Vinayaka Mission’s Kirupananda Variyar Engineering College, Salem &
Aarupadai Veedu Institute of Technology, Ariyanoor
(Constituent Colleges of Vinayaka Mission’s Research Foundation Deemed to be University)
NAAC Accredited

Faculty of Engineering and Technology
Department of Pharmaceutical Engineering
Programme: B.E. Pharmaceutical Engineering
Full Time (4 Years)
STRUCTURED CHOICE BASED CREDIT SYSTEM (SCBCS)
Curriculum & Syllabus
(Semester I to VIII)
Regulation 2017

1
PROGRAM OUTCOMES (POs) OR GRADUATE ATTRIBUTES

Engineering Graduates will be able to:

PO1. **Engineering knowledge:** Apply the knowledge of mathematics, science, and pharmaceutical engineering fundamentals to solve the complex engineering problems in Pharmaceutical Industry.

PO2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex pharmaceutical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Think critically and creatively to generate innovative solutions for complex engineering problems or processes in Pharmaceutical industries that meet specified needs with appropriate consideration that include public health and safety, cultural, societal, and environmental considerations.

PO4. **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.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex pharmaceutical engineering activities, with an understanding of the limitations.

PO6. **The engineer and society:** Apply engineering principles to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to pharmaceutical engineering practice and solutions to complex pharmaceutical engineering problems.

PO7. **Environment and sustainability:** Understand and evaluate the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development in the solutions of complex pharmaceutical engineering problems.
PO8. **Ethics**: Demonstrate commitment to professional ethics and responsibilities pharmaceutical engineering works.

PO9. **Individual and team work**: Play an effective role as a member or leader in diverse teams and in multi-disciplinary settings and demonstrate respect for cultural diversity.

PO10. **Communication**: Communicate effectively on complex pharmaceutical engineering activities and be able to comprehend and write effective reports and design documentation, and give clear presentations to all stakeholders concerned.

PO11. **Project management and finance**: Apply engineering management principles and economic decision-making to one’s own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

PO12. **Life-long learning**: Recognize the need for, and engage in independent and life-long learning in the broadest context of technological change and build up professional skills
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 pharmaceutical products for societal usage and economically sustainable for the present and future.

PSO2: To assess the human health and environmental issues and provide various risk reduction methods as well as relevant professional mitigation measures.

PSO3: To function in a multi-disciplinary team and understand the professional ethics and responsibilities and equip themselves for higher learning for addressing technological challenges.

(B) PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To prepare students for prosperous spectrum of career avenues in academia, advanced research, industries of pharmaceutical technology, biomedicine, biotechnology, law, business and government and other pharmaceutical pursuits through dissemination of knowledge and proficiency in engineering and technology fundamentals related to pharmaceutical technology and the ability to solve problems.

PEO2: To transfuse in students the sense of confidence in professional endeavors application of the derived knowledge and appreciation of economic impact in a societal context.

PEO3: To provide collegial and nurturing environment for the students to realize the professional, ethical obligations and their concern to protect the health and welfare of the public and to be accountable for the social and environmental impact of their practice.

PEO4: To create an enjoyable educational environment in which students participate in multidisciplinary, team oriented, open-ended curricular and co-curricular activities that prepare them to work either individually and as an integrated team member.

PEO5: To facilitate the students to gain the wisdom of fundamentals and advances to practice Pharmaceutical technology and interdisciplinary research as career of constructive service to society and higher learning.
# Credit Requirement for Course Categories

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<th>Category of Courses</th>
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<td>i. Humanities and Sciences (English and Management Subjects)</td>
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<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><strong>E. Employability Enhancement Courses + Co - Curricular Courses + Extra Curricular Courses (EEC)</strong></td>
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| Minimum Credits to be earned | **180** |

** - Mandatory, Credits would be mentioned in Mark sheets but not included for CGPA Calculations.
CURRICULUM

B.E. PHARMACEUTICAL ENGINEERING

SEMESTER I TO VIII
## B.E - PHARMACEUTICAL ENGINEERING - 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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### B.E PHARMACEUTICAL ENGINEERING - SEMESTER I TO VIII

**DETAILS OF ELECTIVE COURSES FOR DEGREE WITH SPECIALISATION**

#### CATEGORY C – ELECTIVE COURSES - CREDITS (18 - 27)

(i) PROGRAMME SPECIFIC (CLASS ROOM OR ONLINE) - CREDITS (12 - 15)

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## B.E. - PHARMACEUTICAL ENGINEERING - SEMESTER I TO VIII

### CATEGORY D – PROJECT + INTERNSHIP + INDUSTRY ELECTIVES (P + I + I) - CREDITS (18)

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### B.E. – PHARMACEUTICAL ENGINEERING - SEMESTER I TO VIII

**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 INDUSTRIAL ELECTIVE COURSES

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## BOARD: BIOTECHNOLOGY
## REGULATION: 2017
## PROGRAM: B.E., – PHARMACEUTICAL ENGINEERING (FULL TIME - REGULAR)

### CURRICULUM AND SYLLABUS

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L – LECTURE HOUR  T – TUTORIAL HOUR  P – PRACTICAL HOUR  C – CREDIT

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21
SYLLABUS

SEMESTER I
PREAMBLE
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

CO1. Listen, understand and respond to others in different scenario.
   Understand

CO2. Speak fluently and correctly with correct pronunciation in different situation.
   Apply

CO3. To make the students experts in professional writing.
   Apply

CO4. To make the students recognize the role of technical writing in their careers in business, technical and scientific field.
   Apply

CO5. To make the students good communicators at the work place and to be theoretically strong.
   Apply

CO6. To make the students in proficient technical communicator.
   Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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**SYLLABUS**

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- 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.


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:**

**REFERENCES:**

**COURSE DESIGNERS:**

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<tr>
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<th>Designation</th>
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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>
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PREAMBLE
This course offers the knowledge of solving 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- NIL

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 tools 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

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S- Strong; M-Medium; L-Low

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:

COURSE DESIGNERS:

<table>
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<td>1</td>
<td>Dr. P. Sasikala</td>
<td>Professor</td>
<td><a href="mailto:sasikalap@vmkvec.edu.in">sasikalap@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs. V. T. Lakshmi</td>
<td>Asso. Prof</td>
<td><a href="mailto:lakshmi@vmkvec.edu.in">lakshmi@vmkvec.edu.in</a></td>
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PREAMBLE
Engineering Physics is the application of the concepts of physics to various technological applications. 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 and design various equipments.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To recall the properties of laser and to explain principles of laser.
2. To examine the applications of laser.
3. To outline the principles of fibre optics.
4. To examine the applications of fibre 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 | Define the principles of laser. | Understand |
| CO2 | Use laser in designing equipments. | Apply |
| CO3 | Explain the principles of fiber optics & the propagation of light in optical fibers. | Understand |
| CO4 | Utilize fibre optics in communication systems and sensors. | Apply |
| CO5 | Inspect materials using non-destructive testing techniques. | Analyze |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
**FIBRE OPTICS:** Principle and propagation of light in optical fibres – numerical aperture and acceptance angle – types of optical fibres (material, refractive index, mode) – Applications: Fibre optic communication system – fibre optic displacement sensor and pressure sensor.


**TEXT BOOK:**
1. “Engineering Physics”, compiled by Department of Physics, Vinayaka Missions University, Salem.

**REFERENCES:**

**COURSE DESIGNERS**

<table>
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<td>Physics</td>
<td><a href="mailto:senthilkumar@vmkvec.edu.in">senthilkumar@vmkvec.edu.in</a></td>
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<td>2</td>
<td>Dr.R.Sethupathi</td>
<td>Assistant Professor</td>
<td>Physics</td>
<td><a href="mailto:sethupathi@vmkvec.edu.in">sethupathi@vmkvec.edu.in</a></td>
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PREAMBLE
Engineering Chemistry explains the fundamentals of Engineering Chemistry and helps the learners to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives a clear idea about electrochemistry. Water technology study gives the initiative about softening of water, desalination and corrosion. Conventional and Non-conventional energy field is essential for the current scenario and the advanced engineering materials are needed for our fast growing life style.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To impart fundamental knowledge in Chemistry so that the student will understand the engineering concept and can face the forthcoming years as well as the industry effectively.
2. To have a clear knowledge of electrochemistry, cells and electrodes.
3. To familiarizes the type of batteries and fuel cell.
4. To lay foundation for practical applications of water softening and desalination in engineering aspects.
5. To inculcate the knowledge of fuel, this is essential for current scenario.

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

<table>
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<th>CO1</th>
<th>Understand the vital knowledge in Engineering Chemistry helps the learners in future studies.</th>
<th>Understand</th>
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<tr>
<td>CO2</td>
<td>Employ the basic knowledge of cells and electrodes.</td>
<td>Apply</td>
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<tr>
<td>CO3</td>
<td>Demonstrate the applications of water softening.</td>
<td>Apply</td>
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<td>CO4</td>
<td>Apply desalination process with engineering aspects.</td>
<td>Apply</td>
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<td>CO5</td>
<td>Discuss about conventional and non-conventional fuel for the current scenario.</td>
<td>Understand</td>
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<tr>
<td>CO6</td>
<td>Generalize polymers and smart materials.</td>
<td>Apply</td>
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MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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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)

TEXTBOOK:
1. “Engineering Chemistry”, Department of Chemistry, Vinayaka Missions University, Salem.

REFERENCES:

COURSE DESIGNERS

<table>
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<tr>
<th>S. No.</th>
<th>Name of the Faculty</th>
<th>Designation</th>
<th>Department</th>
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<tr>
<td>1.</td>
<td>Dr.T.Santhi</td>
<td>Professor</td>
<td>Chemistry</td>
<td><a href="mailto:shanthi@vmkvec.edu.in">shanthi@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
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. Basic knowledge on hardware and software terminologies. Remember and Understand

CO2. Demonstration about various Application Packages like MS-word, MS-Excel etc. Apply


CO5. Implementation of Algorithms for various concepts. Understand and 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>Dr.V.Amirthalingam</td>
<td>Associate Professor</td>
<td>Computer science and engineering</td>
<td><a href="mailto:amirthalingam@vmkvec.edu.in">amirthalingam@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.T.Geetha</td>
<td>Assistant Professor</td>
<td>Computer science and engineering</td>
<td><a href="mailto:geetha@vmkvec.edu.in">geetha@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE

The aim of the subject is to provide a fundamental knowledge of basic Civil Engineering.

PREREQUISITE - NIL

COURSE OBJECTIVES

1. To understand the basic concepts of surveying and construction materials.
2. To impart basic knowledge about building components.

