Faculty of Engineering and Technology

REGULATIONS 2017

DEPARTMENT OF BIOTECHNOLOGY

Programme:

B.Tech.BIOTECHNOLOGY

Full Time (4 Years)

STRUCTURED CHOICE BASED CREDIT SYSTEM (SCBCS)

CURRICULUM AND SYLLABUS

(Semester I to VIII)
PROGRAM OUTCOMES (POs) OR GRADUATE ATTRIBUTES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

(B) **PROGRAM SPECIFIC OUTCOMES (PSOs)**

Upon successful completion of the course the students are expected to:

**PSO1:** To identify, formulate, design, analyse and develop processes and technologies for biotechnological products for societal usage and economically sustainable for the present and future

**PSO2:** To expertise in implementation of modern biotechnological tools to address human health, complex engineering problems and to improve the research approach in interdisciplinary facet.

**PSO3:** To recognise the knowledge, need for and the importance of bioethics, environmental and social responsibilities for life long learning in the broadest context in technological changes.

(C) **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1:** To provide the biotechnology graduates to have expertise in biotechnological aspects which will enable them to have a career and professional achievements in public and private sector

**PEO2:** Address the nuances of biotechnology in real life on application of microorganisms in industrial production of enzymes and products, downstream processing, genetic engineering, tissue culture and applications.

**PEO3:** Identify, design and develop biotechnological process and technologies to meet the industrial challenges and produce tools which a sound and economically viable and sustainable.
## Credit Structure of Course Category

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category of Courses</th>
<th>Credits</th>
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<tr>
<td>01</td>
<td>A. Foundation Courses (FC)</td>
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<tr>
<td></td>
<td>i. Humanities and Sciences (English and Management Subjects)</td>
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<tr>
<td></td>
<td>ii. Basic Sciences (Maths, Physics and Chemistry Subjects)</td>
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<td>iii. Engineering Sciences (Basic Engineering Courses)</td>
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<td>02</td>
<td>B. Core courses (CC) relevant to the chosen programme of study.</td>
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<td>C. Elective Courses (EC)</td>
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<td>D. Project + Internship + Industry Electives (P + I + I)</td>
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<td>i. Project</td>
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<td>ii. Internship / Industry Supported Courses</td>
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<td>E. Employability Enhancement Courses + Co - Curricular Courses + Extra Curricular Courses (EEC)**</td>
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<td>Minimum Credits to be earned</td>
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** - Mandatory, Credits would be mentioned in Mark sheets but not included for CGPA Calculations. Overall CGPA Calculations will be out of minimum 171 credits earned in categories A to D.
CURRICULUM
B.TECH.–
BIOTECHNOLOGY
- SEMESTER
I TO VIII
B.TECH. – BIOTECHNOLOGY - SEMESTER I TO VIII

CATEGORY A – FOUNDATION COURSES - HSS, BS AND ES COURSES - CREDITS (54-63)

(i) HUMANITIES AND SCIENCES (ENGLISH AND MANAGEMENT SUBJECTS) - CREDITS (12 - 21)

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(ii) BASIC SCIENCES (MATHS, PHYSICS AND CHEMISTRY SUBJECTS) - CREDITS (24 - 33)

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### CATEGORY B – CORE COURSES RELEVANT TO THE PROGRAMME - CREDITS (81)

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### CATEGORY E

**EMPLOYABILITY ENHANCEMENT COURSES, CO - CURRICULAR COURSES AND EXTRA CURRICULAR COURSES (EEC)**

**(**MANDATORY, CREDITS WOULD BE MENTIONED IN MARK SHEETS BUT NOT INCLUDED FOR CGPA CALCULATIONS.)**

(i) **EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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FOR DEGREE WITH

SPECIALISATION

CATEGORY C –

PROGRAMME SPECIFIC

ELECTIVE COURSES -

CREDITS (12 - 15)
## SPECIALISATION - INDUSTRIAL BIOTECHNOLOGY

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CATEGORY A – FOUNDATION COURSES - HSS, BS AND ES COURSES - CREDITS (54-63)

(i) HUMANITIES AND SCIENCES (ENGLISH AND MANAGEMENT SUBJECTS) - CREDITS (12 - 21)
Technical English is a life skill course necessary for all students of Engineering and Technology. It aims at developing communication skills in English, essential for understanding and expressing the ideas of different professional context. The outcome of the course is to help the students acquire the language skills of Listening, Speaking, Reading and Writing competency in English language and thereby making the students competent and employable in the globalised scenario.

**PREREQUISITE:** NIL

**COURSE OBJECTIVES**

1. To enable students to develop LSRW skills in English. (Listening, Speaking, Reading, and Writing.)
2. To make them to become effective communicators
3. To ensure that learners use Electronic media materials for developing language
4. To aid the students with employability skills.
5. To motivate students continuously to use English language
6. To develop the students communication skills in formal and informal situations

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

<table>
<thead>
<tr>
<th>CO1</th>
<th>To listen, remember and respond to others in different scenario</th>
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<tr>
<td>CO2</td>
<td>To understand and speak fluently and correctly with correct pronunciation in different situation.</td>
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<tr>
<td>CO3</td>
<td>To make the students experts in professional writing</td>
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<tr>
<td>CO4</td>
<td>To make the students in proficient technical communicator</td>
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<tr>
<td>CO5</td>
<td>To make the students good communicators at the work place and to be theoretically strong</td>
</tr>
<tr>
<td>CO6</td>
<td>To make the students recognize the role of technical writing in their careers in business, technical and scientific field</td>
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**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**SELF INTRODUCTION**


**ARTICLES**

Articles - Phonetics (Vowels, Consonants and Diphthongs) - Pronunciation Guidelines -Listening to Indian speakers from different regions, intrusion of mother tongue - Homophones – Homonyms - Note taking and Note making - Difference between Spoken and Written English- Use of appropriate language - Listening and Responding to Video Lectures (Green India, environment, social talks) - Extempore.

**TENSE FORMS**

Tense forms- Verbal and Non verbal Communication - Describing objects - Process Description- Speaking Practice - Paragraph Writing on any given topic (My favourite place, games / Hobbies / School life, etc.) -Types of paragraphs - Telephone Etiquettes - Telephonic conversation with dialogue.
**IMPERSONAL PASSIVE VOICE**

**SENTENCE PATTERN**
Sentence Pattern (SVOCA) - Statement of Comparison - Transcoding (Flow Chart, Bar Chart and Pie Chart) - Informal letters - Resume Writing- Difference between Bio data, Resume and Curriculum Vitae.

**TEXTBOOK**
1. English for Engineers- Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai

**REFERENCES**

**COURSE DESIGNER:**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Faculty</th>
<th>Mail ID</th>
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<tbody>
<tr>
<td>1.</td>
<td>Dr.P.Saradha / Associate Professor - English</td>
<td><a href="mailto:saradhap@vmkvec.edu.in">saradhap@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mr.S.K.Prem Kishor/Assistant Professor-English</td>
<td><a href="mailto:Prem.english@avit.ac.in">Prem.english@avit.ac.in</a></td>
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</table>
Language is one of the most valued possessions of men. It acts as a repository of wisdom. Among all other languages English, the international language plays a vital role as a propeller for the advancement of knowledge in different fields and as a telescope to view the dream of the future.

**PREREQUISITE : NIL**

**COURSE OBJECTIVES**

1. To impart and enhance corporate communication
2. To enable learners to develop presentation skills
3. To build confidence in learners to use English in Business context
4. To make them experts in professional writing
5. To assist students understand the role of thinking in all forms of communication
6. To equip students with employability and job searching skills

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

CO1. Communicate with a range of formal and informal context

CO2. Students will undergo in activities, demonstrating interaction skills and consider how own communication is adjusted in different scenario

CO3. Strengthening of oral and written skills in the business context

CO4. Create interest among the students about a topic by exploring thoughts and ideas

CO5. Make the students to start with pleasing note and make them to give different ideas

CO6. Make them in better performance in the art of communication

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

UNIT – I: Subject and Verb Agreement (concord) - Preposition and Relative Pronoun - Cause and effect - Phrasal Verbs-Idioms and phrases-Listening Comprehension -Listening to Audio Files and Answering Questions-Framing Questions-Negotiation Skills-Presentation Skills and Debating Skills.


UNIT IV - Corporate Communication -Recommendation-Instruction-Check List- Circulars-Inter Office Memo- Minutes of Meeting and Writing Agenda - Discourse Markers - Rearranging Jumbled Sentences - Technical Articles - Project Proposals-Making Presentations on given Topics -Preparing Power Point Presentations


**TEXTBOOK**
1. English for Effective Communication - Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai

REFERENCES
2. Technical English – Writing, Reading and Speaking – Pickett and Lester, Harper and Row

COURSE DESIGNER:

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<td>English</td>
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PREAMBLE:
Quality is the mantra for success or even for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach for providing quality of products and processes. It becomes essential to survive and grow in global markets, organizations will be required to develop customer focus and involve employees to continually improve Quality and keep sustainable growth.

PREREQUISITE: Not Required

COURSE OBJECTIVES:
1. To understand the Total Quality Management concepts.
2. To practice the TQM principles.
3. To apply the statistical process control
4. To analyze the various TQM tools
5. To adopt the quality systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to

CO1: Understand the importance of quality and TQM at managerial level.

CO2: Practice the relevant quality improvement tools to implement TQM.

CO3: Analyse various TQM parameters with help of statistical tools.

CO4: Assess various TQM Techniques.

CO5: Practice the Quality Management Systems in a different organization Environment.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION

TQM PRINCIPLES

STATISTICAL PROCESS CONTROL (SPC)
The Seven tools of Quality- Statistical Fundamentals – Measures of central Tendency & Dispersion- Population and Sample- Normal Curve- Control Charts for variables and attributes- Process capability- Concept of six sigma- New seven Management tools.

TQM TOOLS

QUALITY SYSTEMS
TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS:

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<td>Associate Professor</td>
<td>Management Studies</td>
<td><a href="mailto:mani@vmkvec.edu.in">mani@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Dr. V. Sheela Mary</td>
<td>Associate Professor</td>
<td>Management Studies</td>
<td><a href="mailto:sheelamary@avit.ac.in">sheelamary@avit.ac.in</a></td>
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PREAMBLE

English Language Laboratory provides technological support to students. It acts as a platform for learning, practicing and producing language skills through interactive lessons and communicative mode of teaching.

PREREQUISITE: NIL

COURSE OBJECTIVES

1. To understand communication nuisances in the corporate sector.
2. To understand the role of mother tongue in second language learning and to avoid interference of mother tongue.
3. To communicate effectively through different activities
4. To understand and apply the telephone etiquette
5. Case study to understand the practical aspects of communication
6. To improve the oral skills of the students

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Give best performance in group discussion and interview

CO2. Best performance in the art of conversation and public speaking.

CO3. Give better job opportunities in corporate companies

CO4. Better understanding of nuances of English language through audio-visual experience and group activities

CO5. Speaking skills with clarity and confidence which in turn enhances their employability skills

CO6. Acquire strategic competence to use both spoken and written language in a wide range of communication strategies

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

MODULE I: Ice Breaker, Grouping, Listening- (Hearing and listening)- Active Listening- Passive Listening – Listening to a song and understanding- (fill in the blanks) Telephone Conversation

MODULE II: Influence of mother tongue, videos, understanding nuances of English language (video) puzzle to solve, Activity.

MODULE III: Why is English important, Communication skills, TED (video) Communication in different scenario – a case study, ingredients of success, Activity – chart, speak the design, feedback on progress, Group wise, Individual.

MODULE IV: Telephone Etiquette, Dining Etiquette, Meeting Etiquette.

MODULE V: Case study of Etiquette in different scenario.

COURSE DESIGNER
### PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT

**Category** | **L** | **T** | **P** | **Credit**
---|---|---|---|---
HSS | 0 | 0 | 2 | 1

To develop students with good presentation and writing skills (Professionally & technically). Articulate and enunciate words and sentences clearly and effectively. Develop proper listening skills. Understand different writing techniques and styles based on the communication being used.

**PREREQUISITE**: NIL

### COURSE OBJECTIVES

1. To develop communication and personality skills.
2. To improve Aptitude skills, train to improve self-learning / researching abilities, presentation skills & technical writing.
3. To improve students employability skills.
4. To develop communication and problem solving skills.
5. To develop professional with idealistic, practical and moral values.
6. To produce cover letters, resumes and job application strategies.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

**CO1**. Improve students their vocabulary and use them in appropriate situation

**CO2**. Demonstrate effective use of team work skills to complete given tasks.

**CO3**. Speaking with clarity and confidence thereby enhancing employability skills of the students.

**CO4**. Train the students in organized and professional writing

**CO5**. Develop students reading skills that could be adopted while reading text

**CO6**. Improve communication and personality skills.

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

### SYLLABUS

**UNIT – I: COMMUNICATION AND SELF DEVELOPMENT**: Basic Concepts of Communication; Barriers in Communication; How to Overcome Barriers to Communication.

**UNIT – II: GRAMMAR & SYNTAX**: Subject verb concord, tenses, Homophones, Homonyms, Spotting errors.

**UNIT – III. READING AND WRITING SKILLS**: Reading Comprehension; and suggesting title for given passage Back office job for organizing a conference / seminar (member of organizing committee and submit a report); Jumbled sentences, respond to real time advertisement and prepare a covering letter with CV.

**UNIT IV. SPEAKING SKILLS**: Hard and soft Skills; Feedback Skills; Skills of Effective Speaking; Component of an effective Talk; how to make an effective oral presentation

**UNIT V TECHNICAL REPORT, RESEARCH CASE STUDY & REPORTING**: Types and Structure of Reports; Collecting Data; Technical Proposals; Visual Aids; General Tips for Writing Reports. Research Case Study and reporting, how to make an effective power point presentation.
TEXTBOOK

REFERENCES
2. Business Communication, Asha Kaul, Prentice Hall of India

COURSE DESIGNER

<table>
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<tr>
<td>1</td>
<td>Dr.P.Saradha</td>
<td>Associate Professor</td>
<td>English</td>
<td><a href="mailto:saradhap@vmkvec.edu.in">saradhap@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr.S.K.Prem Kishor</td>
<td>Assistant Professor</td>
<td>English</td>
<td><a href="mailto:Prem.english@avit.ac.in">Prem.english@avit.ac.in</a></td>
</tr>
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</table>
(ii) BASIC SCIENCES (MATHS, PHYSICS AND CHEMISTRY SUBJECTS) - CREDITS (24 - 33)
PREAMBLE
This course offers the knowledge of solving basic problems involving rates of change of variables subject to a functional relationship, to solve optimization problems, to find the area under curves and the area between curves, to develop skills and knowledge of standard concepts in ordinary differential equations, to design data collection plans, analyze data appropriately and interpret and draw conclusions from those analyses.

PREREQUISITE

COURSE OBJECTIVES
1. To improve their ability in solving geometrical applications of differential calculus problems.
2. To develop the knowledge in integral calculus.
3. To enable the students to solve ordinary differential equations.
4. To get the single value that describes the characteristic of the entire group and to analyze variation of items from the central value.
5. To correlate two or more variables, one needs simple, multiple and partial correlations and suitable interpretation.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Apply the concept of differentiation in functions of single and several variables.
CO2. Apply the methods to find area and volume.
CO3. Apply knowledge of Ordinary differential equations in biological processes.
CO4. Apply statistics in conducting the experiments about the plants and animals.
CO5. Apply the concept of correlation and regression in computational biology.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS


ORDINARY DIFFERENTIAL EQUATIONS: Formation of differential equations – Solution of first order equation – Variable separable and solution of Linear differential equation of the form – Linear Second Order ordinary differential equation with constant coefficients (exp(ax), cos(ax), sin(ax)).

STATISTICS: Measure of central value – Average – Type of average – Arithmetic: Mean, Median, Mode – Measures of Dispersion – Measure of Skewness and Kurtosis – measure of Skewness based on Moments.

CORRELATION AND REGRESSION ANALYSIS: Correlation analysis – methods of correlation. Regression analysis – Regression equation – Multiple and partial correlation – Notations – Equation of regression plane (Three variables) – Multiple correlation coefficients – Partial Correlation coefficients

TEXT BOOKS:
REFERENCES:

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<tr>
<td>1</td>
<td>Dr.L.Tamilselvi</td>
<td>Professor</td>
<td>AVIT</td>
<td><a href="mailto:ltamilselvi@avit.ac.in">ltamilselvi@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.P.Sasikala</td>
<td>Professor</td>
<td>VMKVEC</td>
<td><a href="mailto:sasikalap@vmkvec.edu.in">sasikalap@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
Engineering Physics is the study of advanced physics concepts and their applications in various technological and engineering domains. Understanding the concepts of laser, types of lasers, the propagation of light through fibers, applications of optical fibers in communication and different types of non-destructive techniques will help an engineer to analyze, design and to fabricate various conceptual based devices.

PREREQUISITE : NIL

COURSE OBJECTIVES
1. To recall the properties of laser and to explain principles of laser
2. To assess the applications of laser
3. To detail the principles of fiber optics
4. To study the applications of fiber optics
5. To explain various techniques used in Non-destructive testing

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Understand the principles laser, fiber optics and non-destructive testing
CO2. Understand the construction of laser, fiber optic and Non-Destructive testing equipments
CO3. Demonstrate the working of laser, fiber optic and Non-Destructive testing based components and devices
CO4. Interpret the potential applications of laser, fiber optics and Non-Destructive testing in various fields.
CO5. Differentiate the working modes of various types of laser, fiber optic and Non-Destructive testing based devices.

SYLLABUS
UNIT-I

UNIT-II
FIBRE OPTICS: Principle and propagation of light in optical fibers – numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode) – Applications: Fiber optic communication system – fiber optic displacement sensor and pressure sensor.

UNIT-III

TEXT BOOK
1. Engineering Physics, compiled by Department of Physics, Vinayaka Mission’s Research Foundation (Deemed to be University), Salem.
### REFERENCE BOOKS


### COURSE DESIGNERS

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<tr>
<td>1</td>
<td>Dr. C. Senthil Kumar</td>
<td>Professor</td>
<td>Physics</td>
<td><a href="mailto:senthilkumarc@vmkvec.edu.in">senthilkumarc@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr. R. Sethupathi</td>
<td>Associate Professor</td>
<td>Physics</td>
<td><a href="mailto:sethupathi@vmkvec.edu.in">sethupathi@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>3</td>
<td>Dr. G. Suresh</td>
<td>Associate Professor</td>
<td>Physics</td>
<td><a href="mailto:suresh.physics@avit.ac.in">suresh.physics@avit.ac.in</a></td>
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<tr>
<td>4</td>
<td>Dr. B. Dhanalakshmi</td>
<td>Associate Professor</td>
<td>Physics</td>
<td><a href="mailto:dhanalakshmi.phy@avit.ac.in">dhanalakshmi.phy@avit.ac.in</a></td>
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PHYSICAL SCIENCES
PART B - ENGINEERING CHEMISTRY
Semester I (Common to All Branches)

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PREAMBLE
Objective of this course is to present a better understanding of basic concepts of chemistry and its applications on different engineering domains. It also imparts knowledge on fundamentals of Electrochemistry, Energy storage technologies, properties of water and its treatment methods, classification of fuels, Non conventional sources of Energy and various advanced Engineering materials.

PREREQUISITE: NIL

COURSE OBJECTIVES
1. To impart basic knowledge in Chemistry so that the student will understand the engineering concept
2. To familiar with electrochemistry and Battery and fuel Cells
3. To lay foundation for practical applications of water softening methods and its treatment methods in engineering aspects.
4. To inculcate the knowledge of fuels and advanced material.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

- CO1: Describe the electrochemistry, batteries and working principle of energy storage devices Understand
- CO2: Estimate the hardness of water Apply
- CO3: Identify suitable water treatment methods Analyze
- CO4: Outline the important features of fuels and advanced materials Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

Electrochemistry, Batteries and Fuel cells
Electrode potential - Nernst equation – Electrodes (SHE, Calomel and Glass) - cells - EMF measurement.
Primary battery (Daniel and dry cell) – secondary battery (lead Acid storage battery and Nickel-Cadmium battery) – Fuel cell (H2-O2 fuel cell)

Water Technology and Corrosion

Fuels And Chemistry of Advanced Materials
Basics and Applications:-Organic electronic material, shape memory alloys, polymers (PVC, Teflon, Bakelite)

TEXT BOOK
Engineering Chemistry by prepared by Vinayaka Mission’s Research Foundation, Salem.

REFERENCES:
A text book of Engineering Chemistry by S.S. Dara, S.Chand & company Ltd., New Delhi
# COURSE DESIGNERS

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<tr>
<td>1.</td>
<td>Dr. V. Anbazhagan</td>
<td>Professor</td>
<td>Chemistry</td>
<td><a href="mailto:anbu80@gmail.com">anbu80@gmail.com</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mr. A. Gilbert Sunderraj</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td><a href="mailto:asmgill80@gmail.com">asmgill80@gmail.com</a></td>
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<tr>
<td>3.</td>
<td>Dr. R. Nagalakshmi</td>
<td>Professor</td>
<td>Chemistry</td>
<td><a href="mailto:nagalakshmi.chemistry@avit.ac.in">nagalakshmi.chemistry@avit.ac.in</a></td>
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<td>4.</td>
<td>Dr. K. Sanghamitra</td>
<td>Associate Professor</td>
<td>Chemistry</td>
<td><a href="mailto:sanghamitra.chemistry@avit.ac.in">sanghamitra.chemistry@avit.ac.in</a></td>
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PREAMBLE
Biostatistics is the application of statistical methods in studies in biology by collection of data, analysis and interpretation of data. The data come from a wide range of sources, including genomic studies, experiments with cells and organisms, and clinical trials. Testing of hypothesis is a Statistical procedure to draw inferences from samples about population. Statistical Quality control is a method of quality control, which employs statistical methods to monitor and control a process. This helps ensure the process operates efficiently, producing more specification-conforming product. Acceptance sampling allows measuring the quality of a batch of products by selecting a specified number of products for testing.

PREREQUISITE
Mathematics for Bio-Engineering (17MABS03)

COURSE OBJECTIVES
1. Develop skills in presenting quantitative data using appropriate diagrams, tabulations and summaries
2. Gain fundamental knowledge of the probability concepts with respect to how they are applied to the fundamental interpretation of statistical data.
3. To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample.
4. To get exposed to the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
5. To understand the concept of Quality control and the use of operating characteristic (OC) curves in Acceptance sampling.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Plan a statistical data investigation in the biosciences and related fields, and propose a method for data collection and analysis. Apply

CO2. Apply probability rules and probability models to solve problems and translate real-world problems into probability models. Identify and recognize the appropriate sample survey design for related problems. Apply

CO3. Identify and perform statistical significance tests for small, large samples and interpret the test results appropriately. Analyze

CO4. Interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations. Analyze

CO5. Prepare Control charts and decide on the in-control status of the process. Estimate whether a lot is acceptable or unacceptable based on acceptance sampling plans. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOSTATISTICS: Statistics – Definition, Scope, Limitation – Collection of data – Primary & Secondary Data; Classification & Tabulation of data – Type of Classification & Tabulation – Diagrammatic and Graphical representation of data – Types and significance.


DESIGN OF EXPERIMENTS: Analysis of variance – One way and Two way classifications – Completely randomized design – Randomized block design.

STATISTICAL QUALITY CONTROL: Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Dr.P.Sasikala</td>
<td>Professor</td>
<td>VMKVEC</td>
<td><a href="mailto:sasikalap@vmkvec.edu.in">sasikalap@vmkvec.edu.in</a></td>
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<td>2</td>
<td>Dr.L.Tamilselvi</td>
<td>Professor</td>
<td>AVIT</td>
<td><a href="mailto:ltamilselvi@avit.ac.in">ltamilselvi@avit.ac.in</a></td>
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PREAMBLE
Smart Materials gives an outlook about various types of materials having potential application in Engineering and Technology. In particular, Students learn about Smart Materials and their applications, Properties of Crystalline Materials & Nanomaterials, Characteristics of Magnetic materials. They also get a clear picture about superconducting materials.

PREREQUISITE : NIL

COURSE OBJECTIVES
1. To explain the fundamental properties and classification of smart materials, crystalline materials, Nano materials, Magnetic materials and Super conducting materials.
2. To paraphrase the basic crystalline structure and its properties.
3. To illustrate the synthesis and fabrication of Nano materials.
4. To predict the application of smart materials, crystalline materials, Nano materials, Magnetic materials and Super conducting materials.
5. To analyze the various parameters of crystalline materials.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Restate the properties of various materials. Understand
CO2. Summarize the various structures of materials. Understand
CO3. Predict the applications of various materials to designing equipments. Apply
CO4. Illustrate the properties of materials to designing equipments. Apply
CO5. Calculate the crystalline parameters of the materials. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

SMART MATERIALS: Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and applications.

CRYSTALLINE MATERIALS: Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures.


SUPERCONDUCTING MATERIALS: Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High Tc Superconductors – Applications of superconductors.

TEXT BOOK:

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PREAMBLE
Bioorganic Chemistry explains the study of living cell chemistry in an organism. The Bioorganic study gives the knowledge of proximity effects in organic chemistry, molecular recognition and the supramolecular systems. It also deals analogy between organic reaction, energy transfer and biochemical transformations. It gives the basic knowledge of enzymes, peptides, proteins amides and metals and their roles. Acquiring the knowledge of concepts and principles will facilitate students to understand how they work in the research fields and show the way to the higher levels of various fields.

PREREQUISITE: NIL

COURSE OBJECTIVES
1. To acquire the knowledge of living cells chemistry.
2. To study the proximity effects in organic chemistry, molecular recognition and the supramolecular systems - concepts.
3. To know the importance of enzyme catalysis in the living cells.
4. To understand the various reactions of metal ions in proteins and biological molecules.
5. To apply the knowledge of enzymes designing in molecular cleft and steroid templates.

COURSE OUTCOMES
On the successful completion of the course, students will be able to:

CO1 Discuss about the chemistry of living cells
CO2 Describe the Proximity effects in organic chemistry, molecular recognition and the supramolecular systems - concepts
CO3 Generalize the importance of enzyme catalysis in the living cells.
CO4 Employ the various reactions of metal ions in proteins and biological molecules
CO5 Use the knowledge of designing in molecular cleft and enzymes

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

INTRODUCTION TO BIO-ORGANIC CHEMISTRY
Basic Considerations - Proximity effects in Organic chemistry - Molecular recognition and the supramolecular systems

BIO-ORGANIC CHEMISTRY OF AMINO ACIDS AND PEPTIDES
Chemistry of living cells, Analogy between organic reactions and Biochemical Transformations, Chemistry of the peptide bond, Asymmetric synthesis of amino acids - Retrosynthetic analysis, Transition state analogues.

ENZYME CHEMISTRY
Introduction to catalysis - Multifunctional, Acid - base and Covalent catalysis, Introduction to enzymes - Chymotrypsin, Pyruvate dehydrogenase, Ribonuclease, Lysozyme, Enzymes in synthetic organic chemistry, Design of molecular clefts.

ENZYME MODELS

METAL IONS IN BIOLOGICAL SYSTEMS
Metal ions in proteins and biological molecules: Carboxy peptidase and role of zinc, Hydrolysis of amino acid esters, amides and peptides, Iron and oxygen transport, Biomodels for photosynthesis and energy transfer.

**TEXT BOOK**

**REFERENCE BOOKS**

**COURSE DESIGNER**

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<td><a href="mailto:Srajkrishna85@gmail.com">Srajkrishna85@gmail.com</a></td>
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<td>Professor</td>
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PREAMBLE

Environmental science and Engineering is an interdisciplinary field that integrates physical, chemical, biological, information sciences and provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices. The course helps to create a concern for our environment that will generate pro-environmental action, including activities we can do in our daily life to protect it. Furthermore, it deals the social issues and ethics to develop quality engineer in our country.

PREREQUISITE : NIL

COURSE OBJECTIVES

1. Applying Science and Engineering knowledge to protect environment
2. To provide comprehensive insight in natural resources and protect natural resources
3. To create awareness on the various pollutions and their impact.
4. To educate the ways and means to manage natural calamities
5. To impart fundamental knowledge on human welfare measures

COURSE OUTCOMES

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

CO1: Comprehend the impact of engineering solutions in a global and societal context
CO2: Illustrate the contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO3: Illustrate the importance of ecosystem and biodiversity
CO4: Practice to improve the environment and sustainability
CO5: Conclude the importance of conservation of resources.
CO6: Estimate the important role of IT in healthy environment for future generations

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

ENVIRONMENT AND NATURAL RESOURCES

Environment - Definition, scope & importance - Public awareness- Forest resources, mineral resources , water resources, food resources , energy resources (uses, over -exploitation & adverse effects in each case) - Scope & role of environmental engineers in conservation of natural resources - Sustainability development

ECOSYSTEMS AND BIO – DIVERSITY

Ecosystem - Definition, structure and function - Energy flow -Ecological succession - food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest, grassland, desert and Aquatic ecosystems - Bio - Diversity :values and uses, hotspots, threats and conservation.

ENVIRONMENTAL POLLUTION

Pollution - Definition, man made impacts and control measures of air, water and land pollution - Water quality standards & characterization - Importance of sanitation -Nuclear hazards – Hazardous waste management : Solid waste, waste water and biomedical waste - Prevention of pollution and role of individual – Disasters management : Floods, earthquake, cyclone and land slides - Clean technology options

SOCIAL ISSUES AND ENVIRONMENT

Urban problems related to energy - Water conservation – Resettlement and rehabilitation of people - Environmental ethics - Climate change - Global warming - Acid rain - Ozone depletion-Waste land reclamation, Environment Protection Act for air, water, wild life and forests - Pollution Control Board.
HUMAN POPULATION AND ENVIRONMENT

TEXT BOOK
1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai

REFERENCE BOOKS
2. Bharucha Erach "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India

COURSE DESIGNER

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<td>4</td>
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<td><a href="mailto:sanghamitra.chemistry@avit.ac.in">sanghamitra.chemistry@avit.ac.in</a></td>
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**PREAMBLE**

Nanotechnology is the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science and engineering. Nanomaterials exhibit enhanced properties such as higher strength, lighter weight, and greater chemical reactivity than their larger-scale counterparts. The study about nanomaterials is extremely important for an engineer to understand its properties and design equipment.

**PREREQUISITE:** NIL

**COURSE OBJECTIVES**

1. To identify the properties and types of nanomaterials
2. To illustrate the preparation methods of nanomaterials
3. To illustrate about lithography techniques
4. To categorize about carbon nanotubes
5. To identify the various characterization techniques

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

- CO1. Describe the properties of nanomaterials
- CO2. Demonstrate the preparation methods of nanomaterials
- CO3. Interpret the properties of carbon nanotubes
- CO4. Utilize the lithographic techniques
- CO5. Categorize various characterization techniques

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION:** Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nanoparticles, quantum dots, nanowires- ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).
PREPARATION METHODS: Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

LITHOGRAPHY FOR NANOSCALE DEVICES: Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma/reactive ion) etching, Etch resists-dip pen lithography

CARBON NANO TUBE: Introduction to Carbon Nano Tube (CNT) - Types of carbon nano tube - Characteristics of carbon nano tube - synthesis of CNT- Properties of CNT- Application of CNT.


TEXT BOOKS

REFERENCES:

COURSE DESIGNERS

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PREAMBLE
In this laboratory, experiments are based on the calculation of physical parameters like Young’s modulus, rigidity modulus, viscosity of water, wavelength of spectral lines, thermal conductivity and band gap. Some of the experiments involve the determination of the dimension of objects like the size of a microparticle and thickness of a thin wire. In addition to the above real lab experiments, students gain hands-on experience in virtual laboratory.

PREREQUISITE: NIL

COURSE OBJECTIVES
1. To impart basic skills in taking reading with precision of physics experiments
2. To inculcate the habit of handling equipments appropriately
3. To gain the knowledge of practicing experiments through virtual laboratory.
4. To know the importance of units
5. To obtain results with accuracy

COURSE OUTCOMES
On the successful completion of the course, students will be able to

- CO6. Recognize the importance of units while performing the experiments, calculating the physical parameters and obtaining results
- CO7. Operate the equipments with precision
- CO8. Practice to handle the equipments in a systematic manner
- CO9. Demonstrate the experiments through virtual laboratory
- CO10. Calculate the result with accuracy

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | S   | S   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2 | S   | S   | M   | M   | S   |     | M   | M   | M   |      |      |      |      |      |
| CO3 | S   |     |     |     |     |     |     |     |     |      |      |      |      |      |
| CO4 | S   | S   | M   | M   | S   |     | S   | M   | M   |      |      |      |      |      |
| CO5 | S   | S   |     |     |     |     |     |     |     |      |      |      |      |      |

S- Strong; M-Medium; L-Low

SYLLABUS
1. Young’s modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser
6. Wavelength of spectral lines – grating – Spectrometer
7. Thickness of a wire - Air wedge Method
8. Thermal conductivity of a bad conductor - Lee’s disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer

LAB MANUAL
Physical Sciences Lab: Part A – Real And Virtual Lab In Physics Manual compiled by Department of Physics, Vinayaka Missions Research Foundation (Deemed to be University), Salem.

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<td>1</td>
<td>Dr. C. Senthil Kumar</td>
<td>PROFESSOR</td>
<td>PHYSICS</td>
<td><a href="mailto:senthilkumar@vmkvec.edu.in">senthilkumar@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Dr. R. Sethupathi</td>
<td>ASSOCIATE PROFESSOR</td>
<td>PHYSICS</td>
<td><a href="mailto:sethupathi@vmkvec.edu.in">sethupathi@vmkvec.edu.in</a></td>
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<tr>
<td>3</td>
<td>Dr. G. Suresh</td>
<td>ASSOCIATE PROFESSOR</td>
<td>PHYSICS</td>
<td><a href="mailto:suresh.physics@avit.ac.in">suresh.physics@avit.ac.in</a></td>
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<tr>
<td>4</td>
<td>Dr. B. Dhanalakshmi</td>
<td>ASSOCIATE PROFESSOR</td>
<td>PHYSICS</td>
<td><a href="mailto:dhanalakshmi.phy@avit.ac.in">dhanalakshmi.phy@avit.ac.in</a></td>
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</table>
**Preamble**
The main objective of this course is to develop the intellectual and psychomotor skills of the students by imparting knowledge in water technology and quantitative analysis.

**Prerequisite**
Not required

**Course Objectives**
1. To impart basic skills in Chemistry so that the student will understand the engineering concept.
2. To inculcate the knowledge of water and electrochemistry.
3. To lay foundation for practical applications of chemistry in engineering aspects.

**Course Outcomes**
After the successful completion of the course, learner will be able to

- **CO1.** Estimate the chemical properties of water  
  - **Apply**
- **CO2.** Determine the presence of various elements in the water  
  - **Analyze**
- **CO3.** Calculate the strength of acids, oxidizing and reducing agents  
  - **Analyze**

**Mapping with Programme Outcomes and Programme Specific Outcomes**

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S- Strong; M-Medium; L-Low

**SYLLABUS**
1. Determination of Hardness by EDTA method
2. Estimation of Hydrochloric acid by conductometric method
3. Acid Base titration by pH method
4. Estimation of Ferrous ion by Potentiometric method
5. Determination of Dissolved oxygen by Winkler’s method
6. Estimation of Sodium by Flame photometer
7. Estimation of Copper from Copper Ore Solution
8. Estimation of Iron by Spectrophotometer

**TEXT BOOKS**

**REFERENCE BOOKS**

**Course Designers:**

<table>
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<th>Designation</th>
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<tr>
<td>1.</td>
<td>Dr. V. Anbazhagan</td>
<td>Professor</td>
<td>Chemistry</td>
<td><a href="mailto:anbu80@gmail.com">anbu80@gmail.com</a></td>
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<tr>
<td>2.</td>
<td>Mr. A. Gilbert Sunderraj</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td><a href="mailto:asmgill80@gmail.com">asmgill80@gmail.com</a></td>
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<td>Dr. R. Nagalakshmi</td>
<td>Professor</td>
<td>Chemistry</td>
<td><a href="mailto:nagalakshmi.chemistry@avit.ac.in">nagalakshmi.chemistry@avit.ac.in</a></td>
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<tr>
<td>4.</td>
<td>Dr. K. Sanghamitra</td>
<td>Associate Professor</td>
<td>Chemistry</td>
<td><a href="mailto:sanghamitra.chemistry@avit.ac.in">sanghamitra.chemistry@avit.ac.in</a></td>
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PREAMBLE
The purpose of teaching Bioorganic Chemistry is a fundamental science and has contributed immensely to the improvement of the life of human beings by providing many of human requirements and essentialities. The developments in Bioorganic Chemistry during last few decades are phenomenal. It is also seen that these developments are crossing the traditional vertical boundaries of scientific disciplines; the more inclination is seen towards biological sciences. The practice of Bioorganic Chemistry at industrial scale also is undergoing radical changes and is more or more based on deep understanding the phenomena.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To Recognize the basics of stoichiometry
2. To Express the knowledge about measurements and units
3. To Demonstrate the students in preparation of bioorganic solutions and their material balance equations
4. To Organise the Students should be able to develop their skills in the inter-conversions of one bioorganic compound to desired products.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to
CO1. Describe about the basic bioorganic chemistry Understand & Apply
CO2. Illustrate the importance of measurements and units in bioorganic reaction procedures Apply
CO3. Estimate the basics steps involved in the synthesis of various bioorganic substances Analyze
CO4. Evaluate their understanding skills in the inter-conversions Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Synthesis of Aspirin
2. Hydrolysis of Sucrose
3. Preparation of Pyruvic acid from Tartaric acid.
4. Preparation of Oleic acid
5. Preparation of alpha D-glucopyranose pentaacetate
6. Preparation of Lycopene from Tomato paste
7. Preparation of L-Proline.
8. Preparation of 1,2,5,6 di-O-Cyclohexylidine-alpha-D-glucofuranose.
9. Preparation of s-ethyl hydroxybutonate from ethyl acetoacetate using Yeast.

