnology. Gene editing techniques: CRISPR/Cas9, TALENs, and ZFNs. Animal cloning: methods and applications. Stem cell technology: types, sources, and applications.

**Unit IV: Animal Biotechnology in Research and Production**

Animal models in biomedical research: selection, applications, and ethical considerations. Production of biopharmaceuticals: recombinant proteins, vaccines, and therapeutic antibodies. Biotechnology in animal breeding: marker-assisted selection, genomic selection, and reproductive technologies. Animal biotechnology in agriculture: transgenic livestock, aquaculture, and animal nutrition. Bioreactors and

tissue engineering: principles and applications. Ethical and regulatory issues in animal biotechnology: animal welfare, biosafety, and public perception.

**Unit V: Immunological Disorders and Therapies**

Immunodeficiency disorders: primary and secondary immunodeficiencies, causes, and treatments. Autoimmune diseases: mechanisms, examples, and therapies. Allergies and hypersensitivity reactions: types, mechanisms, and treatments. Cancer immunology: tumor antigens, immune evasion, and immunotherapy. Vaccines and immunization: types of vaccines, development, and challenges. Recent advances in immunotherapy: CAR-T cells, checkpoint inhibitors, and cytokine therapies.

**Textbooks:**

1. "Kuby Immunology" by Judith A. Owen, Jenni Punt, and Sharon A. Stranford
2. "Cellular and Molecular Immunology" by Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai
3. "Animal Biotechnology: Science-Based Concerns" by National Research Council (US) Committee on Defining Science-Based Concerns Associated with Products of Animal Biotechnology

**References:**

1. "Immunology: A Short Course" by Richard Coico and Geoffrey Sunshine
2. "Fundamental Immunology" by William E. Paul
3. "Principles of Animal Cell Culture" by John W. Davis

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO’s and PO’s Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Allied:** | **Biostatistics & Computer Application** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with foundational knowledge and practical skills in biostatistics and computer applications relevant to biological research, data analysis, and interpretation.

**Course Outcome:**

CO1: Students will be able to understand basic statistical concepts and their applications in biological research.

CO2: Students will be able to perform statistical analyses using various techniques and interpret the results.

CO3: Students will be able to apply statistical software for data analysis in biological studies.

CO4: Students will be able to understand the principles and applications of computer technology in biology.

CO5: Students will be able to prepare graphs and use computer data analysis tools for biological data management.

**Unit I: Introduction to Biostatistics** **12hrs**

Overview of biostatistics: definition, scope, and importance in biological research. Types of data: qualitative and quantitative. Data collection and presentation: sampling methods, data organization, graphical representation. Measures of central tendency: mean, median, mode. Measures of dispersion: range, variance, standard deviation.

**Unit II: Statistical Inference and Hypothesis Testing** **12hrs**

Introduction to hypothesis testing: null and alternative hypotheses, significance level, and p-value. Parametric tests: t-test, ANOVA, chi-square test. Correlation and regression analysis: Pearson and Spearman correlation, simple linear regression. Introduction to statistical software: SPSS and R.

**Unit III: Experimental Design and Data Analysis** **12hrs**

Principles of experimental design: randomization and replication. Types of experimental designs: completely randomized design, randomized block design. Data analysis and interpretation: summarizing data, drawing conclusions. Case studies in biological research.

**Unit IV: Computer Applications in Biology** **12hrs**

Introduction to computer hardware and software. Basic computer applications: word processing, spreadsheets, and presentations. Internet and its applications in biology: online databases, literature search. Introduction to bioinformatics: scope and importance. Bioinformatics tools: BLAST, ClustalW for sequence analysis.

**Unit V: Graph Preparation and Data Analysis Tools** **12hrs**

Introduction to graph preparation using computer software: Excel, R, GraphPad Prism. Creating different types of graphs: bar charts, line graphs, scatter plots, histograms. Data visualization techniques. Data analysis tools: SPSS, R, Python for data analysis. Interpreting results and presenting data in a meaningful way. Case studies in biological data analysis.