COURSE OUTCOMES

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

1. CO1. An ability to apply knowledge of mathematics, science, and engineering. Apply
2. CO2. An ability to design and conduct experiments, as well as to analyze and interpret data. Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

S- Strong; M-Medium; L-Low

SYLLABUS

SURVEYING AND CIVIL ENGINEERING MATERIALS


BUILDING COMPONENTS AND STRUCTURES:

FOUNDATIONS: Types, Bearing capacity – Requirement of good foundations.


TEXT BOOKS:

REFERENCES:

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<tr>
<td>1</td>
<td>S. Supriya</td>
<td>Assist. Professor</td>
<td>CIVIL</td>
<td><a href="mailto:jansupriyanair@gmail.com">jansupriyanair@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>C. Kathirvel</td>
<td>Assist. Professor</td>
<td>CIVIL</td>
<td><a href="mailto:geologykathir@gmail.com">geologykathir@gmail.com</a></td>
</tr>
</tbody>
</table>
# PREAMBLE

Basic Mechanical Engineering gives the fundamental ideas in the areas of engineering design, manufacturing and Automobile engineering. An engineer needs to understand, the basic manufacturing techniques and working principle of an Automobile Engineering Components.

# PREREQUISITE - NIL

## COURSE OBJECTIVE

1. To demonstrate the principles of casting and metal joining processes in manufacturing.
2. To describe and to apply the in depth knowledge in automotive engines and important components.

## COURSE OUTCOMES:

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

- **CO1.** Illustrate the application of casting and metal joining processes in manufacturing
- **CO2.** Demonstrate the operation of automotive engines and important components

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

## SYLLABUS

### FOUNDRY AND WELDING


### AUTOMOTIVE ENGINES AND COMPONENTS

- Introduction, Two stroke and four stroke cycle – Petrol and Diesel Engines - Construction and working.
- Fundamentals of automotive components - Brakes, Clutches, Governor, Flywheel, Axles, Drives etc., Fuel supply systems, Exhaust emission and control.
### TEXT BOOKS

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<tr>
<td>1</td>
<td>Basic Civil and Mechanical Engineering, School of Mechanical Engineering Sciences, VMU, Salem</td>
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### REFERENCE BOOKS

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<tbody>
<tr>
<td>1</td>
<td>K. Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai</td>
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<tr>
<td>2</td>
<td>NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida</td>
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<td>TJ. Prabu, Basic Mechanical Engineering, SCITECH Publications, Chennai</td>
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### COURSE DESIGNERS

<table>
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<tr>
<th>S.No</th>
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<tr>
<td>1</td>
<td>S. Duraithilagar</td>
<td>Associate Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:sduraithilagar@vmkvec.edu.in">sduraithilagar@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>T. Raja</td>
<td>Assistant Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:rajat@vmkvec.edu.in">rajat@vmkvec.edu.in</a></td>
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</table>
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. Understand
CO2. Best performance in the art of conversation and public speaking. Apply
CO3. Give better job opportunities in corporate companies. Apply
CO4. Better understanding of nuances of English language through audio-visual experience and group activities. Apply
CO5. Speaking skills with clarity and confidence which in turn enhances their employability skills. Understand
CO6. Acquire strategic competence to use both spoken and written language in a wide range of communication strategies. Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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

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

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.

Telephone Etiquette, Dining Etiquette, Meeting Etiquette.

Case study of Etiquette in different scenario.

**COURSE DESIGNERS:**

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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>
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</table>
PREAMBLE
Real and Virtual Lab in Physics trains the students to take readings with precision. The experiments involve
the calculation of physical parameters. In addition to the above, the students have the hands-on experience in
performing the experiments through 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

CO1. Operate the equipments with precision. Apply
CO2. Practice to handle the equipments in a systematic manner. Apply
CO3. Demonstrate the experiments through virtual laboratory. Apply
CO4. Recognize the importance of units while performing experiments, during
calculating the physical parameters and in obtaining results. Understand
CO5. Calculate the result with accuracy. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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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.
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer.
5. Particle size determination using Laser.
8. Thermal conductivity of a bad conductor - Lee's disc.
10. Specific resistance of a wire – Potentiometer.

LAB MANUAL


COURSE DESIGNERS

<table>
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<th>Designation</th>
<th>Department</th>
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<tr>
<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>
</tr>
<tr>
<td>2</td>
<td>Dr.R.Sethupathi</td>
<td>Assistant Professor</td>
<td>Physics</td>
<td><a href="mailto:sethupathi@vmkvec.edu.in">sethupathi@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE
Engineering Chemistry Lab experiments explains the basics and essentials of Engineering Chemistry. It also helps the students to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives clear basic application oriented knowledge about electrochemistry. Water technology study gives the idea about hardness and its disadvantages. Now-a-days the practical and handling of equipments are needed for our fast growing life style.

PREREQUISITE – NIL

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

CO1. Understand the basic skills for his/her future studies.
CO2. Analyze the water comprehensively.
CO3. Apply the practical knowledge in engineering aspects.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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.

TEXT BOOK:
1. Engineering Chemistry Lab Manual by VMU.

COURSE DESIGNERS

<table>
<thead>
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<th>Designation</th>
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<tr>
<td>1.</td>
<td>Dr. T. Shanthi</td>
<td>Professor</td>
<td>Chemistry</td>
<td><a href="mailto:shanthi@vmkvec.edu.in">shanthi@vmkvec.edu.in</a></td>
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### PREAMBLE
Engineering Skills Practice is a hands-on training practice to Mechanical, Civil and Mechatronics Engineering students. It deals with fitting, carpentry, sheet metal and related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

### PREREQUISITE - Nil

### COURSE OBJECTIVES
1. To understand the basic concepts of surveying and construction materials.
2. To impart basic knowledge about building components.

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

- **CO1.** Prepare the different types of fitting.  
  - Apply

- **CO2.** Prepare the different types of joints using wooden material  
  - Apply

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

### SYLLABUS

#### Buildings:
1. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.

#### Plumbing Works:
2. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
3. Study of pipe connections requirements for pumps and turbines.
4. Preparation of plumbing line sketches for water supply and sewage works.
5. Hands-on-exercise: Mixed pipe material connection – Pipe connections with different joining components.
6. Demonstration of plumbing requirements of high-rise buildings.

#### Carpentry using Power Tools only:
7. Study of the joints in roofs, doors, windows and furniture.
   Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
TEXT BOOK
1. Basic civil engineering Lab Manual by Department of Civil Engineering, VMRF.

COURSE DESIGNERS

<table>
<thead>
<tr>
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<tr>
<td>1</td>
<td>M. Senthilkumar</td>
<td>Asst. Professor</td>
<td>VMKVEC</td>
<td><a href="mailto:senthilkumar@vmkvec.edu.in">senthilkumar@vmkvec.edu.in</a></td>
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PREAMBLE
Workshop is a hands-on training practice to Mechanical Engineering students. It deals with fitting, carpentry, foundry and welding related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

PREREQUISITE - NIL

COURSE OBJECTIVE
1. To perform the practice in different types of fitting processes.
2. To executive joints using wooden materials.
3. To apply in depth knowledge in metal joining processes.
4. To demonstrate the pattern using foundry processes

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

CO1. Perform the different types of fitting using MS plate. Apply
CO2. Practice the different types of joints using wooden material Apply
CO3. Demonstrate the different types of joints in metal by Arc Welding Apply
CO4. Utilize the different types of green sand mould Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS
Tee – Fitting
Vee – Fitting
Preparation of a mould for a single piece pattern
Preparation of a mould for a split piece pattern
Half- Lap Joint in Carpentry
Dove Tail Joint in Carpentry
Lap Joint – Welding
Butt Joint – Welding

**Text Books**

1. Basic mechanical engineering, lab manual

**Reference Books**

1. K. Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai
2. NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida

**Course Designers**

<table>
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<tr>
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<tr>
<td>1</td>
<td>V K Krishnan</td>
<td>Associate Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:vkkrishnan@vmkvec.edu.in">vkkrishnan@vmkvec.edu.in</a></td>
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<td>2</td>
<td>S. Duraithilagar</td>
<td>Associate Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:sduraithilagar@vmkvec.edu.in">sduraithilagar@vmkvec.edu.in</a></td>
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CURRICULUM AND SYLLABUS

**SEMESTER – II**

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L – LECTURE HOUR T – TUTORIAL HOUR P – PRACTICAL HOUR C – CREDIT

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<td>EE</td>
<td>EMPLOYABILITY ENHANCEMENT COURSES + EXTRA CURRICULAR COURSES + CO - CURRICULAR COURSES</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
17MABS03 - Mathematics for Bio-Engineering

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 be 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. Apply

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. Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>
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>
<thead>
<tr>
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<tr>
<td>1</td>
<td>Dr.P.Sasikala</td>
<td>Professor</td>
<td>Mathematics</td>
<td><a href="mailto:sasikalap@vmkvec.edu.in">sasikalap@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Ms.M.Usha</td>
<td>Assistant Professor</td>
<td>Mathematics</td>
<td><a href="mailto:usha@vmkvec.edu.in">usha@vmkvec.edu.in</a></td>
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**PREAMBLE**
This is a course offered in first semester for the students of Bio-Tech Engineering. This course has three credits dedicated to provide the students a strong foundation on programming concepts and its application. It also enables the students to solve problems using programmable logic.

**PREREQUISITE** - NIL

**COURSE OBJECTIVES**
1. To introduce Basics of C.
2. To understand Control Structures & Arrays.
3. To learn about String concept, Structure and Union in C.
4. To introduce the concepts of Functions and Pointers.
5. To introduce Memory and File management concepts in C.

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

| CO1. To understand the basics of C Data types, scope of variables, different types of Operators | Understand |
| CO2. Demonstrate the difference between iteration and recursion in terms of C programming | Understand |
| CO3. Develop C programs for arrays and structure | Apply |
| CO4. Develop C programs for functions | Apply |
| CO5. Develop C programs for File Management concept | Understand |

**SYLLABUS**

**BASICS OF C**
Identifiers, variables, expression, keywords, data types, constants, scope of variables. Operators: arithmetic, logical, relational, conditional and bitwise operators – Special operators: size of () & comma (,) operator – Precedence and associativity of operators – Type conversion in expressions.

**CONTROL STRUCTURES**
Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche(), putchar() – Formatted input/output: printf() and scanf() – Library functions (mathematical and character functions). Decision Making and Branching – Looping statements.

**ARRAYS, STRING, STRUCTURE & UNION**
Arrays – Initialization – Declaration – One dimensional and two dimensional arrays. Strings: Declaration –
Initialization and string handling functions. Structure and Union: structure declaration and definition – Accessing a Structure variable – Structure within a structure – Union.