REFERENCES:
1. Laboratory Manual.

COURSE DESIGNERS

<p>| S.No. | Name of the Faculty | Designation | Department | Mail ID |</p>
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<td>Dr. T. Shanthi</td>
<td>Professor &amp; Head</td>
<td>Chemistry</td>
<td><a href="mailto:shanthi@vmkvec.edu.in">shanthi@vmkvec.edu.in</a></td>
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**PREAMBLE**
Biotechnology is the Combination of biological sciences and engineering in order to understand and improve the lifestyle of living organisms. Bioprocesses and pathways, living microorganisms, plant and animal cells and/or cellular materials are exploited to develop new expertise. Advanced tools and technologies developed by biotechnologists are used in research and development, healthcare, agriculture, and the industry to further enhance organisms and bioprocesses. Fundamental principles of genetic engineering, rDNA technology helps to produce commercial manufacture of new recombinant DNA derived products.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**

1. To acquire knowledge on principles of biotechnology.
2. To study in detail about mechanism and applications of genetic engineering in the food and agricultural industry.
3. To understand importance of biotechnology to develop genetically modified animals its applications.
4. To analyze in details about performance of drugs developed using rDNA technology.
5. To apply the knowledge of biotechnology to enhance the environment.

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

- **CO1.** Knowledge about fundamental principles about biotechnology. Understand
- **CO2.** Acquired good knowledge on genetically modified products in food and agricultural field. Understand
- **CO3.** Understand in detail about the applications of genetically modified animals in research and development Understand
- **CO4.** Apply the knowledge of biotechnology to improve global environment. Apply
- **CO5.** Analyzing in detail about the performance of drugs produced by novel methods Analyze

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**FOOD BIOTECHNOLOGY**
Scope and importance of Food Biotechnology, Arctic Apples, Golden Rice, Flavr – Savr Tomato, Bt- potatoes, Virus resistant Squash, Fermented Food, Single Cell Protein – Spirulina.

**AGRICULTURAL BIOTECHNOLOGY**
Basics of plant tissue culture – callus induction, organogenesis, embryogenesis – embryo rescue, somatic
embryogenesis, somaclonal variation, artificial seeds, secondary metabolites and their uses, Protoplast technology – hybrids and Cybrids, Biofertilizer, Biological Pest Control.

ANIMAL BIOTECHNOLOGY
Transgenic animals – Knock out mice, chimeric mice, Baculoviruses and transgenic silkworm, Hybridoma Technique for Monoclonal antibodies, Pharmaceuticals from animal systems, Animal bioreactors to produce therapeutic proteins, Karyotyping, FISH – Fluorescent in situ hybridization.

MEDICINAL BIOTECHNOLOGY

ENVIRONMENTAL BIOTECHNOLOGY
Molecular approaches towards bioremediation, Biosensors for detection of environmental pollutants, Ecofriendly & sustainable Environmental Technologies, Renewable energy technologies.

TEXT BOOKS

REFERENCE BOOKS

COURSE DESIGNERS

<table>
<thead>
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<tr>
<td>1</td>
<td>Mr.N.Jawahar</td>
<td>Assistant Professor</td>
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<td><a href="mailto:jawahar@vmkvec.edu.in">jawahar@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.M.Sridevi</td>
<td>Professor &amp; Head</td>
<td>Biotechnology</td>
<td><a href="mailto:sridevi@vmkvec.edu.in">sridevi@vmkvec.edu.in</a></td>
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## ESSENTIALS OF COMPUTING

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### PREAMBLE
This course aims to provide the fundamental concepts of Computer operations like hardware and software installation, and emphasizing principles application packages. Studying the fundamentals concepts of Algorithms, to resolve the real world application.

### PREREQUISITE – Nil

### COURSE OBJECTIVES

1. To provide basic knowledge of hardware and software components of computers.
2. To introduce and demonstrate various software application packages.
3. To study Problem solving Techniques and program development cycle.
4. To learn about various algorithm and identifying the algorithm efficiency.
5. To learn different algorithm for various application.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

- **CO1.** To understand the Basic knowledge on hardware and software terminologies. **Understand**
- **CO2.** To Demonstrate the various Application Packages like MS-word, MS-Excel etc. **Apply**
- **CO3.** To Understand Program Development Cycle and apply various Problem Solving Techniques. **Apply**
- **CO4.** To analyze the efficiency of Algorithms. **Analyze**
- **CO5.** To Implement of Algorithms for various concepts. **Apply**

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

### SYLLABUS


TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>K.Karthik</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:karthik@avit.ac.in">karthik@avit.ac.in</a></td>
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<tr>
<td>2</td>
<td>Mrs.T.Geetha</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:geetha@vmkvec.edu.in">geetha@vmkvec.edu.in</a></td>
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17CSES85 PROGRAMMING IN C LAB

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PREAMBLE
This course is designed to complement the course Problem Solving using Computer. The purpose of this laboratory course is to give hands on training to the students in understanding and practicing the programming concepts and algorithms. This will improve the problem solving capability of the students.

PREREQUISITE NIL

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1 Write, compile, debug, link and execute C program for the given specification/application

CO2 Design and implement algorithms involving decision structures, loops, arrays and pointers.

CO3 Use different data structures for solving the given problem using computer

CO4 Create/update data files.

CO5 Analyze the implementation complexity of algorithm by modularizing the problem into small modules for the given problem

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS
1. Basic programs to understand different types of data, operators and expressions.
2. Programs using control structures
   i) Factorial of a number
   ii) Fibonacci series
   iii) Generating prime numbers
   iv) Generating Armstrong numbers
   v) Greatest common divisor
3. Programs using arrays
   i) Merging of arrays
   ii) Array order reversal
   iii) Selection sort
   iv) Bubble sort
   v) Insertion sort
4. Programs using strings
   i) Palindrome checking
   ii) String sorting
iii) Linear pattern search
iv) Text line editing

5. Programs using functions
6. Programs using pointers
7. Programs using structures
8. Programs using file structure

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17BMES01  BIOSENSORS & MEASUREMENT DEVICES

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PREAMBLE
This course is designed to acquire knowledge about the different components of biosensors, bio-amplifier, transducers and display units in biomedical equipment and its working principle and to measure various physiological parameters.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To understand the concepts of transducers and its classification.
2. To study the various types of transducers and classification of bio-sensors.
3. To know about bioelectric signals, electrodes and its types.
4. To know the various Bio potential amplifiers.
5. To study about various Physiological measurements.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Explain the acquisition of various bio signals using various types of Electrodes. Understand

CO2. Describe about the biosensors and transducers for measuring biosignal. Understand

CO3. Utilize the electrode and amplifier for measuring biosignal. Apply

CO4. Record and analyze various physiological signals. Analyze

CO5. Examine the bio amplifiers and their applications. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

TRANSUCERS AND BIOSENSORS
Temperature transducers, flow transducer, optical transducer, photoelectric transducers, pressure transducer, Biomedical applications. Introduction, biological elements – Enzymes, antibodies, nucleic acids, receptors. Immobilization of biological components.

ELECTRODES AND BIO AMPLIFIERS
Bio amplifier, Need for Bio amplifier, Basic operational amplifier circuits, differential amplifier, Instrumentation amplifier, Chopper amplifier, Isolation Amplifier.

**BIO SIGNALS RECORDING**

ECG – Anatomy and Electrical conducting system of heart, Genesis of ECG, Einthoven triangle, Lead system, Segments and intervals of ECG, Normal and abnormal ECG wave forms, ECG Machine, Recording set up of EMG and EEG. Heart sounds and PCG, ERG, EOG.

**CARDIAC FUNCTION MEASUREMENTS**

Blood pressure measurement – direct and indirect method, Respiration rate measurement, Measurement of heart rate and pulse rate, Plethysmography technique. Blood flow measurement – electromagnetic, ultrasonic. Cardiac output measurement – Indication dilution method and dye dilution method

**TEXT BOOKS:**


**REFERENCES:**


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<tr>
<td>2</td>
<td>Ms.R.Sandhiya</td>
<td>Assistant Professor (Gr-I)</td>
<td>BME</td>
<td><a href="mailto:sandhiya@avit.ac.in">sandhiya@avit.ac.in</a></td>
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<tr>
<td>3</td>
<td>Mr. R. Ezhilan</td>
<td>Assistant Professor</td>
<td>BME</td>
<td><a href="mailto:ezhilan@vmkvec.edu.in">ezhilan@vmkvec.edu.in</a></td>
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PREMABLE
To enable the students to develop knowledge of principles, design and applications of the Biomedical Instruments.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To know about bioelectric signals, electrodes and its types.
2. To know the various Biopotential recording methods.
3. To study about patient monitoring concept and various Physiological measurements methods.
4. To study the principle of operation blood flow meter, blood cells counter.
5. To study about bio chemical measurements and details the concept of biotelemetry and patient safety.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO6. Explain the different Bio signal or biopotential. Understand

CO7. Discuss the working principles of diagnostic and therapeutic equipments. Understand

CO8. Examine the various instruments like as ECG, EMG, EEG, X-ray machine. Apply

CO9. Illustrate medical instruments based on principles and application used in hospital. Analyze

CO10. Analyze and calibrate fundamental biomedical instrumentation used in hospital. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

BIOELECTRIC SIGNALS AND ELECTRODES

BIO AMPLIFIER AND BIOMEDICAL RECORDERS
Bioamplifier, Need for Bioamplifier, Differential amplifier, Instrumentation amplifier, Chopper amplifier, Isolation Amplifier, ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform.

PATIENT MONITORING SYSTEM AND NON ELECTRICAL PARAMETERS MEASUREMENTS
System concepts of patient monitoring system, Bedside patient monitoring system, central monitors, Blood pressure measurement, Measurement of temperature, Respiration rate measurement, cardiac output measurement, Measurement of pulse rate, Plethysmography technique.

**BLOOD FLOW METERS, BLOOD CELL COUNTERS**
Electromagnetic blood flow meter, ultrasonic blood flow meter, Laser Doppler blood flow meter, Types of blood cells, Methods of cell counting, coulter counters, automatic recognition and differential counting.

**BIO- CHEMICAL MEASUREMENTS AND BIOTELEMETRY AND PATIENT SAFETY**

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<td><a href="mailto:lakshmi@avit.ac.in">lakshmi@avit.ac.in</a></td>
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PREAMBLE
This course is designed to complement the course Problem Solving using Computer. The purpose of this laboratory course is to give hands on training to the students in understanding and practicing the programming concepts and algorithms. This will improve the problem solving capability of the students.

PREREQUISITE       NIL

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1 Write, compile, debug, link and execute C program for the given specification/application  Apply

CO2. Design and implement algorithms involving decision structures, loops, arrays and pointers.  Apply

CO3. Use different data structures for solving the given problem using computer  Apply

CO4. Create/update data files.  Apply

CO5. Analyze the implementation complexity of algorithm by modularizing the problem into small modules for the given problem  Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS
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PREAMBLE
The curriculum of biosensors and measuring devices lab is concerned to enable the students to know and operate the various biomedical instruments for measuring and diagnosing biological signals using basic components such as sensors, amplifiers, signal processing and display unit.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To design of amplifiers for biological signals.
2. To recording and analysis of bio signals.
3. To measurement of Ph, blood pressure.
4. To study and measurement of various transducers like temperature, pressure, optical and piezoelectric.
5. To measurement of galvanic skin resistance.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO11. Examine the operational amplifier for inverting and non-inverting mode.  
Apply

CO12. Categorize Filters for bio signals.  
Analyze

CO13. Record and analyze EEG, ECG, EMG signals.  
Analyze

CO14. Test the PH value of a given solution.  
Evaluate

CO15. Measure temperature, pressure, optical and piezoelectric using different sensors.  
Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
List of Experiments
2. Characteristics of pressure and optical transducers.
3. Characteristics of strain gauge.
5. Design of instrumentation amplifier.
7. Galvanic Skin resistance measurement.
8. Recording of ECG using ECG simulator.
9. Recording of EEG using EEG simulator.
10. Recording of EMG using EMG simulator.
### COURSE DESIGNERS

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<td>1</td>
<td>Mrs. S. Vaishnodevi</td>
<td>Assistant Professor</td>
<td>BME</td>
<td><a href="mailto:vaishnodevi@vmkvec.edu.in">vaishnodevi@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Ms. R. Sandhiya</td>
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</tr>
<tr>
<td>3</td>
<td>Mr. R. Ezhilan</td>
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<td><a href="mailto:ezhilan@vmkvec.edu.in">ezhilan@vmkvec.edu.in</a></td>
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PREAMBLE
To provide hands on training on measurement of physiological parameters, biochemical parameters measurement and biosignal analysis.

PREREQUISITE – NIL

COURSE OBJECTIVES

1. To study the application of optical isolation amplifier.
2. To recording and diagnosis using bio signals.
3. To understanding working principle of biotelemetry.
4. To study of galvanic skin resistance.
5. To study the human auditory response using audiometer.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Explain about the pH and conductivity.
CO2. Record and analyze EOG, ECG, EMG signals
CO3. Measure the bio signals using biotelemetry
CO4. Operate diathermy for cutting and coagulation
CO5. Calculate the human auditory response using audiometer

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
List of Experiments
1. Design and analysis of biological pre amplifiers.
3. Recording of ECG signal and analysis
4. Recording of EMG-Signal
5. Recording of EEG-Signal
6. Recording of various physiological parameters using patient monitoring system and telemetry units.
8. Study of ESU – cutting and coagulation modes
9. Study of characteristics of optical Isolation amplifier
10. Galvanic skin resistance (GSR) measurement

TEXT BOOKS:
Department Lab Manual
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<tr>
<td>2</td>
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<td><a href="mailto:babu@vmkvec.edu.in">babu@vmkvec.edu.in</a></td>
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<tr>
<td>3</td>
<td>Mrs. R.Indumathi</td>
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<td>BME</td>
<td><a href="mailto:indhumr@avit.ac.in">indhumr@avit.ac.in</a></td>
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PREAMBLE
Essentials of biochemistry deals with the study of biomolecules found in living organism. The course exposes the students to classification, properties, basic structure and functions of biomolecules like carbohydrate, amino acid, lipids, nucleic acid and vitamins. Knowledge of this course will enable students to understand the importance of biomolecules and give awareness to the various diseases associated with the deficiency of biomolecules.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To understand the basic structure and properties of carbohydrate, lipids, amino acids and nucleic acids
2. To emphasize the functional importance and role of biomolecules in living organisms
3. To illustrate the nutritional importance of Minerals.
4. To illustrate the nutritional importance of Vitamins and its deficiency diseases.

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1. Recall the classification, properties and structure of carbohydrates, lipids, amino acids and protein
   Remember
CO2. Discuss the biological importance of biomolecules and its nutritional value.
   Understand
CO3. Identify about the structures of amino acids, proteins and Nucleic acids.
   Understand
CO4. Correlate the vitamins and its deficiency diseases
   Apply
CO5. Illustrate the minerals and its deficiency diseases
   Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
CARBOHYDRATE
Biological importance, Classification and Properties of Monosaccharides, Disaccharides and Polysaccharides (Starch, Glycogen, Cellulose and their derivatives, Chitin, Peptidoglycans, Glycoaminoglycans, Glycoconjugates).

LIPIDS
Biological importance, Classification. Fattyacids: classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, Triacylglycerols: nomenclature, physical properties, chemical properties. Glycerophospholipids (lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, sphingomyelins).

AMINO ACIDS AND PROTEINS
Amino acids – Classification, Structure, Properties and Biological importance. Proteins – Classification, Structural organization of Proteins – Primary, Secondary (α-helix, β-pleated structure, triple helix), Tertiary and Quaternary (Myoglobin and Hemoglobin), Factors stabilizing, Properties and Biological importance, Denaturation and Renaturation.

NUCLEIC ACIDS
Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA, Physico-chemical properties of nucleic acids – effect of alkali, acid and heat (denaturation and renaturation), features of phosphodiester
bond, endonucleases. Complementary base pairing, secondary structure of RNA, features of DNA double helix (Watson-Crick model), Nucleoproteins – histone and nonhistone

VITAMINS

TEXT BOOKS

REFERENCES:

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>Dr.M.Sridevi</td>
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<td>Biotechnology</td>
<td>sridevi@ vmkvec.edu.in</td>
</tr>
<tr>
<td>2</td>
<td>Dr.B.Prabasheela</td>
<td>Associate Professor</td>
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<td><a href="mailto:prabasheela@avit.ac.in">prabasheela@avit.ac.in</a></td>
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</table>
PREAMBLE
Cell biology deals with the structures, organization and functions of the cells and organelles, their physiological properties, life cycle, metabolic processes, signalling pathways and their interactions with their environment at microscopic and molecular level. The subject helps to gain knowledge in fundamentals of cells to all biological sciences, for research in bio-medical fields such as cancer, and other diseases and also in research related to genetics, biochemistry, molecular biology, immunology, and developmental biology.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will understand how these cellular components are used to generate and utilize energy in cells and the concepts behind cell division.
3. To give an overview of cell signaling molecules and their receptors.
4. To outline the pathways and intracellular signal transduction.
5. To make students to apply their knowledge of cell biology to selected examples of changes or losses in cell function.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

- CO1. Differentiate fundamental features of prokaryotic and eukaryotic cells, their structure, composition and role of cell membranes and the major stages of the cell cycle
  Understand
- CO2. To infer the specific processes and proteins involved in membrane transport
  Understand
- CO3. To illustrate about intercellular chemical messengers, receptor subclasses and their possible uses in cell signalling.
  Apply
- CO4. To examine the mechanisms by which different messenger-receptor interactions bring about long or short-term changes in cell state.
  Analyze
- CO5. To analyze and characterize the cell, cell line and culture techniques
  Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

CELL AND FUNCTIONS OF THE ORGANELLES

CELL MEMBRANE AND PERMEABILITY
Passive and active transport, Permeases, Sodium potassium pump, Ca2+, AT Pase pumps, Lysosomal and vacuolar membrane, Co-transport, Uniport, Symport, Antiport, Protein localization & Membrane trafficking, Endocytosis and exocytosis, Entry of viruses and toxins into cells.

CELL SIGNALING MOLECULES AND THEIR RECEPTORS
Cytosolic, Nuclear and membrane bound receptors, Examples of receptors, Modes of cell – cell signaling: Autocrine, Paracrine and Endocrine models of action, Secondary messenger’s molecules, Quantitation and characterization of receptors.

PATHWAYS AND INTRACELLULAR SIGNAL TRANSDUCTION
Signal amplification – Different models of signal amplifications, Cyclic AMP, Role of inositol phosphates as messengers, Biosynthesis of inositol triphosphates, Cyclic GMP and G proteins role in signal transduction, Calcium ion flux and its role in cell Signaling, Current models of signal amplification, Phosphorylation of protein kinases.

CELL CULTURE
Techniques for the propagation of prokaryotic and eukaryotic cells, Cell line, Generation of cell lines, Maintenance of stock cells, Characterization of cell, Morphological analysis techniques in cell culture, Explant cultures, Primary cultures, Contamination, Differentiation.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<tr>
<td>1</td>
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<td>Assistant Professor</td>
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<tr>
<td>2</td>
<td>Dr.R.Subbaiya</td>
<td>Associate Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:subbaiya@avit.ac.in">subbaiya@avit.ac.in</a></td>
</tr>
</tbody>
</table>
### PREAMBLE
Microbiology deals with the study of microbes. It will cover a wide spectrum of classification, cellular organization and characteristics of microscopic organisms, diseases caused and beneficial effects, environmental damage or stress. Microbiologists often use cutting-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms. Knowledge of these principles will enable students to understand how they react under different conditions and how they cause different diseases and their control.

### PREREQUISITE - NIL

### COURSE OBJECTIVES

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<td>To Explain the Structure and replication in microorganisms – concepts.</td>
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<td>To interpret the effects of Microbes in food and the clinical importance of microorganisms.</td>
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<td>To explain about the various Control measures and assessing the environmental impacts.</td>
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<td>To outline the requirements of Microbial nutrition for growth of microorganisms and the impact of environment on its growth.</td>
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### COURSE OUTCOMES

After the successful completion of the course, learner will be able to

| CO1 | Explain about historical perspective of microbiology and its developments |
| CO2 | Describe the fundamental structure, functions of a cell and the control of microbes using physical and chemical methods |
| CO3 | Demonstrate the microbial nutritional requirements for growth |
| CO4 | Demonstrate the microorganism have an indispensable role in the environment |
| CO5 | Categorize the role of microorganisms in environmental applications |

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

### SYLLABUS

**WORLD OF MICROORGANISMS AND MICROSCOPY**

- Historical review of the foundation of microbiology,
- Characteristics of microorganisms,
- Taxonomy methods of studying microorganisms,
- Microscopy - Light, Electron, Micrometry.

**STRUCTURAL ORGANISATION OF MICROORGANISMS**

- General structural and cellular organization of Bacteria, virus, fungi, algae and protozoa.

**MICROBIAL GROWTH AND NUTRITION**

- Nutritional requirements, Growth of microorganisms,
- Aerobic and anaerobic growth,
- Different methods of microbial enumeration,
- Methods of preservation of microbes.
- Effects of physical, chemical and environmental factors on microbial growth.

**FOOD AND CLINICAL MICROBIOLOGY**

- Food spoilage and poisoning,
- Clinically important microorganisms and their effects on infections,
- Formation of toxic materials by microorganisms and their role in clinical microbiology.

**CONTROL OF MICROORGANISMS AND ITS ENVIRONMENTAL APPLICATIONS**
Pollution control through use of microorganisms, Recycling of biomaterials, Production of biogas, Leaching of ores by microorganisms, Microbial indicators, Biofouling.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<tr>
<td>1</td>
<td>Mrs.G.Arthi</td>
<td>Assistant Professor</td>
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PREAMBLE
Genetics is a field of biology that deals with the study of genes, genetic variation, and heredity in living organisms that intersects with many other life sciences and information systems. Genetics is concerned with the problem of how the hereditary information in DNA controls, what an organism looks like and how it works. Classically this involved the use of genetic variants to upset the biological function of the cells or organisms and from the effect of these mutations, to make deductions about the way cells and organisms worked.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To define the basic principles of inheritance at the molecular, cellular and organismal levels.
2. To explain on how genes, work together in biological processes.
3. To discuss about the causal relationships between molecule/cell level phenomena (“modern” genetics) and organism-level patterns of heredity (“classical” genetics).
4. To correlate the concepts of linkage and crossing over and Genetic mapping of chromosomes.
5. To make the students to test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Recall the development of genetic concepts, the differences between transmission genetics, molecular genetics and classical genetics
   Remember

CO2. Explain the genetic data to determine the modes of inheritance, linkage and predict outcomes in future generations
   Understand

CO3. Illustrate the various theories of how new species form and the molecular role of inheritance.
   Apply

CO4. Determine the factors that play a role in the process of disease development and understand the genetic basis of evolutionary change.
   Apply

CO5. Explain about various genetic transfer methods
   Apply

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S- Strong; M-Medium; L-Low

SYLLABUS
BASICS OF GENETICS & GENES
Classical genetics, Mendelian laws, Mendel’s experiment monohybrid and dihybrid inheritance, Fine structure of genes, Gene as the unit of expression, Control sequences - promoter, operator, terminator and attenuator.

KARYOLOGY
Chromosome structure and organization in prokaryotes and eukaryotes, Extra chromosomes and their inheritance, Biology of plasmids, Giant chromosomes – Polytene and Lamp brush chromosome.

ALLELES
Classical concept of allelomorphs, Multiple alleles, Sex linkage in Drosophila, Sex determination in Human beings, Sex linkage in Human beings, Colour blindness, Haemophilia, Blood group antigens.

**LINKAGE AND CROSSING OVER**
Coupling and repulsion – Hypothesis, Test cross in maize and Crossing over, Sex chromosomes, Sex linked inherited disorders, Linkage, Crossing over and Genetic mapping of chromosomes.

**MICROBIAL GENETIC TRANSFER**
Identification of the genetic material – Classical experiments, Hershey Chase, Avery McLeod etc., Conjugation, Transduction and Transformation, Transposons- mechanism.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<td>Mrs.C.Nirmala</td>
<td>Assistant Professor</td>
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<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Dr.R.Subbaiya</td>
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<td><a href="mailto:subbaiya@avit.ac.in">subbaiya@avit.ac.in</a></td>
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</table>
PREAMBLE
In the Engineering related fields, a unit operation is a basic step in a process. Unit operations involve a physical change (or) a chemical transformation such as separation, crystallization, evaporation, filtration, polymerization, isomerization, and other reactions. For example, in milk processing, homogenization, pasteurization, and packaging are each unit operations which are connected to create the overall process. A process may require many unit operations to obtain the desired product from the starting materials, or feedstocks. Knowledge of various unit operation principles will enable students to understand to work in any biotechnology industries.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To describe the knowledge about the various modes of heat transfer.
2. To explain about the radiation, black bodies and its application
3. To outline about the heat exchanger and its operation
4. To discuss about the fluids, types and its measurement.
5. To evaluate the drying and other mechanical separation processes and its role in industries

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Describe about basic concepts of various modes of heat transfer, radiation, convection and black bodies and its application. Understand

CO2. Practice the usage of heat exchanger, evaporators and its application Apply

CO3. Demonstrate the fluid flow and its measurement. Apply

CO4. Categorize about drying, mechanical separation techniques and its applications Analyze

CO5. Evaluate various unit operations and heat transfer equipment in chemical and biochemical industries. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
CONDUCTION

CONVECTION AND RADIATION
Convection – Dimensional Analysis – Forced Convection and Natural convection – Boiling and condensation, Concept of Radiation, Laws of Radiation, Grey & Black Bodies

HEAT EXCHANGER

FLUID MECHANICS
Introduction – Nature of Fluids, Properties of Fluids, Types of Fluids, Fluid Statics, Pressure measurement, Measurement of Fluid flow – Venturi meter, orifice meter, rotometer, Fluidization – Mechanism, types and its applications

**DRYING AND MECHANICAL SEPARATION**

Drying – Air properties – Drying Equipment – Drying Rates and Drying time.

**TEXT BOOKS:**


**REFERENCES:**


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<tr>
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<td><a href="mailto:karthigadevi@avit.ac.in">karthigadevi@avit.ac.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE
Advanced Biochemistry uses the knowledge and understanding gained in the prerequisite course and provides understanding of metabolism of macromolecules like carbohydrate, amino acid, lipids and nucleic acid. This course also highlights the process of Biological oxidation involved in the energy production by burning the food materials and give awareness to the various diseases associated with the errors of metabolism of the biomolecules.

PREREQUISITE
17BTCC01- ESSENTIALS OF BIOCHEMISTRY

COURSE OBJECTIVES
1. To Discuss the metabolic pathways of major bio-molecules
2. To Describe the starting, intermediate and ending molecule, enzymes and cofactors in the pathways
3. To Differentiate biochemical basis of various disease processes
4. To Outline the process of Biological oxidation involved in the energy production by burning the food materials

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Explain the metabolic pathways of carbohydrates, amino acids, nucleic acids and lipids

CO2. Describe the causes of metabolic disorder

CO3. Examine the importance of molecules derived from amino acids

CO4. Illustrate the Integration of energy metabolism of macromolecules

CO5. Infer the bioenergetics and oxidative phosphorylation concepts

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
CARBOHYDRATE METABOLISM
Introduction to Metabolism- Glycolysis- Citric acid cycle-Gluconeogenesis- Glycogen Metabolism-Glycogenesis-Glycogenolysis- HMP Shunt. Carbohydrate disorder - Glycogen storage diseases, Diabetes mellitus.

AMINO ACID METABOLISM

FATTY ACID METABOLISM
Introduction-Fatty acid oxidation-Ketone bodies &Ketogenesis-Biosynthesis of Fatty acids- Cholesterol Biosynthesis-Lipoproteins- Metabolism of glycolipids- Lipid disorder - Niemann Pick disease, Gaucher’s disease, Fabrys disease, Tay-sach’s disease.

NUCLEIC ACID METABOLISM
Nucleic acids: Biosynthesis of nucleotides, denovo and salvage pathways for purines and its regulation, Biosynthesis of pyrimidines & its regulatory mechanisms. Degradation of nucleic acid by exo and endo nucleases. Nucleic acid disorder - Xanthinuria, Oroticacidiuria, Leach-Nyhan syndrome, Nucleoside Phosphorylase deficiency.

INTEGRATION OF METABOLISM & OXIDATIVE PHOSPHORYLATION
Integration of major Metabolic pathways of energy metabolism, Organ specialization and metabolic integration, metabolism in starvation.
Introduction-Bioenergetics, High energy compounds, Biological Oxidation-Electron transport chain, Oxidative phosphorylation, Chemiosmotic theory-inhibitors of ETC & Oxidative phosphorylation, Shuttle pathway – Glycerol phosphate Shuttle, Malate aspartate Shuttle.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td>1</td>
<td>Dr.M.Sridevi</td>
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<tr>
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PREAMBLE
Enzyme Engineering is the process of designing and modifying enzymes structures by altering amino acid sequences using recombinant DNA technology. Knowledge of structure and functions of proteins gained from advanced biochemistry can be applied here to design and modify structure of enzymes to perform different useful roles including enhanced catalytic activity, drug discovery and diagnostic applications.

PREREQUISITE -NIl

COURSE OBJECTIVES

1 To Describe about the different classes of enzymes and their characteristics.
2 To Illustrate in detail about mechanism and kinetics of enzyme activity.
3 To Generalize about enzyme inhibition and enzyme immobilization and its applications.
4 To correlate in details about performance of immobilized enzymes in different types of bioreactors and their own design restrictions.
5 To examine the knowledge of enzymes to enhance bioreactions and to design sensors for diagnostic applications.

COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Classify about classification of enzymes and their characteristics. Understand

CO2. Exemplify fundamental knowledge about enzyme kinetics and mechanism of enzyme activity. Understand

CO3. Demonstrate the effect of enzyme inhibition and enzyme immobilization. Apply

CO4. Utilize the enzyme kinetics to design biosensors. Apply

CO5. Categorize in detail about consequences of immobilized enzymes and its effect in bioreactors. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION, PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES
Classification of enzymes, Production and purification of crude enzyme extracts from plants, Animals and microbial sources – Case studies (Isolation and purification of lipase and protease from microbial sources), Methods of characterization of enzymes, Overview of enzymatic assays.

MECHANISMS AND KINETICS OF ENZYME ACTION
Mechanisms of enzyme action, Concept of active site and energetics of enzyme substrate complex formation, Specificity of enzyme action, Kinetics of single substrate reactions –Michaelis – Menton kinetics, Determination of Km, Lineweaver – Burk plot, Eadie – Hofsteet plot, Hanes – Woolf’ plot, Multi substrate reaction mechanisms (Ping – Pong, Bi – Bi and Random Bi – Bi), Monod Changeux Wyman model.

INHIBITION OF ENZYME ACTIVITY AND ENZYME IMMOBILIZATION
Covalent binding etc., Advantages and disadvantages of different immobilization techniques, Application of immobilized enzyme systems.

**IMMOBILIZED ENZYME REACTORS AND DIFFUSIONAL LIMITATIONS**

Immobilized enzyme reactors – Packed bed, Fluidized bed, Membrane reactors, Air - lift bioreactors and CSTRs suited for immobilized enzymes. Diffusion effects in surface – bound enzymes on non-porous support materials, Diffusion effects in enzyme immobilized in a porous material.

**APPLICATIONS OF ENZYMES**

Applications of enzyme in disease diagnosis, Food industry, Pharmaceutical industry and Paper industry. Enzyme electrodes as biosensors – Calorimetric, Optical and Potentiometric biosensors, Applications of biosensors.

**TEXT BOOKS:**


**REFERENCES:**

5. Wiseman, A. Topics in Enzyme and Fermentation Biotechnology. Vol.5 Ellis and Harwood, UK.

**COURSE DESIGNERS**

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<tr>
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</table>
PREAMBLE
Bioinstrumentation course includes the principle, instrumentation and applications of the analytical instruments applied in various fields in biotechnology industry. Students also gain knowledge about the methods to analyze Biomolecules. The course acts as a link between academics and industry.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To discuss about various instruments used in biotechnology.
2. To describe in detail about the Molecular spectroscopy
3. To summarize about different separation and purification techniques used in DNA and protein purification.
4. To distinguish the protein structure using thermal an X-ray based methods.
5. To perform various immunological techniques to identify biomolecules and to analyze different bioprocess techniques

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Outline the basic principles and instruments in biotechnology. Understand
CO2. Explain about spectroscopy and its principles along with instrumentation. Understand
CO3. Demonstrate separation and purification techniques in biotechnology. Apply
CO4. Identify the biomolecular structure by thermal and X-ray based analysis. Apply
CO5. Analyze biomolecules by immunological techniques Analyze

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S- Strong; M-Medium; L-Low

SYLLABUS
BASICS OF BIOINSTRUMENTION
Classification and calibration of instrumental methods, Principles and Instrumentation of pH meter & Electronic balance, Gel documentation system, Turbidimetric and Nephelometric titrations.

SPECTROSCOPY
General design and components of spectroscopy, Principles, Instrumentation and applications of colorimetry, UV – Visible – IR- Raman spectroscopy –NMR spectroscopy, Auger electron and Atomic absorption spectroscopy (AAS)

SEPARATION AND PURIFICATION TECHNIQUES
Principles and Instrumentation of centrifugation, Paper and column chromatography, Ion exchange, Size exclusion, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC), Gas chromatography, Electrophoresis of Nucleic acid and protein.

THERMAL AND X-RAY

IMMUNOTECHNIQUES AND ANALYSIS OF BIOPROCESS
Radio Immuno Assay (RIA), Enzyme Linked Immunosorbent Assay (ELISA), Immunoblotting, Measurement of BOD and COD in waste waters, Gas analysis for O2 and CO2, Flow injection analysis.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<td>2</td>
<td>Mrs. C. Nirmala</td>
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<td>Biotechnology</td>
<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
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</table>
MOLECULAR BIOLOGY

PREAMBLE
Molecular Biology gives in-depth knowledge of basic principles and Structure of DNA, RNA, DNA Replication, Transcription, Translation, Gene regulation and Mutation and repair mechanism. Students will gain an understanding of chemical and molecular processes that occur in cell and between cells and also capable to explain mechanism which occur in the living organisms. The paper starts with the basic organization of the genome in prokaryotes and eukaryotes along with their discerning features. This is followed by chapters on prokaryotic and eukaryotic replication, transcription, translation processes, gene regulation and mutation.

PREREQUISITE
17BTCC04 - CLASSICAL AND MOLECULAR GENETICS

COURSE OBJECTIVES
1. To describe on Nucleic acids, structure, their characteristics and organization, biological importance, replication process etc.,
2. To discuss about the process of Transcription, mechanism, types of RNA and inhibitors involved in this process.
3. To interpret the relation of genetic code and translation mechanism, post translation modification, translation inhibitors.
4. To outline the mechanism of Gene regulation in prokaryotes and eukaryotes
5. To categorize the mutations, its types and repair mechanism.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Describe the basic concepts and principles of nucleic acids in prokaryotic and eukaryotic organisms. Discuss and distinguish the replication of prokaryotic and eukaryotic DNA
Understand

CO2. Explain the synthesis of RNA and post-transcriptional modifications
Understand

CO3. Interpret the genetic code and protein synthesis mechanism
Apply

CO4. Develop understanding about the molecular mechanisms behind different modes of gene regulation in bacteria and eukaryotes
Analyze

CO5. Examine about Mutations, DNA damage and repair mechanisms
Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
NUCLEIC ACIDS AND DNA REPLICATION

TRANSCRIPTION
Structure and function of mRNA, rRNA and t RNA, Exon, Intron, Transcription in prokaryotes and eukaryotes, Inhibitors, Post transcriptional modifications, Reverse transcription.

TRANSLATION
Genetic code and its features, Wobble hypothesis and its importance, Collinearity of gene and polypeptide, Translation mechanism, Post translational modifications, Protein folding.

REGULATION OF GENE EXPRESSION

MUTAGENESIS AND REPAIR
Mutagens, DNA Mutations and their mechanism, various types of DNA repair mechanism.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<tr>
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<td>Dr.R.Devika</td>
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<td>Biotechnology</td>
<td><a href="mailto:devika@avit.ac.in">devika@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.C.Nirmala</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
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PREAMBLE
The course introduces the basic principles and calculation techniques in the field of chemical engineering. It provides a concrete understanding of fundamentals and applications of material balances and energy balances which help students to understand the concepts of thermodynamics and fluid mechanics. It also provides a basis for non-chemical engineers to realize the chemical engineering aspects of subsequent modules.