**Textbooks:**

1. "Biostatistics: A Foundation for Analysis in the Health Sciences" by Wayne W. Daniel
2. "Principles of Biostatistics" by Marcello Pagano and Kimberlee Gauvreau
3. "Bioinformatics: Sequence and Genome Analysis" by David W. Mount

**References:**

1. "Biostatistics for the Biological and Health Sciences" by Marc M. Triola and Mario F. Triola
2. "Statistics for Biologists" by R. C. Campbell
3. "Bioinformatics: Principles and Applications" by Zhumur Ghosh and Bibekanand Mallick

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Lab in Immunology** | | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Antigen-Antibody reactions – Agglutination (Blood grouping testing).
2. Ouchterlony Double Diffusion
3. Immuno-electrophoresis,
4. Dot ELISA
5. DNA Isolation Animal tissue/Blood
6. SDS PAGE
7. Western Blotting

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Lab in Animal Biotechnology** | | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Preparation of cell culture media
2. Isolation of cells from Chick embryo
3. Establishment and maintenance of primary cell cultures
4. Subculture of monolayer cells
5. Subculture of suspension cells
6. Determination of viable cells by trypan blue test

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal
S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Core:** | **Molecular Biology & Genetics** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with a comprehensive understanding of the principles, concepts, and techniques in molecular biology and genetics, including gene structure, regulation, and manipulation.

**Course Outcome:**

CO1: Students will be able to understand the fundamental principles of molecular biology and genetics.

CO2: Students will be able to explain the molecular mechanisms of gene expression and regulation.

CO3: Students will be able to apply molecular biology techniques for gene manipulation and analysis.

CO4: Students will be able to analyze and interpret genetic data.

CO5: Students will be able to discuss the ethical and societal implications of genetic research and technologies.

**Unit I: Introduction to Molecular Biology** **12hrs**

Overview of molecular biology: historical development, scope, and importance. Central dogma of molecular biology: DNA replication, transcription, and translation. Structure and function of nucleic acids: DNA and RNA. DNA packaging: chromatin structure, histones, and nucleosomes.

**Unit II: Gene Expression and Regulation** **12hrs**

Genetic code: codons, anticodons, and translation. Transcriptional regulation: operons, transcription factors, enhancers, and silencers. Post-transcriptional regulation: RNA processing, splicing, and stability. Epigenetics: DNA methylation, histone modification, and chromatin remodeling.

**Unit III: Molecular Techniques in Biology** **12hrs**

Polymerase chain reaction (PCR): principles and applications. DNA cloning: vectors, restriction enzymes, and transformation. DNA sequencing methods: Sanger sequencing, next-generation sequencing (NGS). Gene editing technologies: CRISPR/Cas9, TALENs, and ZFNs.

**Unit IV: Genetics and Genomics** **12hrs**

Principles of classical genetics: Mendelian inheritance, genetic crosses, and pedigrees. Chromosomal theory of inheritance: linkage, recombination, and mapping. Population genetics: Hardy-Weinberg equilibrium, genetic drift, and gene flow. Genomics: genome organization, sequencing projects, and comparative genomics.

**Unit V: Population Genetics and Ethical Issues** **12hrs**

Hardy-Weinberg equilibrium and its applications. Genetic drift, gene flow, and natural selection. Microevolution vs. macroevolution. Molecular evolution and phylogenetics. Human evolution and genetic diversity. Ethical considerations in genetic research: informed consent, privacy, and confidentiality. Genetic counseling and testing: principles and applications. Genetic engineering: applications in agriculture, medicine, and industry. Societal implications of genetic technologies: GMOs, gene therapy, and personalized medicine.

**Textbooks:**

1. "Molecular Biology of the Gene" by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick
2. "Principles of Genetics" by D. Peter Snustad and Michael J. Simmons
3. "Genetics: From Genes to Genomes" by Leland H. Hartwell, Michael L. Goldberg, Janice Fischer, and Leroy Hood

**References:**

1. "Essential Cell Biology" by Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter
2. "Genetics: Analysis and Principles" by Robert J. Brooker
3. "Genomes 4" by T.A. Brown

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO’s and PO’s Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

**Semester V:**

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Skilled : Genetic** | **Engineering** | **4** | **5** | **0** | **0** | **Theory** |

Course Focus on: Employability & Skill Development

Course Outcome
CO 1 : To understand the role of restriction enzymes
CO 2 : To know the properties of recombinant vectors
CO 3 : To apply the screening of cDNA library
CO 4 : To analyze the PCR based molecular marker
CO 5 : To understand the bacterial transformation and conjugation

Unit I : [12 Hours]

Restriction Enzymes: History, origin of Restriction endonuclease – Ligation – Alkaline phosphate – Digestion –Modification of Restriction Fragment ends.