FUNCTIONS AND POINTERS

MEMORY AND FILE MANAGEMENT

TEXT BOOK:

REFERENCES:

COURSE DESIGNERS

<table>
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<td>Mr. B. Sundharamurthy</td>
<td>Assistant Professor</td>
<td>Computer science and engineering</td>
<td><a href="mailto:sundharamurthy@vmkvec.edu.in">sundharamurthy@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr. S. Senthilkumar</td>
<td>Assistant Professor</td>
<td>Computer science and engineering</td>
<td><a href="mailto:senthilkumars@vmkvec.edu.in">senthilkumars@vmkvec.edu.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 understand 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. List the fundamental features of prokaryotic and eukaryotic cells, their structure, composition and role of cell membranes and the major stages of the cell cycle

CO2. To understand the specific processes and proteins involved in membrane transport

CO3. To understand about intercellular chemical messengers, receptor subclasses and their possible uses in cell signalling.

CO4. To analyze the mechanisms by which different messenger-receptor interactions bring about long or short-term changes in cell state.

CO5. To Integrate the different levels of biological organization, from molecules to cells to organisms.

CO6. To apply critical thinking and logical analysis in the assessment and evaluation of issues in cell biology and genetics.

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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<td>1</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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<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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**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 properties of smart materials
2. To demonstrate the structure of crystalline materials
3. To examine the synthesis of Nano materials
4. To explain the properties and classification of magnetic materials
5. To outline the concept of superconducting materials and their properties

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

- CO1. Utilize the smart materials for designing equipments **Apply**
- CO2. Interpret the structure of crystalline materials **Apply**
- CO3. Develop equipments using nanomaterials **Analyze**
- CO4. Use the properties of magnetic materials in designing equipments **Apply**
- CO5. Develop the efficiency of superconducting materials **Analyze**

**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.


**MAGNETIC MATERIALS:** Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials.

**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:**

**REFERENCES:**

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<td><a href="mailto:senthilkumar@vmkvec.edu.in">senthilkumar@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>
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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, properties and functions of Biomolecules
2. To emphasize the role of biomolecules by providing basic information on specific metabolic diseases.

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

CO1. Explain the classification properties and biological importance of carbohydrates
CO2. Discuss the classification, nomenclature, structure and properties of fatty acids
CO3. Knowledge about amino acids and proteins
CO4. Know about the importance of nucleic acid
CO5. Distinguish the vitamins and its deficiency
CO6. Know about the importance of minerals

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

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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<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.in</a></td>
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PREAMBLE
This Laboratory course will enable students to identify, formulate and solve real world engineering problems that require usage of algorithms in C. The course serves as a foundation laboratory for improving the problem solving skills of students.

PREREQUISITE - Nil

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

CO1: Design algorithms for the given problem specifications

CO2: To write simple programs and understand the basics of C.

CO3: Develop C programs for array sorting, searching and structure

CO4: To write C programs for matrix multiplication using functions

CO5: To write C programs for read, write and manipulate data using file concept.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS
1. Write a C Program to Implementation of Sine and cosine series.
2. Write a C Program to calculate Simple Interest.
3. Write a C Program to generate Fibonacci Series using for loop.
4. Write a C program to calculate factorial using while loop.
5. Write a C Program to
   a. Find the greatest of three numbers using if condition.
   b. Find the greatest of three numbers using conditional operator.
6. Write a C program for finding the roots of a given quadratic equation using conditional control statements.
7. Write a C program to
   a) Compute matrix multiplication using the concept of arrays.
      b) Illustrate the concept of string handling functions.
8. Write a C program to find the largest element in an array using pointers.
9. Write a C program to read and write data using file concepts.
10. Write a C program to store employee details using the concept of structures.
REFERENCES:

COURSE DESIGNERS

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<td><a href="mailto:sundharamurthy@vmkvec.edu.in">sundharamurthy@vmkvec.edu.in</a></td>
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<tr>
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<td>Computer science and engineering</td>
<td><a href="mailto:senthilkumars@vmkvec.edu.in">senthilkumars@vmkvec.edu.in</a></td>
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</table>
**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. 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. Demonstrate safe laboratory practices and handle the equipment safely
- CO2. Prepare solutions and biological buffers
- CO3. Isolate biomolecules from various source
- CO4. Determine the quality and quantity of biomolecules

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

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S- Strong; M-Medium; L-Low

**SYLLABUS**
1. pH measurements and Buffer preparations.

**TITRIMETRIC EXPERIMENTS**
2. Estimation of Ascorbic acid by Titrimetric method using 2, 6 Dichloro phenol indophenols.
3. Determination of Saponification value of Edible oil
4. Determination of Acid number of Edible oil.
5. Determination of Iodine value of Oil.

**BIOCHEMICAL PREPARATIONS**
6. Isolation of Chloroplast from Spinach leaves.
7. Cheese Production from Milk.
8. Casein from Milk.
9. Starch from Potato.

**REFERENCES:**
1. Laboratory Manual.
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17BTCC82  CELL BIOLOGY LAB

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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

CO6. Demonstrate the basic concepts of sterilization techniques
CO7. Interpret the behaviour of cells in their microenvironment
CO8. analyze scientific work and experimental results in of cell biology
CO9. Categorize the cell organelles
CO5. Examine 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).

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SYLLABUS
SEMESTERS
III TO VIII
CATEGORY ‘A’

FOUNDATION COURSES – HS, BS AND ES COURSES

(i) HUMANITIES AND SCIENCES
    (ENGLISH AND MANAGEMENT COURSES)
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

| CO1 | Listen, understand and respond to others in different scenario | Understand |
| CO2 | Speak fluently and correctly with correct pronunciation in different situation. | Apply |
| CO3 | To make the students experts in professional writing | Apply |
| CO4 | To make the students recognize the role of technical writing in their careers in business, technical and scientific field | Apply |
| CO5 | To make the students good communicators at the work place and to be theoretically strong. | Apply |
| CO6 | To make the students proficient technical communicator | Apply |

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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 Designers:

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

CO1. Communicate with a range of formal and informal context Understand

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

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

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

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

SUBJECT - VERB AGREEMENT
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

STRESS
Stress (Word Stress and Sentence Stress) - Intonation - Difference between British and American English
Vocabulary - Indianism - Compound Words (including Technical Terminology).

READING SKILLS
Reading Skills - Understanding Ideas and making Inferences - Group Discussion - Types of Interviews - FAQs - E-
Mail Netiquette - Sample E-mails - Watching Documentary Films and Responding to Questions.

CORPORATE COMMUNICATION
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

CRITICAL READING
Critical Reading - Book Review - Finding Key Information and Shifting Facts from Opinions - Business Letters
(Calling for Quotation, Placing Orders and Complaint Letters) - Expansion of an Idea - Creative Writing

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 Designers:

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PREAMBLE:
Total Quality Management (TQM) is a management approach describes to long–term success through customer satisfaction and, is an integrative philosophy of management for continuously improving the quality of products and processes.

PREREQUISITE: Not Required

COURSE OBJECTIVES:
1. To understand the introduction about Quality and Total Quality Management.
2. To understand the TQM principles.
3. To understand the statistical process control
4. To impart the various TQM tools
5. To understand 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. Understand
CO2: Explain the required tools to implement TQM. Apply
CO3: Analyse various TQM parameters with help of statistical tools. Analysing
CO4: Evaluating various TQM Techniques Evaluate
CO5: Propose the Quality Management Systems in a different organization environment Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS:
INTRODUCTION
Quality: Definition - Dimensions - Planning- costs – Analysis Techniques for Quality Costs- Basic concepts of Total

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:

<table>
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<th>S.No</th>
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<tr>
<td>1</td>
<td>A. Mani</td>
<td>Associate Professor</td>
<td>Management Studies</td>
<td><a href="mailto:asmanimba@gmail.com">asmanimba@gmail.com</a></td>
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<tr>
<td>2</td>
<td>B. Rajnarayanan</td>
<td>Assistant Professor</td>
<td>Management Studies</td>
<td><a href="mailto:Rajsachin.narayanan@gmail.com">Rajsachin.narayanan@gmail.com</a></td>
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</table>
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
UNIT – I: Ice Breaker, Grouping, Listening- (Hearing and listening)- Active Listening- Passive Listening – Listening to a song and understanding- (fill in the blanks) Telephone Conversation
UNIT – II: Influence of mother tongue, videos, understanding nuances of English language (video) puzzle to solve, Activity.
UNIT – 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.
UNIT IV  Telephone Etiquette, Dining Etiquette, Meeting Etiquette.
UNIT V  Case study of Etiquette in different scenario.

TEXTBOOK REFERENCES

<table>
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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 communication and personality skills. **Apply**
CO2. Demonstrate effective use of team work skills to complete given tasks. **Apply**
CO3. Speaking with clarity and confidence thereby enhancing employability skills of the students. **Apply**
CO4. Train the students in organized and professional writing **Apply**
CO5. Develop students reading skills that could be adopted while reading text **Apply**
CO6. Improve students their vocabulary and use them in appropriate situation **Understand**

**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

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<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>
</tbody>
</table>
CATEGORY ‘A’
FOUNDATION COURSES – HS, BS AND ES COURSES

(ii) BASIC SCIENCES
(MATHS, PHYSICS AND CHEMISTRY COURSES)
PREAMBLE
This course offers the knowledge of solving 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 tools 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

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S- Strong; M-Medium; L-Low

SYLLABUS


ORDINARY DIFFERENTIAL EQUATIONS: Formation of differential equations – Solution of first order equation – Variable separable and solution of Linear differential equation of the form \( \frac{dy}{dx} + Py = Q \) – Linear Second Order ordinary differential equation with constant coefficients (exp(ax), cosax, sinax).

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:

COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Faculty</th>
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<th>Name of the College</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr.P.Sasika</td>
<td>Prof</td>
<td>VMKVEC</td>
<td><a href="mailto:sasikalap@vmkvec.edu.in">sasikalap@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.V.T.Lakshmi</td>
<td>Asso.Prof</td>
<td>VMKVEC</td>
<td><a href="mailto:lakshmi@vmkvec.edu.in">lakshmi@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE
Engineering Physics is the application of the concepts of physics to various technological applications. 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 and design various equipments.

PREREQUISITE

COURSE OBJECTIVES
1. To recall the properties of laser and to explain principles of laser
2. To examine the applications of laser
3. To outline the principles of fibre optics
4. To examine the applications of fibre 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 | Define the principles of laser | Understand |
| CO2 | Use laser in designing equipments | Apply |
| CO3 | Explain the principles of fiber optics & the propagation of light in optical fibers | Understand |
| CO4 | Utilize fibre optics in communication systems and sensors | Apply |
| CO5 | Inspect materials using non-destructive testing techniques | Analyze |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS


FIBRE OPTICS: Principle and propagation of light in optical fibres – numerical aperture and acceptance angle –
types of optical fibres (material, refractive index, mode) – Applications: Fibre optic communication system – fibre optic displacement sensor and pressure sensor.