PREREQUISITE
17BTCC05- UNIT OPERATIONS IN PROCESS INDUSTRIES

COURSE OBJECTIVES

1. To express words into diagrams and mathematical expressions.
2. To describe problem-solving skills, specifically the ability to think quantitatively by including numbers and units.
3. To interpret vague and ambiguous language in problem statements.
4. To implement judicious use of approximations and reasonable assumptions to simplify problems.
5. To compare principles of operation and design for a range of items of plant.

COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Demonstrate the engineering principles for problem solving in process industries, fundamental concepts of stoichiometry and laws of conservation of mass and energy. Understand

CO2. Interpreting the problems in material and energy balances related to chemical and bioreactors Understand

CO3. An ability to employ knowledge to spot and create simple engineering troubles linked to material balance, energy balance, thermodynamics and energy transformation Apply

CO4. Practice material balances on unit operations and processes in various industries and to evaluate humidity with/without the use of psychrometric chart. Apply

CO5. Formulating and optimizing various parameters with respect to the industrial processes. Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF STOICHIOMETRY
Introduction, Units and dimensions, conversion factors, Stoichiometric principles, Composition relation - Atomic, Molecular, Equivalent weights, Molar concepts - Moles, Mole fraction, Mass fraction, Mixtures and solutions - Molarity, Molality and Normality. Density and specific gravity. Conversion factors, Ideal Gas law, Gaseous mixtures- Dalton's law of additive volumes, Dimensional analysis.

MATERIAL BALANCES
Material balances without chemical reactions - Overall and component balances; Material balances with chemical reactions - Limiting reactant, Excess reactant; Unit operations- Distillation, Evaporation, Drying, crystallization; Recycling and bypass; Material balance of unsteady state operations; Problems in industrial applications.

VAPOUR PRESSURE, HUMIDITY AND SOLUBILITY
Vapour pressure - Effect of temperature; Vapourization; Humidity and saturation; Condensation, Solubility, Dissolution

ENERGY BALANCE
Thermochemistry - Calculation of heat of reaction at other temperatures - Hess's law of summation, heat capacity, heat capacities of gases at constant pressure, heat capacities of gas mixture, heat capacities of liquid mixture, Latent heat - Heat of formation, Reaction, Mixing, Theoretical flame temperature.

**FLUID MECHANICS**
Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<td><a href="mailto:karthigadevi@avit.ac.in">karthigadevi@avit.ac.in</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mrs.G.Arthi</td>
<td>Assistant Professor</td>
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<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
The course is customized to provide a perceptive of the basic concepts, techniques and methods underlying plant and animal biotechnology. The learners will gain understanding of theoretical principles enabling them to employ the knowledge to solve problems related to plant protection and disease diagnosis through biotechnological approaches.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. Summarize about different types of cell culture methods
2. To develop an understanding on patenting genetically engineered animals and ethical issues
3. Describe about the genetic transformation in plants by the aid of different vector systems.
4. Outline cell culture technique, significance of its cultivation and its application in the disease diagnosis and protection

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Explain the basics of tissue culture

CO2. Demonstrate the techniques for development of Hybrids, screening and selection procedure. Apply the techniques in production of Cybrids.

CO3. Appraise the plant tissue culture and genetic manipulation of plants

CO4. Categorize about the different animal tissue culture and Molecular biological technique for rapid diagnosis of genetic disease.

CO5. Inspect the animal gene transfer techniques and their ethical issues

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

BASICS OF TISSUE CULTURE
Tissue culture media – Composition and preparation, aseptic techniques, Organogenesis, Somatic embryogenesis, Shoot-tip culture, Embryo culture and embryo rescue, totipotency.

SOMATIC HYBRIDIZATION AND TRANSFORMATION TECHNIQUES
Protoplast isolation, Culture and fusion, hybrids and Cybrids, Plant vectors, basic features of vectors, Direct gene transfer methods, Agrobacterium mediated gene transfer, applications.

TRANSGENIC PLANTS AND MOLECULAR MARKERS
Herbicide resistance-use of herbicide in modern agriculture, pest resistance-nature, insect resistant crops-Bt approach to insect resistance and food safety. Molecular markers.

TRANSGENIC ANIMALS AND DISEASE DIAGNOSIS
Basic techniques of animal cell culture and their application, Gene cloning techniques for mammalian cells, Transgenic animals, In-vitro fertilization and embryo transfer, Molecular biological technique for rapid diagnosis of genetic disease and gene therapy.

TRANSFECTION METHODS, PATENT AND ETHICAL ISSUES
Gene transfer methods in animals, Xenotransplantation, Manipulation of Growth hormone, thyroid hormone, patenting genetically engineered animals - Ethical issues

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td>Professor and Head</td>
<td>Biotechnology</td>
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<tr>
<td>2</td>
<td>Dr.A.Nirmala</td>
<td>Assistant Professor yse(Gr-II)</td>
<td>Biotechnology</td>
<td><a href="mailto:nirmalabt@avit.ac.in">nirmalabt@avit.ac.in</a></td>
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PREAMBLE
Genetic engineering has developed genetic recombination techniques to manipulate gene sequences in plants, animals and other organisms to express specific traits. Applications of genetic engineering are increasing as engineers and scientists work together to identify the locations and functions of specific genes in the DNA sequence of various organisms. Once each gene is classified, engineers develop ways to alter them to create organisms that provide benefits such as cows that produce larger volumes of meat, fuel- and plastics-generating bacteria, and pest-resistant crops.

PREREQUISITE
17BTCC09-MOLECULAR BIOLOGY

COURSE OBJECTIVES
1. To understand the principle of nucleic acid isolation, PCR and their uses in genetic engineering, nucleic acid hybridization
2. The students after completing this course would be aware of how to clone commercially important genes
3. The students would be aware of Analysis of Gene expression
4. To discuss the gene cloning methods and the tools and techniques involved in gene cloning
5. To explain the heterologous expression of cloned genes in different hosts, production of recombinant proteins and its applications

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Choose the various recombinant DNA techniques and their applications. Understand
CO2. Identify the problems they could encounter and how to troubleshoot and learn various types of host-vector systems and steps in creating a recombinant DNA molecule Apply
CO3. Inspect both in-vitro and in-vivo activity of gene expression Analyze
CO4. Utilize the functioning of Recombinant DNA molecules, their constructions, analysis and fine tuning. Apply
CO5. Explain the rDNA Techniques in production of commercially important recombinant proteins. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

BASIC TOOLS IN GENETIC ENGINEERING
Role of genes and core techniques in gene manipulations; Restriction enzymes - Cutting and joining of DNA; Gene specific and degenerate primer design - DNA amplification using PCR, Types of PCR - RAPD, RT-PCR and applications of PCR; DNA sequencing - Maxam and Gilbert method and Sanger and Coulson enzymatic chain termination method; DNA labelling Methods; Nucleic acid hybridization techniques – Southern, Northern and Western.

CLONING AND EXPRESSION VECTORS
Vectors; Plasmid biology, Plasmids as vectors – pBR 322, Derivatives of pBR 322, pUC vectors, Lambda vectors, In vitro packaging, M13 vectors, Cosmids, Phasmids, Retroviral vectors, Baculovirus vectors, Cloning vectors in Gram positive bacteria (pJ1J01), Cloning vectors in Gram negative bacterium (Col E1, R1, pT181, pSC 101), Expression vectors – Prokaryotic expression vectors (E. coli, Streptomyces) and Eukaryotic expression vectors.

GENE LIBRARIES AND GENE MAPPING

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Construction and screening of Genomic DNA and cDNA Library; Analysis of gene expression; Chromosome walking, Chromosome jumping; DNA probes; Molecular markers - Variable Nucleotide Tandem Repeats (VNTR’s), Short Tandem Repeats (STR); Mini and Microsatellite sequences; Restriction mapping; Transcript mapping; Gene targeting.  

**CLONING STRATEGIES**

Safety lines for recombinant DNA techniques; Construction of recombinant DNA; Preparation of competent cells- Transformation and Transfection; Selection and screening of recombinants; Gene transfer - Shotgun method, Nuclear injection method; Cloning in plants-Ti Plasmids of *Agrobacterium*, Structure and function of T-DNA  

**GENE MODIFICATIONS AND APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY**

Mutagenesis – Deletion mutagenesis, Oligonucleotide derived mutagenesis, Site directed mutagenesis and their applications; DNA Fingerprinting - RFLP analysis; Applications of recombinant DNA technology for the production of recombinant proteins – Insulin, Interferon and Growth hormones; Guidelines for the disposal of recombinant product wastes.  

**TEXT BOOKS:**


**REFERENCES:**


**COURSE DESIGNERS**

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PREAMBLE
Thermodynamics for Biotechnology deals with the basic laws and its application. This course deals with various laws, volumetric applications, Phase equilibria and Chemical Reaction Equilibria. Knowledge of this course will enable students to understand the importance of thermodynamics and its applications in the field of biotechnology.

PREREQUISITE
17BTCC10-PRINCIPLES OF CHEMICAL ENGINEERING.

COURSE OBJECTIVES
1. To list fundamental laws of thermodynamics.
2. To interpret its application to simple biological systems.
3. To discuss properties of pure fluids and property changes in fluid mixtures.
4. To implement the concepts to phase and reaction equilibria.
5. To formulate the equilibrium criteria for the chemical reactions

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Summarize the fundamentals of thermodynamics and laws of thermodynamics. Understand
CO2. Explain the laws of thermodynamics to different systems and processes Understand
CO3. Describe the thermodynamics concepts to explain the properties of pure fluids and their Understand
CO4. Deduce the concepts of thermodynamic to phase equilibrium. Analyze
CO5. Appraise and adapt biochemical reaction equilibrium to biological systems. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

LAWS OF THERMODYNAMICS AND ITS APPLICATIONS

VOLUMETRIC AND THERMODYNAMIC PROPERTIES OF FLUIDS

SOLUTION THERMODYNAMICS
Partial molar properties, Concepts of chemical potential and fugacity; Activity and activity co-efficient, Gibbs Duhem equation, Margules activity model, Ideal and non-ideal solut ions, Excess properties of mixtures, Composition models.
PHASE EQUILIBRIA

CHEMICAL REACTION EQUILIBRIA
Equilibrium criteria for homogeneous chemical reactions, Evaluation of equilibrium constant, Effect of temperature and pressure on equilibrium constant, Calculation of equilibrium conversion for single and multiple reactions, Heterogeneous reaction equilibria.

TEXT BOOK:

REFERENCES:
1. Rao, Y.V.C. Chemical Engineering Thermodynamics.

COURSE DESIGNERS

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<td>1</td>
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<td>Biotechnology</td>
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### PREAMBLE
The course aims in imparting the fundamental knowledge in the science of immunology and a detailed study of various types of immune systems and their classification, structure, and mechanism of immune activation. It discusses about the principles of microbial pathogenesis, production of new drugs and diagnostic methods.

### PREREQUISITE - NIL

### COURSE OBJECTIVES

1. To gain knowledge about the general concepts of immune system, immune organ and cells
2. To learn the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology
3. To acquire knowledge on the principles of microbial pathogenesis the concepts and principle of immunoassay techniques in routine diagnosis, research
4. To demonstrate a capacity for problem-solving about immune responsiveness and be able to provide an overview of the interaction between the immune system and pathogens
5. Explore strategies to improve existing Immunotechnology.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

| CO1 | Explain the general concepts of immune system, describe the cells and organs of the immune system, and describe the properties of antigens and antibodies | Understand |
| CO2 | Illustrate the concept of cell mediated immunity and hypersensitivity | Understand |
| CO3 | Identify the mechanisms behind transplantation immunology and autoimmunity | Apply |
| CO4 | Identify the principles and molecular mechanisms involved in microbial pathogenesis and their applications in production of vaccines. | Apply |
| CO5 | Inspect the various antigen-antibody interactions and techniques and explore the diagnostic methods | Analyze |

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S- Strong; M-Medium; L-Low

### SYLLABUS

#### INTRODUCTION TO IMMUNE SYSTEM
Phylogenyofimmunesystem,Innateandacquiredimmunity,Clonalnatureofimmune response,Organizationandstructureoflymphoidorgans, antigens: chemical and molecular nature, haptens, adjuvants, Cells ofimmunesystem– Haematopoiesisanddifferentiation–B-Lymphocytes, T- Lymphocytes, Macrophages, Dendrite cells

#### ASSESSMENTOFCELLMEDIATEDIMMUNITY
Identificationoflymphocytesandeirs subsetsinblood,Tcellactivation,Estimationof cytokines,Macrophagesactivation,Macrophage-microbialidalassays,Hypersensitivity.

#### TRANPLANTATIONANDAUTOIMMUNITY

#### MOLECULAR IMMUNOLOGY
Immunity to virus, Bacteria, Parasites, Genetic control of immune response, MHC associated predisposition to disease, Principles and strategy for developing vaccines, Newer methods of vaccine production. Immunodeficiency diseases.

### IMMUNOTECHNOLOGY

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td>2</td>
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<td><a href="mailto:sridevim@vmkvec.edu.in">sridevim@vmkvec.edu.in</a></td>
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PREAMBLE
Food Processing Technology deals with the study of food production, processing, packaging, preservation and the use of technology and Engineering techniques in aiding the above-mentioned stages. It also deals with artificial food, artificial edible items, nutrition science and its Chemistry. It allows students to learn about food and nutrients, role of functional foods and the strategies to produce specific food ingredients.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To explain different types of foods, factors affecting food & food products and the micro-organisms which cause food borne diseases
2. To explain the concepts of food spoilage and different food preservation methods, and their impact on the shelf life, quality, and other physical and sensory characteristics of foods
3. To discuss the different food processing methods and its applicability in food product preparations
4. To choose appropriate modern methods of food preservation for industrialization
5. To Choose the materials and types of packaging for foods and its quality testing

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Identify different microbes associated with foods, and food borne diseases. Understand

CO2. Infer the role of microbes in food spoilage and food preservation Apply

CO3. Illustrate all food processing methods and demonstrate its application in food product Apply

CO4. Utilize the modern methods for foods preservation using biotechnology. Apply

CO5. Inspect the packing methods, materials and factors affecting food packing. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF FOOD MICROBIOLOGY
Microbiology of different types of foods-Vegetables, fruits, milk and milk products, meat and meat products. Factors affecting the food products. Food borne diseases and causative organisms. Food intoxication.

FOOD SPOilage

PROCESSING OF FOODS

INDUSTRIALIZATION/ MODERN FOOD PRESERVATION
Pasteurization, Vacuum packing, irradiation, bio preservation, Modified atmosphere packing, cryopreservation, Pickling, salting, drying, freezing, refrigeration. Food additives- Intentional and Nonintentional additives, Food colorants- natural and artificial, food flavours.

PACKAGING AND QUALITY TESTING
TEXT BOOKS
2. Sivashankar B. Food processing Preservation, Prencice Hall of India Pvt. Ltd. 2002

REFERENCE BOOKS

COURSE DESIGNERS

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17BTCC16 | BIOPROCESS ENGINEERING

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**PREAMBLE**

This course aims to develop the skills of students in the area of Bioprocess engineering. This will also help the students to undertake project in Bioprocess technology.

**PREREQUISITE**

17BTCC07- ENZYME ENGINEERING AND TECHNOLOGY.

**COURSE OBJECTIVES**

1. To Explain about the historical development of Bioprocess technology, Design and construction of fermenter.

2. To Interpret the kinetics of Microbial growth and product formation.

3. To Summarize the knowledge on Design and operation of Bioreactors.

4. To Perform the Mass transfer principles in bioreactor and scale-up criteria.

5. To Execute the Methods of Online and Offline monitoring of bioprocess.

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

CO1. Explain the appropriate bioreactor configurations, operation modes based upon the nature of Bio products, cell lines and other process criteria.

CO2. Illustrate about modelling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.

CO3. Plan a research career to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.

CO4. Develop a various integrations of unit operations in bioprocessing.

CO5. Examine the problems and seek practical solutions in research lab and Industry; for large scale implementation of Biotechnology.

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION TO BIOPROCESS AND FERMENTATION**

Historical development of the fermentation industry, General requirements of fermentation process, Basic configuration of fermenter and ancillaries, Main parameters to be monitored and controlled in fermentation processes.

**KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION**

Kinetics of Batch, Fed batch and Continuous culture processes, Comparison of batch and continuous culture in industrial process, Introduction to structured and unstructured models – Using unstructured non-segregated models to predict specific growth rate – Substrate limited growth (Monod equation and alternatives to Monod equation), Models with growth inhibitors (Substrate, Product inhibition and Inhibition by toxic compounds).

**DESIGN OF BIOREACTORS**

Classification of bioreactors – Immobilized enzyme bioreactors, Packed bed bioreactors, Membrane bioreactors, Airlift loop reactor, Fluidized bed and Trickle bed bioreactors, Design of bioreactors – Aseptic operation and containment, Body construction, Aeration and agitation Types of agitators and spargers, Sterilization of Media, Fermentor, Air supply and Exhaust and Sterilization kinetics.

**BIOREACTOR SCALE-UP AND MASS TRANSFER**
Scale up of fermentation process – Factors involved in scale-up, Scale-up of aeration / agitation, Oxygen mass transfer in bioreactors, Determination of $K_La$ values – Sulphite oxidation technique, Gassing out technique, Oxygen balance technique, Mass transfer correlations.

**MONITORING OF BIOPROCESSES**

Methods of measuring process variables – Online and offline analysis for measurement of important biochemical parameters, Biomass estimation, Control systems – Manual and automatic control.

**TEXT BOOKS**


**REFERENCES:**

2. James M. Lee, Biochemical Engineering. *PHI, USA*.

**COURSE DESIGNERS**

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<td>1</td>
<td>Mrs.G.Arthi</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.R.Devika</td>
<td>Professor and Head</td>
<td>Biotechnology</td>
<td><a href="mailto:devika@avit.ac.in">devika@avit.ac.in</a></td>
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</table>
**PREAMBLE**
Downstream processing is defined as various stages of cascade or non-cascade process that occurs after the completion of the fermentation or biotransformation to recover and purify synthetic bio products includes drugs, antibiotics, enzymes, hormones, etc., from fermentation broth. Downstream processing includes separation, purification, and packaging of the fermented products.

**PREREQUISITE**
17BTCC16- BIOPROCESS ENGINEERING

**COURSE OBJECTIVES**
1. To interpret role of downstream processing in biotechnology.
2. To explain in detail about the physical methods of separation.
3. To summarize the knowledge on isolation of products.
4. To execute product fractionation and purification.
5. To implement the knowledge of formulation of the final product and finishing.

**COURSE OUTCOMES**
After the successful completion of the course, learner will be able to

CO1. Explain the knowledge about Role and importance of Downstream processing in biotechnology

CO2. Summarize the fundamental knowledge about the physical methods of separation.

CO3. Apply the various downstream processing techniques for the isolation of products.

CO4. Select the methods for product fractionation and purification

CO5. Compare the various techniques to formulate the final product.

**SYLLABUS**
**DOWNSTREAM PROCESSING IN BIOTECHNOLOGY**
Role and importance of Downstream processing in biotechnological processes, Characteristic of Biomolecules and Bioprocesses, Cell disruption for product release - Mechanical, Enzymatic and Chemical methods. Pretreatment and stabilization of bioproducts.

**PHYSICAL METHODS OF SEPARATION**
Unit operation for solid liquid separation - Removal of Insoluble, Biomass, Flocculation, sedimentation, Centrifugation and Filtration methods.

**ISOLATION OF PRODUCTS**
Adsorption, Liquid - Liquid extraction, Aqueous two-phase extraction, Membrane separation - Ultra filtration and Reverse osmosis, Dialysis, Precipitation of proteins by Various methods – Salting out, Isoelectric point, Organic solvents, Polyelectrolytes, Polyvalent metallic ions and Non – ionic hydrophilic polymers.

**PRODUCT FRACTIONATION / PURIFICATION**
Partition Chromatography – single dimensional and Two-dimensional Chromatography – Thin layer chromatography, Gas liquid chromatography, Adsorption Chromatography – Column chromatography and, Ion Exchange Chromatography, High performance liquid Chromatography (HPLC) and Hybrid separation Technology.

**PRODUCT FORMULATION AND FINISHING OPERATION**
Crystallization - Basic concepts, Crystal size distribution, Batch crystallisation, Continuous crystallization of pharmaceuticals and Solution crystallization, Drying - Drying equipment - Conduction dryers, Adiabatic dryers, Drying rate and Drying time, Zone refining, Lyophilization in final product formulation.

**TEXT BOOKS:**
1. H. Sivasankaran. Bioseparation

**REFERENCE BOOKS:**

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<td>Assistant Professor</td>
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<td><a href="mailto:jawahar@vmkvec.edu.in">jawahar@vmkvec.edu.in</a></td>
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<tr>
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<td>Dr.B. Prabasheela</td>
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<td><a href="mailto:prabasheela@avit.ac.in">prabasheela@avit.ac.in</a></td>
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PREAMBLE
Mass transfer is the net movement of mass from one location, usually meaning stream, phase, fraction or component, to another. Mass transfer occurs in many processes, such as absorption, evaporation, drying, precipitation, membrane filtration, and distillation. Mass transfer is used by different scientific disciplines for different processes and mechanisms. The phrase is commonly used in engineering for physical processes that involve diffusive and convective transport of chemical species within physical systems. Mass transfer operations include separation of chemical components in distillation columns, absorbers such as scrubbers or stripping, absorbers such as activated carbon beds, and liquid-liquid extraction.

PREREQUISITE
17BTCC13-THERMODYNAMICS FOR BIOTECHNOLOGY.

COURSE OBJECTIVES
1. To Explain the Mass transfer principles
2. To Demonstrate the principles of adsorption, absorption, leaching and drying extraction
3. To Perform the distillation, crystallization operations
4. To Express the concept of Liquid – Liquid Extraction
5. To Study the concept of Solid – Fluid operation

COURSE OUTCOMES
On the successful completion of the course, students will be able to

- **CO1.** Illustrate the principles of diffusion and apply the concepts of interphase mass transfer
- **CO2.** Make use the concept of absorption in bioprocess industries and multi component system
- **CO3.** Construct the distillation and multi stage tray tower
- **CO4.** Examine the various principles of liquid-liquid equilibrium and Differential extractor
- **CO5.** Contrast the application process of extraction process in biotech industries

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

SYLLABUS

**DIFFUSION**
Molecular diffusion in fluids, Mass transfer coefficients, Diffusion in solids, Inter phase mass transfer.

**SOLID – FLUID OPERATION**

**GAS – LIQUID OPERATION**
Equipment for gas liquid operation, Principles of gas absorption, Equilibrium solubility of gases in liquid, One component transfer material balance, Counter current multistage operation, Continuous contact equipment, Multi component system, Absorption with chemical reaction.

**DISTILLATION**
Vapour – Liquid Equilibria, Single stage- Flash vaporization, Differential or simple distillation, Continuous rectification – Binary system, Multistage tray towers – Mc Cabe- Thiele and Ponchon Savarit principles.

**LIQUID – LIQUID EXTRACTION**
Liquid – Liquid Equilibria, Stage wise contact, Stage type extractor, Differential extractor.
TEXT BOOKS

REFERENCES:

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17BTCC81  BIOCHEMISTRY LAB  

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PREAMBLE
The course is a laboratory course that focuses on developing the skills of the students by providing hands on training in various techniques in Biochemistry

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To Understand laboratory safety and standard operating procedures of common laboratory equipment’s.
2. To impart skills in preparation of solutions and biological buffers.
3. To extend knowledge in analysis & estimation of biomolecules

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Observe safe laboratory practices and handle the equipment safely
CO2. Prepare solutions and biological buffers
CO3. Estimate the quantity of lipids
CO4. Separate biomolecules from various source
CO5. Determine the quality and quantity of biomolecules

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
1. pH measurements and Buffer preparations.
2. Titrimetric experiments
3. Estimation of Ascorbic acid by Titrimetric method using 2, 6 Dichloro phenol indophenols.
4. Determination of Saponification value of Edible oil
5. Determination of Acid number of Edible oils.
6. Determination of Iodine value of Oil.
7. Isolation of Chloroplast from Spinach leaves.
8. Cheese Production from Milk.
9. Casein from Milk.
10. Starch from Potato.

REFERENCES:
1. Laboratory Manual.

COURSE DESIGNERS

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<tr>
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<td>Biotechnology</td>
<td><a href="mailto:subbaiya@avit.ac.in">subbaiya@avit.ac.in</a></td>
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</table>

PREAMBLE
To offer hands on training in the areas of cell culture, cell identification and to demonstrate various techniques to learn the morphology, identification and propagation of cells.

PREREQUISITE - NIL
COURSE OBJECTIVES

1. Demonstrate working principles of microscopy
2. Perform the basic techniques to work with cells.
3. Differentiate the cells by staining techniques.
4. Categorize the various stages of mitosis.
5. Differentiate the types of blood cells.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO14. Demonstrate the basic concepts of sterilization techniques
CO15. Interpret the behaviour of cells in their microenvironment
CO16. Analyze scientific work and experimental results in cell biology
CO17. Categorize the cell organelles
CO5. Illustrate physiological processes of cell e.g. cell divisions

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

1. Introduction to principles of sterilization techniques and cell propagation.
3. Isolation of Cell organelle – Mitochondria, Microtubules, Actin and Myosin filaments.
5. Cell staining - Gram’s staining, Leishman staining
7. Osmosis and Tonicity.
8. Staining for different stages of mitosis in Allium cepa (Onion).

REFERENCES


COURSE DESIGNERS

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<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.G.Karthigadevi</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:karthigadevi@avit.ac.in">karthigadevi@avit.ac.in</a></td>
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</table>
PREAMBLE
This course includes preparing stained smears, culturing microorganisms, conducting immunology experiments, performing tests to identify bacteria and fungi, and studying microbial growth control.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. Describe the safe practices in a microbiology laboratory.
2. Perform various cell staining techniques.
3. Demonstrate proper usage, identify the parts/functions of the following microscopes
4. Perform transfer of living microbes using aseptic technique.
5. Differentiate the microbes enumerated from various environments.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Experiment with microscope to reveal the structure and function of microorganisms
CO2. Identify the methods for isolation, subculture, and maintenance of bacterial and fungal specimens
CO3. Examine the uses of various media and testing protocols with focus on clinical applications.
CO4. Inspect the causes and consequences of microbial evolution and the generation of diversity as well as human impacts on adaptation.
CO5. Determine the evidence of bacterial and fungal metabolism as it relates to identification and control of pathogenic organisms

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

S- Strong; M-Medium; L-Low

SYLLABUS
1. Sterilization Techniques.
2. Culture Media Preparations
   a. Broth media
   b. Agar
3. Culturing of Microorganisms
   a. Pure Culture techniques - Streak plate
   - Pour plate
4. Isolation, Enumeration and Purification of Microbes from a given sample.
5. Preservation of Bacterial Culture.
6. Identification of Microorganisms
   a. Staining techniques - Simple-Gram-Spore-Hanging drop
   b. Biochemical identification
7. Quantification of Microorganisms
   - Microscopy
   a. Serial dilution and plating
8. Environmental Sample Analysis - MPN Test
9. Food Microbiology
- Milk
- Fermented food

10. Clinical Microbiology
   - Blood and Urine Culture
   - Antibiotic Disc test Assay.

REFERENCES:
4. Laboratory Manual

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PREAMBLE
The course focuses on the general biochemical reactions for the identification of biomolecules. The students also learn about qualitative and quantitative analysis of macromolecules.

PREREQUISITE- NIL

COURSE OBJECTIVES
1. Discuss about basic reactions of Biomolecules
2. Calculate the different concentration of macro-molecules
3. To distinguish the importance of blood sampling site and estimation of hemoglobin
4. To perform various techniques for separation of pigments

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Identify the reactions of proteins, carbohydrates and amino acids  Apply
CO2. Experiment with Hemoglobin concentration in the blood  Apply
CO3. Distinguish the plant pigments using chromatography  Analyze
CO4. Compare the various biomolecules  Analyze
CO5. Evaluate the Normal and abnormal constituents of Urine  Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Amino acids.
3. Qualitative Analysis of Lipids.
4. Qualitatively analysis of Normal and abnormal constituents of Urine
5. Estimation of Glucose by O-toludine method.
6. Protein estimation by Biuret,
7. Estimation of Cholesterol by Zak’s method.
10. Separation of plant pigments by column chromatography (Demo).

REFERENCES:
1. Laboratory Manual.

COURSE DESIGNERS

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REFERENCES:
1. Laboratory Manual.
PREAMBLE
The Molecular Biology laboratory has become a prominent and essential fixture in the training of undergraduate students for careers related to the molecular techniques.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To discuss about sample preparation
2. To perform the principle of isolation of DNA from bacterial, plant, human and mitochondria.
3. Estimate the nucleic acids- RNA / DNA.
4. Acquire laboratory skills in techniques such as micro pipetting, spectrophotometry and electrophoresis.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

- CO1. Explain the concepts and principles of sample preparation
- CO2. Practice laboratory techniques used for the isolation of nucleic acids from bacterial, plant, human & mitochondria.
- CO3. Illustrate the enzymatic action on nucleic acids & proteins
- CO4. Quantify the nucleic acids
- CO5. Examine the Purification of biomolecules by electrophoresis

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Isolation of Bacterial Genomic DNA
2. Isolation of DNA – Isolation of plant Genomic DNA
3. Isolation of Human genomic DNA
4. Isolation of Mitochondrial DNA.
5. Quantification of RNA / DNA.
6. Agarose gel electrophoresis
7. Extraction of DNA from agarose gel.

REFERENCES:

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17BTCC86 CHEMICAL ENGINEERING LAB

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PREAMBLE
Chemical engineering laboratory includes pilot and lab scale experimental set-up on Fluid mechanics, Unit Operations, Mass Transfer and Heat Transfer. It helps students for the development of their skills in understanding and operating basic and more complex industrial systems.

PREREQUISITE- NIL

COURSE OBJECTIVES
1. To interpret chemical engineering principles and their practical applications in the areas of mass transfer, reaction engineering and particle mechanics.
To differentiate and categorize chemical processes that span molecular to macroscopic scales.

To assess different coefficients and factors involved in fluid flow.

To construct the governing equations for designing and analyzing heat transfer equipment.

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to:

| CO1. Explain the terminology and knowledge of contemporary issues associated with chemical engineering. | Understand |
| CO2. Plan, co-ordinate, implement and validate laboratory procedures to conduct quantitative and qualitative Analyzes. | Apply |
| CO3. Apply process principles learnt in chemical engineering courses to practical situations. | Apply |
| CO4. Analyze the fundamental theoretical concepts of an experimental system | Analyze |
| CO5. Examine the industrial problems along with appropriate approximations and boundary condition. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S - Strong; M - Medium; L - Low

**SYLLABUS**

1. Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter
2. Filtration.
3. Heat exchangers.
4. Simple and Steam distillation.
5. Fluidization.
6. Pressure drop in pipes and packed columns.
7. Distillation in packed column.
8. Liquid – liquid equilibria in extraction.
9. Solid liquid extraction
10. Adsorption equilibrium.
12. Determination of Screen effectiveness.

**REFERENCE BOOKS:**

Laboratory Manual

**COURSE DESIGNERS**

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PREAMBLE

Bioinstrumentation is used to provide the understanding and knowledge of various instrumentation through handling and working. This course also highlights the various instruments used in the biotechnology industries for various analytical purpose.

PREREQUISITE - NIL

COURSE OBJECTIVES

1. To understand the concepts of instrumentation used to measure factors that characterize biological systems and physical or chemical factors that have a profound effect on biological entities.
2. To demonstrate the proper operation, maintenance and applications of common analytical laboratory instruments, including equipment for electrophoresis, spectrophotometry, and chromatography.
3. To properly apply scientific mathematical skills to calculations relevant to the laboratory.
4. To demonstrate qualitative and quantitative analytical skills with various common instruments using common biotechnology laboratory protocols.
5. To develop critical thinking skills relevant to biotechnology rough data analysis, troubleshooting experiments and equipment, suggesting continuous improvements.

COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Interpret the purpose of measurement, the methods of measurements, errors associated with measurements. Understand

CO2. Apply the principle of various instrumentation Apply

CO3. Compare the various spectrometers for analysis purpose Analyze

CO4. Inspect the various parameters by using Conductivity meter and Potentiometer. Analyze

CO5. Measure the dissolved oxygen in the given solution Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

1. Validating Lambert – Beer’s law using KMnO₄
2. Determination of complementary color and complementary wavelength
3. Precision and Validity in an experiment using Absorption spectroscopy.
4. Finding the Stoichiometry of the Fe (1,10Phenanthroline Complex) using Absorption spectroscopy.
5. UV spectra of Nucleic Acid.
6. Estimation of Alizarin Aluminium complex
7. Estimation of Al³⁺ concentration using Alizarin in the spectrometer.
9. Experiments on
   a. Conductivity meter
   b. Turbidity meter.
11. Determination of Fe²⁺ content in fruit juices

TEXT BOOKS:

1. Laboratory Manual.
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<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.R.Subbaiya</td>
<td>Associate Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:subbaiya@avit.ac.in">subbaiya@avit.ac.in</a></td>
</tr>
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</table>
PREAMBLE
To understand and develop the skills involved in rDNA Technology.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To explain the preparation of recombinant DNA molecule
2. To construct a method for amplifying a gene
3. To perform DNA fingerprinting using RAPD
4. To demonstrate gene cloning and screening of recombinants
5. To differentiate proteins through SDS-PAGE

COURSE OUTCOMES
After the successful completion of the course, learner will be able to
CO1. Articulate core Nucleic acid techniques such as extraction, nucleic acid separations and elution. Apply
CO2. Illustrate DNA amplification using Polymerase Chain Reaction Apply
CO3. Employ Gene cloning and screening of recombinants. Apply
CO4. Categorize the methods of Nucleic acids characterization, through the application of gene probes Analyze
CO5. Compare the proteins through SDS-PAGE. Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
1. Isolation of Plasmid DNA.
2. Isolation of Bacteriophage Genomic DNA
3. Polymerase Chain Reaction.
4. Electroelution of DNA from Agarose gel.
5. Restriction digestion of λ DNA.
6. Restriction Digestion of Plasmid DNA.
7. Ligation of DNA.
8. Preparation of Competent Cells – Calcium chloride Method.
10. DNA Fingerprinting using Restriction fragment length polymorphism (RFLP)
11. DNA Fingerprinting using Random Amplified Polymorphic DNA (RAPD)
12. Blue White Screening of Recombinants.
13. SDS Poly Acrylamide Gel Electrophoresis.

REFERENCES:
1. Laboratory Manual.

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<tr>
<td>2</td>
<td>Dr.R.Devika</td>
<td>Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:devika@avit.ac.in">devika@avit.ac.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE
The Immunology Laboratory provides hands on training on laboratory testing and simple experiments in evaluation of autoimmune disease, immune deficiencies etc., as well as having responsibility for some aspects of infectious disease serology. To develop skills of students in Immunological techniques by performing simple experiments in the laboratory.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To define about immune system, their structure, classification and genetic control of antibody production
2. To summarize the techniques like blood grouping, ELISA and identification of T-cell, Immunofluorescence etc.
3. To execute skills in Isolation and purification of antibodies
4. To compare the various Immunological techniques and its applications
5. To evaluate and correlate test results with associated diseases or conditions.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Develop a comprehensive and practical knowledge of basic immunological principles involved in research and clinical science

CO2. Employ the knowledge for identification of immunological cells, their structure, function and characteristics.

CO3. Apply principles of safety, quality assurance and quality control in Immunology.

CO4. Correlate the immunological disorders and the factors involved in it by various immunological assays.

CO5. Assess the Immuno assay to understand complement fixation system and other diseased conditions.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Handling of animals, immunization and raising antisera.
2. Identification of cells in a blood smear.
3. Identification of blood groups.
4. Immuno diffusion
5. Immunelectrophoresis.
7. Enzyme Linked Immuno Sorbent Assay (ELISA).
8. Isolation of peripheral blood mononuclear cells.
9. Isolation of monocytes from blood.
10. Immunofluorescence

REFERENCE BOOKS:
1. Laboratory Manual

COURSE DESIGNERS
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<tr>
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<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Dr.B.Prabasheela</td>
<td>Associate Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:prabasheela@avit.ac.in">prabasheela@avit.ac.in</a></td>
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</table>
PREAMBLE
The Course aims to promote the chances of entrepreneurial success and to create trained and skilled human resources well versed in engineering aspects of food processing to cater the needs of the rapidly growing food processing sector.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. Recognise the basic knowledge about the preparation of instant and Convenience food.
2. Students can interpret the techniques to improve the nutritive value and minimize loss of essential nutrients during processing and preservation.
3. Implementation of appropriate processing, preservation and packaging method.
4. To differentiate and compare methods of fruits and vegetable processing.
5. Formulate the principals involved in preparation of different Food stuffs

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Schedule the process flow diagrams, combination and sequence within a process of food materials Apply

CO2. Interpret the ability to process the different categories of food and mechanisms of preservation. Apply

CO3. Categorize the properties of food materials and their processing methods Analyze

CO4. Develop and analyze the processes, various unit operations and the scientific principles behind processing the food materials. Analyze

CO5. Validate the changes occurring during various food processing techniques and during storage and preservation. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Preparation of orange squash.
2. Preparation of mango jam and guava jelly.
3. Preparation of tomato ketchup
5. Preparation of mango pickle /garlic pickle
6. Experiment on preparation of fruit bar.
7. Preparation of frozen prawn.
8. Experiment on preparation of sauce
9. Preparation of bread
10. Identification of Adulterants

REFERENCE BOOKS:
4. Laboratory Manual

COURSE DESIGNERS

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<td><a href="mailto:nirmalabt@avit.ac.in">nirmalabt@avit.ac.in</a></td>
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</table>
PREAMBLE
This bioprocess engineering lab course will provide practical training on upstream and downstream process operations, designing of fermentation medium, effect of varies parameters on fermentation and bioproduct production including recombinant protein synthesis.