Unit II: [12 Hours]

Recombinant vectors: Plasmid vector – Vector based on the Lambda Bacteriophage – Cosmids – M13 Vector - Expression vectors - Vector for Cloning and expression in Eukaryotic cells - Super vectors; YACs and BACs.

Unit III: [12 Hours]

Genomic and cDNA libraries : Genomic libraries – Growing and storing libraries – cDNA libraries – Screening Libraries with Gene probes – Screening expression Libraries with antibodies – characterization of plasmid clone.

Unit IV: [12 Hours]

Molecular Markers – PCR- Principle, Mechanism and application, Ligase chain reaction, RAPD, RFLP, AFLP, Site Directed Mutagenesis – DNA Sequencing – Maxam Gilbert and Sanger's dideoxynucleotide method, Next generation sequencing (NGS), Gene mapping.

Unit V: [12 Hours]

Transgenic – Bacterial transformation – Conjugation – Transduction - Transgenic plants – Transgenic animals – DNA finger printing in forensic application - ethical issues involved in rDNA technology.

Text Book

1. Introduction to gene cloning – 7th Ed, (2016), Brown T A , Stanley Thomas Pub ltd, Germany.
2. Principles of gene manipulation – 7th Ed (2005), Primrose S.B, Black well Sci ld, Germany.
3. Gene Biotechnology (2009), Jogdand, Himalaya publishing House, Mumbai.
4. Genetic Engineering (1996), Mitra, S, MacMillan India Ltd. New Delhi

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| | **Lab in Genetic engineering** | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Bacterial DNA Isolation.
2. Plasmid DNA Isolation
3. Restriction Digestion
4. Ligation
5. Polymerase chain Reaction (PCR)

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| | **Lab in Molecular Biology** | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Competent cell preparation
2. Transformation of plasmid
3. RAPD
4. Polyacrylamide gel electrophoresis (PAGE) with silver staining
5. Southern Hybridization

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

## Semester VI

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Core:** | **Environmental Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with comprehensive knowledge of environmental biotechnology principles, techniques, and applications for sustainable environmental management, with a focus on wastewater treatment.

**Course Outcomes:**

CO1: Students will be able to explain the fundamental concepts and principles of environmental biotechnology.

CO2: Students will be able to analyze environmental issues and propose innovative biotechnological solutions.

CO3: Students will be able to demonstrate proficiency in environmental monitoring, analysis, and bioremediation techniques.

CO4: Students will be able to evaluate the environmental impact of biotechnological processes and develop strategies for mitigation.

CO5: Students will be able to design and implement advanced bioremediation strategies for environmental restoration, including wastewater treatment.

**Unit I: Introduction to Environmental Biotechnology** **12hrs**

Overview of environmental biotechnology. Role of microorganisms in environmental processes. Environmental microbiology: microbial diversity, ecology, and interactions. Applications of biotechnology in environmental management. Environmental biotechnology research trends.

**Unit II: Environmental Monitoring and Analysis** **12hrs**

Principles and methods of environmental monitoring. Sampling techniques and data analysis. Monitoring of air, water, and soil quality. Analytical techniques: chromatography, spectroscopy, and molecular techniques. Advanced instrumentation in environmental monitoring.

**Unit III: Bioremediation Techniques** **12hrs**

Principles and applications of bioremediation. Types of bioremediation: in situ and ex situ. Biodegradation of organic pollutants. Phytoremediation and microbial remediation. Bioremediation case studies: industrial and environmental applications. Emerging bioremediation technologies.

**Unit IV: Wastewater Treatment** **12hrs**

Overview of wastewater treatment processes. Primary treatment: screening, grit removal, sedimentation. Secondary treatment: activated sludge process, trickling filters, sequencing batch reactors. Tertiary treatment: advanced oxidation, membrane filtration, nutrient removal. Anaerobic digestion for sludge treatment. Case studies and examples of wastewater treatment technologies.

**Unit V: Environmental Impact Assessment and Regulation** **12hrs**

Principles of environmental impact assessment (EIA). EIA process and methodologies. Environmental legislation and regulations. Role of biotechnology in environmental sustainability.

Ethical, legal, and social aspects of environmental biotechnology. Environmental policy development and implementation.