**TEXT BOOK**

Engineering Physics, compiled by Department of Physics, Vinayaka Missions University, Salem.

**REFERENCE BOOKS**


**COURSE DESIGNERS**

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<td>Dr. C. SENTHIL KUMAR</td>
<td><a href="mailto:senthilbdu@gmail.com">senthilbdu@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr. R. SETHUPATHI</td>
<td><a href="mailto:sethupathivmkv@gmail.com">sethupathivmkv@gmail.com</a></td>
</tr>
</tbody>
</table>
PREAMBLE
Engineering Chemistry explains the fundamentals of Engineering Chemistry and helps the learners to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives a clear idea about electrochemistry. Water technology study gives the initiative about softening of water, desalination and corrosion. Conventional and Non-conventional energy field is essential for the current scenario and the advanced engineering materials are needed for our fast growing life style.

PREREQUISITE
NIL

COURSE OBJECTIVES
1 To impart fundamental knowledge in Chemistry so that the student will understand the engineering concept and can face the forthcoming years as well as the industry effectively.
2 To have a clear knowledge of electrochemistry, cells and electrodes.
3 To familiarizes the type of batteries and fuel cell.
4 To lay foundation for practical applications of water softening and desalination in engineering aspects.
5 To inculcate the knowledge of fuel, this is essential for current scenario.

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

CO1. Understand the vital knowledge in Engineering Chemistry helps the learners in future studies Understand
CO2. Employ the basic knowledge of cells and electrodes Apply
CO3. Demonstrate the applications of water softening Apply
CO4. Apply desalination process with engineering aspects Apply
CO5. Discuss about conventional and non-conventional fuel for the current scenario. Understand
CO6 Generalize polymers and smart materials Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: 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)

UNIT – II: WATER TECHNOLOGY AND CORROSION

UNIT – III: FUELS AND CHEMISTRY OF ADVANCED MATERIALS
Basics and Applications: Organic electronic material, shape memory alloys, polymers (PVC, Teflon, Bakelite)

TEXTBOOK
1. Engineering Chemistry by VMU.

REFERENCES

COURSE DESIGNERS

<table>
<thead>
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<tbody>
<tr>
<td>1</td>
<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>
</tr>
<tr>
<td>2</td>
<td>Mr. A. Gilbert sunderraj</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td><a href="mailto:gilbertsunderraj@vmkvec.edu.in">gilbertsunderraj@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
**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

**COURSE OBJECTIVES**

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<td>Gain fundamental knowledge of the probability concepts with respect to how they are applied to the fundamental interpretation of statistical data.</td>
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<td>To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample.</td>
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<td>To be get exposed to the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.</td>
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<td>To understand the concept of Quality control and the use of operating characteristic (OC) curves in Acceptance sampling.</td>
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</table>

**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. Apply

**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. Apply

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

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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

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<td>Dr.P.Sasikala</td>
<td>Professor</td>
<td>Mathematics</td>
<td><a href="mailto:sasikalap@vmkvec.edu.in">sasikalap@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Ms.M.Usha</td>
<td>Assistant Professor</td>
<td>Mathematics</td>
<td><a href="mailto:usha@vmkvec.edu.in">usha@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
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
-

COURSE OBJECTIVES
1. To explain the properties of smart materials
2. To demonstrate the structure of crystalline materials
3. To examine the synthesis of Nano materials
4. To explain the properties and classification of magnetic materials
5. To outline the concept of superconducting materials and their properties

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1. Utilize the smart materials for designing equipments
CO2. Interpret the structure of crystalline materials
CO3. Develop equipments using nanomaterials
CO4. Use the properties of magnetic materials in designing equipments
CO5. Develop the efficiency of superconducting materials

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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:

REFERENCES:

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<td>2</td>
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<td><a href="mailto:sethupathivmkv@gmail.com">sethupathivmkv@gmail.com</a></td>
</tr>
</tbody>
</table>
### 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 equipments.

### PREREQUISITE

### COURSE OBJECTIVES
1. To learn the properties and types of nanomaterials
2. To know about the preparation methods of nanomaterials
3. To learn about lithography techniques
4. To know about carbon nano tubes
5. To learn about various characterization techniques

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

| CO1. Describe the properties of nanomaterials | Understand |
| CO2. Compare the preparation methods of nanomaterials | Analyze |
| CO3. Utilize the lithographic techniques | Apply |
| CO4. Interpret the properties of carbon nanotubes | Apply |
| CO5. Categorize various characterization techniques | Analyze |

### 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- nanoparticlesquantum 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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<td><a href="mailto:senthilbd@gmail.com">senthilbd@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr. R. SETHUPATHI</td>
<td><a href="mailto:sethupathivmkv@gmail.com">sethupathivmkv@gmail.com</a></td>
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</tbody>
</table>
PREAMBLE
Fundamentals of Chemistry provide a detailed understanding of the fundamental principles behind the structure, nomenclature, classification, stereoisomerism, and reaction mechanisms of the chemical compounds such as aliphatic, aromatic and heterocyclic compounds.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To define various terms involved in the structure, properties of chemical compounds and reactions
2. To describe the fundamental concepts in stereochemistry & its significance in medicinal compounds
3. To summarize aliphatic compounds & some of their important reaction mechanisms
4. To compose the structure and reactions of aromatic compounds
5. To explain the structure and reactions of heterocyclic compounds

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

CO1. Recall the fundamental principles behind the structure & reactions of chemical compounds
CO2. Recognizing stereoisomerism & its importance in therapeutic agents
CO3. Review the structure and important reactions of aliphatic compounds
CO4. Demonstrate the structure and important reactions of aromatic compounds
CO5. Discuss the heterocyclic compounds with heteroatom N, O and S

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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S- Strong; M-Medium; L-Low

SYLLABUS
Structure & Properties
Atomic structure, Atomic orbitals, Molecular orbitals, hybrid orbitals, bonds, Polarity of bond, Polarity of molecule, Dipole moment, Bond dissociation energy, Energy of activation, Inductive effect, Electromeric effect, Mesomeric effect, Resonance, Tautomerism, Conjugation, Hyper conjugation, Electrophiles and Nucleophiles. IUPAC nomenclature of organic compounds.
Stereochemistry
Isomerism, nomenclature, optical activity, stereoisomerism, specification of configuration, Stereoisomerism and its significance in medicinal compounds.

Chemistry of Aliphatic Compounds
Structure and important reactions of Alkanes, ethers, alcohols, amines, carbonyl compounds, and nitro compounds, Reactive intermediates - carbocations, carbanions, carbenes, nitrene and nitrenium ions. Reaction mechanisms - SN1, SN2, E1 and E2

Chemistry of Aromatic Compounds
Introduction, Huckel structure of Benzene, Resonance, theory of effect of substituent on reactivity and orientation. Polynuclear aromatic compounds.

Chemistry of Heterocyclic compounds
Classification and nomenclature. Important reactions of heterocyclic compounds containing N, O and S.

Text Books

Reference Books

Course Designers:

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<td>Assistant Professor</td>
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<td><a href="mailto:gilbertsunderraj@vmkvec.edu.in">gilbertsunderraj@vmkvec.edu.in</a></td>
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</table>
Environmental science is an interdisciplinary field that integrates physical, chemical, biological, information, telemedicine, and atmospheric sciences. Environmental studies also incorporate the social sciences for understanding human relationships, a solution to the environmental and social-related problems and conserving the environment for the future. Environmental engineering focuses on sustainable development for improving environmental quality in every aspect.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

1. To create the awareness of environment studies and its scope
2. To inculcate the knowledge of significance and conserving the natural resources.
3. To help the learners to know the value of ecosystem and food chain.
4. To assess the importance of biodiversity
5. To familiarizes the different pollution sources, consequences and its control measures.
6. To educate the ways and means to manage natural calamities.
7. To help the learners to know the urban energy-related problems and social issues.

**COURSE OUTCOMES**

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

- CO1. Discuss and appreciate the unity of life in all its forms, the implications of life style on the environment. **Understand**
- CO2. Initiate the awareness and recognize the social responsibility in environmental issues. **Apply**
- CO3. Illustrate the importance of ecosystem and biodiversity **Apply**
- CO4. Interpret the society on the various pollutions and their impact. **Apply**
- CO5. Demonstrate the Solid waste and disaster management. **Apply**
- CO6. Recognize the issues of environment and sustainable development **Understand**
- CO7. Schedule the urban problems and social issues. **Apply**

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

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

UNIT-I 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

UNIT-II 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.

UNIT-III 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

UNIT-IV 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

UNIT-V HUMAN POPULATION AND ENVIRONMENT

Text Book

REFERENCES:

Course Designers:

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<td><a href="mailto:Shantht@vmkvec.edu.in">Shantht@vmkvec.edu.in</a></td>
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</table>
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 theft and steroid templates.
6. To understand the biomodels of photosynthesis and energy transfer.

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 theft and enzymes
CO6. Recognise the biomodels of photosynthesis and energy transfer.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO12 | PSO1 | PSO2 | PSO3 |
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| CO2 | M   | S   | M   | L   | M   | M   | -   | -   | -   | -    | -    | M    | -    | -    | -    | -    |
| CO3 | S   | L   | M   | L   | L   | S   | M   | -   | -   | -    | -    | M    | -    | -    | -    | -    |
| CO4 | M   | -   | L   | -   | M   | M   | L   | -   | -   | -    | -    | -    | -    | -    | -    | -    |
| CO5 | M   | L   | S   | M   | M   | -   | -   | -   | -   | -    | -    | S    | -    | -    | -    | -    |
| CO6 | S   | -   | S   | L   | S   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    | M    |

S- Strong; M-Medium; L-Low

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 - Mutifunctional, 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 BOOKS:

REFERENCE BOOKS:

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<td><a href="mailto:gilbertsunderraj@vmkvec.edu.in">gilbertsunderraj@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
Real and Virtual Lab in Physics trains the students to take readings with precision. The experiments involve the calculation of physical parameters. In addition to the above, the students have the hands-on experience of performing the experiments through virtual laboratory.