PREREQUISITE - Nil

COURSE OBJECTIVES
1. To Interpret the Growth factors.
2. To Summarize the medium optimization.
3. To Describe Enzyme activity.
4. To Execute Enzyme Immobilized Reaction.
5. To Perform large scale production of bioproducts.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Produce information on behavior and growth of microorganisms in growth medium. Apply
CO2. Develop knowledge about optimization on growth medium. Apply
CO3. Report information on activity of enzyme and parameters affects enzyme activity. Apply
CO4. Employ the knowledge of Enzyme Immobilized to exploit in bioreactors. Apply
CO5. Focus the knowledge in producing bioproducts in reactors. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

S- Strong; M-Medium; L-Low

SYLLABUS
2. Medium optimization – Plackett Burman design.
3. Enzyme activity – Effect of pH.
5. Enzyme Immobilization – Gel Entrapment.
7. Production of Wine by Yeast.
8. Production of Amino acid.

TEXT BOOKS:

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PREAMBLE
Downstream processing laboratory is used to provide the understanding and knowledge on techniques like solid-liquid separation, cell disruption, high resolution purification, and product polishing of bio-products from fermenter. This course provides deeper understanding about the techniques in downstream processing.

PREREQUISITE - Nil

COURSE OBJECTIVES
1. To explain the importance of downstream processing in biotechnology.
2. To describe in detail about the Solid-Liquid Separation methods such as centrifugation, microfiltration.
3. To describe the knowledge on cell disruption techniques to extract valuable biomolecules.
4. To demonstrate in detail about chromatography techniques for product purification.
5. To demonstrate the knowledge of extraction techniques to separate biomolecules.

COURSE OUTCOMES
On the successful completion of the course, students will be able to:

CO1. Illustrate the role and importance of downstream processing in biotechnology. Apply

CO2. Apply the knowledge about the solid-liquid separation to acquire the product. Apply

CO3. Compute the information on cell disruption techniques for separation of biomolecules. Apply

CO4. Focus the knowledge about product fractionation and purification by chromatography technique. Analyze

CO5. Test the knowledge of flocculation and aqueous two-phase extraction to extract living or non-living cells/intracellular materials such as enzymes, proteins, etc. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
2. Mechanical cell disruption – homogenizer
4. Separation of Pigments by Thin Layer Chromatography.
5. Precipitation – Ammonium Sulphite Precipitation.
7. Aqueous Two Phase Extraction of Biologicals.
8. Flocculation

TEXT BOOKS

REFERENCE BOOKS

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</table>
CATEGORY ‘C’ – ELECTIVE COURSES - PROGRAMME SPECIFIC – 12-15 CREDITS GENERAL
PREAMBLE
Plant and animal diseases and their control deals with the study of different types of pests and their impact on agriculture and live stocks. Students will learn about the fungus, bacteria, virus or nematodes that can cause damages to the plant parts above or below the ground. The farmers challenges will be solved by identifying the proper ecofriendly control measures will pave the new path in the area of plant breeding. To familiarize the students with principles of insect pest management, including concept and philosophy of Integrated Pest Management. Knowledge of these principles will enable students to understand the different factor that threatens the agricultural productivity and humans.

PREREQUISITE
17BTCC03 - MICROBIOLOGY

COURSE OBJECTIVES

1. To recognize the pest morphology and its corresponding pesticides
2. To describe the pest in agriculture and their control measures.
3. To choose the appropriate pest control method
4. To outline the vector plant pathogen interaction and management of vectors for controlling diseases.
5. To formulate the different sampling methods and monitoring protocol

COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Demonstrate the common plant pathogens in agriculture

CO2. Discuss about epidemiology of diseases caused by pests in plant and animals.

CO3. Classify about the plant and animal disease & integrated control measures.

CO4. Examine the diseases in plants and animal & its control

CO5. Infer the different samplings methods

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
CLASSIFICATION OF PESTS AND PESTICIDES
Pests – Definition, Morphology and Life cycle, classification of pests – Vertebrate pests, Invertebrate pests and plant pests, Classification of pesticides on chemical nature and according to target species, mode of action.

AGRICULTURAL PESTS AND THEIR CONTROL
Concept of Pest and Types of pests in agricultural products - stored grains- veterinary- forestry and nursery. Major insect pests of agricultural- importance -Marks of identification- life cycle- nature of damage, chestnut blight, potato late blight, downy mildew, Damage economic threshold level and control measures.

PEST CONTROL PRACTICES
Issues, Challenges and Opportunities in the Control of Insects in Vegetable Crops, Control measures- Cultural, Physical, Mechanical, Chemical, Herbal and Biological control. Pheromonal and autocidal control.
EMERGING CONCEPTS AND PRACTICES IN INTEGRATED CONTROL MEASURES
The integrated control/IPM concept, Damage thresholds, Forecasting, Increasing agro-ecosystem resistance, Pesticide selectivity, Eradication versus control, Pests and humans – direct pests and vectors of plant and animal diseases, potential human practices and the occurrence of pests, Prevention of communicable diseases after the disaster.

SAMPLING AND MONITORING ARTHROPODS
Methods of sampling and monitoring, Components of a sampling plan, Types of sampling plans, Allocation of Sampling units.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td>2</td>
<td>Ms.G.Arthi</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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PREAMBLE
Ocean science deals with the various aspects of marine ecosystem. It gives the basic knowledge about availability of the bio resources and its applications. It also deals with exploration of various culturing techniques of few marine organisms in the laboratory conditions. This study further facilitates the student to understand the economic importance of marine derived products.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To state the art of marine ecosystem and their properties
2. To describe the about biodiversity in marine environment and their resources
3. To perform various culture techniques of marine organisms
4. To develop drug from marine compounds and their economic Values
5. To assess the human impact on marine environment

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Outline the Marine ecosystem sources and their properties Understand
CO2. Describe the biodiversity in marine environment Understand
CO3. Demonstrate the different culture techniques of marine organisms Apply
CO4. Assess the drug developed from natural marine derived compounds Analyse
CO5. Examine the human impact on marine environment Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MARINE ENVIRONMENT
Stratification of coastal environment- Bathymetric map, Thermo cline; components of marine ecosystem; Biotic and Abiotic and their interrelationships-Role in food chain, food web ;Tropic systems; Taxonomy of marine flora and fauna; Physico chemical properties of marine water.

BIODIVERSITY AND BIORESOURCES
Biodiversity of marine ecosystem – Phytoplankton; Algal bloom; Indicator organisms. Bio-geocycles; Bioresources and their economic importance; Adaptations of flora and fauna in marine & estuarine environment.

CULTURE TECHNIQUES
Culture Techniques of microalgae; seaweeds; tiger shrimp; lobsters; Common marine pathogens and symptoms; Transgenesis and cryopreservation.

ECONOMIC VALUE
Economic importance of marine products; Economic value - corals, sponges, pearls, oysters, molluscs; Drug development from natural marine derived compounds.

IMPACTS ON MARINE ENVIRONMENT
Human Impact on Marine Environment – Oil spill, Nuclear reactors, Thermal impact, Bio fouling; Heavy metal pollution.

TEXT BOOKS:
2. Proksch and Werner E.G.Muller, Frontiers in Marine Biotechnology, Horizon Bioscience,  2006

REFERENCES:

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PREAMBLE
Principles of Bioinformatics is an interdisciplinary field that combines Computer Science, Molecular Biology, Genetics, Mathematics, Statistics and Engineering etc. to analyze and interpret biological data. Bioinformatics has been used for in silico analyses of biological queries using mathematical and statistical techniques. This course includes the use of computer programming as part of their methodology, in the field of genomics, the identification of candidate genes, genetic basis of disease etc. leading to specific drug discovery by molecular modelling.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. Define the basis of Bioinformatics in the biological field
2. Explain the in-silico analysis of biological queries using mathematical and statistical techniques.
3. Implement the Bioinformatics software and tools based on its applications
4. Construct the phylogenetic tree based on the biological information and queries using bioinformatics tools.
5. Develop bioinformatics tools in various fields like medicine, agriculture etc..

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Relate the basics of computer science and interdisciplinary subjects related to Bioinformatics

CO2. Demonstrate the importance of biological databases and their significance in Biotechnology

CO3. Construct various tools and software which can be adopted in different fields of Biotechnology

CO4. Build the evolutionary traits using Bioinformatics tools and software

CO5. Apply the various bioinformatics tools in different fields

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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SYLLABUS
INTRODUCTION TO BIOINFORMATICS

DATABASES
Introduction to databases – Flat files, Relational databases, Object oriented databases and hypertext databases, Biological databases and their uses, Introduction to EMB net and NCBI, Classification of biological databases; Primary nucleic acid sequence databases – Gen Bank, EMBL, DDBJ; Primary protein sequence databases – PIR, SWISS-PROT; Composite databases – NRDB, OWL, SWISS-PROT+TrEMBL; Secondary databases – PROSITE, PRINTS; Structural databases – PDB, MMDB.

SEQUENCE ALIGNMENT
Introduction to sequence alignment and its significance, Types – Global, Local, Pairwise and Multiple alignment. DOT PLOTS, Scoring matrices – PAM, BLOSSUM. Dynamic programming algorithms, BLAST, FASTA. Multiple sequence alignment by PSI-BLAST.
PHYLOGENETIC ANALYSIS
Terminology and basics of Phylogenetics – Clades, Taxons, Baranches, Nodes; Orthologs and Paralogs. Steps to construct a Phylogenetic tree – Constructing a Multiple Sequence Alignment, Determining the substitution model, Tree building and tree evaluation.

APPLICATION OF BIOINFORMATICS
Application of bioinformatics in various fields – Medicine, Agriculture and Industries.

TEXT BOOKS:

REFERENCES:

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PREAMBLE
The Diagnostics and Therapeutics is to explore the fundamental mechanisms of disease and use the knowledge to design, test and evaluate new drugs and develop innovative drug delivery and release strategies. It creates technologies and tools to combat disease, promote health, and safeguard the environment. The Knowledge gained will help in realization of physical systems at scales and dimensions similar to biological entities such as bacterial and mammalian cells, viruses, spores, etc.

PREREQUISITE
17BTCC03- MICROBIOLOGY

COURSE OBJECTIVES
1. List the nature of infection, procedural skills to collect and interpret data.
2. Classify the cause of infection and the pathogens.
3. Demonstrate the genetic nature of Human diseases.
4. Organize current Molecular diagnostics of infectious diseases.
5. Assess the biosafety aspects involved in molecular diagnosis.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Demonstrate about collection, Transport, Processing of samples and Classify infection and interpret the result. Understand

CO2. Explain about the most appropriate infectious agent. Understand

CO3. Identify the microorganism and its role in disease diagnosis Apply

CO4. Make use of the genomic knowledge. Apply

CO5. Assume the tool for disease diagnosis and plan diagnostics based on the bio-safety aspects Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

INTRODUCTION TO DIAGNOSTICS AND THERAPEUTICS
Mode of transmissions of infection, Pre-disposing factors of microbial pathogenicity, Normal microbial flora of the human body. Types of infectious diseases, Host - Parasite relationships, Clinical specimens – Collection, Transport and Processing of samples, Interpretation of results.

MICROBIAL INFECTIONS and DIAGNOSIS

MEDICAL GENETICS
Organization of Human genome, Identifying human disease genes, Genetic disorders - Sickle cell anemia, Duchenne muscular Dystrophy, Retinoblastoma, Cystic Fibrosis, Neonatal and Pre-natal disease diagnostics, Gender identification, Analysis of mitochondrial DNA for maternal inheritance, Genetic counselling.

METHODS IN MOLECULAR DIAGNOSTICS
Isolation and purification of nucleic acids, Nucleic acid labelling, Hybridization, PCR and types, PCR based molecular typing, Molecular diagnosis of pathogens based on 18S and 16S rRNA sequences, Automated DNA sequencing, Microarrays - types and applications.

BIOSAFETY FOR MOLECULAR DIAGNOSTICS
Good Laboratory Practices, Different levels of biosafety containments for rDNA experiments, Biosafety aspects of tissue / Cell transplantation.

TEXT BOOKS:
5. Parasitology, Chatterjee K.D, Chatterjee Medical Publisher

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PREAMBLE

Cytogenetics is the branch of genetics that studies the structure and behaviour of chromosomes and their relation to human disease and disease processes. It also deals with chromosomes and their inheritance, particularly as applied to medical genetics. The application of cytogenetics is to monitor mutagenic and clastogenic exposures, and evaluates the importance of these tests for preventive health measures. Cytogenetics often use cutting-edge tools for the diagnosis of various genetic disorders, paving the way for possible treatment and management.

PREREQUISITE – NIL

COURSE OBJECTIVES

1. State the basic concept of genetic material and their structural organization
2. Compare the structure of the gene and their genetic mapping
3. Differentiate the sex in plants and animals
4. Assess the effects of Structural changes in chromosomes and their translocations
5. Check the genetic material in population and their frequency of occurrence

COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Compare the Knowledge about concept of genotype and phenotype characters
CO2. Demonstrate the structure of gene and their mapping system
CO3. Identify, determine and differentiate Sex in plants and animals.
CO4. Relate the variations and changes in chromosome.
CO5. Analyze genes mutations and reproduction

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S- Strong; M-Medium; L-Low

SYLLABUS

GENETICS AND HEREDITY

Introduction to genetics. Genotype and phenotype, Mendelian laws of Inheritance, Test cross, back cross; Structural organization of eukaryotic chromosomes: Nucleosome structure, Euchromatin, heterochromatin, telomeres, Satellite DNA, centromeres, Types of chromosome on the basis of centromeres; Lampbrush chromosomes; polytene chromosomes; Extrachromosomal inheritance; maternal effects and cytoplasmic inheritance, Chi square analysis.

LINKAGE AND CROSSING OVER

Fine structure of the gene: cistron, recon, mutan; Linkage; crossing over: molecular mechanism - double strand break model, Holiday model, Genetic mapping of chromosomes: Diploid mapping - two point cross, three point cross, Haploid mapping; Lod score analysis.

SEX DETERMINATION AND DIFFERENTIATION

Theories of sex determination – chromosome theory and genic balance theory of sex determination, sex determination in dioecious plants {Marchantia, Ceratopteris, Silene (Melandrium), Humulus, Coccinia, Rumex, Papaya}, mouse and in man; genetic basis of sex differentiation (genes located on sex chromosomes and autosomes), single gene control of sex. Hormonal control of sex, sex reversal and gynandromorphs, human sex anomalies (Klinefelter’s syndrome and Turner’s syndrome); brief idea of dosage compensation and Lyon’s hypothesis.
VARIATIONS AND CHANGES IN CHROMOSOME STRUCTURE
The origin and adaptive significance of duplications, deletions, inversions, and translocations, iso/chromosomes, ring chromosomes, centric fusions and fissions, Changes in chromosome number - aneuploidy and euploidy in both plants and animals, their origins, cytogenetic effects, evolution of the karyotype.

MUTATION AND REPRODUCTION
Types of gene mutation- insertion, deletion, missense, nonsense, Mutagens-physical, chemical, DNA repair mechanism, beneficial and harmful effects of mutations, transposable elements, Chromosome-asexual reproduction, modified sexual reproduction (various forms of parthenogenesis), chromosome diminution and elimination.

TEXT BOOKS:

REFERENCES:
7. Strickberger, M.W. “Genetics”, Pearson Education India, New Delhi. 2015

COURSE DESIGNERS

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PREAMBLE
Stem cells in regenerative medicine holds promise for improving human health by restoring the function of cells and organs damaged due to degeneration or injury. Stem cell biology has potential application in several areas of biomedical research that includes drug development, toxicity testing, developmental biology, disease modeling, tissue engineering etc.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To define topics related to stem cells and regenerative biology
2. To describe Stem cell basics and their applications for the benefit of mankind.
3. To execute technologies in engineering stem cells
4. To organize scaffold for tissue engineering
5. To Assess the ethical issues in stem cell research

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. To outline the basics of stem cell Understand
CO2. To identify the basic applications of stem cell in regenerative medicine Apply
CO3. To make use of the latest tissue engineering concepts Apply
CO4. To develop the scaffold tissue using stem cell Apply
CO5. To infer the research in tissue engineering. Analyze

SYLLABUS
INTRODUCTION TO STEM CELL BIOLOGY
Definition and concepts of stem cell terminology. Classification of stem cells. Basic biology of stem cells - Types & sources of stem cell with characteristics. Stem cells in embryonic and adult tissues. Overview of basic and translational research of stem cells modeling disease states, gene/cell therapies,

EMBRYONIC STEM CELLS AND INDUCED PLURIPOTENT STEM CELLS
Early steps in human reproduction (Zygote to blastocyst stage), Totipotent vs Pluripotent stem cells, Embryonic stem cells: Sources, characterization and experimental manipulations, Discovery of Induced pluripotent stem cells (iPSC) and its experimental differentiation into specific tissue types, Generation and characterization of pluripotent stem cells. Experimental breakthroughs and limitations.

ADULT STEM CELLS
Multipotent stem cells from adult tissues and organ systems, stem cell niches. Advantages and disadvantages for use, characterization, experimental manipulations, Immune markers and tissue/organ rejection, Hematopoietic stem cells -
characteristics and differentiation pathways, Lymphoid vs myeloid cell pathways and stem cells. Cord blood transplantation, Mesenchymal stem cells – Isolation, characterization and functional assessment.

**TISSUE REGENERATION AND BIOENGINEERING OF TISSUE AND ORGANS**

Overview of regeneration and bioengineering of tissues. Role of stem cells in controlling tissue regeneration. Experimental strategies to bioengineer tissues and organs from cultured stem cells. 3-D organoid cultures and tissue scaffolds. Characterization of functional bioengineered organs.

**ETHICAL, POLITICAL AND SOCIETAL IMPLICATIONS**


**TEXT BOOKS:**


**REFERENCES:**


**COURSE DESIGNERS**

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PREAMBLE
Genetically modified organisms and ethical issues course deals with the study of modified genes found in and around us. Genetically modified organisms classify the genetic modification and characteristics of modified genes and beneficial effects. Genetically modified organisms use pioneering techniques in science along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms. Knowledge of these principles will enable students to understand how they react under different conditions and how they cause different diseases and their control.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To state the knowledge on concept of Genetically modified organisms
2. To explain the principles of risk benefit analysis of genetically modified organisms
3. To study the sex in different organisms, sex linked inheritance and karyotyping
4. To determine structural changes and mutations in chromosomes.
5. To study about population genetics

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Summarise about the genetically modified microbes and organisms
CO2. Discuss the modified gene copy number and chromosomal changes
CO3. Identify and differentiate Sex in plants, animals and other organisms.
CO4. Relate the Structural changes in chromosomes.
CO5. Analyze the genetic material, mutation and their frequency of occurrence in population for reproduction

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
GENETIC MODIFICATION
Generation of Genetic Modification- Genetically Modified Microbes (bacteria and yeast) and Genetically Modified Organism (plants and animals) - Recombinant DNA technology for GMOs with examples of applications in plants - applications of GMM and GMO within basic science- Biological and medical research.

DETECTION AND ANALYSIS OF GMOS AND GMO PRODUCTS
Modified gene copy number determination, detection of chromosomal changes, toxicological studies, residual DNA analysis, product analysis – microbial, biochemical and molecular, toxicological evaluation.

SEX DETERMINATION
Sex determination in plants and animals: Concepts of autosomes and allosomes, XX - XY, XX - XO, ZW - ZZ, ZO – ZZ Types; Sex differentiation; Dosage compensation; Sex linked inheritance, Sex influenced inheritance Multiple Alleles; Lethality and Interaction of genes. Karyotyping - amniocentesis; banding techniques.

CHROMOSOMAL ABERRATIONS & MUTATIONS
Structural changes: duplications, translocations, inversions; Numerical changes: aneuploidy; Euploidy; polyploidy; Types of mutations; Spontaneous & Induced mutation, lethal mutations, silent mutations, adaptive mutations, biochemical mutations & chemical mutagens, ionizing and non-ionizing radiations; Ames Test.

GENETIC MATERIAL IN POPULATIONS
Population genetics: gene pool, gene frequencies, Hardy - Weinberg law and its applications, factors affecting allele frequencies - selection, mutation, migration and genetic drift; Inbreeding depression; Heterosis; speciation; pedigree analysis.

TEXT BOOKS:
1. David E Newton. 2014. Genetically Modified Organisms food, Santa Barbara, California: ABC-CLIO

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17BTEC08 | MOLECULAR EVOLUTION

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PREAMBLE
This course provides a review of current knowledge in molecular evolution, with attention to evolutionary theory, the patterns and mechanisms of molecular change, the reconstruction of evolutionary trees from gene sequences, the evolution of gene families and their functions, and the evolution of development.

PREREQUISITE
17BTCC09 - MOLECULAR BIOLOGY

COURSE OBJECTIVES

1. To state the students about genes and its structure, and effect of mutation of genes
2. To describe the students about the classical models used to find out the changes in the nucleotide sequence during evolution
3. To demonstrate the students about the conventional method of sequence alignment and building the phylogenetic tree
4. To outline the gene duplication and dating of gene duplication
5. To develop and interpret phylogenetic trees

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Describe the concept and processes of protein and genes in the molecular evolution

CO2. Explain how the evolutionary changes act at the molecular level

CO3. Employ the diversity of molecular evolution computational methods to analyze and interpret molecular evolutionary patterns

CO4. Correlate the bioinformatics tools to find out the evolutionary relationship.

CO5. Deduce the domains of gene duplication and exon shuffling

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

GENES, GENETIC CODES, AND MUTATION
Genes and gene structure- Protein-coding genes, RNA-specifying genes, Un transcribed genes
Mutation- Substitution mutations, Recombination, Deletions and insertions, Inversions, Mutation rates, Spatial distribution of mutations.

EVOLUTIONARY CHANGE IN NUCLEOTIDE SEQUENCES
Nucleotide substitution in a DNA sequence- Jukes and Cantor’s one-parameter model, Kimura’s two-parameter model, Number of substitutions between two noncoding sequences, Substitution schemes with more than two parameters

ALIGNMENT OF NUCLEOTIDE AND AMINO ACID SEQUENCES
Manual alignment by visual inspection, The dot matrix method, Distance and similarity methods, Alignment algorithms, Multiple alignments

MOLECULAR PHYLOGENETICS
Impacts of molecular data on phylogenetic studies, Advantages of molecular data in phylogenetic studies, Rooted and unrooted trees, Scaled and unscaled trees, The Newick format, Number of possible phylogenetic trees, True and inferred trees, Gene trees and species trees, Taxa and clades. Methods of tree construction

GENE DUPLICATION, EXON SHUFFLING, AND CONCERTED EVOLUTION

TEXT BOOKS:
2. D.B. Futuyma. Evolutionary Biology, Third Edition. Sinauer, 1997. This is an excellent general evolution textbook. While it is expensive, it is a great reference and learning tool for anyone interested in evolution in general.

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PREAMBLE
Microbial Biotechnology deals with the study of Microbial products, organization and function of prokaryotes. As the pioneering field in the area of microbial it clearly shows that the industrially important microbes and metabolites. Industrially important microbial metabolites were identified and they were taken to the different steps for the production of antibiotics. Genetically modified organisms are concerned with the application of microbial metabolites in pharma industry and also the types of drugs, how the biofertilizers and biopesticides are useful to the agriculture for the enormous amount of production. Classically recovery and purification of microbial products were analysed for the application in agriculture.

PREREQUISITE
17BTEC09- MICROBIAL BIOTECHNOLOGY

COURSE OBJECTIVES
1. To learn the basic principles of isolation and purification of microbial products
2. To understand the kinetics of microbial metabolites and their actions
3. To understand the recovery and product identification from the microbes
4. To know the importance and application of microbial metabolites in the Parma industry
5. To make the students to test and deepen their mastery of microbial products by applying this knowledge in a variety of problem-solving situations.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

| CO1 | Describe the historical background and cultural characteristics of microbes | Understand |
| CO2 | Cite the differences between culturing techniques, product purification and recovery process | Understand |
| CO3 | Choose the production process for microbial metabolites | Apply |
| CO4 | Examine the production of primary and secondary metabolites | Apply |
| CO5 | Correlate the factors that play a role in the production of antibiotics. | Analyse |

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SYLLABUS
MICROBES AND APPLICATION
Introduction, aims and scope: Organization and function of prokaryotes, Isolation of industrially important microorganisms from different sources. Extremophiles and their applications: Characteristics of selected groups of microbes. Control of microorganisms- physical and chemical agents. Culture concept and cultural characteristics

ISOLATION OF INDUSTRIALLY IMPORTANT MICROBES
Methods in microbiology- Pure culture techniques, Microbial nutrition and growth principles. Growth measurement techniques: Isolation of microorganisms from various sources, long term preservation and improvement of cultures. Design and Preparation of Media- fermentation processes. Study of various methods of biomass measurement- Growth curve studies of microbes in Batch culture and continuous culture. Determination of yield coefficient and Monod’s constant

INDUSTRIALLY IMPORTANT MICROBIAL METABOLITES
Industrially important microbial metabolites - Process technology for the production of primary metabolites e.g. enzymes (Amylases, Proteases, Lactases, Pectinase and Lipases), baker’s yeast, ethanol, citric acid, polysaccharides, nucleosides and bioplastics. Production of secondary metabolites - penicillin, Tetracycline, streptomycin, vitamins etc.

APPLICATIONS OF GREEN CONCEPTS
Applications of microbial metabolites: Pharmaceutical industry, Therapeutics, and Clinical analysis- glucose isomerase, aminopeptidase; amylase, cellulase, penicillin acylase, lipase, oxido-reductase; protease etc. for the production of different types of drugs and drugs intermediates. Biogenic synthesis of nanoparticles from microbes-mechanism, characterization, and applications. Microbes in environmental management, Biocontrol, Biofertilizers, and biopesticides.

RECOVERY AND PURIFICATION OF MICROBIAL PRODUCTS
Removal of microbial cells- Precipitation, filtration, centrifugation. Cell disruption- extraction and chromatography, Drying and crystallization

TEXT BOOKS:

REFERENCES:

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PREAMBLE
Cryopreservation Theory and Applications subject deals with the basic knowledge in the preservation techniques. The course often use cutting-edge techniques and sophisticated machinery along with other applied fields of research to study how the eggs and sperm are preserved for later uses. Knowledge of these principles will enable students to understand the various free drying preservation techniques and its usefulness.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To recognise the basics of cryopreservation and effects caused by it.
2. Summarize about different types cryopreservation
3. To implement cryopreservation in fertilization process.
4. To outline the knowledge of cryopreservation in therapeutics and other fertilization process
5. To assess the role of cryopreservation in therapeutics.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Generalize the basic principle cryopreservation. Understand
CO2. Discuss about different types of cryopreservation. Understand
CO3. Practice the cryopreservation techniques in fertilization process Apply
CO4. Illustrate the cryopreservation techniques for storage system Apply
CO5. Establish the importance of cryopreservation process. Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
INTRODUCTION
Cryopreservation – History and Definition, temperature factor – normal biochemical reaction leading to death, Damages caused by general freezing of cell and tissues, Natural cryopreservation, Gaia theory (James Love Lock), freezing and refrigeration.

VARIATION IN CRYOPRESERVATION
Cryobiology, Cryogenics, Frozen zoo, *ex situ* conservation, Long time preservation.

TECHNOLOGY OF CRYOPRESERVATION
General Biotechnology in cryopreservation, Cellular cryobiology and hydrobiology, Deep freezing damages, *in vitro* storage and cryopreservation.

CRYOPRESERVATION AND FERTILITY
Fertility failures, Embryo cryofreezing, techniques in embryo freezing, Storage thawing, retrieval, Cryoprotectant solution.
CRYOPRESERVATION MAN’S HOPE
Cryopreservation of egg, Sperm of Homosapiens, Techniques employed in aquaculture (Fish Plankton), Cawthron collection, Design and use of thermal transport containers for cryopreservation, Role of cryopreservation in therapeutics.

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**PREAMBLE**

The aim of the course is to explain the molecular mechanisms at the basis of the structure-function relationships of proteins and the experimental approaches to modulate the protein functionality and to evolve a desired function or structure. The course is also aimed to provide the most updated knowledge/skills related to the production of recombinant proteins. This course is a blend of modern discoveries and applications in protein sciences.

**PREREQUISITE** –NIL

**COURSE OBJECTIVES**

1. To recall the translation and post translational modification processes.
2. To discuss the structure, functional correlation and the prediction of properties of protein based on its sequence.
3. To illustrate the role of analytical methods to determine protein structure and protein – protein interactions.
4. To observe the similarities in structure at basal level in a group of having similar function, thereby predicting the strategies to modify and design novel proteins.
5. To provide updated knowledge about recombinant proteins and its application in therapeutics.

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to:

- CO1. Describe the structure and classification of proteins
- CO2. Identify the amino acid sequence and structure of proteins, and relate this information to the function of proteins strategies
- CO3. Interpret the characteristics of individual amino acids and their effect on the solubility, structure and function of proteins
- CO4. Develop biotechnical methods to construct plasmids for the expression of natural and modified genes
- CO5. Employ new methodologies for protein engineering and protein design.

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**BONDS AND ENERGIES IN PROTEIN MAKEUP**

Covalent and Non-covalent interactions in Protein structure, Translation and Post Translational Modifications

**PROTEIN ARCHITECTURE**

Primary structure, Secondary structures, Super secondary structures, Topology diagrams, Nucleotide binding folds, Tertiary structures, Modular nature and Formation of complexes in Quaternary structures.

**PROTEIN FOLDING AND STRUCTURE DETERMINATION**

Protein Denaturation and Renaturation, Protein folding pathways, Stability of folded conformation of proteins, Methods to determine primary, tertiary and quaternary structure - Peptide mapping, Peptide sequencing, Circular Dichroism, Mass spectroscopy and X-ray diffraction.

**PROTEIN STRUCTURE - FUNCTION RELATIONSHIP**
Helix-turn-Helix motifs, Cro, Lamda and Trp repressor, Zn fingers, Tata Box binding proteins, Homeodomain, Leucine zippers, Enzyme - Understanding the catalytic design by engineering trypsin, chymotrypsin and elastase.

PROTEIN ENGINEERING AND PROTEIN DESIGN
Site directed mutagenesis, Engineering of T4 Lysozyme and Recombinant Insulin, Protein design - Principles and examples.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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PREAMBLE
Neurobiology is the scientific study of the nervous system. It is a multidisciplinary branch of biology, that deals with the anatomy, biochemistry, molecular biology and physiology of neurons and neural circuits. It also drawn upon other fields, with the most obvious being pharmacology, psychology and medicine. The scope of neuroscience has broadened over time to include different approaches used to study the molecular, cellular, developmental, structural, functional, evolutionary, computational, psychological and medical aspects of the nervous system.

PREREQUISITE –NIL

COURSE OBJECTIVES
1. To learn the basic principles of nervous system and function of neurons
2. To develop knowledge on neurophysiology and synaptic transmission
3. To understand the basic concept of neuropharmacology and neuronal function
4. To understand the concepts of applied neurobiology and its mechanism
5. To make the students to test and deepen their mastery of neurobiology and the importance of behavioural science.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Discuss the anatomy and organization of nervous systems
Understand
CO2: Describe the function of nervous systems
Understand
CO3: Predict the influence of drugs in the nervous system
Apply
CO4: Examine the basic mechanisms associated with behavioural science
Apply
CO5: Correlate the neurological responses associated with nervous system.
Analyse

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S- Strong; M-Medium; L-Low

SYLLABUS

NEUROANATOMY
Central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

NEUROPHYSIOLOGY
Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

NEUROPHARMACOLOGY
Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; characteristics of neurites; hormones and their effect on neuronal function

APPLIED NEUROBIOLOGY
Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction

**BEHAVIOUR SCIENCE**
Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system

**TEXT BOOKS:**

**REFERENCES:**

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PREAMBLE
Food microbiology is the study of the microorganisms that inhibit, create, or contaminate food, including the study of microorganisms causing food spoilage, pathogens that may cause disease especially if food is improperly cooked or stored, those used to produce fermented foods such as cheese, yogurt, bread, beer, and wine, and those with other useful roles such as producing probiotics. Knowledge of these principles will enable practice well in handling food substances carefully.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To recognize the basic knowledge on food safety levels.
2. To discuss various factors affecting the growth of microorganisms.
3. To classify the role of food preservation techniques
4. To categorise the fermented dairy products
5. To check and prevent the ways of food spoilage substances

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Cite the various food safety levels. Understand
CO2: Explain the various factors affecting growth of microorganisms Understand
CO3: Articulate the role of food preservation techniques Apply
CO4: Predict the risk involved in fermented dairy products Apply
CO5: Able to discriminate the various food spoilage substances and practice the safety procedures Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

SCOPE OF FOOD MICROBIOLOGY

FACTORS AFFECTING THE GROWTH OF MICROORGANISMS

FOOD PRESERVATION
The Microbiology of Food Preservation - Heat Processing, Irradiation, High-pressure Processing – Pasteurization, Low-temperature Storage and Chemical Preservatives.

FERMENTED DIARY PRODUCTS
Production of fermented dairy products: Cheese, yoghurt, butter milk, sour cream Fermented vegetables; Sauerkraut, pickles, olives and soy sauce. Fermented meat, Fermented Indian foods - leavening of bread.
FOOD SPOILAGE

TEXT BOOKS:

REFERENCES:

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PREAMBLE
Endocrinology is a branch of biology and medicine dealing with the endocrine system, its diseases and its specific secretions known as hormones. It is also concerned with the integration of developmental events proliferation, growth and differentiation and the psychological or behavioural activities of metabolism, growth and developmental events proliferation, growth and differentiation, tissue function, sleep, digestion, respiration, excretion, mood, stress, lactation, movement, reproduction and sensory perception caused by hormones. Specializations include behavioural endocrinology and comparative endocrinology.

PREREQUISITE –NIL

COURSE OBJECTIVES
1. To define the basic principles of endocrine system which consists of several glands
2. To explain about hormones and behavioural endocrinology
3. To outline the basic concept of female reproductive tract and endocrine regulation of ovarian functions
4. To compare the concepts of fertilization and conception of sexual reproduction
5. To develop diagnostic method for detection of diseases related to endocrine system.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Enumerate about the background and development of endocrine system
CO2: Indicate the importance of sexual differentiation and the role of biochemical and hormonal aspects
CO3: Predict the sources of ovarian hormones and regulation of ovarian functions
CO4 Sketch the internal and external fertilization and genetic recombination.
CO5: Evaluate the role of hormones in developmental

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

GENERAL ENDOCRINOLOGY

GONADAL DIFFERENTIATION

FEMALE REPRODUCTIVE TRACT-I
Study of ovary Ovary: Structure, folliculogenesis, Ovulation. Sources of ovarian hormones, Ovarian androgen, inhibin, Endocrine regulation of ovarian functions
CONCEPTION
Fertilization, Conception, Parturition, Maternal- foetal placental hormones.

APPLIED ENDOCRINOLOGY
Hormones, growth and development, Hormones and human health. Production of hormones as Pharmaceuticals.

TEXT BOOKS:

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17BTEC15  BIOREMEDICATION TECHNOLOGY  
Category  L  T  P  Credit
EC (PS)  3  0  0  3

PREAMBLE
Bioremediation technology is one of the emerging technologies in the branch of biotechnology which deals with controlling the pollution with the help of microorganism. Bioremediation technology often use leading-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms in degrading the waste materials. With the Knowledge of these principles students will enable to understand the different approaches to reduce the waste and turning them into valuable bio products.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To discuss the basics about the bioremediation and biodegradation.
2. To describe about the various techniques involved in bioremediation.
3. To outline the role of microorganism in decomposition process.
4. To categorise the different transformation process during bioremediation.
5. To develop a high value bioproducts from renewable sources.
COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Explain about the concepts of bioremediation and biodegradation.    **Understand**

CO2. Explain about the usage of different techniques involved in bioremediation    **Understand**

CO3. Compare the aerobic and anaerobic mode of decomposition    **Analyse**

CO4. Compare the energy transformation process    **Analyse**

CO5. Appraise the product produced from the renewable sources    **Evaluate**

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S- Strong; M-Medium; L-Low

SYLLABUS

BASIC STUDIES ON BIOREMEDIATION

History, stages to set up study on bioremediation (Preliminary investigation, site evaluation, laboratory studies, start up, operational support), limitation of bioremediation, relative biodegradability, Process design of aerobic and anaerobic system – Activated sludge process – Trickling filter – Rotating biological contactors – Fluidized bed reactor – Up flow anaerobic sludge blanket reactor (UASB).