**Textbooks:**

1. "Environmental Biotechnology: Principles and Applications" by Bruce E. Rittmann, Perry L. McCarty
2. "Biotechnology for Environmental Management and Resource Recovery" by Ram Chandra

**References:**

1. "Environmental Biotechnology: Concepts and Applications" by Hans-Joachim Jördening, Josef Winter
2. "Principles of Environmental Biotechnology" by Ramesh C. Ray, P. Rath

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO’s and PO’s Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Skilled:** | **Nanoscience & Nanotechnology** | **4** | **5** | **0** | **0** | **Theory** |

**Course Objective:**

To provide students with a comprehensive understanding of the principles, techniques, and applications of nanoscience and nanotechnology.

**Course Outcomes:**

CO1: Students will be able to understand the fundamental principles and concepts of nanoscience and nanotechnology.

CO2: Students will be able to describe various nanomaterial synthesis methods and their properties.

CO3: Students will be able to analyze the applications of nanotechnology in various fields.

CO4: Students will be able to demonstrate proficiency in handling nanomaterials and using characterization techniques.

CO5: Students will be able to evaluate the ethical, societal, and environmental impact of nanotechnology.

**Unit I: Introduction to Nanoscience and Nanotechnology** **12hrs**

Overview of nanoscience and nanotechnology. Historical development and milestones. Size-dependent properties of nanoparticles. Quantum confinement, surface effects, and quantum dots. Nanomaterial classification.

**Unit II: Synthesis and Characterization of Nanomaterials** **12hrs**

Methods of synthesis: top-down and bottom-up approaches. Chemical vapor deposition, sol-gel synthesis, and self-assembly. Characterization techniques: microscopy (TEM, SEM), spectroscopy (UV-Vis, FTIR), and diffraction (XRD).

**Unit III: Properties and Applications of Nanomaterials** **12hrs**

Physical, chemical, and biological properties of nanomaterials. Carbon-based nanomaterials (carbon nanotubes, graphene). Metal and metal oxide nanoparticles. Applications in electronics, medicine, catalysis, and environmental remediation.

**Unit IV: Nanotechnology in Medicine and Healthcare** **12hrs**

Nanomedicine: drug delivery systems, imaging techniques (MRI, CT, PET). Nanosensors for disease detection. Therapeutic applications of nanoparticles. Challenges and ethical considerations in nanomedicine.

**Unit V: Nanotechnology in Energy and Environment** **12hrs**

Nanotechnology for energy storage (batteries, supercapacitors) and conversion (solar cells, fuel cells). Nanomaterials for environmental remediation (water purification, air filtration). Nanotechnology for sustainable development.

**Textbooks:**

1. "Introduction to Nanoscience and Nanotechnology" by Gabor L. Hornyak, Joydeep Dutta, et al.
2. "Nanomaterials: Synthesis, Properties, and Applications" by A. S. Edelstein, R. C. Cammarata

**References:**

1. "Nanotechnology: Principles and Practices" by Sulabha K. Kulkarni, P. K. Ajikumar
2. "Nanotechnology: Understanding Small Systems" by Ben Rogers, Jesse Adams, Sumita Pennathur

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO’s and PO’s Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester VI

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **21BBT6CP** | **Lab in Environmental & Industrial Biotechnology** | **2** | **0** | **0** | **5** | **Practical** |

Course Focus on: Employability & Research

1. Estimation of Dissolved Oxygen
2. Estimation of Total hardness
3. Estimation BOD
4. Estimation of COD
5. Isolation of Bacteria and fungi from industrial effluent
6. Ethanol production from fruit waste
7. Wine production
8. Citric acid production from waste product
9. Industrial enzyme production Protease/Amylase
10. Production of antibiotics by using the isolated microbes from effluent.

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective I:** | **Entrepreneurship Development** | **4** | **5** | **0** | **0** | **Theory** |

## Elective I: Entrepreneurship Development

**Course Objective:**

To provide students with a comprehensive understanding of entrepreneurship, including the principles, processes, and challenges involved in starting and managing a business.

**Course Outcomes:**

Upon completion of this course, students will be able to:

**CO1:** Define entrepreneurship and its role in economic development.

**CO2:** Develop skills in identifying and evaluating business opportunities.

**CO3:** Create a business plan, including financial projections and marketing strategies.

**CO4:** Understand the various sources of financing available to entrepreneurs.

**CO5:** Develop leadership and management skills necessary for entrepreneurial success.

**Unit I: Introduction to Entrepreneurship** **12hrs**

Introduction to entrepreneurship, its definition, and significance in economic development. Characteristics of successful entrepreneurs. Different types of entrepreneurship, including small business, scalable startup, and social entrepreneurship. Relevance of entrepreneurship in the field of biotechnology.