PREREQUISITE

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

CO1 Operate the equipments with precision
CO2 Practice to handle the equipments in a systematic manner
CO3 Demonstrate the experiments through virtual laboratory
CO4 Recognize the importance of units while performing experiments, during calculating the physical parameters and in obtaining results
CO5 Calculate the result with accuracy

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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SYLLABUS
11. Young's modulus of a bar - Non-uniform bending
12. Rigidity modulus of a wire - Torsional Pendulum
13. Viscosity of a liquid - Poiseuille's method
14. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
15. Particle size determination using Laser
16. Wavelength of spectral lines – grating – Spectrometer
17. Thickness of a wire - Air wedge Method
18. Thermal conductivity of a bad conductor - Lee's disc
19. Band gap determination of a thermistor - Post Office Box
20. Specific resistance of a wire – Potentiometer

LAB MANUAL

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<td><a href="mailto:senthilbdu@gmail.com">senthilbdu@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr. R. SETHUPATHI</td>
<td><a href="mailto:sethupathivmkv@gmail.com">sethupathivmkv@gmail.com</a></td>
</tr>
</tbody>
</table>
PREAMBLE
Engineering Chemistry Lab experiments explains the basics and essentials of Engineering Chemistry. It also helps the students to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives clear basic application oriented knowledge about electrochemistry. Water technology study gives the idea about hardness and its disadvantages.. Now-a-days the practical and handling of equipments are needed for our fast growing life style.

PREREQUISITE
NIL

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
On the successful completion of the course, students will be able to
CO1. Understand the basic skills for his/her future studies. Understand
CO2. Analyze the water comprehensively. Apply
CO3. Apply the practical knowledge in engineering aspects Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

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 Book:
1. Engineering Chemistry Lab Manual by VMU.
<table>
<thead>
<tr>
<th>S.No.</th>
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<th>Designation</th>
<th>Department</th>
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<tr>
<td>1.</td>
<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>
</tr>
<tr>
<td>2</td>
<td>Mr. A. Gilbertraj</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td><a href="mailto:gilbertsunderraj@vmkvec.edu.in">gilbertsunderraj@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
**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 | Analyse |
| CO4. Evaluate their understanding skills in the inter-conversions | Evaluate |

**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.

REFERENCE BOOKS:

1. Laboratory Manual.

COURSE DESIGNERS

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CATEGORY ‘A’

FOUNDATION COURSES – HS, BS AND ES COURSES

(iii) ENGINEERING SCIENCES (BASIC ENGINEERING COURSES)
PREAMBULE
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. Basic knowledge on hardware and software terminologies. | Remember and Understand |
| CO2. Demonstration about various Application Packages like MS-word, MS-Excel etc. | Apply |
| CO3. Understand Program Development Cycle and apply various Problem Solving Techniques. | Understand, Apply |
| CO4. Identifying and analyzing the efficiency of Algorithms. | Understand |
| CO5. Implementation of Algorithms for various concepts. | Understand and Apply |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

**BASICS OF COMPUTER AND INFORMATION TECHNOLOGY:** Computer – Generations, Types of Computers, Block diagram of a computer – Components of a computer system – Hardware and software


TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S. No.</th>
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<tr>
<td>1</td>
<td>Dr.V.Amirthalingam</td>
<td>Associate Professor</td>
<td>Computer Science and Engineering</td>
<td><a href="mailto:amirthalingam@vmkvec.edu.in">amirthalingam@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.T.Geetha</td>
<td>Assistant Professor</td>
<td>Computer Science and Engineering</td>
<td><a href="mailto:geetha@vmkvec.edu.in">geetha@vmkvec.edu.in</a></td>
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</tbody>
</table>
PREAMBLE
The aim of the subject is to provide a fundamental knowledge of basic Civil Engineering.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To understand the basic concepts of surveying and construction materials.
2. To impart basic knowledge about building components.

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

CO1. An ability to apply knowledge of mathematics, science, and engineering.  Apply
CO2. An ability to design and conduct experiments, as well as to analyze and interpret data.  Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

SURVEYING AND CIVIL ENGINEERING MATERIALS

BUILDING COMPONENTS AND STRUCTURES:
FOUNDATIONS: Types, Bearing capacity – Requirement of good foundations.

TEXT BOOKS:

REFERENCES:
<table>
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<tr>
<td>1</td>
<td>S. Supriya</td>
<td>Assist. Professor</td>
<td>CIVIL</td>
<td><a href="mailto:jansupriyanair@gmail.com">jansupriyanair@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>C. Kathirvel</td>
<td>Assist. Professor</td>
<td>CIVIL</td>
<td><a href="mailto:geologykathir@gmail.com">geologykathir@gmail.com</a></td>
</tr>
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</table>
PREAMBLE
Basic Mechanical Engineering gives the fundamental ideas in the areas of engineering design, manufacturing and Automobile engineering. An engineer needs to understand, the basic manufacturing techniques and working principle of an Automobile Engineering Components.

PREREQUISITE - NIL

COURSE OBJECTIVE
1. To demonstrate the principles of casting and metal joining processes in manufacturing.
2. To describe and to apply the in depth knowledge in automotive engines and important components.

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

CO1. Illustrate the application of casting and metal joining processes in manufacturing (Apply)

CO2. Demonstrate the operation of automotive engines and important components (Apply)

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

S- Strong; M-Medium; L-Low

SYLLABUS

FOUNDRY AND WELDING

AUTOMOTIVE ENGINES AND COMPONENTS
Introduction, Two stroke and four stroke cycle – Petrol and Diesel Engines - Construction and working, Fundamentals of automotive components - Brakes, Clutches, Governor, Flywheel, Axles, Drives etc., Fuel supply systems, Exhaust emission and control.

TEXT BOOKS
### REFERENCE BOOKS

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<tr>
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<td>K.Venugopal</td>
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### COURSE DESIGNERS

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<tr>
<td>1</td>
<td>S. Duraithilagar</td>
<td>Associate Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:sduraithilagar@vmkvec.edu.in">sduraithilagar@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>T.Raja</td>
<td>Assistant Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:rajat@vmkvec.edu.in">rajat@vmkvec.edu.in</a></td>
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**PREAMBLE**
This is a course offered in first semester for the students of Bio-Tech Engineering. This course has three credits dedicated to provide the students a strong foundation on programming concepts and its application. It also enables the students to solve problems using programmable logic.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**

1. To introduce Basics of C.
2. To understand Control Structures & Arrays.
3. To learn String concept, Structure and Union in C.
4. To understand the concepts of Functions and Pointers.
5. To understand Memory and File management concepts in C.

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

**CO1.** To understand the basics of C Data types, scope of variables, different types of Operators
Understand

**CO2.** Demonstrate Input/Output functions, Decision making and Loop structures in C programming.
Understand

**CO3.** Develop C programs for arrays and structure.
Apply

**CO4.** Develop C programs for functions and pointers.
Apply

**CO5.** Develop C programs for File Management concept
Understand

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

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

UNIT – I - BASICS OF C
Identifiers, variables, expression, keywords, data types, constants, scope of variables. Operators: arithmetic, logical, relational, conditional and bitwise operators – Special operators: size of ( ) & comma (,) operator – Precedence and associativity of operators – Type conversion in expressions.

UNIT – II- CONTROL STRUCTURES
Basic input/output and library functions: Single character input/output i.e. getch( ), getchar( ), getche( ), putchar( ) – Formatted input/output: printf( ) and scanf( ) – Library functions (mathematical and character functions). Decision Making and Branching – Looping statements.

UNIT – III- ARRAYS, STRING, STRUCTURE & UNION

UNIT-IV- FUNCTIONS AND POINTERS

UNIT – V- MEMORY AND FILE MANAGEMENT

TEXT BOOKS

REFERENCES

COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Faculty</th>
<th>Designation</th>
<th>Department</th>
<th>Mail ID</th>
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<tr>
<td>1.</td>
<td>Mr.B.Sundaramurthy</td>
<td>Associate Professor</td>
<td>Associate Professor</td>
<td><a href="mailto:sundaramurthy@vmkvec.edu.in">sundaramurthy@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mrs.T.Narmadha</td>
<td>Assistant Professor</td>
<td>Computer Science and Engineering</td>
<td><a href="mailto:narmadhat@vmkvec.edu.in">narmadhat@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
Preamble
This course provides knowledge and understanding on various types of manufacturing processes

Prerequisite : NIL

Course Objective

1. To understand the all process that involved in metal casting technology.
2. To impart the knowledge of various metal joining processes.
3. To apply the various conventional machining operations and metal forming processes.
4. To impart the knowledge of forming and shaping in plastics processes
5. To impart the knowledge of various metal forming and powder metallurgy.

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

CO1. To understand the concepts of casting technology Understand
CO2. Apply the concepts of various welding processes. Apply
CO3. Enhance the application of various machining processes Apply
CO4. To understand the applications of various forming and shaping of plastics. Understand
CO5. Apply the concepts of various metal forming and powder metallurgy. Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

### Introduction and Casting

Casting types, procedure, makes, sand mould, types of core making, moulding tools, machine moulding, special moulding processes—CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

### Welding


### Machining

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining and Electron beam machining and Laser beam machining.

### Forming And Shaping Of Plastics

Types of plastics- Characteristics of the forming and shaping processes—Moulding of Thermoplastics. working principle sand typical applications of Injection moulding—Plunger and screw machines—Blow moulding—Rotational moulding—Film blowing—Extrusion—Typical industrial applications—Thermoforming—Processing of Thermo sets—Working principles and typical applications—Compression moulding—Transfer moulding—Bonding of Thermoplastics—Fusion and solvent methods—Induction and Ultrasonic methods.

### Metal Forming And Powder Metallurgy

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy—Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

### Text Books

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### Reference Books

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<td>1</td>
<td>M.Saravanan</td>
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<td>2</td>
<td>C.Thangavel</td>
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</tbody>
</table>
17BMES02 | MEDICAL INSTRUMENTATION
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FC-ES | 3 | 0 | 0 | 3

PREAMBLE
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

CO1. Explain the different Bio signal or biopotential. Understand
CO2. Identify the working principles of diagnostic and therapeutic equipments. Understand
CO3. Operate various instruments like as ECG, EMG, EEG, X-ray machine. Apply
CO4. Differentiate the medical instruments based on principles and application used in hospital. Analyze
CO5. Evaluate 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
Basic medical instrumentation system, Origin of Bioelectric Potential, Recording electrodes – Electrode Tissue interface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artifacts. Electrodes – Silver – silver chloride electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, Electrical
conductivity of electrode jellies and creams, Microelectrodes.

**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**

Ph, Pco2, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, auto-analyser. Biotelemetry-wireless telemetry, single channel telemetry, multichannel telemetry, multi patient telemetry.

**TEXT BOOKS:**


**REFERENCES:**


**COURSE DESIGNERS**

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<tr>
<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>
</tr>
<tr>
<td>2</td>
<td>Dr. N.Babu</td>
<td>Professor</td>
<td>BME</td>
<td><a href="mailto:babu@vmkvec.edu.in">babu@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>3</td>
<td>Mrs. R.Indumathi</td>
<td>Assistant Professor (Gr-II)</td>
<td>BME</td>
<td><a href="mailto:indhumr@avit.ac.in">indhumr@avit.ac.in</a></td>
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</table>
PREAMBLE
Engineering Skills Practice is a hands-on training practice to Mechanical, Civil and Mechatronics Engineering students. It deals with fitting, carpentry, sheet metal and related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

PREREQUISITE - Nil

COURSE OBJECTIVES
1. To understand the basic concepts of surveying and construction materials.
2. To impart basic knowledge about building components.