BIOREMEDIATION TECHNIQUES

Bioremediation types - In situ and ex situ bioremediation, biophiles, bioventing, land forming, bio stimulation, bioaugmentation, biosparging,biofilters, bio scrubbers and phytoremediation – bioleaching, bio precipitation, bioaccumulation and biosorption. Merits and demerits.

MICROBIAL METABOLISM IN BIODEGRADATION AND BIOREMEDIATION PROCESS


BIOREMEDIATION PROCESS

Bioremediation process, metabolic process, energy transformation process, growth requirement, microbial and enzymatic biodegradable mechanism on heavy metals like cadmium and mercury nuclear waste, Bioremediation of greenhouse gas, hydrocarbons. Environmental variation in field.

BIOPRODUCTS FROM RENEWABLE SOURCES

Overview of renewable sources, Production of bio compost and vermicomposting. Production of biofertilizers and biopesticides. Production of biomethane, bioethanol, biohydrogen, biodiesel. Production of bioplastics and biopolymers, Bioelectricity generation and value-added products from renewable sources.

TEXT BOOKS:


REFERENCES:
1. Popular Biotechnology Lecture Series Focus: Bioremediation by Division of Biotechnology, PSCST, 2013.

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17BTEC16 CANCER BIOLOGY

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PREAMBLE
Cancer Biology is to learn the foundation principles in cancer mechanisms. It creates a broad base of knowledge to differentiate normal and cancerous cell and also about different types of agents leading to carcinogenesis. It aims to provide the strength to acquire an advanced knowledge and understanding of the molecular mechanism, diagnosis, prevention and therapeutic management.

PREREQUISITE
17BTCC09-MOLECULAR BIOLOGY

COURSE OBJECTIVES

1. To define the basic principles in cancer biology.
2. To discuss about the carcinogens.
3. To demonstrate students on various genetic and molecular changes normal cells undergo during transformation into malignant cancer.
4. To outline mechanism of cancer development and progression.
5. To have an understanding in a multidisciplinary approach to cancer treatment.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

CO1. Summarize the hallmarks of cancer. Understand
CO2. Discuss about the Carcinogens. Understand
CO3. Identify the types of gene mutations and cancer formation. Apply
CO4. Utilize the molecular mechanisms underlying the development of cancer. Apply
CO5. Infer about cancer progression, metastasis and new therapies. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO1 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
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CO5 | M    | -   | M   | M   | S   | M   | S   | M   | M   | M    | M    | M    | S     | S      |       |

SYLLABUS

FUNDAMENTALS OF CANCER BIOLOGY
Cell cycle and check points, Cancer mechanism, Receptors, Signal molecules, Signal transduction – Modulation study, Tumour suppressor gene, Different forms of cancers, Diet and cancer. Detection using biochemical assays, Tumor markers, Molecular tools for early diagnosis of cancer.

PRINCIPLES OF CARCINOGENESIS

PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER

PRINCIPLES OF CANCER METASTASIS
Clinical significances of invasion, Heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion, Angiogenesis.

NEW MOLECULES FOR CANCER THERAPY
Different forms of therapy, Chemotherapy, Radiation therapy, Detection of cancers, Prediction of aggressiveness of cancer, Advances in cancer detection, Use of signal targets towards therapy of cancer, Gene therapy

TEXTBOOKS

REFERENCES:

COURSE DESIGNERS

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<td><a href="mailto:sridevi@vvec.ac.in">sridevi@vvec.ac.in</a></td>
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PREAMBLE
This is a multidisciplinary course deals with various aspects like plant and animal biotechnology, medical biotechnology, Biopharmaceutical technology, Bioprocess and Environmental biotechnology to educate students within the field of Biotechnology. Students will gain theoretical and practical competence within the broad field of Biotechnology, both in the molecular level as well as with its applications.

PREREQUISITE
17BTCC11-PLANT AND ANIMAL BIOTECHNOLOGY

COURSE OBJECTIVES
1. To list the basic techniques of plant tissue culture for crop improvement.
2. To describe the novel techniques used in medical biotechnology.
3. To outline the recombinant therapeutics in pharmaceutical industry.
4. To distinguish the uses of different microbes in various industry.
5. To execute the use of genetically engineered organisms in environment.

COURSE OUTCOMES
On the successful completion of the course, students will be able to:

CO1. Outline the basic information about plant tissue culture techniques
CO2. Demonstrate the various novel techniques used in medical field
CO3. Apply the different methods for the production of therapeutic agents in pharmaceutical industry
CO4. Examine the uses of genetically engineered microbes in Industrial application
CO5. Employ the uses of genetically engineered organism in Environmental issues

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

PLANT AND ANIMAL BIOTECHNOLOGY
Plant tissue culture and application of transgenic for crop improvement in agriculture, horticulture and forestry, Plantibodies, plastic from plant, genetically modified soybean, transgenic animals and its uses.

MEDICAL BIOTECHNOLOGY

BIOPHARMACEUTICAL TECHNOLOGY
Production of recombinant pharmaceutical products – Biotechnology derived products (Therapeutic proteins): Study of hematopoietic growth factor, Interferon’s and Interleukins, Insulin, Growth hormones, Vaccines and Monoclonal antibody-based pharmaceuticals, Recombinant coagulation factors and thrombolytic agents, Somatostatin, Somatotropin.

BIOPROCESS TECHNOLOGY
Application of microbes in industry – Industrial Processing, recovery, extraction and purification, Production of antibiotics, solvents, organic acids, amino acids, enzymes, vitamins, single cell protein, food substances from brewing and dairy industry.

**ENVIRONMENTAL BIOTECHNOLOGY**


**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE DESIGNERS**

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<td><a href="mailto:vinogenes@gmail.com">vinogenes@gmail.com</a></td>
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# 17BTEC18: METABOLIC ENGINEERING

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## PREAMBLE

Metabolic engineering involves the redesign of metabolism to enable cells to produce new products such as valuable chemicals and biofuels, and/or remediate toxins. This field is growing rapidly in both academia and industry. The biotechnology industry requires skilled engineers with knowledge of how to apply engineering principles to metabolic pathways in order to analyse, design, and alter cell functions. The introduction of basic concepts, current technologies, and challenges within the field will provide students with a valuable toolset to address metabolic engineering problems that are relevant to the emerging biotechnology industry.

## PREREQUISITE –

17BTCC06-ADVANCED BIOCHEMISTRY

## COURSE OBJECTIVES

1. To define the appropriate host and/or metabolic pathways to produce a desired product or remediate a toxin
2. To describe and compare the potential metabolic engineering strategies using quantitative metabolic modeling
3. To analyze metabolic flux and to determine metabolic pathway utilization using 13C-labeling strategies
4. To assess and derive effective combinatorial metabolic engineering strategies
5. To produce those strategies to implement genetic manipulations

## COURSE OUTCOMES

After the successful completion of the course, learner will be able to:

- **CO1.** Translate the energetics of cellular metabolism
- **CO2.** Describe the structure and regulation of metabolic networks
- **CO3.** Establish the optimal strategy for introducing directed genetic changes in the microorganisms with the aim of obtaining better production strains
- **CO4.** Relate the modern biology with engineering principles.
- **CO5.** Write Case studies on metabolically engineered products and processes in various expression systems

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S - Strong; M-Medium; L-Low

## SYLLABUS

### INTRODUCTION

Overview of metabolism, Basic concept of metabolic engineering, Cellular metabolism, Transport Processes-Active and passive transports, Biosynthetic and degradation pathways of amino acids, nucleotides, fats and nucleotides

### METABOLIC FLUX ANALYSIS

Introduction to metabolic engineering, comprehensive models of cellular reactions with stoichiometry and reaction rates; metabolic flux analysis of exactly/over/under determined systems. Shadow price, sensitivity analysis.

### CONSTRAINT BASED GENOMIC SCALE METABOLIC MODEL
Underdetermined systems- linear programming, sensitivity analysis, Development of Genomic scale metabolic model, Flux balance analysis, Regulatory on-off Minimization and Minimization of metabolic adjustments and Opt knock tool development, Elementary mode analysis, Extreme pathways.

**METABOLIC FLUX ANALYSIS BY ISOTOPIC LABELLING**
Methods for the experimental determination of metabolic fluxes by isotope labeling metabolic fluxes using various separation-analytical techniques. Validation of flux estimates by 13C labeling studies in mammalian cell culture

**CASE STUDIES IN METABOLIC ENGINEERING**
Metabolic engineering examples for bio-fuel, bio-plastic and green chemical synthesis. Study of genome scale model in various systems for the production of green chemicals using software tools. Validation of the model with experimental parameters

**TEXTBOOKS**

**REFERENCES**

**COURSE DESIGNERS**

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<td><a href="mailto:karthigadevi@avit.ac.in">karthigadevi@avit.ac.in</a></td>
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PREAMBLE
Clinical Trial is to expose the students to literature survey and to understand research objectives, learn the advanced instrumental techniques to be used in research, and computational application in Pharmaceutical and Medicinal Chemistry research. The students should also be made aware of the research ethics, principles and conduct of clinical trials for medical research and Intellectual Property Right.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To recognize the research objectives
2. To discuss with the essential components necessary to conduct clinical trial research
3. To Demonstrate the basic principles for design of clinical trials
4. To Execute toxicological studies
5. To Check the interventions

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Review the research work. Understand
CO2. Select the research component Understand
CO3. Prepare the procedures for clinical trial Apply
CO4. Appraise the role of toxicology in drug development Analyze
CO5. Organize a Clinical trial Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

PURPOSE OF RESEARCH

BASIC TERMINOLOGY USED IN CLINICAL RESEARCH

CLINICAL TRIALS
New drug discovery process – Purpose, Main steps involved in new drug discovery process, Timelines of each steps, Advantages and purposes of each steps, Ethics in clinical research, Unethical trials, Thalidomide tragedy, Phase – I, II, III, IV trials (Introduction and designing, Various phases of clinical trials, Post marketing surveillance, Methods, Principles of sampling, Inclusion and exclusion criteria, Methods of allocation and randomization, Informed consent process in brief, Monitoring treatment outcome, Termination of trial, Safety monitoring in clinical trials).

PRECLINICAL TOXICOLOGY
General principles, Systemic toxicology (Single dose and repeat dose toxicity studies), Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity, Animal toxicity requirements.

APPLICATIONS
Study of various clinical trials (completed or ongoing), Clinical trial applications in India Import and export of drug in India, Investigational New Drug application (IND), Abbreviated New Drug Application (ANDA), New Drug Application (NDA).

TEXTBOOKS

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### PREAMBLE
This course deals about the biology of plants, plant microbe’s interaction, genetic manipulation of crops, different vectors and their applications and how plant act as factories for the production of various compounds. This course will prepare the students for a variety of careers, including modern plant biotechnology processes, breeding of healthy plants, plants with improved characteristics and plants for biomolecule production.

### PREREQUISITE – NIL

### COURSE OBJECTIVES
1. To state the basic of cell structure and function
2. To describe the interaction of microbes and plants
3. To perform the novel techniques used in genetic manipulation in crops
4. To categorise the uses of different vectors in biotechnology
5. To produce the different organic compounds using Plants as Factories

### COURSE OUTCOMES
After the successful completion of the course, learner will be able to

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<td>Demonstrate the plant and microbes interactions</td>
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<td>Apply the novel techniques used in genetic engineering and genetic manipulation in crop improvement</td>
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<td>Identify the uses of different vectors and their application in biotechnology field</td>
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<td>Examine the different organic compounds like vitamins, amino acids and proteins etc, using plant as a major source.</td>
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S- Strong; M-Medium; L-Low

### SYLLABUS

#### BIOLOGY OF PLANTS
Plant cell structure and functions. Plant nutrition, Water and mineral availability and uptake. Growth regulators- Phytohormones, auxins, cytokines, Gibberellins, Abscisic acid, ethylene.

#### PLANT –MICROBES INTERACTIONS

#### GENETIC MANIPULATION IN CROPS
Genetic engineering- scope and methods. Gene guns, electroporation, transformation, microinjections, CRISPR, TALEN. Types of modifications- Transgenic, cisgenic, subgenic. Stress resistance, pest resistance, herbicide tolerance and other modified traits.

#### PLASMIDS AND PROMOTERS

**PLANTS AS BIO–FACTORIES**
Seed storage proteins, essential amino acids, vitamins and minerals, heterologous protein production in transgenic plants for agriculture, industry and pharmaceuticals uses, biodegradable plastics.

**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE DESIGNERS**

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PREAMBLE
Genomics and Proteomics deals with a rapidly evolving scientific area that introduces students into genomes, proteomes and databases that store various data about genes, proteins, genomes and proteomes. Students would learn about genomics, proteomics and bioinformatics and offer basic knowledge of genome sequencing, major differences between prokaryotic and eukaryotic genomes, basic proteomics and its applications. Students would gain skills in applied bioinformatics, comparative, evolutionary, human genomics and functional genomics. The acquired knowledge during the course would be helpful to those students who want to work in core facilities and commercial biological and medical laboratories as well as in their postgraduate studies.

PREREQUISITE –NIL

COURSE OBJECTIVES
1. To explain advanced theoretical knowledge on the organization and function of genomes
2. To execute different mapping techniques.
3. To Perform gene identification and gene expression studies
4. To outline the identification, separation and sequencing of proteins
5. To evaluate the principles of bioinformatics and databases

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. To describe the organisations genes in prokaryotes and eukaryotes
   Understand

CO2. To illustrate various genome mapping techniques and its strategies.
   Understand

CO3. To compute the flow of genetic information from DNA to RNA to protein
   Apply

CO4. To determine the advantages and the drawbacks of various proteomics technologies with the emerging technologies
   Apply

CO5. To evaluate the role of proteomics in drug discovery
   Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S: Strong; M: Medium; L: Low

SYLLABUS
OVERVIEW OF GENOMES OF PROKARYOTES, EUKARYOTES AND HUMAN
Organisation of genes, Coding and non-coding chromosomes and high order structures, Genome relatedness, Introduction of genomics.

MAPPING TECHNIQUES
Mapping strategies, Maps – Physical and Genetic maps, Comparative map, Integrated map, Top down and bottom up approach, linking and jumping of clones, STS maps, Human Genome Project

FUNCTIONAL GENOMICS
Gene identification and prediction, Annotation, Functional prediction, Gene expression and micro arrays, Subtractive DNA library screening, differential display and representational difference analysis, SAGE.
PROTEOMIC TOOLS
Edman protein microsequencing, Proteome analysis, 2D gel electrophoresis, Metabolic labeling, Detection of protein on SDS gels. Mass spectrometry – MALDI - TOF, Tandem MS - MS, Peptide mass finger printing.

PROTEIN PROFILING AND APPLICATION OF PROTEOMICS
Protein – protein interaction, Post translational modification, Proteomics in drug discovery.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
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MOLECULAR MODELLING AND DRUG DESIGNING

PREAMBLE
This course enables the students to broaden their interests to use structure-based and non-linear classification methods in drug design.

PREREQUISITE
17BTEC03-PRINCIPLES OF BIOINFORMATICS

COURSE OBJECTIVES
1. To list concepts involved in molecular modelling
2. To summarize molecular mechanisms involved in energy minimization
3. To execute the molecular dynamics using different models
4. To develop basic steps involved in modeling of proteins
5. To justify the molecular dynamics in drug designing and discovery

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Recognize about molecular modelling concepts
CO2. Classify molecular mechanisms behind energy minimization problems
CO3. Illustrate the models to study the molecular dynamics
CO4. Compare molecular dynamics with drug designing concepts
CO5. Design new techniques for the discovery of drugs

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

QUANTUM MECHANICS & CONCEPTS IN MOLECULAR MODELING
Introduction – coordinate systems – potential energy surfaces – introduction to quantum mechanics – postulates – Schrödinger wave equation – hydrogen molecule – Born-Oppenheimer approximation, introduction to computer hardware and software

MOLECULAR MECHANICS AND ENERGY MINIMIZATION

MOLECULAR DYNAMICS AND MONTE CARLO SIMULATION
Introduction – Using single Model – time steps – Multiple steps – Setting up MD – energy conservation in MD Simulation Examples – Monte Carlo – Random number generation – Difference in MD & MC

HOMOLOGY MODELING

DRUG DESIGN

TEXTBOOKS:

REFERENCES:
   “Advanced Drug Design and Development” Kourounakis Taylor and Francis

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>G. Karthiga Devi</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:karthigadevi@avit.ac.in">karthigadevi@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.G.Arthi</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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**PREAMBLE**

One of major applications of nanoscience is in biotechnology field. In various disciplines, a single course which starts by sensitizing students from a varied background about the biological/biotechnological basics and culminates into modern day applications of nanoscience in biotechnology field will be highly useful. This course will act as a bridge between students from non-biology course at all levels.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**

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**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to:

- CO1. Explain the terms and properties of nanoparticles
  - Understand
- CO2. Interpret and characterise the nanoparticles
  - Understand
- CO3. Identify the properties of nanoparticle in signalling pathway
  - Apply
- CO4. Examine the role of microorganisms in Nanobiotechnology
  - Analyse
- CO5. Correlate the role of Nano particles in treatment of disease
  - Analyse

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION TO NANOBIO TECHNOLOGY**

Introduction to types and properties of nanoparticl, Overview of nanodevices and techniques, Inorganic nano scale systems for biosystems–Nanostructured materials–Fullerens: Properties and characterization – Carbon nanotubes: Characterisation and application–Quantum dots and wires–Gold Nanoparticles –Nanopores

**FABRICATION AND CHARACTERISATION**


**NANOMOLECULES IN BIOSYSTEMS**


**MICROORGANISMS AND NANOBIO TECHNOLOGY**
Nanobiotechnology and microorganisms – Polyhydroxy alkanotes (PHA) Cyanophycin inclusions– Magnetosomes– Alginate s-layer proteins – Bacteriorhodopsin.

APPLICATIONS OF NANOBIOtechnology

TEXT BOOKS:

REFERENCES:

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<td>Dr. R. Deepapriya</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:deepapriya.biotech@avit.ac.in">deepapriya.biotech@avit.ac.in</a></td>
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PREAMBLE
This course will provide knowledge of comprehensive understanding of the biofertilizer technology and its current trends. It develops the entrepreneurship to catch with the current trends as well as creating the industry ready professionals.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To state the basic knowledge on biofertilizer in agriculture.
2. To discuss about the role of biofertilizer in crop production
3. To implement the production and application of biofertilizer technology
4. To outline the marketing strategies of biofertilizer.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

O1. Explain the types and importance of biofertilizer. Understand
CO2. Outline in detail about the different chemical fertilizer, green manuring and its role in crop production Understand
CO3. Identify the functions of microorganism from various sources and their mass production Apply
CO4. Inspect in detail about the application and limitation of biofertilizer in crop field Apply
CO5. Examine the promotion and strategies improvement in distribution system. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

BIOFERTILIZER

BIOFERTILIZER AND ITS ROLE IN CROP PRODUCTION SYSTEM
Different chemical fertilizer, its function and effect on agriculture. Role of organic matter on crop production and soil health. Various type of bio-inocula and techniques application and keep soil environment free from pollution. Green manuring, its sources, use and role in cropping system.

FUNCTION AND MASS SCALE PRODUCTION
Total and differential count of microorganisms from soil, water and carrier material. Nitrogen cycle and nitrogen fixation technology. Isolation, purification, screening, selection, mass scale production and preservation of *Rhizobia/Bradyrhizobia, Azotobacter, Azospirillum*, PSB and KSB. General biology, function, use and important of green manuring, particularly Sesbania and Azolla.

APPLICATION TECHNOLOGY
Strain selection, sterilization, growth and fermentation, mass production of various biofertilizers. Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Limitation of bio-fertilizer and bio-pesticide application in agriculture.

EXTENSION, PROMOTION AND MARKETING
Extension strategies, diagnosis for the effectiveness of inoculation, improvement in distribution system.

TEXT BOOKS:
1. Dr. HLS Tomdon, Fertilizers, organic manures, recyclable water and biofertilizer, Fertilizer development and consultation organization 204-204 A New Delhi.

REFERENCES:
1. HLS. Tandan, Biofertilizer technology marketing and uses, Fertilizer development.

COURSE DESIGNERS

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<td><a href="mailto:deepapriya.biotech@avit.ac.in">deepapriya.biotech@avit.ac.in</a></td>
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<tr>
<td>2</td>
<td>Dr M. Sridevi</td>
<td>Professor &amp; Head</td>
<td>Biotechnology</td>
<td><a href="mailto:sridevi@vkvec.edu.in">sridevi@vkvec.edu.in</a></td>
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PREAMBLE
The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To list out the students with the basic organization of organisms and subsequent building to a living being
2. To summarize about the machinery of the cell functions that is ultimately responsible for various daily activities.
3. To implement the knowledge about biological problems that requires engineering expertise to solve them.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Outline the structure and cell theory of living organism. Understand
CO2: Infer about the biological diversity of life. Understand
CO3: Utilize the application of enzymes in industrial level. Apply
CO4: Identify the uses of Bioremediation and Biosensors using molecular machines. Apply
CO5: Analyse in detail about the principles of cell signalling in nervous system and immune system. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOLOGY – CELL AND CELL STRUCTURE AND FUNCTION
Introduction, Scope, Disciplines of biology – An over View of plants, animal, Microorganism.

INTRODUCTION TO BIOLOGY – BIO CHEMISTRY, ENZYME, INDUSTRIAL USE

FOOD DIET NUTRITION

ENVIRONMENT

HEALTH, IMMUNE SYSTEM AND MEDICINE
TEXT BOOKS:
3. Frank H.Deis, Nancy Count Gerber, Roger E.Koeppe, 2 Molecular motors

REFERENCE BOOKS:
1. Albert’s, 2003, Molecular Biology of the cell
2. Lodish, 2004, Molecular cell Biology

COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S.No.</th>
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<tr>
<td>1</td>
<td>R. Deepa Priya</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:deepapriya.biotech@avit.ac.in">deepapriya.biotech@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr M.Sridevi</td>
<td>Professor &amp; Head</td>
<td>Biotechnology</td>
<td><a href="mailto:sridevi@vkvec.edu.in">sridevi@vkvec.edu.in</a></td>
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</table>
PREAMBLE
The built environment is a major source of society’s environmental impact, and is a major opportunity to find solutions. Recent attention to “green construction” emerges in many domains including energy systems, water use, construction processes, architectural design, site planning and brownfield development. At present, environmental issues can be considered in seemingly unlimited areas of the design and construction process.

PREREQUISITE – NIL

COURSE OBJECTIVES
1 To state about the infrastructure providing clean drinking water, clean air to breath and safe building to live in.
2 To explain the students about the threats due to pollution leading to sustainable infrastructure
3 To demonstrate the impact and aspects of green building and Architecture

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Explain the concepts related to pollution problem during construction. Understand
CO2. Classify the design of system for comfortable living Understand
CO3. Apply geochemical transport model to maintain the thermodynamics equilibrium and kinetic control. Apply
CO4. Model the Construction of buildings for economically, environmentally and socially sustainable to future. Apply
CO5. Analyse the resources and sustainability of construction and green buildings Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

CONCEPTS OF CONSTRUCTING MULTI STOREY BUILDING
Study of water, soil, air and their related pollution problems in construction. Identification and development of technical solution to solve / control problems- legislative, economic and social concern.

CONCEPT OF HUMAN HABITAT
Design of systems – Living area, ventilation, electrical circuits (less consumption) technologies and structures to suit the growing population for comfortable living.

GEOCHEMICAL ASPECTS OF GREEN BUILDING
Geochemical transport model maintaining thermodynamics equilibrium and kinetic control-Hydrology transfer resources and impact of bioremediation, treatment plant design, problem solving techniques, civil and environmental application of engineering science and creative problems solving methods

ENGINEERING ARCHITECTURE
Impact of architecture, engineering and construction on individuals, communities and nation. Construction of buildings which are economically, environmentally and socially sustainable to future - knowledge, tools and materials that enhance the safety and cost effective
RESOURCES AND SUSTAINABILITY
Environmental chemistry, advanced air and water treatment technologies durability of construction, green building (sustainable buildings). Resource efficient building from planning to design, construction, maintenance, renovation and demolition.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE DESIGNERS

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<td><a href="mailto:vinogenes@gmail.com">vinogenes@gmail.com</a></td>
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<td>2</td>
<td>Mr.N.Jawahar</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:jawahar@vmkvec.edu.in">jawahar@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
Course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To list out the explore society’s present needs and future energy demands.
2. To explain conventional energy sources and systems, including fossil fuels and nuclear energy.
3. To perform on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro.
4. To outline the energy conservation methods will be emphasized.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Relate the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment. Understand

CO2. Explain remedies/potential solutions to the supply and environmental issues associated with fossil fuels and other energy resources. Understand

CO3. Identify and describe the primary renewable energy resources and technologies. Apply

CO4. Choose the basic electrical concepts and system components. Apply

CO5. Analyse and quantify energy demands and make comparisons among energy uses, resources, and technologies. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

PRINCIPLES OF SOLAR RADIATION
Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

SOLAR ENERGY COLLECTION STORAGE AND APPLICATIONS
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

WIND ENERGY
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

BIO-MASS
# OCEAN ENERGY AND DIRECT ENERGY CONVERSION

OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. Need for DEC, Carnot cycle, limitations, principles of DEC.

## TEXT BOOKS:
1. GD Rai- Non-Conventional Energy Sources, Khanna Publishers, 2004

## REFERENCES:

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<td>Biotechnology</td>
<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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</table>
**PREAMBLE**
This course will make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities. At the end of this course the student shall have a reasonable knowledge about the various construction procedures for sub to super structure and also the equipment needed for construction of various types of structures from foundation to super structure.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**
1. To list out the students, who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
2. To summarize the synthesis data with sound engineering principles, methodologies, and the latest technology into creative, sustainable, safe and economical engineering solutions to environmental engineering problems.
3. To classify the Characterize and mitigate natural and man-made hazards.
4. To outline the fundamental knowledge of the inter-relationships between the built environment and natural systems.
5. To design the technological innovations needed to safeguard, improve, and economize infrastructure and society.
6. To generate and apply high performance eco-friendly structural materials and systems.

**COURSE OUTCOMES**
After the successful completion of the course, learner will be able to

CO1. Explain the function on multidisciplinary teams. **Understand**

CO2. Illustrate, formulate, and solve engineering problems. **Understand**

CO3. Identify the professional and ethical responsibility. An ability to communicate effectively. **Apply**

CO4. Inspect the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. **Analyze**

CO5. Examine the units of energy—to quantify energy demands and make comparisons among energy uses, resources, and technologies. **Analyze**

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**CIVIL ENGINEERING IN TWENTY FIRST CENTURIES**
Essential skills and strategies- critical thinking, finance and economics, design skill, communication, law and ethics, heritage and future.

**ENVIRONMENTAL IMPACT DESIGN (EID)**
Definition, scope and strategies of EID, categorical types- Direct, indirect and cumulative and its impact. Focus on construction process, materialization and building efficiencies and its life cycle.

**GEOCHEMICAL ASPECTS OF GREEN BUILDING**
Geochemical transport model maintaining thermodynamics equilibrium and kinetic control-Hydrology transfer resources and impact of bioremediation, treatment plant design, problem solving techniques, civil and environmental application of engineering science and creative problems solving methods

**ENVIRONMENTAL GEOLOGY**
Introduction, definition, scope, geological factors- location, design, construction, operation and maintenance (residential, commercial and industrial development) stormwater drainage system, sewage treatment plant, geohazards.

**ENVIRONMENTAL PUBLIC HEALTH PROTECTION**
Definition, discipline - epidemiology, toxicology, exposure science, environmental engineering, law. Environmental health profession.

**TEXT BOOKS**

**REFERENCE BOOKS**

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<tr>
<td>1</td>
<td>Dr. R. Subbaiya</td>
<td>Associate Professor</td>
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<td><a href="mailto:rsubbaiya80@gmail.com">rsubbaiya80@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.R.Subashini</td>
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<td>Biotechnology</td>
<td><a href="mailto:subashini@vmkvec.edu.in">subashini@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
Before starting with this course, one must get a clear knowledge on the basics of green building, learning the plan details of HVAC for a building, energy efficient modelling.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To define, develop and plan the details of Implementation.
2. To summarize the fundamentals of electric power systems and building electric wiring.
3. To demonstrate about the Bioclimatic design and concepts.
4. To construct the water conservation & water management systems.
5. To assess the key components of remodelling project.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Interpret the basics of green building
CO2. Explain the advantages and benefits of green building practices
CO3. Construct low energy architecture features in residential and commercial buildings
CO4. Develop proper water conservation systems to make up a healthy building
CO5. Analyse the green sustainable materials and practices

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
GREEN BUILDING BASICS AND PRACTICES:

ENERGY MANAGEMENT SYSTEM OF BUILDINGS
The objective of the course is to provide students the necessary tools to control, monitor and optimize the building’s facilities, mechanical and electrical equipment for comfort, safety, and efficiency. It starts with the fundamentals of electric power systems and building electric wiring and then works through building automation systems (BAS) principles. The course allows students to acquaint applying BAS to commercial HVAC equipment, lighting systems, fire systems and security/observation systems.

LOW ENERGY ARCHITECTURE, PASSIVE BUILDING DESIGN
Solar geometry, climate/regional limitations, natural lighting, passive design and sustainability initiatives, insulating and energy storing material. Bioclimatic design and concepts. Case studies will be used extensively as a vehicle to discuss the success/failure of ideas and their physical applications.
WATER MANAGEMENT, BUILDING METHODS & MATERIALS

Water conservation, water management systems, water efficient landscaping, green roofing, rainwater harvesting, sanitary fixtures and plumbing systems, wastewater treatment and reuse, and process water strategies. AAC (Aerated Autoclave Concrete), ICF (Insulated Concrete Forms), new Advanced Framing & Insulation Techniques, SIPs (Structural Insulated Panels), Straw Bale and Pumice-crete Rammed Earth, Timber Frame, Straw Clay, and Earth ship buildings.

ENERGY EFFICIENT REMODELLING

Key components of remodelling projects-windows, walls, roofs, heating and ventilation, insulation, tighten up the building envelope, Advances in building technology and materials, incorporate active and passive solar into the home or commercial building. Mistakes to avoid, various improvements cost

TEXT BOOKS:

   2. Thermal analysis and design of passive solar buildings by A. K. Athienitis and Mat Santamouris.

REFERENCES:


COURSE DESIGNERS

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<td><a href="mailto:subashini@vmkvec.edu.in">subashini@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
Bioresource management showers the knowledge on importance of various resource available in the world and its economic importance. Students will gain the knowledge in wide spectrum of bioresource availability and its culturing method. This paper also deals with the conservation of wild resource and cultivation of valuable products for the sophistication of human life.

PREREQUISITE – Nil

COURSE OBJECTIVES
1. To state about the kinds and importance of bioresource management.
2. To describe about the various types of aquaculture and its breeding types.
3. To construct the characteristics of vermiculture and its scope and importance.
4. To categorise and preserve the afforestation process with certain conservation policies.
5. To develop the economic importance of value-added products.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

<table>
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<th>Course Objective</th>
<th>Outcome</th>
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<tr>
<td>CO1. Interpret the basic concepts and importance of Bioresource management</td>
<td>Understand</td>
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<tr>
<td>CO2. Explain the culturing process and various types of aquaculture.</td>
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<tr>
<td>CO3. Identify the scope and economic importance of vermiculture and sericulture.</td>
<td>Apply</td>
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<td>CO4. Categorize the strategies on conservation and management of forest resource.</td>
<td>Analyze</td>
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<td>CO5. Analyze the crop improvement technologies in the production of bioresource products.</td>
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S: Strong; M: Medium; L: Low

SYLLABUS
BASICS OF BIORESOURCE MANAGEMENT
Basics of Bioresources - Concept, kinds, importance. Human Resource: Management, scope and importance of human resource management (HRM) and personnel management; human development index (HDI). Animal Resources Conservation and Management: Concept on livestock and livestock production management; role in livelihood and nutritional securities; sustainable livestock production, problems and opportunities.

AQUACULTURE
Introduction to aquaculture; Prawn culture, Methods of prawn fishing, Preservation and processing of prawn; Pearl culture and status of pearl culture in India; Economically important of fishes. Setting up of a fish farm, Monoculture and composite fish culture, Bundh breeding, Induced breeding, methods of fishing, Fish preservation and processing; Identification of fish diseases and their control.

VERIMICULTURE AND SERICULTURE

FOREST MANAGEMENT AND PLANTS CULTIVATION
Classification and distribution of forests, current strategies of conservation and management of forest resource; agro-forestry, social forestry; Joint Forest Management; National Forest Policy; Forest (conservation) Act, 1980. A brief account of Harlan and Hawkes theories; practices of floriculture, agroforestry, BT crops (brief account).

**VALUE ADDED BIORESOURCE PRODUCTS**
Economic uses of important cereals, legumes (pulses and fodders), fruits and vegetables, spices and condiments, beverages, oils and fats, essential oils, medicinal plants, hallucinogens (psychotropic drugs), timber plants, fibre plants, natural rubber, resins, raw materials for paper. A brief account of crop improvement technologies, biosafety considerations, natural products.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

<table>
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<td>Associate professor</td>
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<td><a href="mailto:chozhavendhan@avit.ac.in">chozhavendhan@avit.ac.in</a></td>
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<tr>
<td>2</td>
<td>Mrs. R. Subashini</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:subashini@vmkvec.edu.in">subashini@vmkvec.edu.in</a></td>
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PREAMBLE
This course explains about different waste generation in environment, management of waste, general characters of enzymes, their immobilization process, makes an attempt to bring students in direct contact with nature, to find the environmental problems and possible solutions. To empower the students to enrich their knowledge on waste treatment using biocatalyst to solve the environmental pollution.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To state the basic knowledge on different wastes
2. To discuss about the waste management methods
3. To perform the waste treatment using enzymes
4. To implement the basics of enzyme immobilization process
5. To outline the students to basic knowledge concerning biodegradation with the usage of enzymes

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Illustrate and classify the different wastes in environment Understand
CO2. Plan the waste management methods using enzyme engineering techniques Apply
CO3. Develop waste treatment using enzymes Apply
CO4. Identify the basics of enzyme immobilization process Apply
CO5. Analyze different method of biodegradation of waste using enzymes Analyse

SYLLABUS
CLASSIFICATION AND TECHNOLOGIES IN REDUCING WASTE
Definition of waste, and its classification, Waste treatment technologies including waste incineration and energy from waste, advanced conversion technologies of pyrolysis and gasification, anaerobic digestion, composting and biological treatment of wastes.

WASTE AND RESOURCE MANAGEMENT
3 RS, Advances in waste recycling and recovery technologies to deliver added value products; Landfill engineering, Sustainability and resource efficiency with consideration for materials flow through the economy, steps towards designing out waste and maximizing the value of outputs from waste treatment processes.

ENZYME IN WASTE TREATMENT
Enzymes in enhanced oil recovery; treatment of wastewater of brewery, pharmaceutical, textile dyeing, metal processing, petrochemical, pulp and paper industry; role of natural/stimulated, dead/spent microbial cultures, GMOs, phytoremediation. Biological indicators of waste by enzyme.

ENZYME ACTION AND IMMOBILIZATION
Action of enzyme on xenobiotic compound, phenolic compounds, pesticides (organo chlorinated, organo phosphorous and carbonated) immobilization techniques.

**BIOSENSOR AND OPTICAL INSTRUMENTS**
Birth of biosensors, advantages and disadvantages, construction of biosensors- enzyme and microbial biosensor. Transducers-piezoelectric, potentiometric, amperometric and fiber optics.

**TEXTBOOKS:**

**REFERENCES:**
1. Popular Biotechnology Lecture Series Focus: Bioremediation by Division of Biotechnology, PSCST, 2013.

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<td>Biotechnology</td>
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<td><a href="mailto:subashini@vmkvec.ac.in">subashini@vmkvec.ac.in</a></td>
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17BTEC32 BIOLOGICAL DATABASE

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PREAMBLE
This course is designed to impart the knowledge on Biological database and they deals with libraries of life sciences information, collected from scientific experiments, published literature, high-throughput experiment technology, and computational analysis.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To state the knowledge on Bioinformatics and Database management
2. To explain the basics of Genome databases
3. To demonstrate the different methods of sequence databases
4. To outline the basics of homology modelling
5. To assess the regulatory of structural similarities

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Explain the design and Database management Understand
CO2: Infer the genome browsers and databases Understand
CO3: Identify different methods of sequence databases Apply
CO4: Distinguish the Molecular modelling and enzyme databases Analyse
CO5: Inspect the sequence and motif-based search engines Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO BIOINFORMATICS DATA AND DATABASES
Types of Biological data:- Genomic DNA, Complementary DNA (cDNA), Recombinant DNA (rDNA), Expressed sequence tags (ESTs), Genomic survey sequences (GSSs). Primary Databases: - GenBank, EMBL, DDBJ, Composite Databases:-NRDB, UniProt, Literature Databases:- Open access and open sources, PubMed, PLoS, Biomed Central

GENOME DATABASES
Viral genome database (ICTVdb, VirGen), Bacterial Genomes database (Genomes OnLine Database –GOLD, Microbial Genome Database-MBGD), Organism specific Genome database (OMIM / OMIA, SGD, WormBase, PlasmoDB, FlyBase, TAIR), and Genome Browsers (Ensembl, VEGA genome browser, NCBI-NCBI map viewer, KEGG, MIPS, UCSC Genome Browser).