**Unit II: Opportunity Recognition and Feasibility Analysis** **12hrs**

Identification and evaluation of business opportunities. Market research and analysis. Conducting feasibility studies, including technical, financial, and organizational aspects. Creativity and innovation in entrepreneurship, with a focus on biotechnology-related opportunities.

**Unit III: Business Planning and Management** **12hrs**

Development of a comprehensive business plan. Considerations for legal and regulatory compliance. Financial planning and management, especially in the context of biotechnology startups. Marketing strategies for biotechnology ventures.

**Unit IV: Financing Entrepreneurial Ventures** **12hrs**

Sources of financing for startups, including equity, debt, and government funding. Venture capital and angel investment, with a focus on biotechnology investment trends. Crowdfunding and alternative financing models. Financial management and valuation in the biotechnology sector.

**Unit V: Marketing and Sales Strategies** **12hrs**

Planning and implementing effective marketing strategies for biotechnology products and services. Utilizing digital marketing and social media for business growth in the biotechnology industry. Sales techniques and customer relationship management specific to the biotechnology sector. Building and managing sales teams in biotechnology companies.

**Textbook:**

- "Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko

**References:**

- "Entrepreneurship Development" by S. Anil Kumar and K. Jayachandran
- "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries
- "Disciplined Entrepreneurship: 24 Steps to a Successful Startup" by Bill Aulet

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective II:** | **Biosafety, Bioethics & GLP** | **4** | **4** | **0** | **0** | **Theory** |

**Course Objective:** To learn the Biosafety precaution and ethics should follow the Biotechnology course towards the good lab practice.

**Unit I:** **12hrs**

**P**rinciples of Biosafety; procedures and good laboratory practices (GLPs); Biotechnology: benefits and concerns/risks; Standard operating procedures for research involving microbes and recombinant DNA.

Unit II: 12hrs

Designing of containment facilities: laboratories, Biosafety cabinets, and greenhouses; Ethical theories; ethical principles; Ethical issues surrounding GMOs and recombinant DNA research; national policies for biotechnology products and research; Principles of Risk assessment and management.

Unit III: 12hrs

Biosafety procedures: Assigning of Biosafety levels; The concept of Biosecurity; International conventions and treaties of relevance to Biosafety; National guidelines for research with GMOs and microbes.

Unit IV: 12hrs

Bioethics and social issues: Theories of bioethics, challenges facing modern biotechnology research and application; Challenges of Biotechnology policy development and implementation; Features of the biotechnology and Biosafety policy and its linkage to other national and global policies **.**

Unit V: 12hrs

Management of intellectual property: patenting, copyrights and trademarks; intellectual property rights as applied to biotechnology: Intellectual Property key policy issues in the research setting; Protection of traditional knowledge for biotechnology innovation; national and international and legal and regulatory framework for Intellectual property and relevance to biotechnology.

REFERENCE LIST

1. DUTFIELD, G. (1997). Can TRIPS Agreement Protect Biological and Cultural Diversity? Biopolicy International.
2. HENDRIX, F., KOESTER, V and PRIP, C. (1994). Access to Genetic Resources. In

*Biodiplomacy: Genetic Resources and International Relations.* Edited by V. Sanchez, ans Juma, C, Nairobi, Act Press.
3. KLEMM, C. De. (1990). Wild Plant Conservation and the Law. IUCN Environmental Policy and Law Paper Number 24. ICN
4. MUGABE, J, BARBER, C.V, HENNE, G, GLOWKA, L and LA VINA, A. (1996). Managing Access to Genetic Resources : Towards Strategies for Benefit-Sharing.
5. NELSON, D.L and COX, M.M. (2008). *Principles of Biochemistry*. Fifth Edition. W.H. Freeman and Company. New York
6. TANUI, W.K. (2007). *Laboratory Safety Handbook*. 1st Edition. King's Script Publishers.

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective III:** | **Medical Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

Course Focus on: Employability & Skill Development

Course Outcome
CO 1: To understand the associated reproductive technology and animal cell culture
CO 2: To know the chromosomal disorders and disease
CO 3: To apply the methods of diagnosis used in microbial disease
CO 4: To analyze the prevention and treatment of bacterial disease.
CO 5: To understand the modern medicine system and stem cell therapy.

UNIT I: [12 Hours]

Art and Acc : Assisted reproductive technology- Pregnancy diagnosis - Animal cell culture-media, maintenance and culture of primary, secondary and continuous cell lines- organ culture-applications- cancer cell lines- apoptosis.