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

CO1. Prepare the different types of fitting. Apply

CO2. Prepare the different types of joints using wooden material Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
Buildings:
8. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.

Plumbing Works:
9. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
10. Study of pipe connections requirements for pumps and turbines.
11. Preparation of plumbing line sketches for water supply and sewage works.
13. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
14. Study of the joints in roofs, doors, windows and furniture.

Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

TEXT BOOK
2. Basic civil engineering Lab Manual by Department of Civil Engineering, VMRF.

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>M. Senthilkumar</td>
<td>Asst. Professor</td>
<td>VMKVEC</td>
<td><a href="mailto:senthilkumar@vmkvec.edu.in">senthilkumar@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE
Workshop is a hands-on training practice to Mechanical Engineering students. It deals with fitting, carpentry, foundry and welding related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

PREREQUISITE - NIL

COURSE OBJECTIVE

1. To perform the practice in different types of fitting processes.
2. To executive joints using wooden materials.
3. To apply in depth knowledge in metal joining processes.
4. To demonstrate the pattern using foundry processes

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

CO1. Perform the different types of fitting using MS plate. Apply
CO2. Practice the different types of joints using wooden material Apply
CO3. Demonstrate the different types of joints in metal by Arc Welding Apply
CO4. Utilize the different types of green sand mould Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

Tee – Fitting
Vee – Fitting
Preparation of a mould for a single piece pattern
Preparation of a mould for a split piece pattern
Half- Lap Joint in Carpentry  
Dove Tail Joint in Carpentry  
Lap Joint – Welding  
Butt Joint – Welding  

**Text Books**

1. Basic mechanical engineering, lab manual

**Reference Books**

1. K. Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai  
2. NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida

**Course Designers**

<table>
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<th>S.No</th>
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<tbody>
<tr>
<td>1</td>
<td>V K Krishnan</td>
<td>Associate Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:vkkrishnan@vmkvec.edu.in">vkkrishnan@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>S. Duraithilagar</td>
<td>Associate Professor</td>
<td>Mech / VMKVEC</td>
<td><a href="mailto:sduraithilagar@vmkvec.edu.in">sduraithilagar@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
This laboratory course will enable students to identify, formulate and solve real world engineering problems that require usage of algorithms in C. The course serves as a foundation laboratory for improving the problem solving skills of students.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. Gain knowledge about basic’ C’ language syntax and semantics to write ‘C’ programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of String handling functions, structures and pointers.
3. Understand the concepts of file handling.

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

CO1. Design algorithms for the given problem specifications
CO2. To write simple programs and understand the basics of C.
CO3. Develop C programs for array sorting, searching and structure
CO4. To write C programs for matrix multiplication using functions
CO5. To write C programs for read, write and manipulate data using file concept.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

Lab Experiments
Develop C programs for.
1. Write a C Program to Implementation of Sine and cosine series.
2. Write a C Program to generate Fibonacci Series using for loop.
3. Write a C program to calculate factorial using while loop.
4. Write a C Program to
   a) Find the greatest of three numbers using if condition.
   b) Find the greatest of three numbers using conditional operator.
5. Write a C program for finding the roots of a given quadratic equation using conditional control statements.
6. Write a C program to
   a) Compute matrix multiplication using the concept of arrays.
   b) Illustrate the concept of string handling functions.
7. Write a C program to find the largest element in an array using pointers.
8. Write a C program to read and write data using file concepts.
9. Write a C program to store employee details using the concept of structures.

REFERENCES


COURSE DESIGNERS

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<td>2</td>
<td>Mrs. T. Narmadha</td>
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<td>Computer Science and Engineering</td>
<td><a href="mailto:narmadhat@vmkvec.edu.in">narmadhat@vmkvec.edu.in</a></td>
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</tbody>
</table>
Preamble
To impart practice in operation of special machines like turning, milling shaping and grinding.

Prerequisite – NIL

Course Objective
1. To impart practice in lathe operations
2. To apply the practical training by using drilling machine, shaping machine operations
3. To apply the practical training by using milling, planning and grinding machines

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

CO1. Undergo practical skill training in lathe machine and various Lathe machining operations
Apply

CO2. Undergo practical skill training in drilling machine, shaping machine
Apply

CO3. Gain the of knowledge skill practice in planning and grinding machines
Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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S- Strong; M-Medium; L-Low

SYLLABUS:

LIST OF EXPERIMENTS:

1. Plain turning and step turning on lathe.
2. Taper turning on lathe.
3. Thread cutting on lathe.
4. Drilling, reaming and tapping in a drilling machine.
5. Plain milling.
6. Making square shape job in shaping machine.
7. Making Cutting key ways in a slotting machine.
8. To Perform Grinding process using a grinding machine

MANUFACTURING ENGINEERING LAB Manual

Course Designers

<table>
<thead>
<tr>
<th>S.No</th>
<th>Faculty Name</th>
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<th>Department/College</th>
<th>Email id</th>
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<tr>
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</table>
CATEGORY ‘B’

CORE COURSES RELEVANT TO THE PROGRAMME

81 CREDITS
PREAMBLE
Essentials of biochemistry deals with the study of biomolecules found in living organisms. The course exposes 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, properties, and functions of biomolecules
2. To emphasize the role of biomolecules by providing basic information on specific metabolic diseases.

COURSE OUTCOMES
On the successful completion of the course, students will be able to
1. CO1. Explain the classification, properties, and biological importance of carbohydrates
2. CO2. Discuss the classification, nomenclature, structure, and properties of fatty acids
3. CO3. Knowledge about amino acids and proteins
4. CO4. Know about the importance of nucleic acid
5. CO5. Distinguish the vitamins and its deficiency
6. CO6. Know about the importance of minerals

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. Fatty acids: 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>2</td>
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<td><a href="mailto:nirmala@vmkvec.edu.in">nirmala@vmkvec.edu.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, signaling 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 understand 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. List the 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 understand the specific processes and proteins involved in membrane transport
Understand

CO3. To understand about intercellular chemical messengers, receptor subclasses and their possible uses in cell signalling.
Understand

CO4. To analyze the mechanisms by which different messenger-receptor interactions bring about long or short-term changes in cell state.
Apply

CO5. To Integrate the different levels of biological organization, from molecules to cells to organisms.
Apply

CO6. To apply critical thinking and logical analysis in the assessment and evaluation of issues in cell biology and genetics.
Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**CELL AND FUNCTIONS OF THE ORGANELLES**

**CELL MEMBRANE AND PERMEABILITY**
Passive and active transport, Permeases, Sodium potassium pump, Ca2+, ATPase 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 – cellsignaling: 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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Microbiology deals with the study of microbes. It will cover 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
1. To describe about the evolution of microorganisms and microscopy.
2. To Explain the Structure and replication in microorganisms – concepts.
3. To interpret the effects of Microbes in food and the clinical importance of microorganisms.
4. To explain about the various Control measures and assessing the environmental impacts.
5. To outline the requirements of Microbial nutrition for growth of microorganisms and the impact of environment on its growth.

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

CO1. Recall about historical perspective of microbiology and its developments
   Remember

CO2. Describe the fundamental structure and functions of a cell
   Understand

CO3. Explain the control of microbes using physical and chemical methods
   Understand

CO4. Demonstrate the microbial nutritional requirements for growth
   Apply

CO5. Demonstrate the microorganism have an indispensible role in the environment
   Apply

CO6. Categorize the role of microorganisms in environmental applications
   Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

WORLD OF MICRORGANISMS 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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UNIT OPERATIONS IN PHARMA INDUSTRIES

Category | L | T | P | Credit
---|---|---|---|---
CC | 3 | 0 | 0 | 3

PREAMBLE:
The concept and the importance of plant construction material particle size and particle shape in drug formulation. Understanding the mechanism of basic pharmaceutical operations including size reduction, mixing, separation processes, filtration, centrifugation and crystallization and evaporation.

PREREQUISITE
NIL

COURSE OBJECTIVES

1. To list out the construction materials of pharmaceutical plant.
2. To describe the Characterization and properties of particulate solids and screening equipment
3. To demonstrate the crystallization operations and its mechanism.
4. To describe the theory of filtration and centrifugation processes.
5. To describe the concept of mixing of powdered materials and its mechanism.

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

CO1. Recognize the construction materials for pharmaceutical plant and its various properties. Remember

CO2. Discuss the properties and characterization of particulate solids. Understand

CO3. Discuss the Characters of crystals and mechanism of nucleation. Understand

CO4. Illustrate the theories of filtration and factors affecting it. Apply

CO5. Categorize the process of centrifugation and centrifugal filters in industrial process. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

MATERIALS OF PHARMACEUTICAL PLANT CONSTRUCTION
Overview of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass - Industrial Hazards and Safety Precautions – Mechanical, Chemical, Electrical, Fire and Dust hazards, etc.

SIZE REDUCTION & SEPARATION
Properties and characterization of particulate solids — Introduction to storage and conveying of solids - Analysis and technical methods for size determination of powders - Size reduction equipment – Screening equipment

CRYSTALLIZATION

FILTRATION AND CENTRIFUGATION

MIXING
Mixing of powdered materials – Mechanism of random mixing and interactive mixing. Sampling techniques, size and mixing indices. Factors affecting the mixing process. Types, characteristics and operation of mixers.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<tbody>
<tr>
<td>1.</td>
<td>Mr. A. Gilbertsunderraj</td>
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<tr>
<td>2.</td>
<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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</table>
**PREAMBLE**
The course deals with the various physical, physicochemical properties and principle involved in dosage form formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**

1. To discuss various physicochemical properties of drug molecules in the designing the dosage forms.
2. To perform the formulation of emulsions and suspensions, access the physical stability of the product.
3. To execute the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
4. To compare the rheology of Newtonian and non-Newtonian fluids and to determine the various possible interaction of protein with drugs.
5. To outline the various laws of thermodynamics associated with formulation of dosage forms.

**COURSE OUTCOMES**
After completion of course, student is able to know

- CO1. To describe the properties of drug molecules in the dosage form design
- CO2. To demonstrate the formulation of emulsions and suspensions.
- CO3. To illustrate the stability of various formulations.
- CO4. To differentiate the rheology of various fluids used in development of various formulations.
- CO5. To develop formulation of various drugs using thermodynamic laws.

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

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S- Strong; M-Medium; L-Low

**SYLLABUS**
Physical properties of drug molecules & Colloids
Physical properties- Bulk characteristic-crystallinity and polymorphism, Hygroscopicity, flow property, compressibility, excipient compatibility. Solubility analysis—Ionisation constant, Solubilisation, Partition coefficient, thermal effect, Dissolution, common ion effect. Stability analysis. Introduction, types of colloidal systems, optical properties of colloid, kinetic properties of colloids, electric properties of colloids, solubilization.