SEQUENCE DATABASES
Nucleotide sequence Databases (GenBank, EMBL, DDBJ). Protein sequences Databases (Swiss-Prot, TrEMBL, UniProt Knowledgebase – UniProtKB, UniProt Archive –UniParc, UniProt Reference Clusters –UniRef, UniProt Metagenomic and Environmental Sequences –UniMES. Sequence motifs Databases:-Prosite, ProDom, Pfam, InterPro. Sequence file formats:-GenBank, FASTA, PIR, ALN/ClustalW2, GCG/MSF.
STRUCTURE AND DERIVED DATABASES

BIOINFORMATICS DATABASE SEARCH ENGINES
Text-based search engines (Entrez, SRS, DBGET / LinkDB). Sequence similarity based search engines (BLAST and FASTA). Motif-based search engines (ScanProsite and eMOTIF). Structure similarity based search engines (VAST and DALI). Proteomics tools at the ExPASy server, GCG utilities and EMBOSS

TEXT BOOKS

REFERENCES BOOK

COURSE DESIGNERS

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<td>1</td>
<td>Dr. R. Balachandar</td>
<td>Assistant Professor (Gr-II)</td>
<td>Biotechnology</td>
<td><a href="mailto:balaclone1@gmail.com">balaclone1@gmail.com</a></td>
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<tr>
<td>2</td>
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<td>Assistant Professor</td>
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PREAMBLE
This syllabus is intended for the Computer science students and enables them to learn Object Oriented Programming and the design of computer solutions in a precise manner. The syllabus emphasizes on OOP concepts, Functions, Polymorphism, Inheritance and I/O. The intention is to provide sufficient depth in these topics to enable candidates to apply Object Oriented Programming approach to programming. The modules in the syllabus reflect solving general problems via programming solution. Thus, modules collectively focus on programming concepts, strategies and techniques; and the application of these toward the development of programming solutions.

PREREQUISITE
Nil

COURSE OBJECTIVES
1. To learn about the syntax and semantics of C++ programming language
2. To learn about the concepts of object oriented programming.
3. To determine how to reuse the code, Constructors and member functions
4. To Analyse how to reduce the coding by applying overloading concepts
5. To Analyse how to reuse the code, how to verify and validate the coding

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1. Construct object-oriented programs for a given scenario using the concepts of abstraction, encapsulation, message-passing and modularity
CO2. Construct object-oriented programs for a given application by using constructors
CO3. Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism
CO4. Develop object-oriented applications through inheritance concepts
CO5. Construct object-oriented applications for a given scenario using files, Sting handling and to handle exceptions

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES
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S- Strong; M-Medium; L-Low
SYLLABUS
INTRODUCTION TO FUNDAMENTAL CONCEPTS OF OOP

Object Oriented Paradigm: Elements of Object Oriented Programming – Working with classes, Classes and Objects-Class specification- accessing class members- defining member functions - Passing and returning objects – Array of objects - inline functions - accessing member functions within class - Static members.

OBJECT INITIALIZATION AND FRIEND FUNCTION

Constructors - Parameterized constructors - Constructor overloading. Copy constructor, Destructors, Default arguments - new, delete operators - “this” pointer, friend classes and friend functions.

OVERLOADING AND GENERIC PROGRAMMING


INHERITANCE AND VIRTUAL FUNCTION

Inheritance-Base class and derived class relationship-derived class declaration-Forms of inheritance- inheritance and member accessibility, abstract class, virtual functions, pure virtual function.

EXCEPTION HANDLING AND STREAMS

Exception handling - Try Catch Throw Paradigm - Uncaught Exception- Files and Streams-Opening and Closing a file- file modes- file pointers and their manipulation, sequential access to a file-random access to a file-Reading and Writing – Exception handling. String Objects.

TEXT BOOKS:


REFERENCES:


COURSE DESIGNERS

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<tr>
<td>1</td>
<td>Dr. K. Sasikala</td>
<td>Associate Professor</td>
<td>CSE</td>
<td><a href="mailto:sasikalak@vmkvec.edu.in">sasikalak@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr. S. Muthuselvan</td>
<td>Assistant Professor Gr. II</td>
<td>CSE</td>
<td><a href="mailto:muthuselvan@avit.ac.in">muthuselvan@avit.ac.in</a></td>
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</table>
PREAMBLE
The student will be able to understand the concepts of operating system to distributed environment like cloud computing, mobile computing etc. This course also includes set of case studies that provides insight into some existing distributed operating systems.

PREREQUISITE
Nil

COURSE OBJECTIVES
1. To be aware of the evolution of operating systems.
2. To learn what processes are, how processes communicate, how process synchronization is done and how to manage processes.
3. To have an understanding of the main memory and secondary memory management techniques.
4. To understand the I/O Subsystem.
5. To have an exposure to the role of operating system in cloud and mobile environment operating systems.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. To learn the concepts of operating system to an evolution of operating systems and identify the features specific to operating systems

CO2. To understand the process synchronization concepts for the given scenario in operating systems environment.

CO3. Illustrate the different techniques of management of memory (the main memory and secondary memory management techniques).

CO4. Apply the I/O Subsystem concepts for a given scenario.

CO5. Identify the role of operating system in cloud and mobile environment.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low
SYLLABUS
OPERATING SYSTEM


PROCESSES & SYNCHRONIZATION


STORAGE MANAGEMENT


I/O SYSTEMS


CLOUD OS & MOBILE OS


TEXT BOOKS:


REFERENCES:


COURSE DESIGNERS

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PREAMBLE
This course of study builds on the skills gained by students in Java Fundamentals and helps to advance Java programming skills. Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities.

PREREQUISITE
NIL

COURSE OBJECTIVES

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be aware of the important topics and principles of software development.
4. Understand Event Handling and Swing Components.
5. Understand Generic Programming.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO1. Knowledge of the structure and model of the Java programming language

CO2. Use the Java programming language for various programming technologies

CO3. Develop software in the Java programming language

CO4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements

CO5. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF JAVA

ARRAYS, STRINGS & OBJECTS
PREAMBLE
To study and understand the concepts in cloud computing and apply them practically.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To understand cloud computing concepts.
2. To study various cloud services.
3. To apply cloud computing in collaboration with other services.
4. To apply cloud computing services.
5. To apply cloud computing online.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1: Able to Understand basics in Cloud Computing
Understand

CO2: Able to apply cloud computing concepts in real time
Apply
CO3: Able to develop cloud computing projects

CO4: Able to apply cloud services

CO5: Able to collaborate cloud services with other applications

CO1: Able to understand basics in Cloud Computing

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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Strong: M-Medium; L-Low

SYLLABUS

INTRODUCTION

DEVELOPING CLOUD SERVICES

CLOUD COMPUTING FOR EVERYONE
Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

USING CLOUD SERVICES

COLLABORATING ONLINE

TEXT BOOKS

REFERENCES
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<thead>
<tr>
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<tr>
<td>1</td>
<td>Dr.R.Jaichandran</td>
<td>PROFESSOR</td>
<td>CSE</td>
<td><a href="mailto:rjaichandran@avit.ac.in">rjaichandran@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>T.GEETHA</td>
<td>Assistant professor</td>
<td>CSE</td>
<td><a href="mailto:geetha_kcs@yahoo.com">geetha_kcs@yahoo.com</a></td>
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</table>
PREAMBLE
To understand the need for Cyber Security in real time and to study techniques involved in it.

PREREQUISITE: NIL

COURSE OBJECTIVES
1. To understand the fundamentals of Cyber Security
2. To study various attacking techniques
3. To apply exploitation in cyber space
4. To study about Malicious codes
5. Defending against cyber attacks

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1: Able to understand basics in cyber security
CO2: Able to apply attackers techniques in real time
CO3: Able to apply exploitation in web applications
CO4: Able to understand and apply malicious in networks.
CO5: Able to apply defense and analysis techniques in real time

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

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

INTRODUCTION

ATTACKER TECHNIQUES
Antiforensics – Tunneling techniques – Fraud Techniques - Threat Infrastructure.

EXPLOITATION
Techniques to gain a foot hold – Misdirection, Reconnaissance, and disruption methods.

MALICIOUS CODE

DEFENSE AND ANALYSIS TECHNIQUES

TEXT BOOKS

REFERENCES

COURSE DESIGNERS

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</tr>
<tr>
<td>2.</td>
<td>Mr. B. Sundharamurthy</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:sundharamurthy@vmkvec.edu.in">sundharamurthy@vmkvec.edu.in</a></td>
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</table>
This talk is a brief guide to UNIX programming languages, tools and concepts. It is aimed at programming novices or programmers migrating from a Windows system. The aim is to introduce you to the concepts, the possibilities and the tools used in UNIX programming.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**

1. To understand the design of the UNIX operating system
2. To become familiar with the various data structures used

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

**CO1:** To learn The basic Unix operating systems and its basic commands. Understand

**CO2:** To analyze the buffers and kernel representation. Analyze

**CO3:** To analyze the UNIX system structure, system calls. Analyze

**CO4:** To understand UNIX segmentation, scheduling, paging. Analyze

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S - Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION**

**DISK BLOCKS**
The Buffer Cache-Headers-Buffer Pool-Buffer Retrieval-Reading and Writing Disk Blocks - Advantages and Disadvantages. Internal Representation of Files-Inodes- Structure-Directories-Path Name to Inode- Super Block-Inode Assignment-Allocation of Disk Blocks -Other File Types

**FILE SYSTEM**

**PROCESS MANAGEMENT**

**MEMORY MANAGEMENT**
Memory Management Policies-Swapping-Demand Paging-a Hybrid System-I/O Subsystem-Driver Interfaces-Disk Drivers-Terminal Drivers.

**TEXT BOOKS**

REFERENCES

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<tr>
<td>1</td>
<td>Mr. S. Muthuselvan</td>
<td>Assistant Professor (G-II)</td>
<td>CSE</td>
<td><a href="mailto:muthuselvan@avit.ac.in">muthuselvan@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>V. Amirthalingam</td>
<td>Associate Professor</td>
<td>CSE</td>
<td><a href="mailto:Amirthalingam@vmkvec.edu.in">Amirthalingam@vmkvec.edu.in</a></td>
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</tbody>
</table>
PREAMBLE
To understand and learn the scripting languages with design of web applications and maintenance and evaluation of web design management.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To introduce the student to the tools and facilities of web design
2. To understand and learn the scripting languages with design of web applications
3. To learn the maintenance and evaluation of Web design/development process, with Macromedia Dreamweaver as the primary Web development tool
4. Topics covered include basic and enhanced site structure, local and remote site management, and optimization of Web graphics

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1: Apply an Information Architecture document for a web site. Apply
CO2: Construct a web site that conforms to the web standards of today and includes e-commerce and web marketing Analyze
CO3: Perform regular web site maintenance (test, repair and change). Analyze
CO4: Understand the principles of various process of Project management Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

SITE ORGANIZATION AND NAVIGATION

ELEMENTS OF PAGE DESIGN

SCRIPTING LANGUAGES AND ANIMATION USING FLASH

PRE-PRODUCTION MANAGEMENT

PRODUCTION, MAINTENANCE AND EVALUATION

TEXT BOOKS

REFERENCES

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>K.Karthik</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:karthik@avit.ac.in">karthik@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>R.Bharanidharan</td>
<td>Professor</td>
<td>CSE</td>
<td><a href="mailto:bharanidharan@vmkvec.edu.in">bharanidharan@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
The proposed elective course exposes the non-CS/IT students to IT Essentials. The core modules of this Elective includes programming, Database and web Technology amongst other related topics. This course refers to the basic tools and technologies for the right type of website development and enable student to create simple web applications.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To learn about the essentials of Information Technology
2. To get an idea about the scripting languages.
3. To get an idea about the internet protocols

COURSE OUTCOMES
On the successful completion of the course, students will be able to

| CO1 | Understand the networking concept internet protocols, network routing | Understand |
| CO2 | Understand the fundamentals of web applications and its modeling    | Understand |
| CO3 | Understand and learn the scripting languages with design of web applications | Understand |
| CO4 | Analyze the process of mobile communication and network technologies | Analyze |
| CO5 | Build simple interactive applications, database applications and multimedia applications | Analyze |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

S- Strong; M-Medium; L-Low
SYLLABUS
Fundamentals of Computer architecture

Operating system

RDBMS
Data processing – the database technology – data models-ER modeling concept –notations – Extended ER features - Logical database design - normalization -SQL – DDL statements – DML statements – DCL statements
Writing Simple queries – SQL Tuning techniques – Embedded SQL - OLTP

Object oriented concepts

Client server computing

REFERENCES
3. Dromey R.G., How to solve it by Computers, PHI, 1994

Course Designers:

<table>
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<tr>
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<tbody>
<tr>
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PREAMBLE
In this modern era almost every hands has a handheld devices. Each handheld device have the computing capability to meet the half the needs of user such as banking, browsing, education and emergency etc. It is a must for a computer engineer to have some basic knowledge about the handheld devices platform and its supporting software development. This course will give adequate knowledge in developing a mobile applications for different such as Android, iOS, Windows.

PRE REQUISITE – NIL

COURSE OBJECTIVES

1. Understand system requirements for mobile applications
2. Generate suitable design using specific mobile development frameworks
3. Generate mobile application design
4. Implement the design using specific mobile development frameworks
5. Deploy the mobile applications in marketplace for distribution

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Expose to technology and business trends impacting mobile applications Understand
CO2. Understand enterprise scale requirements of mobile applications Understand
CO3. Familiarize in the Graphics used for Android application development Apply
CO4. Competent with the characterization and architecture of mobile applications Apply
CO5. Competent with designing and developing mobile applications using one application development framework. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

UNIT I INTRODUCTION
Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II BASIC DESIGN

UNIT III ADVANCED DESIGN
Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV TECHNOLOGY I – ANDROID

UNIT V TECHNOLOGY II – IOS
Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi – iPhone marketplace.

TEXT BOOKS

REFERENCES

Course Designers:

<table>
<thead>
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<tr>
<td>1.</td>
<td>Dr. K. Sasikala</td>
<td>Associate Professor</td>
<td>CSE</td>
<td><a href="mailto:sasikalak@vmkvec.edu.in">sasikalak@vmkvec.edu.in</a></td>
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<tr>
<td>2.</td>
<td>Mrs. S. Leelavathy</td>
<td>Assistant Professor (G-II)</td>
<td>CSE</td>
<td><a href="mailto:leelavathy@avit.edu.in">leelavathy@avit.edu.in</a></td>
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</tbody>
</table>
## PREAMBLE
The course is designed to make the student acquire conceptual knowledge of the transducers and biological components used for the detection of an analyte. The relation between sensor concepts and biological concepts is highlighted. The principles of biosensors that are currently deployed in the clinical side are introduced.

## PREREQUISITE
- Nil

## COURSE OBJECTIVES

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<tr>
<td>1</td>
<td>To use the basic concepts of transducers, electrodes and its classification.</td>
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<td>2</td>
<td>To discuss the various types of electrodes.</td>
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<td>3</td>
<td>To determine the recording of biological components.</td>
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<td>4</td>
<td>To employ the knowledge in electrochemical and optical biosensors.</td>
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<td>5</td>
<td>To outline the various biological components using biosensors.</td>
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## COURSE OUTCOMES
On the successful completion of the course, students will be able to

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<td>Describe the working principles of transducers.</td>
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<td>Explain the various types of electrodes.</td>
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<td>Utilize various FET sensors for recording of biological components.</td>
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<td>CO4</td>
<td>Distinguish various biosensors like electrochemical and optical biosensors.</td>
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<td>CO5</td>
<td>Analyze the biological components using biosensors in various applications.</td>
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## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

S- Strong; M-Medium; L-Low

## SYLLABUS

### INTRODUCTION
General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

### TRANSDUCERS:
Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

### BIO POTENTIAL ELECTRODES:
Half cell potential, Types of Electrodes – Micro electrodes, Depth and needle electrodes, Surface electrodes, Chemical electrodes, Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.
BIOSENSORS:
Biological elements, Immobilization of biological components, Chemical Biosensor-ISFET, IMFET, electrochemical sensor, chemical fibro sensors.

APPLICATIONS OF BIOSENSORS:
Bananatrobe, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

TEXT BOOKS:

REFERENCES:

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<tr>
<td>2</td>
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</tr>
<tr>
<td>3</td>
<td>Dr.N.Babu</td>
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<td>BME</td>
<td><a href="mailto:babu@vmkvec.edu.in">babu@vmkvec.edu.in</a></td>
</tr>
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</table>
PREAMBLE
The curriculum of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis. The topics build the concepts of how human system works in altered and diseased stage under the influence of various internal and external stimuli. Thus the syllabi of pathology compliments and supplements the necessary knowledge, students have gained in physiology. The Microbiology course has been formulated to impart basic and medically relevant information on the microbes. The microbial structure, growth and development, methods and role of sterilization in the context of study of microbes are included.

PREREQUISITE : NIL

COURSE OBJECTIVES

1. To understand the basic concept in pathology.
2. To understand the altered state of human body in different diseased condition.
3. To illustrate the working principle of various microscopes and demonstrate the specimen preparation.
4. To outline the pathogenesis of viral and bacterial diseases and their control.
5. To categorize the various immunological and sterilization techniques.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Describe the cellular responses to stress, cellular repair and concepts of tumour. Understand

CO2. Explain the causes and pathophysiology of different fluid and Haemodynamic disorders. Understand

CO3. Apply the knowledge to operate the different types of microscopes and prepare the specimens for observation. Apply

CO4. Identify the causes and prevention method to control various infectious diseases due to bacteria, and viruses. Analyze

CO5. Diagnose the infectious diseases using immunological techniques like Immunofluorescence, ELISA, RIA and compare the sterilization techniques. Analyze

SYLLABUS


STRUCTURE OF BACTERIA, VIRUSES AND MICROSCOPY: Morphological features and structural organization of bacteria, Bacterial growth and Nutrition, Growth curve, Culture media and its types, Culture techniques and observation of culture. Viruses – Structure, Classification and Replication. Light microscope, Bright field, Dark field, Phase contrast, Fluorescence and Electron microscope (TEM& SEM), Preparation of samples for electron microscope, Staining methods – Simple, Gram’s staining and AFB staining.


TEXT BOOKS:

REFERENCES:

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<tr>
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<td><a href="mailto:santhoshiniarulvallal@avit.ac.in">santhoshiniarulvallal@avit.ac.in</a></td>
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</table>
**PREAMBLE**

Medical optics is a branch of science uses light as an electromagnetic wave, similar to X-rays, microwaves, and radio waves, which is used as an investigational technique for medical applications. Examples include optical microscopy, spectroscopy, endoscopy, scanning laser ophthalmoscopy and optical coherence tomography.

**PREREQUISITE:** Nil

**COURSE OBJECTIVES**

1. To learn about properties of light and its application
2. To study various instruments in photonics
3. To understand the applications of laser
4. To understand optical holography
5. To study optical tomography

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| CO1 | Describe the optical properties of the tissues. | Understand |
| CO2 | Apply laser in medical field for diagnosis and therapeutic application. | Apply |
| CO3 | Analyze the various instruments used in photonics | Analyze |
| CO4 | Categorize the various techniques for hologram construction. | Analyze |
| CO5 | Illustrate optical tomogram. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**OPTICAL PROPERTIES OF THE TISSUES**
Refraction, Scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

**INSTRUMENTATION IN PHOTONICS**
Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, LASERs, optical filters, polarisers, solid state detectors, time resolved and phase resolved detectors.

**APPLICATIONS OF LASERS**
Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

**OPTICAL HOLOGRAPHY**
Wavefronts, Interference patterns, principle of hologram, optical hologram, applications.

**OPTICAL TOMOGRAPHY**
Optical coherence tomography, Elastography, Doppler optical coherence tomography, Application towards clinical imaging.

**TEXT BOOK**

**REFERENCE**

**COURSE DESIGNERS**

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PREAMBLE
To study the overall concept of a Biotelemetry system and the concept of signal transmission.

PREREQUISITE – NIL

COURSE OBJECTIVES

1. To study the basic concepts and the principles used in a Telemetry system.
2. To study the building blocks used to make a electrical telemetry system.
3. To study the basic components of transmitting and receiving techniques.
4. To know about how optical fibers are used in signal transmission.
5. To understand the real time application in biotelemetry.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Discuss about the basic information about Telemetry system. Understand

CO2. Describe the knowledge about design of Electrical Telemetry Systems. Understand

CO3. Demonstrate the different types of modulation techniques. Apply

CO4. Analyze the implementation of optical fibers in telemetry system. Analyze

CO5. Validate the healthcare system using Telemetry system. Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S: Strong; M: Medium; L: Low
## SYLLABUS

### INTRODUCTION

### ELECTRICAL TELEMETRY

### RADIO TELEMETRY SYSTEM

### OPTICAL TELEMETRY SYSTEM

### APPLICATION OF BIOTELEMETRY
Use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems; hypertext, voice & image transfer protocols, Medical image scanning, Data compression and Transfer, Capturing of medical signals, Analog to digital conversion, Video conferencing, Remote sensing, Rural primary setups, Referral and Super specialty centers, Societal medico legal aspects, Networking (local, national & global).

### TEXT BOOKS

### REFERENCE

### COURSE DESIGNERS

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<td>1</td>
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<td><a href="mailto:vaishnodevi@vmkvec.edu.in">vaishnodevi@vmkvec.edu.in</a></td>
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<td>BME</td>
<td><a href="mailto:sandhiya@avit.ac.in">sandhiya@avit.ac.in</a></td>
</tr>
</tbody>
</table>
**PREAMBLE**
To enable the students to acquire knowledge about the principles and applications of MEMS & Nanotechnology in Biomedical Industry.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**

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**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

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<td>Discuss the concepts of microfluidic systems.</td>
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<td>Explain about the basics of working of MOEMS Technology.</td>
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<td>Illustrate the working principle of MEMS &amp; Microsystems.</td>
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**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**MEMS & MICROSYSTEM**

**MICRO-OPTO ELECTROMECHANICAL SYSTEMS (MOEMS)**
Fundamental principle of MOEMS Technology, Advantages - Light Modulators, Beam splitter – Micro-lens, Micro-mirrors - Digital Micro-mirror Device, Grating Light Valve, Optical Switch, Waveguide and Tuning

**MICROFLUIDIC SYSTEMS**

BIOMEMS

BIOMEDICAL NANOTECHNOLOGY
Introduction to nanoscale phenomena, Nanoparticles - Nanomaterial characterization – XRD,SAXS,TEM,SEM, Scanning Tunneling microscopy, AFM, SPM technique, Biomolecular sensing for cancer diagnostics using carbon nanotubes, Carbon nanotube biosensors, Magnetic nanoparticles for MRImaging, Nano-devicesin biomedical applications.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td>BME</td>
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PREAMBLE
This course will offer students exposure to the core concepts of the global medical device regulatory framework and provide a foundation for the practical application. It includes all elements of the device product lifecycle from idea to initial market entry, sustaining activities and post-market activities.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To understand the post-marketing requirements associated with medical devices.
2. To understand the necessary steps to take an idea to a prototype.
3. To follow a deterministic engineering design process to create new products.
4. To apply engineering theory to practice.
5. To perform risk assessment and countermeasure development.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

| CO21. Discuss the necessary steps to take an idea to a prototype. | Understand |
| CO22. Utilize fundamental design principles, machine elements, manufacturing and assembly techniques. | Apply |
| CO23. Analyze risk management concepts into the quality management system. | Analyze |
| CO24. Assess the medical device regulatory framework for any given country based upon device type. | Evaluate |
| CO25. Create potential regulatory pathway. | Create |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MEDICAL DEVICES AND MEDICAL DEVICE REGULATIONS
Medical Device Classification, Bioethics and Privacy, Biocompatibility and Sterilization Techniques, Design of Clinical Trials, Design Control & Regulatory Requirements.

INTRODUCTION TO SPECIFIC MEDICAL TECHNOLOGIES
Biopotential measurement (EMG, EOG, ECG, EEG), Medical Diagnostics (In-vitro diagnostics), Medical Diagnostics (Imaging), Minimally Invasive Devices, Surgical Tools and Implants.

MEDICAL DEVICES STANDARD AND INTELLECTUAL PROPERTY
HARDWARE AND SOFTWARE DESIGN
Hardware design, Hardware risk analysis, Design and project merits, Design for six sigma, software design, software coding, software risk analysis, software metrics.

DESIGN TRANSFER AND MANUFACTURING
Transfer to manufacturing, hardware manufacturing, software manufacturing, configuration management, documents and deliverables.

TEXT BOOKS:

REFERENCES:

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</table>
PREAMBLE
The goal of tissue engineering is to replace or even improve biological tissues and their functions by the use of engineering methods and life sciences. The fast-moving fields of tissue engineering are considered to have transformative implications for future biomedical applications and the future health care. This course gives an overview on the current state in tissue engineering, for example cell culture, molecular aspects, and engineering biomaterials with additional focus on case study.

PREREQUISITE: NIL

COURSE OBJECTIVES
1. To understand about the different types of tissues.
2. To illustrate the aspects of cell culture.
3. To illustrate the molecular aspects in tissue engineering.
4. To outline the biomaterials for tissue engineering.
5. To analyse the case study and regulatory issues in tissue engineering.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Explain the structure and organization of tissues. Understand

CO2. Describe the different cell types and aspects of cell culture. Understand

CO3. Apply the engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Apply

CO4. Examine the case study in tissue engineering. Apply

CO5. Analyze the molecular aspects in tissue engineering. Analyze

SYLLABUS

INTRODUCTION
Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

CELL CULTURE
Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspects of cell Culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

MOLECULAR BIOLOGY ASPECTS
Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.
SCAFFOLD AND TRANSPLANT
Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology stems cells: introduction, hepatopoiesis.

CASE STUDY AND REGULATORY ISSUES
Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

TEXT BOOK:

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<td>Assistant Professor (Gr-I)</td>
<td>BME</td>
<td><a href="mailto:lakshmi@avit.ac.in">lakshmi@avit.ac.in</a></td>
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## PREAMBLE
To enable the students to acquire knowledge about the medical standards, ethics medicine and drugs acts, Drugs and cosmetics standards and various medical acts.

## PREREQUISITE – NIL

## COURSE OBJECTIVES

1. To enable the students to understand the medical ethics.
2. To analyze medical standards.
3. To study the medicine and drug acts.
4. To learn about drugs and cosmetics standards.
5. To learn about various medical laws.

## COURSE OUTCOMES

On the successful completion of the course, students will be able to

**CO1.** Explain the basic principle of medical ethics. **Understand**

**CO2.** Discuss the various medical standards. **Understand**

**CO3.** Describe the Medicine and drug related acts. **Understand**

**CO4.** Illustrate about drugs and cosmetics standards. **Apply**

**CO5.** Outline the various medical Laws. **Analyze**

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

## SYLLABUS
### MEDICAL ETHICS
Introduction - Medical ethics, Code of conduct, Basic principles of medical ethics, Autonomy and informed consent, Organ transplantation, Medico legal aspects of medical.

### MEDICAL STANDARDS

### MEDICINE AND DRUGS ACTS

### DRUGS AND COSMETICS STANDARDS
MEDICAL ACT

TEXT BOOKS

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17BMSE23 MEDICAL WASTE MANAGEMENT

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PREAMBLE
To learn more about managing medical waste, Health Care and its necessary.

PREREQUISITE - NIL

COURSE OBJECTIVES

1. To understand the process of managing medical waste.
2. To educate awareness among the various Medical Establishments producing Bio-Medical Waste regarding the hazardous effects of Bio-Medical Waste and necessity of compliance of Bio-Medical Waste.
3. To create awareness among people associated with different local bodies and healthcare units about the necessities and requirements for scientific segregation, storage, treatment and disposal of Bio-Medical Waste.
4. To Make available treatment & disposal of Bio-Medical Waste in Most scientific manner at a reasonable cost & to comply all the rules of the Bio-Medical Waste Management.
5. To understand modern technologies for managing medical waste.

COURSE OUTCOMES

On the successful completion of the course, students will be able

**CO1:** Summarize the history of waste management including impacts from early human civilization to current day.

**CO2:** Describe the major categories of waste.

**CO3:** Illustrate waste collection, recycling, and materials recovery techniques for MSW.

**CO4:** Characterize the components and chemical and physical properties of medical waste.

**CO5:** Classify requirements for hazardous waste generation, transportation, treatment, storage, and disposal.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Understand

Apply

Analyze

Analyze
SYLLABUS

INTRODUCTION
General Introduction, Definition of Biomedical Waste, General and Hazardous health care waste – Colour Coding and types of containers for disposal of medical waste, Segregation, Collection & Disposal.

BIOMEDICAL WASTES

BLOOD PRODUCTS
Human Blood and Blood Products, pathological wastes, Contaminated sharps, Contaminated animal carcasses, body parts, and bedding Basic information about infection, Infectious agents on organizations spread of infection, Basic information about Hospital acquired infection.

STERILISATION
Disinfections unit container for Autoclaving, Sharp waste containers for storage & transportation, autoclaving, Incineration, Plasma Pyrolysis / Gasification systems, Composting.

MODERN TECHNOLOGY FOR MEDICAL WASTES

TEXT BOOK:

REFERENCES:

COURSE DESIGNERS

<table>
<thead>
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<th>Name of the Faculty</th>
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<tr>
<td>1</td>
<td>Mr. R. Ezhilan</td>
<td>Assistant Professor</td>
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<td><a href="mailto:ezhilan@vmkvec.edu.in">ezhilan@vmkvec.edu.in</a></td>
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<td>2</td>
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<td>3</td>
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<td><a href="mailto:natarajank@vmkvec.edu.in">natarajank@vmkvec.edu.in</a></td>
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</table>
**PREAMBLE**
The purpose of learning this course on medical technology and entrepreneurship for biomedical engineering students is to acquire knowledge and understand the advanced in medical equipments in therapeutic, diagnostic and entrepreneurship.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**

<table>
<thead>
<tr>
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<th>Objective</th>
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<tbody>
<tr>
<td>1</td>
<td>To impart the knowledge about the Home Medicare in various clinical application.</td>
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<td>2</td>
<td>To make the students understand the active control trials in the evaluation of new treatments.</td>
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<td>3</td>
<td>To impart the knowledge about Legal issues and Health policies related to Biosciences.</td>
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<td>4</td>
<td>To study the minimally invasive device and technique used in medical devices.</td>
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<tr>
<td>5</td>
<td>To get knowledge about the advances in healthcare technologies and wireless technology related to healthcare system.</td>
</tr>
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**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

<table>
<thead>
<tr>
<th>CO26</th>
<th>Explain the system description of different therapeutic &amp; diagnostic equipments.</th>
<th>Understand</th>
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<tbody>
<tr>
<td>CO27</td>
<td>Use the ethical and regulatory guidance.</td>
<td>Apply</td>
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<td>CO28</td>
<td>Categorize healthcare technologies and wireless technology related to healthcare system.</td>
<td>Analyze</td>
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<tr>
<td>CO29</td>
<td>Illustrate the advancement in medical technologies.</td>
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<td>CO30</td>
<td>Support entrepreneurial products for medical applications.</td>
<td>Evaluate</td>
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**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**SYSTEM DESCRIPTION OF THERAPEUTIC EQUIPMENT**
Pacemaker, External cardiovector defibrillator, Implantable cardiovector defibrillator, Deep brain stimulation, Functional electrical stimulator (FES), Hemodialysis delivery system, Mechanical ventilator.

**SYSTEM DESCRIPTION OF DIAGNOSTIC EQUIPMENT**
Patient monitoring system, ECG, EEG, Blood pressure monitor, Digital stethoscope, Thermometer, System description and diagram of pulse oximeter, optical fiber optics for circulatory and respiratory system measurement.

**ETHICAL AND REGULATORY GUIDANCE**

**WIRELESS TECHNOLOGY**

**ADVANCEMENT IN MEDICAL TECHNOLOGIES**

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<tr>
<td>1</td>
<td>Mrs.S.Vaishnodevi</td>
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</tr>
<tr>
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<tr>
<td>3</td>
<td>Mr. S.Kannan</td>
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<td>BME</td>
<td><a href="mailto:kannan@vmkvec.edu.in">kannan@vmkvec.edu.in</a></td>
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**PREAMBLE**
To study about Nano materials, fundamentals of nano technology & applications of Nanotechnology.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**

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<td>1</td>
<td>To know about the concept of Nanotechnology.</td>
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<td>2</td>
<td>To study about the fundamentals of Nanoscience.</td>
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<td>3</td>
<td>To study about materials and properties used for MEMS &amp; NEMS.</td>
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<td>4</td>
<td>To know about the medical use of nanomaterials.</td>
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<tr>
<td>5</td>
<td>To study about the medical applications.</td>
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**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| CO31. | Describe the basic science behind the properties of materials. | Understand |
| CO32. | Explain the basics properties of NEMS. | Understand |
| CO33. | Apply their knowledge of nanotechnology to identify how they can be exploited for new applications. | Apply |
| CO34. | Outline the applications of nanomedicine. | Analyze |
| CO35. | Analyze the biomolecular components like nanotubes with nanotechnology. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION**
Introduction to Nanotechnology: Nanomaterials, Fullerenes and carbon forms. Nanoparticles and Colloids, structure and bonding in nanoparticles, Nanomaterials fabrication by Bottom-up and Top down approaches, Classification of nanodevices based on the characteristics, Quantum dots and their properties.

**FUNDAMENTALS OF NANOSCIENCE**
Size dependence of properties – Particle size determination – Bulk to nanotransition – Semiconducting nanoparticles – Carbon nanostructures – Mechanical properties (hardness, ductility, elasticity) – Optical properties of nanotubes – Electrical properties of nanotubes.

**MEMS & NEMS**
Definition of MEMS, materials for MEMS (Silicon, Polymers and metals) and their properties, Deposition processes, Photolithography, and etching processes, Limitations of MEMS, NEMS, difference between MEMS and NEMS, properties of NMES, fabrication processes, applications.

NANOMEDICINE

BIO MOLECULAR NANO TECHNOLOGY
Nanorobots and their application, nanosensors based on biomolecules such as DNA and proteins, nanoparticles for gene delivery systems, Computational genes, Biosensors for Glucose and measurement, Optical biosensors and their application. Preparation of Nanosystems: Introduction to nanolithography – Carbon nanotubes: preparation – Synthesis and preparation of nanomaterials (crystalline and thinfilm) - Physical and chemical methods - Control and stability (size, shape, composition).

TEXT BOOKS:
1. Lynn E. Foster, Foreword by George Allen, Foreword by Joe Lieberman, “Nanotechnology”.

REFERENCES:

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<tr>
<td>1</td>
<td>Dr. M.Ravindiran</td>
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<td><a href="mailto:kannan@vmkvec.edu.in">kannan@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
Structure is an arrangement and organization of interrelated elements in a material object or system, or the object or system so organized. Material structures include man-made objects such as buildings and machines and natural objects such as biological organisms, minerals and chemicals.

PREREQUISITE
Nil

COURSE OBJECTIVES
1. The on-site/off-site processing of the same and the disposal methods.
2. The student is expected to know about the various effects and disposal options for the municipal solid waste.
3. The collection and supply of water
4. The offsite processing involved in site

COURSE OUTCOMES
On the successful completion of the course, students will be able to
Co1. To know about the types of waste & Sources
    Analyse
Co2. To Study the on site Storage & Processing
    Apply
Co3. To study about the collection & transfer the waste
    Apply
Co4. To Study the process of off site processing
    Apply
Co5. To know about the solid waste disposal
    Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

SOURCES AND TYPES OF MUNICIPAL SOLID WASTES
Sources and types of solid wastes – Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

ON-SITE STORAGE & PROCESSING

COLLECTION AND TRANSFER
Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

OFF-SITE PROCESSING
Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis – options under Indian conditions.

**DISPOSAL**

**TEXT BOOKS**


**REFERENCES**


**COURSE DESIGNERS**

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<td>Assistant Professor</td>
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<td><a href="mailto:jansupriyanair@gmail.com">jansupriyanair@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>SUDIP DAS</td>
<td>Assistant Professor</td>
<td>CIVIL</td>
<td><a href="mailto:sudipdas@avit.ac.in">sudipdas@avit.ac.in</a></td>
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PREAMBLE

The course work offers the basic knowledge on various sources of air pollutants and their possible effects on local, regional and global environment. It provides various techniques for sampling and analyzing the pollutants. Also, it deals with the principles and design of control of particulate/gaseous air pollutants and its emerging trends to fulfill the legal aspects of air pollution to have a sustainable environment for future generation. In addition.

PREREQUISITE

Environmental engineering

COURSE OBJECTIVES

1. About noise pollution and the methods of controlling the same.
2. The student is expected to know about source inventory and control mechanism.
3. To impart knowledge on the sources, effects
4. The control techniques of air pollutants and noise pollution
5. The sources, characteristics and effects of air

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Identify the sources of air pollution, impacts of air pollutants and their measurements

Apply

CO2. Identify the significance of meteorological factors in pollutants dispersion and to predict the pollutant concentration

Understand

CO3. Suggest preventive and control measures for air pollution.