UNIT II : [12 Hours]

Chromosomal Disorders: Chromosomal disorders – Gene controlled diseases –Identification of disease genes- Haemophilia, DMD, Alzheimer's – Molecular basis of human diseases: Pathogenic mutations – Oncogenes - Loss of function - Tumour Suppressor Genes- Immunopathology: Hepatitis, Autoimmune Disorders.

UNIT III : [12 Hours]

Diagnostics Methods: Prenatal diagnosis - Invasive techniques and Non-invasive techniques – Diagnosis of pathogenic microbes: Classical and modern methods- Diagnosis using protein and enzyme markers, DNA/RNA based diagnosis - Molecular markers - Microarray technology - genomic and cDNA arrays.

UNIT IV : [12 Hours]

Prevention and Treatment: Vaccines-conventional, recombinant, synthetic peptide, anti-idiotype, DNA vaccines- Deletion mutant and vaccinia vector vaccine- Antibiotics-mode of action- antibacterial, antifungal, antiviral, antitumor antibiotics- synthetic chemotherapeutic agents- development of microbial resistance to antibiotics.

UNIT V : [12 Hours]

Modern Medicine: Hybridoma technique for MAb production and applications- Gene therapy: Exvivo, Invivo, Insitu- Cell and tissue engineering- Stem cell therapy- Nanomedicines- Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon.

References

1. Jogdand, S. N.. Medical Biotechnology, Himalaya Publishing house, Mumbai, 2005.
2. Click, B. R. and Pasternak.. Molecular Biotechnology: Principle and applications of recombinant DNA. ASM Press, 2010.
3. Ramasamy, P.. *"Trends in Biotechnology*", University of Madras, Pearl press, 2002.
4. Trevan.. "*Biotechnology"*. Tata McGraw-Hill, 2005

**Mapping of Course Outcomes with Programme Outcomes**

| **Course outcomes** | **Programme outcomes** | | | | | | | | **Programme Specific Outcomes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective IV:** | **Pharmaceutical Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

Course Focus on: To impact the knowledge in Pharmaceutical Biotechnology

Course Outcome
CO 1: To understand the biopharmaceuticals current status and future prospects
CO 2: To know the impact of genomes in drug discovery
CO 3: To apply the preclinical studies of drug development
CO 4: To analyze the purification of recombinant protein
CO 5: To understand the patents in the pharmaceutical industry

Unit I: [12 Hours]

Biopharmaceuticals - Introduction to Biotechnology with reference to Pharmaceutical Sciences. Introduction to pharmaceutical products - History of the pharmaceutical industry - The age of biopharmaceuticals; Biopharmaceuticals: current status and future prospects.

Unit II: [12 Hours]

Drug development process – Introduction, Discovery of biopharmaceuticals - The impact of genomics and related technologies upon drug discovery - Gene chips - Proteomics - Structural genomics – Pharmacogenetics - Initial product characterization Delivery of biopharmaceuticals. Genetic engineering applications in relation to production of pharmaceuticals.

Unit III: [12 Hours]

Preclinical studies - Pharmacokinetics and pharmacodynamics - Toxicity studies – Cytokines in interferon family – Growth factors – Therapeutic hormones. Importance of Monoclonal antibodies in Industries.

Unit IV: [12 Hours]

Upstream and Downstream Processing: Sources of biopharmaceuticals – E.coli, animal cell culture, Yeast, fungal, Transgenic animal and plant – cell banking system – microbial cell fermentation – Mammalian cell culture system – Purification of recombinant proteins – final product formulation. Biosensors - Working and applications of biosensors in Pharmaceutical Industries.

Unit V: [12 Hours]

Patents in the Pharmaceutical Biotechnology Industry: The concept of intellectual property law. Introduction to patents, trademarks, copyrights and trade secrets, and the differences between these forms of protection. Patent Law – Patent obtain – subject matter – Types of patents in pharmaceutical Biotechnology – Ethical policy issues in Biotechnology patent - role and remit of regulatory authorities.

Reference:

1. Pharmaceutical Biotechnology Concepts and Applications Gary Walsh University of Limerick, Republic of Ireland.
2. Pharmaceutical Biotechnology, Drug Discovery and Clinical Applications. Edited by O. Kayser and R.H. Muller.
3. Pharmaceutical Biotechnology Fundamentals and Applications Third Edition, Daan J. A. Crommelin and Robert D. Sindelar.