**Coarse Dispersions Surface & Interfacial Phenomenon**

**Kinetics**
Rates and orders of reaction, influence of temperature and other factors on rates, decomposition and stabilization of medical agents, kinetics in the solid state, accelerated stability analysis, kinetics of drug transport in vivo.

**Micromeritics, Rheology & Complexation & Protein Binding**
Particle size and size distribution, methods of determining particle size, particle shape and surface area, methods of determining surface area, pore size, derived properties of powders. Viscosity, Newtonian and non-Newtonian fluids, thixotropy and its application, Rheology of disperse system, viscometers. Metal-complexes, organic molecular complexes, inclusion compounds, protein binding, complexation and drug action.

**Thermodynamics**
Thermodynamics first, second, third law of thermodynamics. Free energy functions and applications. Internal energy–open, closed and isolated systems, Isothermal, adiabatic and reversible process. Enthalpy, entropy, criteria of spontaneity and equilibrium.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<th>S.No.</th>
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<tr>
<td>1</td>
<td>Dr.R.MargretChandira</td>
<td>Professor</td>
<td>Pharmaceutics</td>
<td><a href="mailto:mchandira172@gmail.com">mchandira172@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr. V. Muruganantham</td>
<td>Associate Professor</td>
<td>Pharmaceutics</td>
<td><a href="mailto:svmanand@yahoo.com">svmanand@yahoo.com</a></td>
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</table>
PREAMBLE
This is an introductory course in different modes of heat transfer. The subject has a wide scope and is of prime importance in almost all fields of engineering and biological systems. The course emphasizes the underlying concepts of the conduction and convection modes of heat transfer and enumerates the laws and governing equations relating to the rates of heat transfer, based on derivation from fundamentals. There is a well-balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance. After completion of the course, the students will have a strong foundation on heat and mass transfer.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Define the concepts of Heat transfer by conduction in solids for steady-state and transient conditions
2. To Discuss the problems in heat transfer by convection.
3. To Describe the thermal analysis and design skills of heat exchangers.
4. To Describe the heat transfer process of radiation.
5. To Demonstrate the basics of mass transfer through molecular diffusion.

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

CO1. Define the laws governing the heat transfer operations to solve the problems
   Remember

CO2. Interpret the temperature variations and rate of heat flow in convection heat transfer problems
   Understand

CO3. Discuss about the heat transfer equipment suitable for specific requirement,
   Understand

CO4. Illustrate the real-time applications of radiation mode of heat transfer
   Apply

CO5. Practice the skill of mass transfer and its applications
   Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
HEAT TRANSFER – CONDUCTION

HEAT TRANSFER - CONVECTION

HEAT TRANSFER – HEAT EXCHANGER

HEAT TRANSFER: RADIATION
Radiation heat transfer – concept of black and grey body - monochromatic total emissive power – Kirchoff’s law – Planck’s law - Stefan-Boltzman’s law – heat exchange through non-absorbing media - solving problems in heat transfer by radiation.

MASS TRANSFER

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<tr>
<td>1.</td>
<td>Mr.A.Gilbertsunderraj</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td><a href="mailto:gilbertsunderraj@vmkvec.edu.in">gilbertsunderraj@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2.</td>
<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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</table>
PREAMBLE
This subject is designed to impart fundamental knowledge on the structure and functions of the various systems in the human body. It also helps in understanding the homeostatic mechanisms. The subject provides the basic knowledge required to understand the therapeutic activity of various drugs.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Describe the components of blood and its function
2. To Explain the structure & function of nervous system and various sense organs
3. To Discuss the various parts of Gastro Intestinal & Renal system & to understand how do they function
4. To Describe different parts and function of heart & lungs
5. To Summarize the roles of hormones in human system

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

CO1. Define various blood cells and its importance. Remember

CO2. Demonstrate the functions of central, peripheral and autonomic nervous system and sense organs. Understand

CO3. Recognize the process of digestion excretion and urine formation. Understand

CO4. Explain mechanism of blood circulation by heart and respiration by lungs. Understand

CO5. Tells significance of endocrine glands & its hormones. Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
HEMATOLOGY
Composition and functions of blood, functions of plasma proteins, reaction of blood, coagulation of blood, coagulation factors, functions of bone marrow, erythropoiesis, functions of hemoglobin, blood groups.
NERVOUS AND SENSORY SYSTEM
Anatomy and physiology of brain, blood-brain barrier, spinal cord, structure and types of the neuron, synapses neurotransmitters, organization of spinal and cranial nerves, central and peripheral nervous system, autonomic nervous system, receptors membrane potentials – graded potentials and action potentials, physiology of vision, audition, olfaction, taste and skin.

GASTROINTESTINAL AND RENAL SYSTEM
Anatomy and physiology of the gastrointestinal tract (secretion, motility, digestion and absorption), structure and function of the liver, spleen, gall bladder, pancreas; the renal system structure – Anatomy and physiology of kidney; structure of the nephron and network of blood capillaries, urinary tract, formation of urine, concentration of urine; regulation of acid-base balance; the chemical acid-base buffer systems of body fluids and disease conditions.

CARDIOVASCULAR AND RESPIRATORY SYSTEM
Anatomy and physiology of the heart, lungs, cardiac cycle; circulation of blood, heart rate, blood pressure, ECG and heart sounds, lymphatic vessel, systemic and portal circulation; vascular system – arteries, arterioles, capillaries, venules. Anatomy of respiratory tract, mechanism and dynamics of respiration, lung volumes, transport of oxygen and carbon dioxide, disorders like cyanosis.

ENDOCRINE
Anatomy and physiology of Pituitary, thyroid, parathyroid, adrenal and pancreatic hormones and disorders of these glands, endocrine control of growth and metabolism.

TEXT BOOKS:
4. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother’s medical publishers, New Delhi.

REFERENCE BOOKS:
1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata.
4. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

COURSE DESIGNERS

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<tr>
<td>1.</td>
<td>Mr. P. Senniappan</td>
<td>Assistant Professor</td>
<td>Pharmacognosy</td>
<td><a href="mailto:senniappan1979@gmail.com">senniappan1979@gmail.com</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mr. S. Raghu</td>
<td>Assistant Professor</td>
<td>Pharmacology</td>
<td><a href="mailto:sragusrinivasan@gmail.com">sragusrinivasan@gmail.com</a></td>
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</table>
PREAMBLE
To acquire the basic knowledge on organization and maintenance of the genome and on control of gene expression; to understand the processes that govern cell cycle and control mechanisms of cell death and renewal; to recognize the scheme of the cell-cell interactions and cell signaling; to relate the irregularities in the genome and basic cell processes to the development of cancer; to acquire the principles and practical applications of the basic methods in molecular biology and genetic engineering.

PREREQUISITE
17BTCC02- CELL BIOLOGY

COURSE OBJECTIVES
1 To Define the structure of Nucleic acids, their characteristics and organization, biological importance, replication process etc.,
2 To Describe about the process of transcription and translation mechanism, types of RNA and inhibitors involved in this process.
3 To Discuss about the tools and techniques involved in gene cloning
4 To Perform the nucleic acid isolation, PCR and hybridization techniques.
5 To Outline about gene expression and genome sequencing techniques

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

CO1. Recall the basic concepts and principles of nucleic acids in prokaryotic and eukaryotic organisms and their replication process. Remember

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

CO3. Describe about gene expression and genome sequencing techniques. Understand

CO4. Illustrate various recombinant DNA techniques and their applications. Apply

CO5. Determine the analysis of genomic informations. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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S- Strong; M-Medium; L-Low
SYLLABUS
MOLECULAR GENETICS
Bacterial conjugation, transduction and transformation, prokaryotic and eukaryotic genome organization; Introduction to nucleic acids, Nucleic acids as genetic material, Structure and function of DNA and RNA, DNA replication, Overview of differences in prokaryotic and eukaryotic DNA replication, Telomere replication in eukaryotes. Mutagens, DNA mutations and their mechanism, various types of repair mechanisms.

TRANSCRIPTION AND TRANSLATION

RECOMBINANT DNA TECHNOLOGY

SEQUENCING AND AMPLIFICATION OF DNA
Amplification of DNA; Types of PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Site directed mutagenesis. Organization and structure of genomes, Maxam Gilbert’s and Sanger Coulson’s and automated methods of DNA sequencing, Next generation sequencing technologies, Genetic maps and Physical maps.

GENOME ANALYSIS AND GENOMICS
Gene therapy and Transgenic technology, Introduction to Functional genomics, Microarrays, Serial Analysis of Gene expression (SAGE), Web resources for Genomics, Regulation of Eukaryotic Gene Expression by Small RNAs (RNA Interference, RNAi).

TEXT BOOKS:

REFERENCES:

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<tr>
<td>1.</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>
</tr>
<tr>
<td>2.</td>
<td>Dr.M.Sridevi</td>
<td>Professor &amp; Head</td>
<td>Biotechnology</td>
<td><a href="mailto:sridevim@vmkvec.edu.in">sridevim@vmkvec.edu.in</a></td>
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</table>
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 Generalize about enzyme inhibition with examples.
3. To Illustrate in detail about mechanism and kinetics of enzyme activity.
4. To outline organization and regulation of enzymes in cells.
5. To outline the applications of industrial and clinical enzymes.

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. Demonstrate the effect of enzyme inhibition and enzyme immobilization. Understand

CO3. Exemplify fundamental knowledge about enzyme kinetics and mechanism of enzyme activity. Understand

CO4. Illustrate about the regulation and mechanism of enzymes in cells. Apply

CO5. Categorize in detail about the application of various enzymes in industries and clinical use. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low
SYLLABUS
INTRODUCTION

ENZYME CATALYSIS AND INHIBITION
Lock and key, Induced fit and Transition state Hypotheses. Mechanism of enzyme catalysis- Acid-base catalysis, covalent catalysis, Metal ion catalysis, Proximity and orientation effects etc. Mechanism of Serine proteases. Reversible Inhibition- Competitive, Non Competitive, Uncompetitive, Mixed, Substrate, Allosteric and Product Inhibition. Irreversible Inhibition- Suicide inhibition. Examples and Mechanism of various Inhibitions like Penicillin, Iodoacetamide and DIPF.