Apply

CO4. Suggest locations for industries and appropriate city planning tips for the effective air pollution management of a city

Apply

CO5. The course offers the basic knowledge on various sources of air pollutants and their possible effects on local, regional and global environment.

Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS


AIR POLLUTION CONTROL: Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.


NOISE POLLUTION: Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

TEXT BOOKS:
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996

REFERENCE BOOKS:

COURSE DESIGNERS

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<td>Asst. Professor</td>
<td>Civil / AVIT</td>
<td><a href="mailto:nivetha.c@avit.ac.in">nivetha.c@avit.ac.in</a></td>
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<tr>
<td>2</td>
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<td><a href="mailto:jansupriyanair@gmail.com">jansupriyanair@gmail.com</a></td>
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</table>
It is the science that deals with the waters of the earth, their occurrence, circulation, distribution and their reaction with environment including their relation to living things.

PREREQUISITE

NIL

COURSE OBJECTIVES

1. The mechanics of rainfall, its spatial and temporal measurement and their applications will be understood.
2. The mechanics of rainfall, its distribution and measurement of rainfall using Hydrograph.
3. Analysis of Simple statistical and application of probability
4. Student will also learn simple methods of flood routing and ground water hydrology.
5. Distribution of rainfall and run off shall also be understood.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explain the importance of Hydrological cycle and the measurement and analysis of rainfall data

CO2. Compute the quantity of runoff generated from a catchment

CO3. Develop hydrographs to measure the stream flow

CO4. Estimate floods and propose suitable control measures

CO5. Suggest methods of conserving surface and groundwater storage

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS


HYDROGRAPHS: Factors affecting Hydrograph – Baseflow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations - Synthetic Unit Hydrograph


TEXT BOOKS:


REFERENCES:

COURSE DESIGNERS

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<td><a href="mailto:vaidevi.c@avit.ac.in">vaidevi.c@avit.ac.in</a></td>
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</table>
PREAMBLE
This course deals with the various disasters and to expose the students about the measures, its effect against built structures, and Hazard Assessment procedure in India. This course also deals with the methods of mitigating various hazards such that their impact on communities is reduced.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Understand basic concepts in Disaster Management
2. To Understand Definitions and Terminologies used in Disaster Management
3. To Understand the Challenges posed by Disasters
4. To understand Impacts of Disasters

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1. Understand the various types of disaster viz Hydrological, Coastal and Marine Disasters, Atmospheric Disasters, Geological, Mass Movement and Land Disasters, Wind and Water Driven Disasters.
CO2. Identify the potential deficiencies of existing buildings for Earthquake disaster and suggest suitable remedial measures.
CO3. Derive the guide lines for the precautionary measures and rehabilitation measures for Earthquake disaster.
CO4. Derive the protection measures against floods, cyclone, land slides
CO5. Understand the effects of disasters on built structures in India

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
INTRODUCTION: Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Natural and man-made hazards

RISK ASSESSMENT AND VULNERABILITY ANALYSIS: Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

DISASTER MANAGEMENT MECHANISM: Concepts of risk management and crisis management ; Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness; Planning for relief
**DISASTER RESPONSE:** Mass media and disaster management; Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and Stress Management; Rumour and Panic Management; Minimum Standards of Relief; Managing Relief; Funding.

**DISASTER MANAGEMENT IN INDIA:** Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<td>Civil / VMKVEC</td>
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</tr>
<tr>
<td>2</td>
<td>Dr. D. S. Vijayan</td>
<td>Asst. Professor</td>
<td>Civil / AVIT</td>
<td><a href="mailto:vijayan@avit.ac.in">vijayan@avit.ac.in</a></td>
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</table>
Remote sensing is the science and art of obtaining information about an object, area or phenomenon, by the use of either recording or real time sensing devices that are not in physical contact with the object. The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. These GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. Remote sensing and GPS data are further used in numerous applications, including GIS data collection, surveying, and mapping.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

1. Students will learn about the land use mapping techniques, site suitability techniques
2. Students will learn about the use of zone mapping for water bodies
3. Students will learn about the use of mapping techniques for Agriculture and Earth sciences
4. Students will also learn about the recent techniques used for GPS system

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

CO1. Recollect the fundamentals of physics of Remote sensing and concepts.  
Remember

CO2. Outline the various data acquisition systems and collection methods for remote sensing data information and storage  
Understand

CO3. Apply knowledge of satellites on various Civil Engineering applications.  
Apply

CO4. Utilize the various data input methods for mapping  
Apply

CO5. Creation of data models using remote sensing techniques and GPS  
Create

**SYLLABUS**

**INTRODUCTION:** Definition – Physics of remote sensing – electromagnetic radiation (EMR) – remote sensing windows – interaction of EMR with atmosphere, earth surface, soils, water and vegetation – platform and sensors – image interpretations.

**LAND USE STUDIES:** Definition of land use – land use / land cover classification – schemes and levels of classification systems with RS data – land use mapping – change detection – urban land use planning, site suitability analysis, transportation planning.

**WATER RESOURCES:** Areal assessment of surface water bodies – Capacity survey of water bodies – mapping of snow-covered areas – flood risk zone mapping – identification of groundwater potential zones, recharge areas – droughts, definition, drought assessment and management.


TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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**PREAMBLE**
Introduce the students to study the fundamentals of computing and modeling software environments for electrical engineering. This Course contains Programming in numerical computing and modeling software environments for electrical engineering. No prior programming experience or knowledge of SCILAB is assumed, and the course is structured to allow thorough assimilation of ideas through hands-on examples and exercises.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**

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<tr>
<td>1</td>
<td>To study basic concepts of scientific programming using SCILAB.</td>
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<td>2</td>
<td>To learn about the Basics of Program of SCILAB and related Mathematical Applications.</td>
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<td>3</td>
<td>Analyze the concepts of Program of SCILAB.</td>
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<td>4</td>
<td>To understand the different tools in SCILAB and ODE, DAE</td>
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<td>5</td>
<td>To apply a software program to Electrical circuits and solve the simulation based solutions.</td>
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</table>

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| CO1 | Understand the main features of the SCILAB program development environment to enable their usage in the higher learning. |
| CO2 | Understand the need for simulation/implementation for the verification of mathematical functions. |
| CO3 | Implement simple mathematical functions/equations in numerical computing environment such as SCILAB. |
| CO4 | Interpret and visualize simple mathematical functions and operations thereon using plots/display. |
| CO5 | Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**
INTRODUCTION

GRAPHICAL ANALYSIS USING SCILAB
The media – global plot parameters – 2D and 3D plotting – examples – printing graphics and exporting to Latex.

SCILAB PROGRAMMING

SCILAB TOOLS

APPLICATIONS

TEXT BOOK
1. Claude Gomez  Engineering and Scientific Computing with SCILAB, Birkhauser publications

REFERENCES
4. https://www.scilab.org/resources/documentation/tutorials

COURSE DESIGNERS

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**PREAMBLE**

This course is helpful for students to enhance their knowledge in renewable sources and empower the students to understand the need of renewable sources, utilization of techniques, and its advantages. Energy is a vital input for the development and economic growth of a country. The growth of the energy sector is critical for socio-economic development particularly for rural areas. Students will be exposed to the status of energy resources, interaction with environment, different renewable energy sources technologies, different techniques and technologies for energy management and energy conservation along with the economic aspects of renewable energy based power generation. It is to provide specialist manpower to meet the challenges of the energy sector.

**PREREQUISITE**

- NIL

**COURSE OBJECTIVES**

1. To familiarize the student with the utilization methods of the renewable energy resources
2. To learn about PV Technology principles.
3. To learn economical and environmental merits of solar energy for various applications.
4. To learn modern wind turbine control & monitoring.
5. To learn various power converters in the field of renewable energy technologies.
6. To study and analyze different types of Power converters for Renewable energy conversion

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to:

- CO1: Understand the various PV technologies
- CO2: Implement The PV technology to various applications.
- CO3: Assess the control and monitoring systems
- CO4: Realize modern control methods of wind turbine
- CO5: Analyze various power converters.

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S: Strong; M: Medium; L: Low

**SYLLABUS**

**SOLAR THERMAL TECHNOLOGIES**


**SPV SYSTEM DESIGN AND APPLICATIONS**

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

**DIRECT ROTOR COUPLED GENERATOR (MULTIPOLE) [VARIABLE SPEED VARIABLE FREQ.]**

Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up / Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits

**MODERN WIND TURBINE CONTROL & MONITORING SYSTEM**


**POWER CONVERTERS**


**TEXT BOOK**


**REFERENCES**


**COURSE DESIGNERS**

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</table>
Preamble
Tractors are equipments with automotive engines functioning with different design off the road for agricultural purpose. Most of the components are designed and developed based on a separate set of parameters.

Prerequisite
Nil

Course Objectives
1. To detail on the fundamental operation of tractors and its engine.
2. To describe about the various components of engine for a tractor and farm equipment.
3. To describe the design of engine framework and valve mechanism for tractors.
4. To describe engine cooling, lubrication and fuel supply system.
5. To detail about various farm equipments

Course Outcomes:
After Successful completion of this course, the students will be able to:

| CO1  | Summarize safety rules of tractors and their components. | Understand |
| CO2  | Classify operation of engine cycles and performance of tractors. | Understand |
| CO3  | Appraise on the engine framework design for tractors. | Apply |
| CO4  | Appraise on the cooling, lubrication and fuel supply systems for a tractor. | Apply |
| CO5  | Appraise on the different farm equipments. | Apply |

Mapping with Programme Outcomes and Programme Specific Outcomes

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S - Strong; M - Medium; L - Low

Syllabus

GENERAL DESIGN OF TRACTORS
Classification of tractors – Main components of tractor – safety rules, Control of the Tractor and Fundamentals of Engine Operation

CONTROL DESIGN OF THE TRACTOR AND FUNDAMENTALS
Tractor controls and the starting of the tractor engines – basic notions and definition – Engine cycles – operation of multi cylinder engines - General engine design – Basic engine performance characteristics.

ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTORS
Cylinder and pistons – Connecting rods and crankshafts – Engine balancing – Construction and operations of the valve mechanism – Valve mechanism troubles

COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEMS OF TRACTOR
Cooling system – Classification – Liquid cooling systems – Components, Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps

FARM EQUIPMENTS
Working attachment of tractors – Farm equipments – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

TEXT BOOK:

REFERENCES:

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<td>T.Raja</td>
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<td>3</td>
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</table>
Preamble
Conventional fuels used in automotive are sourced from fossil fuels and in the current scenario, fossil fuels are depleting. Alternate fuels for use in internal combustion engines are increasing as a replacement of fossil fuels.

Prerequisite
Nil

Course Objectives

1. To provide the biochemistry of alternate fuels for use in automotive engines.
2. To detail on the different methods of generation of alternate fuels from various bio resources.
3. To describe the composition and properties of bio-diesel for use in automotive engines.
4. To elucidate the different options available for production of new alternate fuels.

Course Outcomes:
After successful completion of this course, the students will be able to:

| CO1. Summarize on the biochemistry of alternate fuels that are used in automotive engine. | Understand |
| CO2. Summarize on the various methods of production of alternate fuels for internal combustion engines. | Understand |
| CO3. Appraise on the composition and properties of bio-diesel as an alternate fuel. | Apply |
| CO4. Appraise on the various options for production of new alternate fuels. | Apply |

Mapping with Programme Outcomes and Programme Specific Outcomes

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S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION
Chemistry, Biochemistry, and Microbiology of Lignocellulosic Biomass, Biomass as an Energy Source: Traditional and Modern Views, Structural and Industrial Chemistry of Lignocellulosic Biomass, Lignocellulose as a chemical resource, Physical and chemical pretreatment of lignocellulosic biomass, Biological pretreatments, Acid hydrolysis to saccharify pretreated lignocellulosic biomass,

BIOCHEMISTRY
Cellulases: Biochemistry, Molecular Biology, and Biotechnology, Enzymology of cellulose degradation by cellulases, Cellulases in lignocellulosic feedstock processing, Molecular biology and biotechnology of cellulase production, Hemicellulases: New Horizons in Energy Biotechnology, A multiplicity of hemicellulases, Hemicellulases in the processing of lignocellulosic biomass, Lignin-Degrading Enzymes as Aids in Saccharification, Commercial Choices of Lignocellulosic Feedstocks for Bioethanol Production, Biotechnology and Platform Technologies for Lignocellulosic Ethanoles

BIOCHEMICAL ENGINEERING
Biochemical Engineering and Bioprocess Management for Fuel Ethanol, Biomass Substrate Provision and Pretreatment, Wheat straw — new approaches to complete saccharification, Switchgrass, Corn stover, Softwoods, Sugarcane bagasse, Other large-scale agricultural and forestry, biomass feedstocks, Fermentation Media and the “Very High Gravity” Concept, Fermentation media for bioethanol production, Highly concentrated media developed for alcohol fermentations,

COMPOSITION OF BIO DIESEL
Vegetable oils and chemically processed biofuels, Biodiesel composition and production processes, Biodiesel economics, Energetics of biodiesel production and effects on greenhouse gas emissions, Issues of ecotoxicity and
sustainability with expanding biodiesel production, Fischer-Tropsch Diesel: Chemical Biomass–to–Liquid Fuel Transformations

**DEVELOPMENT OF ALTERNATE FUELS**

Radical Options for the Development of Biofuels, Biodiesel from Microalgae and Microbes, Biohydrogen, The hydrogen economy and fuel cell technologies, Bioproduction of gases, Production of H₂ by photosynthetic organisms, Emergence of the hydrogen economy, Microbial Fuel Cells: Eliminating the Middlemen of Energy Carriers Biofuels as Products of Integrated Bioprocesses

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Preamble
To introduce the need, evolution, and motivation for Industrial Automation. Familiarization with basic concepts and different automation strategies being used in practice worldwide.

Prerequisite NIL

Course Objective
1. To explain the factory automation and integration
2. To illustrate about hydraulics and pneumatics circuits
3. To design the various design of pneumatic and electro-pneumatic circuits
4. To design about PLC and its applications
5. To illustrate the automation in transfer machines & assembly.

Course Outcomes: On the successful completion of the course, students will be able to

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<tr>
<th>CO</th>
<th>Explain the factory automation, production system and integration technologies in manufacturing sector</th>
<th>Understand</th>
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<td>Explain the various Hydraulics and Pneumatics Elements used for the industrial applications</td>
<td>Understand</td>
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<td>CO3</td>
<td>Develop the pneumatic and electro-pneumatic circuits for the given applications using standard procedures.</td>
<td>Apply</td>
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<tr>
<td>CO4</td>
<td>Develop PLC for modern manufacturing applications using standard procedures</td>
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<td>CO5</td>
<td>Construct the automatic transfer machines &amp; assembly automation</td>
<td>Apply</td>
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Mapping with Programme Outcomes and Programme Specific Outcomes

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S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FACTORY AUTOMATION AND INTEGRATION
Basic concepts and scope of industrial automation, socio-economic considerations, modern developments
INTRODUCTION TO HYdraulICS AND PNEUMATICS

Basic elements of hydraulics and pneumatics, electro-pneumatic controls and devices, electro-pneumatic systems, fluid power control elements and standard graphical symbols for them, construction and performance of fluid power generators, hydraulic and pneumatic actuators, their design and control devices-Sequence operation of hydraulic and pneumatic actuators-Applications in manufacturing-Hydraulic

DESIGN OF PNEUMATIC AND ELECTRO-PNEUMATIC LOGIC CIRCUITS

Logic circuits to be designed for a given time displacement diagram or sequence of operation-Pneumatic safety and control circuits and their applications to clamping, traversing and releasing operations.

PROGRAMMABLE LOGIC CONTROLLERS (PLC)

PLC for design demonstration, programming and interface the hardware with software for modern manufacturing applications.

AUTOMATIC TRANSFER MACHINES & ASSEMBLY AUTOMATION

Classifications, analysis of automated transfer lines, without and with buffer storage, group technology and flexible manufacturing system- Types of assembly systems, assembly line balancing, performance and economics of assembly system.

Text Books


Reference Books


Course Designers

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<tr>
<th>S.No</th>
<th>Faculty Name</th>
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<tbody>
<tr>
<td>1</td>
<td>M.SARAVANAN</td>
<td>ASST. PROF</td>
<td>MECH./ AVIT</td>
<td><a href="mailto:saravanan@avit.ac.in">saravanan@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>S.NATARAJAN</td>
<td>Assoc.Prof</td>
<td>MECH/VMKVEC</td>
<td><a href="mailto:natarajans@vmkvec.edu.in">natarajans@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
To gain basic knowledge on MEMS (Micro Electro Mechanical System). This enables them to design, analyze, fabricate and test the MEMS based components.

PREREQUISITE: Nil

COURSE OBJECTIVES
1. To understand the concepts of basic MEMS structures.
2. To learn about the various MEMS Sensors and its construction.
3. To learn about the micro machining products.
4. To understand the functioning of various optical MEMS Sensors.
5. To study the various applications of MEMS Sensors

Course Outcomes
On the successful completion of the course, students will be able to

CO1. Understand the basic fabrication of MEMS systems.

CO2. Design various MEMS sensors for required applications.

CO3. Apply the different micromachining process in MEMS sensor fabrication.

CO4. Analyze the light source utilization in MEMS sensors.

CO5. Evaluate the various real time applications of MEMS Sensors.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S – Strong; M – Medium; L – Low
SYLLABUS

INTRODUCTION

MICRO SENSORS AND MICROSYSTEMS

PRINCIPLES OF MICROMACHINING
Introduction, Photolithography, Bulk Micromachining, Thin Film Deposition, Etching, surface Micromachining, LIGA

OPTICAL MEMS

REAL TIME UTILISATION OF MEMS SENSORS

TEXT BOOKS:

REFERENCE BOOKS:

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>R. Karthikeyan</td>
<td>Assistant Professor (Gr-II)</td>
<td>ECE</td>
<td><a href="mailto:rrmdkarthikeyan@avit.ac.in">rrmdkarthikeyan@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr.G.Ramachandran</td>
<td>Assistant Professor</td>
<td>ECE</td>
<td><a href="mailto:ramachandran@vmkvec.edu.in">ramachandran@vmkvec.edu.in</a></td>
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</table>
In the current automated world, Machine Vision plays a major role in several significant applications such as imaging-based automatic inspection and analysis, Intelligent transportation system, Logistics, Robot guidance, Packaging industries and many. It provides an detailed view of the various process involved.

**PREREQUISITE** : Nil

**COURSE OBJECTIVES**

1. To understand the Image filtering operations, Morphological operations, Thresholding Images.
2. To determine the concepts of Binary shape & Boundary Pattern analysis, Detection & Pattern matching techniques.
3. To examine the concepts of 3-D Vision, Image Transformations & Motion.
4. To illustrate the automated visual inception, in vehicle vision systems, inspection of cereal grains & surveillance.

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to:

- CO1. Interpret the Low Level Vision techniques and methods of Machine Vision
- CO2. Demonstrate the Intermediate Level Vision techniques.
- CO3. Paraphrase the 3-D Vision and Motion procedures.
- CO4. Infer the various Real-Time Pattern Recognition systems.

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**LOW-LEVEL VISION**
Images and Imaging Operations, Basic Image Filtering Operations, Thresholding Techniques, Edge Detection, Corner and Interest Point Detection, Mathematical Morphology, Texture

**INTERMEDIATE-LEVEL VISION**

**3-D VISION AND MOTION**
The Three-Dimensional World, Tackling the Perspective n-point Problem, Invariants and Perspective, Image Transformations and Camera Calibration, Motion

**REAL-TIME PATTERN RECOGNITION SYSTEMS**
Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, Statistical Pattern Recognition, Image Acquisition, Real-Time Hardware and Systems Design Considerations

**TEXT BOOK**

**REFERENCE BOOKS**

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<tr>
<td>1</td>
<td>Dr. D. Vijendra Babu</td>
<td>Professor</td>
<td>ECE</td>
<td><a href="mailto:vijendrababu@avit.ac.in">vijendrababu@avit.ac.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr. P. Subramanian</td>
<td>Associate Professor</td>
<td>ECE</td>
<td><a href="mailto:Subramanian@avit.ac.in">Subramanian@avit.ac.in</a></td>
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PREAMBLE
To enlighten on various technological advancements, benefits and prospects of utilizing hydrogen/fuel cell for meeting the future energy requirements.

PREREQUISITE
THERMAL ENGINEERING

COURSE OBJECTIVES
1 To study on the hydrogen production methodologies, possible applications and various storage options.
2 To discuss on the working of a typical fuel cell and to elaborate on its thermodynamics and kinetics.
3 To make students understand the different fuel cells and their applications.
4 To analyze the cost effectiveness and eco-friendliness of Fuel Cells.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Retrieve hydrogen properties and its thermodynamic performance. Remember

CO2. Known the Hydrogen production and working of fuel cells. Understand

CO3. Known the different types of fuel cells and their applications. Understand

CO4. Analyze the cost effectiveness and eco-friendliness of fuel cells. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS


**FUEL CELL – TYPES:** Types of fuel cells – AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – relative merits and demerits.

**APPLICATION OF FUEL CELL AND ECONOMICS:** Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space. Economic and environmental analysis on usage of Hydrogen and Fuel cell. Future trends in fuel cells.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<td>Assistant Professor</td>
<td>MECH / VMKVEC</td>
<td><a href="mailto:chandrasekar@vmkvec.edu.in">chandrasekar@vmkvec.edu.in</a></td>
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<td>2</td>
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<td>17MESE05</td>
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**Preamble**
This subject deals with various techniques involved in waste treatment, waste disposal and how to convert energy from that waste. Detailed study extends to the method of thermo chemical and bio chemical conversion techniques. Also deals a case study of environmental and health impact due to energy conversion from waste.

**Prerequisite - NIL**

**Course Objective**

1. To understand the waste and waste processes.
2. To understand waste treatment and disposal.
3. To apply the convert waste to energy from thermo chemical conversion.
4. To apply the convert waste to energy from bio chemical conversion.
5. To analysis the environmental impact due to waste with case study.

**Course Outcomes: On the successful completion of the course, students will be able to**

**CO1.** Known the types and source of waste

**CO2.** Familiarize the various waste treatment technique and disposal methods.

**CO3.** Apply the various techniques to convert waste to energy by thermo chemical conversion.

**CO4.** Apply various methods to convert waste to energy from bio chemical conversion.

**CO5.** Analyze the environmental and health impacts due to waste with case study.

**Mapping with Programme Outcomes and Programme Specific Outcomes**

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION TO WASTE & WASTE PROCESSING**

Definitions, sources, types and composition of various types of wastes; Characterisation of Municipal Solid Waste (MSW), Industrial waste and Biomedical Waste (BMW), waste collection and transportation; waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of MSW; Life Cycle Analysis (LCA), Material Recovery Facilities (MRF), recycling processes of solid waste.
WASTE TREATMENT AND DISPOSAL
Aerobic composting, incineration, different type of incineration; medical and pharmaceutical waste incinerations- land fill classification, types, methods and sitting consideration, layout and preliminary design of landfills: composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases.

ENERGY FROM WASTE- THERMO CHEMICAL CONVERSION
Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting.- environmental and health impacts of incineration; strategies for reducing environmental impacts.

ENERGY FROM WASTE- BIO-CHEMICAL CONVERSION
Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion- biogas production, land fill gas generation and utilization, present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages.

ENVIRONMENTAL AND HEALTH IMPACTS-CASE STUDIES
Environmental and health impacts of waste to energy conversion, case studies of commercial waste to energy plants, waste to energy- potentials and constraints in India, eco-technological alternatives for waste to energy conversions - Rules related to the handling, treatment and disposal of MSW and BMW in India.

Text Books

Reference Books

Course Designers

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<tr>
<td>2</td>
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17MESE06 BIO ENERGY TECHNOLOGY

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**Preamble**
To disseminate the technologies for utilizing bio-energy and its manifold benefits compared to conventional fossil fuels.

**Prerequisite – RENEWABLE SOURCES OF ENERGY**

**Course Objective**

1. To provide the students knowledge of the sources of biomass.
2. To make understand the students on different processes of biomethanation.
3. To study the application of combustion of bio fuels,
4. To study the application of gasification methods of biomass.
5. To provide the students application knowledge of liquefied biofuels.

**Course Outcomes: On the successful completion of the course, students will be able to**

- **CO1.** To gain the knowledge of the basic concepts of Biomass preparation and also fuel assessments. 
  Understand
- **CO2.** To obtain the methods of biogas production and biogas plants. 
  Understand
- **CO3.** To apply the concepts of combustion processes and fuel handling systems. 
  Apply
- **CO4.** To apply the techniques for preparation of biogases and coals. 
  Apply
- **CO5.** To apply the techniques for preparation of biodiesels from vegetables. 
  Apply

**Mapping with Programme Outcomes and Programme Specific Outcomes**

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S- Strong; M-Medium; L-Low

**SYLLABUS:**
INTRODUCTION

BIOMETHANATION

COMBUSTION
Perfect, complete and incomplete combustion - stoichiometric air requirement for biofuels - equivalence ratio – fixed Bed and fluid Bed combustion – fuel and ash handling systems – steam cost comparison with conventional fuels

GASIFICATION, PYROLYSIS AND CORBONISATION

LIQUID BIOFUELS
History of usage of Straight Vegetable Oil (SVO) as fuel - Biodiesel production from oil seeds, waste oils and algae - Process and chemistry - Biodiesel health effects / emissions / performance. Production of alcoholic fuels (methanol and ethanol) from biomass – engine modifications

TEXT BOOKS
1. Tom B Reed, Biomass Gasification – Principles and Technology, Noyce Data Corporation, 1981
2. David Boyles, Bio Energy Technology Thermodynamics and costs, Ellis Hoknood Chichester, 1984.

Reference Books
4. Iyer PVR et al, Thermochemical Characterization of Biomass, M N E S

Course Designers

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<td>Mech / VMKVEC</td>
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<td><a href="mailto:mahesh@avit.ac.in">mahesh@avit.ac.in</a></td>
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PREAMBLE
To enhance holistic development of students and improve their employability skills

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To improve aptitude, problem solving skills and reasoning ability
2. To collectively solve problems in teams & group
3. To know the concept of Quantitative analysis
4. To have a good knowledge in reasoning
5. To identify and solving the Mathematical Puzzles

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Identify, formulate and solve aptitude problems
CO2. Apply the knowledge of Mathematics, Science and Engineering in mathematical problems
CO3. Use the Techniques & skills.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

NUMBERS-I
Types and Properties of Numbers, LCM, GCD, Surds and indices

ARITHMETIC – I
Percentages, Profit & Loss, Area and volume

QUANTITATIVE ANALYSIS-I.
Time and works, Pipes and cistern, Calendar and Clocks

REASONING-I
Mathematical operations, Coding and decoding , Blood relationship

PUZZLES-I
Classification type, Seating arrangements and Comparison types
TEXTBOOKS:
Agarwal.R.S – Quantitative Aptitude for Competitive Examinations, S.Chand Limited 2011

REFERENCES:

COURSE DESIGNERS

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<tbody>
<tr>
<td>Dr. M.Vijayarakan</td>
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<tr>
<td>Dr.A.K.Thamizhsudar</td>
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<td>AVIT</td>
<td><a href="mailto:thamizhsudar@avit.ac.in">thamizhsudar@avit.ac.in</a></td>
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### PERSONALITY SKILL DEVELOPMENT - II

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#### PREAMBLE: SM & S

Personality Skill Development provides a professional approach and makes the students ready for the industry as well as to make them to understand the entrepreneurial approach through various actions. It also breaks down the barriers between the institute and industry by anticipating the technology update.

#### PREREQUISITE:
Not Required

#### COURSE OBJECTIVES:

1. To learn and practice the Soft skills.
2. To assess the importance of social skills.
3. To practice SWOT analysis for individual and group.
4. To build and enhance the self confidence
5. To apply and observe various personality skills for personality development.

#### COURSE OUTCOMES:

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

| CO1: Understand the importance of Personality related to the working environment. | Understand |
| CO2: Inculcate relevant interpersonal skills for survival. | Apply |
| CO3: Analyse various skills of SWOT analysis. | Analysing |
| CO4: Applying assortment of soft skills for self assessment for both organisationally and socially. | Evaluate |
| CO5: Build self esteem and relevant personality skills according to goal. | Evaluate |

#### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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#### SYLLABUS:

- Importance of Personality and Skill Development.
- Interpersonal Vs Intrapersonal skill.
- Communication and barriers in Communication.
- SWOT analysis for identifying individual, group and organisation.
- Skills required to Win and influence people
Seven essential habits of Effective people followed.
- Goal setting – Individual skill to act in a group dynamics.
- Team Building
- Group Discussion
- Role Play
- Time management
- Corporate Etiquettes.
- Personality Grooming
- Body Language
- Career Guidance.
- Resume preparation
- Interview Skill
- Self Assessment

TEXT BOOK:

REFERENCE BOOK:
1. Narula S. S, Personality Development and Communication Skills, Taxmann Publications Pvt Ltd

COURSE DESIGNERS:

<table>
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<tbody>
<tr>
<td>1.</td>
<td>A. Mani</td>
<td>Associate Professor</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>Dr. V. Sheelamary</td>
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</table>
CATEGORY ‘C’ – ELECTIVE COURSES - PROGRAMME SPECIFIC – 12-15 CREDITS SPECIALISATION

SPECIALISATION – INDUSTRIAL BIOTECHNOLOGY
PREAMBLE
Principles of Chemical Engineering deals with the material and elemental balance in a reaction. A chemical engineers have a broad knowledge on ideal and non-reactor flow models. This paper also impart the knowledge on reaction rate of the reaction and its kinetics gas liquid reactions. Knowledge of these principles will enable students to understand vital role of engineer in a process industry.

PREREQUISITE - NIL

COURSE OBJECTIVES

1. To explain the basic knowledge on the material balance equations.
2. To discuss the performance of ideal reactors
3. To demonstrate the difference between ideal flow and non-ideal flow.
4. To outline the heterogeneous reaction of gas-liquid and solid.
5. To explain the basic knowledge on the material balance equations.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Describe the basics of material balance in chemical reaction
Understand

CO2. Explain the effectiveness of an ideal reactor
Understand

CO3. Classify the various flow pattern of fluids
Apply

CO4. Differentiate the various ideal and non-ideal fluid model
Analyze

CO5. Predict the heterogeneous reactions.
Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

MATERIAL BALANCE
Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; unit operations; recycle and by pass; humidity calculations.

IDEAL REACTORS
Ideal reactors- Definition Isothermal - batch reactor, Continuous flow reactor, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.

IDEAL FLOW AND NON IDEAL FLOW

GAS-SOLID, GAS-LIQUID REACTIONS
Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

FIXED BED AND FLUID BED REACTORS
Broad outline of chemical reactors; Industrial scale reactors. Gas liquid reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors
TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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PREAMBLE
Fermentation design and analysis deals with the basic design of fermentor and its concepts. This paper also deals with the aeration and agitation equipments which were used for proper mixing substrate with the microorganisms. Fermenter design often use cutting-edge techniques and sophisticated machinery for the scale up and scale down issues for their complex mechanisms. Knowledge of these principles will enable students to understand the flow mechanisms, biomass growth and inlet and outlet gas analysis.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To label the body construction and types of fermenter.
2. To describe the power requirement for aerated and non-aerated fermenter.
3. To construct the various designs for studying the heat and mass transfer in the fermenter.
4. To predict the various problems related to scale up and scale down process.
5. To outline the various instrumentation involved in the monitoring and control of fermentation process.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Recall how to construct the fermenter and the materials used for it. Remember
CO2. Interpret the power requirement for aerated and non-aerated fermenter Understand
CO3. Classify the various design of heat transfer mechanism in fermenter design Apply
CO4. Categorize the issues involved in scale up and scale down process Analyze
CO5. Examine the parameters involved in the instrumentation and control Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

BASIC FERMENTER CONCEPTS
Define Fermenter, body construction of fermentor, Bioreactor Operation, Batch operation, fed-batch operation and Continuous Operation, Chemostat, turbidostat, Microbiological reactors, Enzyme reactors, Tank-type, Column-type biological reactors.

AERATION AND AGITATION IN BIOPROCESS SYSTEMS
Mass transfer in agitated tanks, Effect of agitation on dissolved oxygen, Correlations with kLa in Newtonian and non-Newtonian liquid, Power number, Power requirement for mixing in aerated and non-aerated tanks for Newtonian and non-newtonian liquid-Agitation rate studies, Mixing time in agitated reactor, residence time distribution, Shear damage, bubble damage, Methods of minimizing cell damage, Laminar and Turbulent flow in stirred tank bioreactors.

SELECTION AND DESIGN OF BIOPROCESS EQUIPMENT
Materials of construction for bioprocess plants, Design considerations for maintaining sterility of process streams processing equipments, selection, specification, Design of heat and mass transfer equipment used in bioprocess industries, Requirements, design and operation of bioreactor for microbial, plant cell and animal cell.

SCALE UP AND SCALE DOWN ISSUES
Effect of scale on oxygenation, mixing, sterilization, pH, temperature, inoculum development, nutrient availability and supply, Bioreactor scale-up based on constant power consumption per volume, mixing time, impeller tip speed (shear), mass transfer coefficients, Scale up of downstream processes, Adsorption (LUB method), Chromatography (constant resolution etc.), Filtration (constant resistance etc.), Centrifugation (equivalent times etc.), Extractors (geometry based rules), Scale–down related aspects.

FERMENTER INSTRUMENTATION AND CONTROL
Bioreactor controlling probes, Characteristics of bioreactor sensors, Methods of measuring process variables, Temperature, Flow measurement and control, Pressure measurement and control, Agitation, shaft power, rate of stirring. Detection and prevention of foam, Measurement of Microbial biomass, Measurement and control of Dissolved oxygen, Inlet and outlet gas analysis, pH measurement and control - Biosensors.

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PREAMBLE
Bioseparation technology deals with the economics and importance of bioproducts purification process. In this subject the purification process comprises various unit operation in levels of purification process. Bioseparation technology often use pioneering techniques and sophisticated machinery along with other applied field’s chemical engineering and instrumentation for purification of biological products. Knowledge of these principles will enable students to understand various steps involved in purification process of biological products.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To summarize the downstream processes employed in the biotechnology industry.
2. To classify the physical and chemical separation processes in DSP.
3. To demonstrate separation processes by means of membrane separation techniques in DSP.
4. To distinguish the various types of chromatography for the separation process.
5. To outline the concepts for separation and purification.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Describe the need of downstream processing in biotechnology industry
Understand

CO2. Identify the importance of separation process involved in the downstream processes
Understand

CO3. Illustrate the various types of membrane separation process employed in the DSP
Apply

CO4. Categorize the various parameters that governs chromatography techniques
Apply

CO5. Examine the various finishing operations involved in the DSP
Analyze

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S- Strong; M-Medium; L-Low

SYLLABUS

DOWNSTREAM PROCESSING IN BIOTECHNOLOGY
Role and importance of downstream processing in biotechnological processes – Problems and requirements of bio product purification – Economics of downstream processing in Biotechnology, cost-cutting strategies – Separation characteristics of proteins and enzymes – size, stability, properties – Flocculation and conditioning of broth – Process design criteria for various classes of bio products (high volume, low value products and low volume, high value products) – Upstream production methods affect downstream purification strategies.

PHYSICO-CHEMICAL BASIS OF BIO-SEPARATION PROCESSES
Cell disruption methods for intracellular products – Physical, chemical, mechanical – Removal of insoluble, biomass and particulate debris separation techniques – Filtration at constant pressure and at constant rate – Empirical equations for batch and continuous filtration – Types of filtration -
Centrifugal and cross-flow filtration – Types of filtration equipments – Centrifugation – Basic principles, design characteristics – Types of centrifuge and applications – Sedimentation

MEMBRANE SEPARATIONS AND ENRICHMENT OPERATIONS
Theory, Design consideration and configuration of membrane separation processes – Reverse osmosis, microfiltration, ultra filtration and dialysis – Structure and characteristics of membranes – Membrane modules – Enrichment Operations – Extraction–equipment for extraction – Aqueous two-phase extraction process – Evaporators – Types of evaporators – Adsorption isotherms and techniques – Protein precipitation – Methods of precipitational

MECHANISM AND MODES OF CHROMATOGRAPHIC SEPARATION
Chromatography – Classification of chromatographic techniques – General description of column chromatography – Chromatographic terms and parameters – Practice of chromatography – Partition, normal-phase, displacement, reversed-phase, size exclusion, ion exchange, hydrophobic, affinity chromatography – Scale-up of chromatography – Process considerations in Preparative liquid chromatography and HPLC

FINISHING OPERATIONS AND FORMULATIONS
Drying – Mechanism, methods and applications, Types of dryers – Tray, spray, rotary, belt, disc – Crystallization – Nucleation, growth – Types of crystallizers – Tank, scrapped surface, Oslo, Circulating-magma evaporator – Freeze drying – Principle, process, applications

TEXT BOOKS:

REFERENCES

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PREAMBLE
This course will provide an overview of management techniques for industrial wastes, as well as State and Central Pollution Board regulations for waste management. The course will also highlight the business profitability, legal framework, and the economic feasibility of the environmentally sustainable technologies for waste management.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To discuss the present scenario of industrial waste management in India
2. To explain the knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control
3. To execute about the onsite pollution from major industries
4. To outline the various effects and disposal options for the industrial waste.
5. To outline the maintenance of hazardous waste

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Summarise the insight into the pollution from major industries including the sources and characteristics of pollutants

Understand

CO2: Identify the plan minimization of industrial wastes

Understand

CO3: Illustrate the facilities for the processing and reclamation of industrial waste water

Apply

CO4: Correlate the various treatments for disposals of industrial waste.