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective V:** | **Ecology and Biodiversity** | **4** | **5** | **0** | **0** | **Theory** |

Course Outcome
CO 1: To understand the fundamentals of Ecology
CO 2: To know the Diversity of species
CO 3: To apply the population and community based research
CO 4: To analyze the aquatic and terrestrial communities
CO 5: To understand the practical and field experiments using standard methods.

UNIT-I [12 Hours]

Introduction to Ecology & environmental sciences; Flow of energy and cycling of materials; water, carbon, nitrogen and phosphorus. Trophic pyramids and food webs; Alterations of ecosystem function: acid rain, nuclear winter, global warming and ozone hole.

UNIT-II [12 Hours]

Diversity of life; origin of life on earth; Evolution od early life and changes in earth's atmosphere. Mendelian genetics – and Darwin Wallace theory of inheritance. Five kingdoms overview; Monera, Protists, Fungi, plant and animal kingdoms.

UNIT-III [12 Hours]

Populations and communities; Birth, death and population size, age structure; Trends in human population growth; Malthusian growth. Intraspecific interactions and density dependence. Interspecific interactions; Commensalism, mutualism, competition and predation. Species diversity, community stability and disturbance.

UNIT-IV [12 Hours]

Aquatic and terrestrial communities; rare communities; deep earth, deep sea floor, volcanoes. Primary productivity; basic concepts. Ecological succession inland, water; concepts. Invasive species and control.

UNIT-V [12 Hours]

Practical and Field Experiments using standard methods; Estimation of density and relative abundance of species using quadrats and plotless methods. Estimation of species diversity: introduction to indices. Estimation of primary productivity. Ecological adaptations of the Plant and animal species in the hydrophytes, mesophytes and xerophytes.

References:

1. Chapman, J.L. & M.J. Reiss. 1998. Ecology: Principles and Applicatiions. Cambridge Univ. press. 2nd edition. 336 pgs.

2. Krebs, C.J. 2008. Ecology: The experimental Analysis of Distribution and Abundance (6th Edition), Benjamin Cummings Publ. 688pgs.

3. Miller. G.T. 2004. Environmental Science. Thomson, California. 538 pgs.

4. Singh, J.S., Singh, S.P & Gupta, S.R. 2006. Ecology, Environment and Resource conservation. Anamaya Publ., New Delhi, 688 pp.

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective VI: Agriculture Biotechnology** | | 4 | 5 | 0 | 0 | Theory |

Course Outcome
CO 1: To understand the history of Indian agriculture.
CO 2: To know the microbes in agriculture and foods
CO 3: To apply the production and utilization of essential amino acid
CO 4: To analyze the genetic engineering for crop improvement
CO 5: To understand the major crops and major disease in India.

UNIT – I [12 Hours]
History of Indian Agriculture, Green Revolution in India, Cropping patterns in India, Soil, Rainfall Patterns in India.

UNIT - II [12 Hours]
Microbes in Agriculture and Food: microbial enzymes and their applications in food processing and agro-chemical industries, agro-waste utilization, biodegradable polymers and their applications.

UNIT - III [12 Hours]
Production and utilization of essential amino-acids, chemicals from micro-algae, Micorrhiza: Applications in agriculture and forestry.

UNIT - IV [12 Hours]
Genetic Engineering for Crop Improvement: Plant cell and tissue culture, gene transfer techniques into plant cells, application in agricultural and food industries.

UNIT - V [12 Hours]
Plant Pathology – Major crops and major diseases in India. Developing diseases, Drought, Salinity, Cold tolerant crops in India and its economic importance. Post harvest and storage of grains.
.

REFERENCE BOOKS
1. Agricultural Biotechnology Edited by Arie Altman, Pub. Marcel Dekker, Inc., 1998
2. Biotechnology – Expanding Horizons. B. D. Singh. Kalyani Publishers, 2004.
3. Plant Genetic Engineering by J. H. Dodds, Cambridge University Press, 1983.
4. Biotechnology and Utilization of Algae – The Indian Experience. Venkataraman, V. and E.W. Becker 1985.
5. Agricultural Microbiology by Rangaswami G., Bagyaraj D.J. PHI; 2 edition, 1992.
6. Textbook of Agricultural Biotechnology by Dr. Ahindra Nag, PHI Learning Private Ltd., New Delhi, 2009

**Mapping of Course Outcomes with Programme Outcomes**

| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective VII:** | **Industrial Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

Course Outcome

CO 1: To understand the biotechnology based commercial product.
CO 2: To know the industrially importance microorganisms
CO 3: To apply the fermentor for batch and continuous culture.
CO 4: To analyze the downstream processing.
CO 5: To understand the industrial process of amino acid and organic acid.