Analyse

CO5: Examine the physio chemical treatment for hazardous waste.

Analyse

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S - Strong; M - Medium; L - Low

SYLLABUS
INTRODUCTION TO INDUSTRIAL POLLUTION
Types of Industries And Industrial Pollution, Characteristics Of Industrial Wastes, Population Equivalent, Bioassay Studies, Effects Of Industrial Effluents On Streams, Sewer, Land, Sewage Treatment Plants And Human Health Environmental Legislations Related to Prevention And Control Of Industrial Effluents And Hazardous Wastes

CLEANER PRODUCTION

POLLUTION FROM MAJOR INDUSTRIES

TREATMENT TECHNOLOGIES

HAZARDOUS WASTE MANAGEMENT
Hazardous Wastes, Physico Chemical Treatment, Solidification, Incineration, Secure Land Fills.

TEXT BOOKS

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PREAMBLE
Fundamentals of fluid mechanics deals with fundamental concepts of fluid flow with Newtonian laws and application of fluid static equation. This papers also deals with the need of dimensional analysis and dimensionless parameter. Helps to regain the knowledge in type of flow and flow measurement in pipes. Fundamentals of fluid mechanics often use cutting-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, mechanical engineering and chemical engineering. Knowledge of these principles will enable students to understand various types of fluid flow and their importance in the industry.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To acquire knowledge about the fundamentals concepts of fluid flow.
2. To apply the knowledge on fluid static equation.
3. To analyze the need for dimension analysis and dimensionless parameter.
4. To understand the various type of flow through pipes.
5. To analyze the various types of pumps with its working principle.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

<table>
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<tr>
<th>Course Objective</th>
<th>Description</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Recall the concepts of fluid flow.</td>
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<tr>
<td>CO2</td>
<td>Report the fluid static equation based on fluid flow.</td>
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<td>CO3</td>
<td>Compare the dimension and dimensional analysis water.</td>
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<td>CO4</td>
<td>Calculate the types flow measurement in pipes.</td>
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<tr>
<td>CO5</td>
<td>Illustrate the boundary layer concepts.</td>
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SYLLABUS
FUNDAMENTAL CONCEPTS
Definition of Fluid, Continuum concept of fluid, Terminologies of fluid flow, velocity – local, average, maximum, flow rate – mass, volumetric, velocity field; dimensionality of flow; flow visualization – streamline, pathline, streak line, stress field; viscosity; Newtonian fluid; Non-Newtonian fluid; Reynolds’s number—its significance, laminar, transition and turbulent flows: Prandtl boundary layer, compressible and incompressible flows

FLUID STATICS
Fluid statics – basic equation – equilibrium of fluid element – pressure variation in a static fluid – application to manometry – Differential analysis of fluid motion – continuity, equation of motions, Euler’s equation, Bernoulli equation, and Navier- Stokes equation.

DIMENSIONAL ANALYSIS
Formal procedure for dimensional analysis – Dimensional homogeneity – Buckingham’s Pi theorem – Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude – Dimensionless parameters-application of dimensionless parameters – Model analysis

FLOW MEASUREMENT
Reynolds number regimes, internal flow – flow through pipes – pressure drop under laminar and turbulent flow conditions – major and minor losses; Line sizing; External flows – boundary layer concepts, boundary layer thickness under laminar and turbulent flow conditions- Flow over a sphere – friction and pressure drag – flow through fixed and fluidized beds.

**PUMPS**

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**REFERENCES:**

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PREAMBLE
The aim of this course is to develop in students the ability to synthesise design solutions for the biochemical engineering sector that take into account consideration of good design practice, that are inherently safe and that are most economically viable.

PREREQUISITE - NIL

COURSE OBJECTIVES

1. To define economic evaluation of Bioprocess technology
2. To discuss cost estimation analysis of process design and development
3. To describe and synthesise a design in terms of safety and provide measures for its safe operation
4. To demonstrate a design using best practice economic principle
5. To perform experimental design for screening & optimizing the process parameters.

COURSE OUTCOMES

After the successful completion of the course, learner will be able to

CO1. Recall the economic evaluation concepts involved in bioprocess techniques Remember

CO2. Describe the different costs involved in the total product for a typical Chemical Process plant Understand

CO3. Explain the optimal strategy for design and analysis of various Bioreactors Understand

CO4. Demonstrate the instrumentation and control of bioprocess using engineering principles. Apply

CO5. Illustrate case studies on screening designs and optimization of various bioprocess Apply

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S- Strong; M-Medium; L-Low

SYLLABUS

ECONOMIC EVALUATION
Capital cost of a project; Interest calculations, nominal and effective interest rates; basic concepts in tax and depreciation; Measures of economic performance, rate of return, playout time; Cash flow diagrams; Cost accounting-balance sheet and profit loss account; Break even and minimum cost analysis.

BIOPROCESS ECONOMICS

DESIGN AND ANALYSIS OF BIOREACTORS
Chemostat model with cell growth kinetics, Plug flow reactor for microbial processes; optimization of reactor systems; Multiphase bioreactors, packed bed with immobilized enzymes or microbial cells; three phase fluidized bed trickling bed reactor; Component of Fermenter and their design, a sceptic operations, RTD studies in bioreactors, Design and analysis of the above reactor systems; Gas liquid reactors; Reactor with non-ideal mixing; dispersion model; Tanks in series Model; Bubble column reactors, airlift fermenters etc. Air and medium sterilization Mechanical fittings in a bioreactor: vessel, agitation system materials, welds, finish, valves, piping and valves for biotechnology, cleaning

**INSTRUMENTATION AND CONTROL OF BIOPROCESSES**
Physical and chemical sensors for the medium and gases. Online sensors for cell properties, off-line analytical methods; Biosensors.

**DESIGN OF EXPERIMENTS – SCREENING DESIGNS, OPTIMIZATION**
Screening designs: Fractional factorial design – General 2k-p design, Placket-Burman design, confounding and aliasing, resolution of design, main effects, interaction effects, screening criteria, Numerical. Optimization: Response surface methodology, Linear model (method of steepest ascent). Second order models (CCD, CCRD, Taguchi design); generation of experimental design; response variables; model terms: linear, quadratic & interaction terms; ANOVA table, data diagnostics & outlier analysis, contour & surface plots, optimization criteria. D-optimal design, Numerical.

**TEXTBOOKS**

**REFERENCES:**
3. Biochemical Engineering – Atkinson

**COURSE DESIGNERS**

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PREAMBLE
Bioreactor theory subject deals with the basic knowledge in the construction of bioreactor and its working principles. This subject also provides a wide knowledge on various types of bioreactor and with its merits and demerits. Bioreactor theory often use cutting-edge techniques and sophisticated machinery along with other applied fields of research to study how the nutrients are up taken by microbes and converted into products with the elemental balances. Knowledge of these principles will enable students to understand the different kinetic models of microbes to fit into a microbial growth and product formation kinetics.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To recognize knowledge on the basic principle and components of bioreactors
2. To classify the different types of bioreactors and its working principle
3. To implement the design for fermentation process for biomass growth and product formation.
4. To evaluate the stoichiometric elemental balance.
5. To analyze kinetics model on the microbial growth

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Recall the basic principle and components of bioreactors. Remember
CO2. Discuss about different types of bioreactors with its working principle. Understand
CO3. Demonstrate for fermentation process for biomass growth and product formation. Apply
CO4. Estimate the microbial growth and product formation. Analyze
CO5. Validate the stoichiometric elemental balance with microbial growth. Analyze
CO6. Create a kinetic model for microbial growth. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
OVER VIEW OF BIOREACTOR
Definition of Bioreactor, Chronological development of bioreactor design. Basic principles of Bioreactor, Classification of bioreactors, body construction of basic bioreactor, configuration of bioreactors and ancillaries parts, Removal of Heat in bioreactor main parameters to be monitored and controlled in fermentation process.

BIOREACTOR TYPES
Unconventional bioreactors, Packed bed reactor, slurry bioreactor, Hollow fibre reactor. , Multiphase Bioreactor - Air lift Bioreactors, bubble column bioreactor, fluidised bioreactor, Hydrodynamic three phase flow, Perfusion reactor for animal and plant cell culture. Merits and demerits.
DESIGN OF FERMENTATION PROCESSES
Kinetics of substrate utilization, biomass growth and product formation, inhibition on cell growth and product formation. Design and operation of continuous cultures, chemostat in series, batch and fed batch cultures, total cell retention cultivation.

METABOLIC STOICHIOMETRY AND ENERGETICS
Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

TEXT BOOKS

REFERENCES

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</tr>
<tr>
<td>2</td>
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<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:jawahar@vmkvec.edi.in">jawahar@vmkvec.edi.in</a></td>
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</table>
PREAMBLE
The curriculum of Industrial Biotechnology Lab involves in the steps of production of Citric acid, ethanol from yeast and the production of wine from black grapes. As the application part it may deals with the production of beer form cereals and the antibiotics using *streptomyces* species.

PREREQUISITE – NIL

COURSE OBJECTIVES

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<td>To differentiate, the biochemical characters of microorganisms</td>
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<td>To assess the quality of biotechnology products</td>
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<td>To Check preservation procedure for microorganisms</td>
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COURSE OUTCOMES

On the successful completion of the course, students will be able to

- **CO1.** Determine the production of citric acid: Understand
- **CO2.** Outline the steps involved in the production of ethanol from yeast: Understand
- **CO3.** Illustrate the mechanism of wine produced from black grapes: Analyse
- **CO4.** Understand the process of production of antibiotics from *Streptomyces* species: Evaluate
- **CO5.** Outline the process involved in the production of protease from different sources: Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

1. Production of Citric acid
2. Production of ethanol from black grapes
3. Production of Beer from cereals
4. Production of Protease
5. Production of Antibiotics using *Streptomyces* species
6. Production of Vitamins
7. Production of growth regulators
8. Production of Biofertilizers (N – Fixers & P - Solubilizers)
9. Production of Biocontrol Agents
10. Production of Single cell Protein (Spirulina)
11. Production of Vermicompost

REFERENCE BOOKS

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<tr>
<td>2</td>
<td>Mrs.G.Arthi</td>
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<td>Biotechnology</td>
<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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PREAMBLE
The curriculum of Fermentation Lab involved in the steps of production of primary and secondary metabolites for various industrial applications. It determine the growth kinetics of microorganisms in fermentation process. These study may understand the important aspects in fermentation engineering

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To describe and recognize the morphology of different microbes.
2. To Interpret and analyse the different types of media
3. To differentiate, the biochemical characters of microorganisms
4. To assess the quality of biotechnology products
5. To check preservation procedure for microorganisms

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Determine growth of bacterial yeast and to estimate biomass specific growth rate and yield coefficient
CO2. Outline the steps involved in the production process of ethanol and wine
CO3. Illustrate the mechanism of Solid state fermentation for the production of metabolites
CO4. Evaluate process for production of antibiotics using Streptomycyes species
CO5. Evaluate the process involved in the production of protease from different sources

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Growth of Bacterial yeast-Estimation of Biomass, Calculation of $\mu$ and $Y_{p/s}$
2. Production of ethanol from yeast
3. Production of wine from black grapes
4. Growth Kinetics in Fermentation
5. Solid State Fermentation (Production of Metabolite Primary & Secondary)
6. Production of Antibiotics using Streptomycin species
7. Residence Time Distribution
8. Production of Protease
9. Production of Biofertilizers(N – Fixers & P - Solubilizers)
10. Production of Microbial Biomass
11. Production of Single cell Protein (Spirulina)
12. Production of Vermicompost

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PREAMBLE
This lab course is designed to impart good knowledge in fluid mechanics concepts.

PREREQUISITE - Nil

COURSE OBJECTIVES
1. To learn calibration of flow meters
2. To describe in detail about the pressure loss for fluid flows
3. To describe about pump characteristics
4. To demonstrate in detail about hydrodynamic concepts.

COURSE OUTCOMES
On the successful completion of the course, students will be able to:

| CO1 | Students will be familiar with various variable area flow meters and variable head flow meters |
| CO2 | Identify the fundamental knowledge about the open channels |
| CO3 | Demonstrate the techniques for analysing the flow of fluids through closed conduits |
| CO4 | Employ the knowledge of pumps for the transportation of fluids based on process conditions/requirements and fluid properties |
| CO5 | Test the pressure drop studies in packed column |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Viscosity measurement of non-Newtonian fluids
2. Calibration of constant and variable head meters
3. Calibration of weirs and notches
4. Open drum orifice and draining time
5. Flow through straight pipe
6. Flow through annular pipe
7. Flow through helical coil and spiral coil
8. Losses in pipe fittings and valves
9. Characteristic curves of pumps
10. Pressure drop studies in packed column
11. Hydrodynamics of fluidized bed
12. Drag coefficient of solid particle

TEXT BOOKS

**REFERENCE BOOKS**

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SPECIALISATION - MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY
PREAMBLE
This course is designed to impart advanced knowledge and skills required such as Industry plant location, lay out, to learn the concept of pharmaceutical industry, drug manufacture and marketing, various regulatory affairs.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To explain the knowledge about industry layout and Design
2. To explain the basics of industry production, storages, quality control and Personnel management
3. To demonstrate the different methods of Product planning, method of marketing Distribution polices
4. To outline the basics of industrial accountancy and Principles of Costing, Estimating Balance sheet and Profit and Loss Account etc.,
5. To examine the regulatory affairs which involved in pharmaceutical industry

COURSE OUTCOMES
After the successful completion of the course, learner will be able to
CO1: Describe the industry layout and Design
CO2: Discuss the industry production and observe the quality control and Personnel management
CO3: Classify different methods in marketing and distribution
CO4: Infer industry accountancy, costing, profit and loss
CO5: Examine the regulatory affairs which involved in pharmaceutical industry

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
PLANT LOCATION AND LAY-OUT OF AN INDUSTRY
Various factors affecting locational aspect, layout of building and equipment product lay-out v/s process layout, drug store location and selection of premises, drug store management.

PRODUCTION PLANNING AND CONTROL
Scientific purchasing, quality control, problems of productivity, stores organization, location of stores, receiving, inspection of materials, issue from the store, control of stores and stocks, Store Accounting and Records. Personnel management: Selection, Appointment, training, transfer, Promotion, demotion policies, remuneration, job evaluation, human relations.

SALES ORGANISATION
Market, definition–Determent approaches to the study of marketing, institutional approach, Market planning – Product planning, method of marketing, wholesale retailers, functional approach, cost and efficiency in marketing commodity approach. Distribution polices: pharmaceutical product marketing, sales promotion policies-Detailing to physician, professional persons, sampling, window and interior display, product advertising, sales promotion, publicity.
ELEMENTARY INDUSTRIAL ACCOUNTANCY

REGULATORY AFFAIRS

TEXT BOOKS


REFERENCES BOOK


COURSE DESIGNERS

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PREAMBLE
The subject is designed to impart knowledge about recent advances in the field of medicinal chemistry at the molecular level including different techniques involved in rational drug design, pro drug and analog design, pharmaceuticals derived from medicinal plants and their applications.

PREREQUISITE- NIL

COURSE OBJECTIVES
1. To list the Medicinal plants, constituents, isolation, Characterization and purification of phyto constituents.
2. To interpret the basic concepts involved in drug discovery
3. To execute the different mechanism of action involved in pro drug design and analog design
4. To categorise the phyto constituents derived from the medicinal plants
5. To outline the monographs of herbal drugs

COURSE OUTCOMES
CO1. Recall the basic information of different medicinal plants, estimation of phyto constituents, isolation procedure and characterization of phytoconstituents
CO2. Demonstrate the concepts involved in drug discovery
CO 3. Practice the prodrug design and analog design
CO 4. Estimate the different phytoconstituents derived from the medicinal plants
CO 5. Develop the monographs of herbal drugs

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
MEDICINAL PLANTS
Medicinal plants constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbal industries of following phyto-pharmaceuticals containing drugs- Alkaloids, Glycosides, Steroids and Terpenoids:

DRUG DISCOVERY
Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs antagonists, artificial enzymes

PRO DRUG DESIGN AND ANALOG DESIGN
Prodrug design: Basic concept, Carrier linked pro drugs / Bio precursors, Pro drugs of functional group, Pro drugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action.
Analog Design: Introduction, Classical & Non classical, Bio isosteric replacement strategies, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance

PHARMACEUTICALS FROM MEDICINAL PLANTS
New pharmaceuticals for the following class of drugs- Drugs Affecting the Central Nervous System: Morphine Alkaloids, Anticancer Drugs: Paclitaxel and Docetaxel, Etoposide Cardiovascular Drugs: Lovastatin, Teprotide and Dicoumarol.

MONOGRAPHS OF HERBAL DRUGS

TEXT BOOKS

REFERENCE BOOKS

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PREAMBLE
This course is designed to impart knowledge on the area of pharmacology and advances in novel drug delivery systems, contraindications and clinical use of drugs in treatment of disease, formulation, evaluation of novel drug delivery systems, merits, demerits and its applications.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To describe the knowledge on Molecular and Cellular mechanism of action of hormones
2. To summarize the basic concepts of chemotherapy agents
3. To demonstrate the different mechanism of action of immune response and hypersensitivity reactions
4. To construct the Rate Controlled Drug Delivery Systems and their feedback regulation
5. To implement the Novel Drug Delivery Systems and their merits and demerits

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Recognize the molecular and cellular mechanism of action of hormones and their regulation. Understand

CO2. Discuss the basics of chemotherapy, Antifungal and antiviral drugs Understand

CO3. Illustrate the different mechanism of action of immune response and hypersensitivity reactions Apply

CO4. Employ the rate controlled drug delivery system and their feedback regulated Drug Delivery Systems Apply

CO5. Demonstrate the different kind of novel drug delivery system Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

ENDOCRINE PHARMACOLOGY
Molecular and cellular mechanism of action of hormones such as growth hormone, prolactin, thyroid, insulin and sex hormones. Anti-thyroid drugs, Oral hypoglycaemic agents, Oral Contraceptives, Corticosteroids. Drugs affecting calcium regulation.

CHEMOTHERAPY
Cellular and molecular mechanism of actions and resistance of antimicrobial agents such as β-lactams, aminoglycosides, quinolones, Macrolide antibiotics. Antifungal, antiviral, and anti-TB drugs

IMMUNOPHARMACOLOGY
Cellular and biochemical mediators of inflammation and immune response. Allergic or hypersensitivity reactions. Pharmacotherapy of asthma and COPD. Immuno suppressants and Immuno stimulants

RATE CONTROLLED DRUG DELIVERY SYSTEMS

NOVEL DRUG DELIVERY SYSTEMS
Introduction, formulation, merits, demerits, Application and evaluation of following— Mucosal drug delivery system, Transdermal drug delivery system (TDDS), Parenteral implants, ophthalmic inserts, Intrauterine drug delivery system (IUDs), Liposomes, Probiotics and Prebiotics. Gastro retentive drug delivery system, Colon targeted drug delivery system, externally modulated devices and delivery

TEXT BOOKS:
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

REFERENCES:

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PREAMBLE
This subject is designed to provide the advanced knowledge to the students in invaluable areas of advanced microbiology which plays a crucial role in determining its future use and applications in medicine, drug discovery, mechanism of action of antibiotics, and uses in pharmaceutical industry.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To discuss the knowledge about industrially important microorganism and their application
2. To summarize the basic concepts of Antibiotics and Synthetic antimicrobial agents action
3. To outline the Mechanism and action of antibiotics
4. To outline the Mechanisms and action of Bacterial Virulence
5. To check the disease causing microorganisms and the corresponding diseases

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Recall the basic information of industrially important microorganism and their application Understand

CO2: Describe the difference between the Antibiotics and Synthetic antimicrobial agents action Understand

CO3: Predict the Mechanism of action of antibiotics Analyze

CO4: Detect Bacterial Virulence Analyze

CO5: Validate the disease causing microorganism and their related disease Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
MICROBIOLOGY
Introduction – Bacteria, fungi, actionmycetes and virus - structure, chemistry and morphology, cultural, physiological and reproductive features. Methods of isolation, cultivation and maintenance of pure cultures. Industrially important microorganisms - examples and applications

ANTIBIOTICS AND SYNTHETIC ANTIMICROBIAL AGENTS
Mechanism of action; microbial resistance; therapeutic, prophylactic usage and adverse reactions; Antibiotic and Synthetic antimicrobial agents: β-lactam, aminoglycosides, tetracyclines. Antifungal antibiotics: Griseofulvin; Antiviral drugs: Amantidines; Nucleoside analogues, Interferons, Peptide antibiotics.

MECHANISM OF ACTION OF ANTIBIOTICS
Inhibition of cell wall synthesis; nucleic acid and protein synthesis. Bacterial resistance to antibiotics; Penetration of antimicrobial agents (cellular permeability barrier, cellular transport system and drug diffusion). Mode of action of non-antibiotic antimicrobial agents; Mode of action of bacterial killing by quinolinones; Bacterial resistance to quinolinones.
MECHANISMS OF BACTERIAL VIRULENCE
A step wise process of infection – Crossing physical, chemical and biological barriers, Colonization, Association, Adhesion and Invasion of host tissue and toxigenesis with details account of virulence factors.

MICROBIAL PATHOLOGY
Identifying the features of pathogenic bacteria, fungi and viruses. Mechanism of microbial pathogenicity, etiology and pathology of common microbial diseases and currently recommended therapies for common bacterial, fungal & viral infections.

TEXT BOOKS

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PREAMBLE
This subject is designed to impart knowledge on the development and optimization of a synthetic drugs, various stages of process in pharmaceutical industry, Different methods involved in Unit operations and Industrial safety measures.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To acquire knowledge on basics of Process chemistry in industry
2. To know the techniques of Extraction, Filtration, Distillation and Evaporation process
3. To discriminate the Aerobic and anaerobic fermentation
4. To outline the Impurities in Active Pharmaceutical Ingredient
5. To understand the basics of Industrial Safety measures and Occupational Health

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1: Know the basic knowledge on Process chemistry

CO2: Operate the techniques of Extraction, Filtration, Distillation and Evaporation process in industry

CO3: Compare and differentiate the Aerobic and anaerobic fermentation process

CO4: Validate the Impurities in Active Pharmaceutical Ingredient

CO5: Perform the Industrial Safety measures and Occupational Health in work place

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S- Strong; M-Medium; L-Low

SYLLABUS

PROCESS CHEMISTRY
Introduction, Synthetic strategy Stages of scale up process: Bench, pilot and large scale process. In-process control and validation of large scale process. Case studies of some scale up process.

UNIT OPERATIONS
a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction.
b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration,
c) Distillation: steam distillation.
d)Evaporation: Types of evaporators, factors affecting evaporation.

UNIT PROCESSES
Fermentation: Aerobic and anaerobic fermentation. Production of Antibiotics- Penicillin and Streptomycin. Vitamins: B2 and B12

IMPURITIES IN API (ACTIVE PHARMACEUTICAL INGREDIENT)
Impurities in API and their types including genotoxic impurities. Isolation, characterization and profiling of impurities in APIs with at least one example.
INDUSTRIAL SAFETY
MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment, Fire hazards, Occupational Health, Effluents and its management.

TEXT BOOKS:

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PREAMBLE
The course provides fundamental knowledge in pharmacogenomics and implementation of pharmacogenomic studies. The detailed study on human drug response, drug metabolizing enzymes, methods and applications will be focused.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To study about impact of polymorphism in human genome and applications.
2. To know about functional analysis of gene variation
3. To understand the drug dose response relationships with pharmacogenetics.
4. To understand the genomics of biotech products
5. To study about the pharmacogenomics application in diseases

COURSE OUTCOMES
CO1: Know about the different method of analysing the gene variation
CO2: Discuss the response of gene towards drug
CO3: Analyse the techniques in biotech products
CO4: Analyse the techniques in medicine
CO5: Outline the genomics of disease

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

INTRODUCTION TO PHARMACOGENOMICS
Historical perspectives and current status, Human Genome and Genomic Applications, Genetic Polymorphism of Metabolic Reactions, SNPs, Association Studies in Pharmacogenomics, Study on industries developing pharmacogenomic research

FUNCTIONAL ANALYSIS OF GENE VARIATION
Transfection Assays With Allele-Specific Constructs: Functional Analysis of UDP-Glucuronosyltransferase Variants, CYP 2D6, CYP2C19 in drug metabolism, Snapshot of the Allele-Specific Variation in Human Gene Expression, Genome-Wide Analysis of Allele-Specific Gene Expression Using Oligo Microarrays, Roche Ampli Chip, HaploChIP: An In Vivo Assay.

HUMAN DRUG RESPONSE
Pharmacological profile of Human drug response, pharmacokinetics in pharmacogenetics, Drug-dose response relationships in pharmacogenetics, the genetic profile of Human drug response, Twin studies in pharmacogenomics

BIO-TECH PRODUCTS
Biotechnology and Related Techniques: Protein engineering, peptide chemistry and peptidomimetics, nucleic acid technology, catalytic antibodies and glycobiology; Present products in medicine: Insulin, GH, Vaccines, Monoclonal
antibodies, FSH, Tissue plasminogen activator (t-PA) ; Pharmacokinetics and dynamics of the peptide and protein drugs.

**PHARMACOGENOMICS IN MEDICINE**
Pharmacogenomics of Cardiovascular Diseases, Pharmacogenomics of Cancer treatment (Herceptin as model), Pharmacogenomics of Neurodegenerative Diseases, Inflammatory bowel syndrome, Pharmacogenomics in Depression, Pharmacogenomics and Respiratory diseases, Pharmacogenomics in AIDS, Pharmacogenomics in Antibiotics.

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**PREAMBLE**

This course is one of the most advanced introductions in Herbs and drug action that is offered. Students will learn about classification of Medicinal Plants, drugs and allergic reactions, their Science and mechanism of action of drugs, different medicinal plants used for various diseases etc. How herbs influence our physiology and can be helpful against several disorders.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

1. To explain knowledge about the medicinal plants and classification.
2. To describe the basic concepts of allergens involved in allergic reaction
3. To execute, different mechanism of action of drugs in living system
4. To understand the effects of various medicinal plants used for treatment of common disease
5. To elucidate the uses of medicinal plants for various illness

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to

CO1. To Know the basic information of different medicinal plants their uses

CO2. To Gain information about allergens involved in allergic reactions

CO3. To Evaluate the mechanism action of drugs in living system

CO4. To categorise the various medicinal plants used for treatment of common disease

CO5. To develop the disease manifestation and treatment with medicinal plants

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION TO MEDICINAL PLANTS**

Terminologies – Definitions – Classification of medicinal plants based on their effects – Ecological status with special reference to India.

**ALLERGENS**

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples

**MECHANISM OF DRUG ACTION**

Drugs acting on brain and nervous system – Rheumatic arthritis – Psychoactive drugs – Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action

**DRUGS FROM MEDICINAL PLANTS**

DISEASE MANIFESTATION AND COMMONLY USED MEDICINAL PLANTS

Drugs for urinogenital disorders – roots of Withania somnifera – Memory stimulants – Centella asiatica – Drugs for dissolving kidney stones – Musa paradisica (pseudo stem) – Anti-inflammatory drugs – Cardiospermum – Anticancer drugs – Catharanthus roseus

TEXT BOOKS:


REFERENCES:


COURSE DESIGNERS

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PREAMBLE
Ethno medicine course deals with the interaction of people and plants with a broad survey on diversity of plants described both scientifically and culturally. Students learn about the social impact of plants on culture and also gain knowledge on identification, characterization and the uses of different medicinal plants in treating various diseases.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To state the scope and history of people and plant interaction from the past
2. To explain the functions and uses of plants
3. To demonstrate the different tribal medicine used for disease diagnosis and treatment.
4. To develop an understanding of the importance of plants in our daily lives
5. To produce cosmetics using medicinal plants

COURSE OUTCOMES
After the successful completion of the course, learner will be able to

CO1. Recall the basic information and ethnic knowledge about plants
      Remember

CO2. Demonstrate the knowledge about the uses of medicinal plants
      Understand

CO3. Illustrate the uses of different tribal medicine for disease diagnosis and treatment
      Apply

CO4. Appraise the traditional knowledge and utility of some commonly used medicinal plants
      Analyze

CO5. Develop the cosmetics using medicinal plants
      Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
INTRODUCTION TO ETHNOMEDICINE
Ethno medicine – definition, history and its scope – Inter disciplinary approaches in ethno botany – Collection of ethnic information.

MEDICINAL PLANTS AND HEALTH CARE
Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

TRIBAL MEDICINE
Tribal medicine – Plants in folk religion – Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum- methods of disease diagnosis and treatment.

MEDICINAL PLANTS IN DAY TO DAY LIFE
Traditional knowledge and utility of some medicinal plants in Tamilnadu – *Solanum trilobatum*, *Cardiospermum halicacabum*, *Vitex negundo*, *Adathoda vasica*, *Azadirachta indica*, *Gloriosa superba*, *Eclipta alba*, *Aristolochia indica*, *Phyllanthus fraternus* and *Boerhaavia diffusa*. *Ocimum sanctum*, *Centella asiatica*, *Solanum trilobatum*, *Cassia auriculata*, *Aloe vera*.

**HERBAL PLANTS USED IN COSMETICS**

Plants used as a cosmetics- Almond (*Prunus dulcis*), Aloe (*Aloe vera*), Argan Tree (*Argania spinosa*), Buriti Palm (*Mauritia flexuosa*), Cinnamon (*Cinnamomum verum*), Grape (*Vitis vinifera*), Lemonbalm (*Melissa officinalis*), Malabar Tamarind (*Garcinia cambogia*).

**TEXT BOOKS:**

2. *Swapan Kumar Kolay*, Ethno-medicine for Traditional Health Care, 2016, Publisher B.R. Publishing Corporation

**REFERENCES:**


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PREAMBLE
The course is focused on analysis of properties of raw material used for drug preparation and development of pharmaceutical products like syrups, powders, suppositories, gargles and mouth washes.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To know certain properties of raw materials used in drug preparations
2. To classify compound based on the reactions
3. To formulate syrup, powders, suppositories, gargles and mouth washes
4. To distinguish the reactions in drug preparations
5. To outline the drug based reactions

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Understand the different types of reaction during drug preparation
CO2. Demonstrate about the reaction in drug preparations
CO3. Test the melting and boiling point of the given sample
CO4. Distinguish the reactions in drug preparations
CO5. Prepare the drug based on type of reaction

SYLLABUS
1. To analyze the presence of acid radicals (anions) in the given mixture.
2. To perform detection of group I and group II radicals
3. To perform determination of melting point and boiling points.
4. Preparation of simple organic compounds based on different types of reactions
   a) N-Acetylation: Preparation of Acetanilide from Aniline
   b) O-Acetylation: Preparation of Aspirin from Salicylic acid
   c) Bromination: Preparation of p-Bromoacetanilide from Acetanilide
   d) Hydrolysis: Preparation of p-Bromoaniline from p-Bromoacetanilide
   e) Nitration: Preparation of m-dinitrobenzene from Nitrobenzene/picric acid from phenol
   f) Reduction: Preparation of m-nitro aniline from m-dinitro benzene.
   g) Oxidation: Preparation of Benzoic acid from benzyl chloride / benzyl alcohol.
   h) Esterification: Preparation of Benzyl benzoate from benzoyl chloride.

REFERENCES:
1. Laboratory Manual.

COURSE DESIGNERS

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PREAMBLE
The course aims to provide students with the necessary skills for separation of the active constituents obtained from natural sources (alkaloids – glycosides – Coumarins - Tannins) in addition to the different methods of separation (chromatography) and then identify these active ingredients either in pure form of a mixture- as well as the different methods to evaluate these components.

PREREQUISITE – Biochemistry

COURSE OBJECTIVES
1. To discuss and recognize the basics of sample collection, identify plant powder.
2. To explain and analyse the routine phytochemical analysis test.
3. To demonstrate, the compounds like Alkaloids, Steroids, Triterpenoids and their glycosides using different methods.
4. To categorise the phytochemical constituents of plants.
5. To outline and formulate different phyto constituents from plants.

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Recall the basic information of sample collection, process and storage methods. Understand
CO2. Demonstrate the routine phytochemical constituents of plants. Understand
CO3. Distinguish the compounds like Alkaloids, Steroids, Triterpenoids and their glycosides using different methods. Apply
CO4. Test, Extract, isolates and identifies the active substances of the medicinal plants. Analyse
CO5. Validate the different phyto constituents from plants. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

SYLLABUS

I. Preparation of extracts of Organized crude drugs/Herbs by successive solvent extraction method to record the percentage yield and physical status of the respective extracts and for subjecting them to phytochemical screening.

II. Detection of Phytoconstituents such as i) Alkaloids, ii) Steroids, Triterpenoids and their glycosides and Saponins iii) Flavonoids and their glycosides iv) Anthracene Glycosides v) Coumarins vi) Tannins by Test Tube and TLC methods.

III. a) Identification of alkaloids in a mixture by TLC b) Colour reactions of different groups of Alkaloids.

IV) Detection, extraction and estimation of volatile oils by Clevenger’s method (Hydro distillation method) TLC of Volatile oils and their pure constituents.

V) Identification of mono saccharides by paper chromatography

VI) Analysis of recorded spectra of some simple phytochemicals.

TEXT BOOKS

### REFERENCE BOOKS


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PREAMBLE
The course aims to provide students with the necessary skills for the research and development of anti-infective agents, the use of microorganisms to detect mutagenic and carcinogenic activity in prospective drugs, and the use of microorganisms in the manufacture of pharmaceutical products like insulin and human growth hormone.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To discuss and recognize the morphology of different microbes.
2. To Interpret and analyse the different types of media
3. To classify the biochemical characters of microorganisms
4. To check the pure cultures by different streaking methods
5. To assess preservation procedure for microorganisms

COURSE OUTCOMES
On the successful completion of the course, students will be able to

CO1. Recall the basic information of morphology and preparation of various culture media
CO2. Describe the motility of bacteria and biochemical methods
CO3. Estimate the pour plate and microscopic count methods
CO4. To distinguish the extract, isolates and identifies the microbes.
CO5. To categorise the disinfectant and oligodynamic action

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

SYLLABUS

1. Introduction to equipment and glassware used in microbiology laboratory.
2. Study of morphology of different microbes
3. Preparation of various culture media, cultivation of microbes and observation of colony characteristics.
4. Sterilization techniques (moist and dry heat) and their validations.
5. Aseptic transfer of culture into different types of media.
6. Characterisation of microbes by staining techniques (simple, gram’s, acid fast and negative staining).
7. Study of motility of bacteria by hanging drop method.
8. Characterization of microbes through Bio chemical reactions:
   a. Indole test.
   b. Methyl red test.
c. Voges proskauer test.
d. Starch hydrolysis test.
e. Fermentation of carbohydrates.

9. Isolation of pure cultures by streak plate, spread plate & pour plate techniques.

10. Enumeration of bacteria by pour plate/spread plate technique

11. Enumeration of bacteria by direct microscopic count.

12. Evaluation of any disinfectant by phenol coefficient test

13. Study of Oligodynamic action (of metals on bacteria)

14. Preservation of microrganisms (slant and stab cultures)

15. Microbiological Analysis of Water.

REFERENCE BOOKS
1. Garg,F C Experimental Microbiology
2. Gaud,R.S, Gupta G.D, Practical Microbiology
3. Vanitha Kale and kishore Bhusari, Pratical microbiology principles and Techniques

COURSE DESIGNERS:

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**PREAMBLE**

This lab course is designed to impart good knowledge in various analytical techniques in pharmaceutical industry.

**PREREQUISITE**

Nil

**COURSE OBJECTIVES**

1. To interpret the importance of calibration in apparatus
2. To express the different types of Titration processes
3. To summarize the knowledge on gravimetric methods
4. To demonstrate the Chromatographic techniques for product purification.
5. To outline the extraction techniques to separate biomolecules.

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

- CO1. Express the various titration techniques used in pharmaceutical Industry. **Understand**
- CO2. Identify the fundamental knowledge about the gravimetric analysis. **Understand**
- CO3. Demonstrate the techniques for the separation of aminoacids. **Understand**
- CO4. Employ the separation using chromatographic techniques. **Apply**
- CO5. Practice the spectroscopic techniques. **Apply**

**SYLLABUS**

9. Standardization of analytical weights and calibration of volumetric apparatus.
10. Acid Base Titrations; Preparation and standardization of acids and bases, some exercise related with determination of acids and bases separately in mixture form, some official assay procedure e.g. boric acid should also be covered.
11. Oxidation reduction titrations; Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc., some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6-di chlorophenol indophenol, ceric ammonium sulphate be designed.
12. Precipitation Titrations; Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohrs Volhards and Fajans methods.
13. Gravimetric Analysis; Preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.
15. Complexometric titrations; Preparations and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.
16. Separation & identification of amino acids by paper chromatography
17. Separation & identification of alkaloids by TLC
18. UV spectrometric determination of Ibuprofen

TEXT BOOKS

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