UNIT-I [12 Hours]
Introduction to biotechnology and products. Major classes of commercial products using micro organisms-enzymes, amino acids, vitamins, antibiotics, organic solvents, organic acids, food and beverages.

UNIT-II [12 Hours]
Industrially important microorganisms: screening techniques - detection & assay of fermentation products-strain improvements - mutations, protoplast fusion and rDNA techniques for strain development.

UNIT-III [12 Hours]
Bioreactors / Fermentor: Types, features, operation: sterilization (Batch and Continuous), inoculation and sampling. Control of bioprocess parameters. Microbial growth and media formulation. Microbial culture - batch, fed batch, semi-continuous, continuous. Growth kinetics of microorganisms.

UNIT-IV [12 Hours]
Down stream processing: Solid-liquid separation, flotation, flocculation, filtration, centrifugation, cell disruption, concentration, evaporation, liquid-liquid extraction, membrane filtration, precipitation, adsorption. Product purification by chromatography.

UNIT-V [12 Hours]
Industrial process of beverages - enzymes - amino acid - organic acids - organic solvents - antibiotics.

References:
1. Manual of industrial microbiology and Biotechnology, Demain A.L. Solomon, J.J., 1986. ASM press.
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3. Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.
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5. AN introduction to Genetic Engineering, Desmond, S.T., Nicholl, 1994. Cambridge press.

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| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

| Subject Code | Subject title | Credit | Lecture | Tutorial | Practical | Type |
|---|---|---|---|---|---|---|
| **Elective VIII** | **– Food Biotechnology** | **4** | **5** | **0** | **0** | **Theory** |

Course Outcome
CO 1: To understand the associated microorganisms of food industry
CO 2: To know the natural food products and their control.
CO 3: To apply the food preservation methods.
CO 4: To analyze the principle and operations of packing
CO 5: To understand the methods and importance of quality control.

UNIT-I: [12 Hours]
History of microbiology of food - microbial growth pattern, physical and chemical factors influencing structure of micro-organisms - types of micro-organism normally associated with food - mold, yeast and bacteria.

UNIT-II: [12 Hours]
Micro-organisms in natural food products and their control - contaminants of foods - stuffs, vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing - biochemical changes caused by micro-organisms - deterioration of various types of food products - food poisoning and microbial toxins.

UNIT-III: [12 Hours]
Scope and importance of food processing - principles and methods of food preservation - freezing, heating, dehydration, canning, additives, fermentation, irradiation, extrusion cooking, hydrostatic pressure cooking, dielectric heating, microwave processing.

UNIT-IV: [12 Hours]
Introduction to packaging - packaging principles and operation - package functions and design - deteriorative changes in foodstuff and packaging methods for prevention - shelf life of packaged foodstuffs - methods to extend shelf life.

UNIT-V: [12 Hours]
Objectives, importance and functions of quality control - methods of quality - assessment of food materials - fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products - sampling and specification of raw materials and finished products - statistical quality controls - food regulations, grades and standards - food adulteration, food safety and evaluation.

REFERENCES
1. Rsdel W.B., Copley, M.J. and Morgen, A.I. 1973. Food Dehydration, 2nd Edn. (2 Vol. Set). AVI, Westport.
2. Der, A.E. 1978. Food Processing and Nutrition. Academic Press, London.
3. Lows, P. and Ellis H. 1990. Food Processing. Prentice Hall, Reston Virginia, USA.
4. Jelen, P. 1985. Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.
5. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.
6. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York

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| Course outcomes | Programme outcomes | | | | | | | | Programme Specific Outcomes | | | |
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| CO1 | 3 | 2 | | | 1 | | 1 | | 3 | 2 | | 1 |
| CO2 | 3 | 2 | | 2 | | 1 | | | 2 | 3 | 1 | |
| CO3 | | 3 | | 2 | 1 | | | | 3 | | 1 | 2 |
| CO4 | 3 | 2 | | 1 | 2 | 1 | | | 2 | 3 | 1 | |
| CO5 | 2 | 3 | | 1 | | | | | 2 | 1 | | 3 |

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