ENZYME KINETICS

ENZYME REGULATION

INDUSTRIAL AND CLINICAL USES OF ENZYMES (APPLIED ENZYMEOLOGY)
Industrial Enzymes- Thermophilic enzymes, amylases, lipases, proteolytic enzymes in meat and leather industry, enzymes used in various fermentation processes, cellulose degrading enzymes, Metal degrading enzymes. Clinical enzymes- Enzymes as thrombolytic agents, Anti-inflammatory agents, streptokinase, asparaginase, Isoenzymes like CK and LDH, Transaminases (AST, ALT), Amylases, Cholinesterases, Phosphatases. Immobilization of enzymes, ELIZA. Biosensors. Enzyme Engineering and site directed mutagenesis, Designer enzymes

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>
<td>1</td>
<td>Mrs. J. Blessy Juliet</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:catch.blessy@gmail.com">catch.blessy@gmail.com</a></td>
</tr>
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<td>2</td>
<td>Dr.S.Anusuya</td>
<td>Associate Professor</td>
<td>Pharmaceutical Engineering</td>
<td><a href="mailto:dr.s.anusuya@vmkvec.edu.in">dr.s.anusuya@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. The course is designed to impart the knowledge in the field of Pharmaceutical analysis. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics are taught to enable the students to understand and apply the principles involved in the determination of different bulk drugs and their formulation. In addition to the theoretical aspects, the basic practical knowledge relevant to the analysis is also imparted.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To discuss about the principles of modern analytical techniques and its application in pharmacy.
2. To summarize the use of modern techniques of analysis used in different areas / fields of pharmacy.
3. To implement the given technical training and its applications in day to day practices.
4. To give hands on training on use of as many different instruments as possible.

COURSE OUTCOMES
After completion of course student is able to know

CO1. Discuss about the Drugs, Chemicals and Excipients used in Pharmacy
Understand

CO2. Interpretations of the various spectroscopic data
Understand

CO3. Illustrate the fundamental of analysis related to drug discovery.
Apply

CO4. Infer the modern analytical techniques, which is important for qualitative as well as quantitative analysis of drug substances and drug product.
Analyze

CO5. Measure and analysis various drugs in single and combination dosage forms
Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

SEPARATION TECHNIQUES
Fundamental principles, theory, instrumentation and application of Paper chromatography, TLC, Column chromatography, HPLC, HPTLC, Ion Exchange Chromatography and electrophoresis.

SPECTROSCOPIC METHODS
Theory, Instrumentations, chemical applications and structural elucidation by UV, IR, NMR, Mass Spectrometry, ESR and Emission spectroscopy.

ELECTROCHEMICAL METHODS
Potentiometry, Conductometry, Polarography, Colorimetry and Flourimetry

THERMAL METHODS
Thermogravimetry, Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-RAY DIFFRACTION METHODS
Introduction, generation of X-rays, elementary crystallography, Miller Indices, X-rays diffraction, Bragg’s law, X-ray powder diffraction, X-ray powder diffractometer, obtaining and interpretation of X-ray powder diffraction data.

TEXT BOOKS:
5. Spectroscopy by B.K.Sharma

REFERENCE BOOKS:
7. Fundamentals of analytical chemistry by Skoog

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>Mr.S.Alexander</td>
<td>Assistant Professor</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:alexmpharm@gmail.com">alexmpharm@gmail.com</a></td>
</tr>
<tr>
<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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## PREAMBLE
The subject provides knowledge involving basic principle of fermentation process, bioreactor design, scaleup and recombinant protein production along with case studies, to help the students understand fermentation processes involved in Pharmaceutical Industries.

## PREREQUISITE
17PECC06-ENZYME TECHNOLOGY

## COURSE OBJECTIVES
1. To Explain the basics of bioreactor engineering.
2. To Perform a biochemical process for the production of biologically important product.
3. To Implement fermentation processes and its control systems during scale up operations.
4. To Outline the fundamentals of Enzyme kinetics, Inhibition kinetics and Immobilization.
5. To Develop a methodology for recombinant protein production.

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

| CO1 | Describe appropriate bioreactor configurations and operation modes based upon the nature of bioproducts. | Understand |
| CO2 | Illustrate the principles of bioprocesses so as to reduce costs and to enhance the quality of products. | Apply |
| CO3 | Generalize the production process in pharma industry with strong foundation of bioreactor design and scale-up. | Apply |
| CO4 | Appraise the role Enzyme kinetics in bioprocess industry. | Analyse |
| CO5 | Evaluate the problems in bioprocess industry and seek practical solutions for large scale production of a product. | Evaluate |

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

## SYLLABUS

### INTRODUCTION TO BIOREACTOR DESIGN & CONSTRUCTION
General requirements of fermentation processes, Basic design and construction of CSTR, bioreactor design of agitator/agitator motor, power consumption in aerated bioreactor, design of sparger, mixing time estimation, oxygen mass transfer capability in bioreactor, Removal of Heat in bioreactor, Main parameters to be monitored and controlled in fermentation processes.

### 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.

**BIOREACTOR SCALE-UP**

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors – Mass transfer Coefficient - methods for the determination of mass transfer coefficients; mass transfer correlations. Power requirements of Bioreactors. Scale-up considerations on heat transfer oxygen transfer, power consumption and impeller tip speed.

**BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS**

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors.

**CASE STUDIES IN FERMENTATION DERIVED PRODUCTS**

Case studies on Production of penicillin, aminoglycosides, macrolides, recombinant Insulin and interferon. Case studies should deal with strain improvement, medium design, reactor design & process optimization etc.

**TEXT BOOKS**

2. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications

**REFERENCES**

3. James M. Lee, Biochemical Engineering, PHI, USA.
5. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.

**COURSE DESIGNERS**

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<td>1.</td>
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<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:vanathi@vkmvec.edu.in">vanathi@vkmvec.edu.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@vkmvec.edu.in">arthi@vkmvec.edu.in</a></td>
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</table>
PREAMBLE
This Course is designed to impart a fundamental knowledge and to provide the concepts of various parameters involved in the formulation and development of various solid dosage forms, semisolid and semi-liquid formulations and to employ the different unit operations in the preparation and manufacturing of these dosage forms.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To impart the knowledge on the principles of solid and semisolid dosage forms formulation and development.
2. To summarize the concepts involved in troubleshooting and improvement of solid dosage forms, semi-solid and semi-liquid dosage forms
3. To describe the various pharmaceutical dosage forms and their manufacturing techniques
4. To provide the knowledge on the formulation and evaluations of dosage forms.
5. To select the appropriate method of achieving a successful dosage form formulation.

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

| CO1 | To understand the Technology of various solid and semisolid dosage forms. | Understand |
| CO2 | To Recognize the formulation concepts and evaluate different dosage forms to meet out the requirements. | Understand |
| CO3 | To be able to execute this knowledge in Pharmaceutical formulation industries | Apply |
| CO4 | To organize the difference between theoretical and practical concept used in industry | Apply |
| CO5 | To Apprehend the advances in solid dosage forms, semi solid dosage forms and dispersions | Apply |

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SYLLABUS
SOLID DOSAGE FORMS - TABLETS
Types of tablets, brief study of novel tablets, formulation of tablets with detailed study of excipients, theory of compression, process of compression, effect of friction, force – volume
relationships in compression (Heckel’s plot). Tablet manufacturing techniques, machinery for small and large scale tablet manufacturing, inprocess controls, processing problems, evaluation parameters and equipments. Coating of tablets: Objectives, types of coating, film forming materials, formulation of coating solution, equipment for coating, coating process, evaluation of coated tablets, coating defects, specialized coating process.

**SOLID DOSAGE FORMS - CAPSULES**

Types of capsules, size of capsules, material for production of hard gelatin capsules, formulation of hard gelatin capsules, method of capsule filling, problems and remedies in capsule manufacturing Soft gelatin capsule: shell and capsule content, manufacturing equipments, importance of base absorption and minimum/gm factors in soft capsule Quality control, stability testing & storage of capsule dosage forms.

Other Solid dosage Forms: Brief study of effervescent powders and granules, pelletization technology and its applications

**ADDITIVES AND EXCEPIENTS IN SOLID AND SEMISOLID DOSAGE FORMS**


**SEMISOLID DOSAGE FORMS AND DISPERSIONS**


Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions. Biphasic dosage forms: Suspensions and emulsions, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.

**PREFORMULATION CRITERIA AND FORMULATION CHALLENGES**

Study of physical and chemical properties of drugs and their effect on formulation, stability and bioavailability. Stability studies, Importance of accelerated stability study, effect of various environmental / processing on stability of the formulation and techniques for stabilization of products against the same.

Formulation challenges – multiple vitamin and mineral dosage forms, botanicals formulation into oral solid dosage forms, special tablets formulation for slow oral dissolution, osmotic systems, tableting of multi particulate modified release systems.

**TEXT BOOKS:**


REFERENCES:
2. Indian Pharmacopoiea, British Pharmacopoiea, United States Pharmacopoiea
4. G. C. Cole, Pharmaceutical Coating Technology, New York,

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</table>
PREAMBLE
The students will be able to understand important physical and chemical properties, pharmaceutical uses, storage conditions and chemical incompatibility of various important medicinal compounds. The discipline also includes concepts and processes of drug discovery, delivery, biomedical Analysis, Pharmacology, Pharmacokinetics, and Pharmacodynamics.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Discuss the importance of pH maintenance in various chemical reactions.
2. To Describe the Drug-based cures and remedies for disease.
3. To Demonstrate antibiotics as life-saving remedies.
4. To Compare the uses of various radiopharmaceutics.
5. To Outline Quality assurance of drug.

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

CO1. Explain the role of buffer and pH in different reaction. Understand
CO2. Summarize the function of antioxidant, antimicrobials and astringents. Understand
CO3. Illustrate the mechanism of action of antibiotics and their side effects. Apply
CO4. Examine the use of radiopharmaceuticals in drug formulation and diagnostics. Analyse
CO5. Appraise the quality of a pharmaceutical product. Analyse

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S- Strong; M-Medium; L-Low

SYLLABUS

ACIDS, BASES, BUFFERS
Boric acid, Hydrochloric acid, Strong Ammonium hydroxide, Sodium hydroxide and official buffers.

ANTIOXIDANTS, ANTIMICROBIALS AND ASTRINGENTS
Antioxidants - Hypophosphorous acid, Sulphur dioxide, Sodium bisulphite, Sodium meta-bisulphite, Sodium thiosulphate, Nitrogen and Sodium nitrite. Antimicrobials - Hydrogen peroxide, Potassium permanganate, Chlorinated lime, Iodine, Solutions of Iodine, Povidone-iodine, Boric acid, Borax, Silver nitrate, Mild silver protein, Mercury yellow, Mercuric oxide, Ammoniated mercury. Sulphur and its compounds- Sublimed sulphur, Precipitated sulphur, Selenium sulphide. Astringents- Alum and Zinc
Sulphate.

**ANTIBIOTICS**
Benzyl penicillin, Phenoxy methyl penicillin, Benzathine penicillin, Ampicillin, Cloxacillin, Carbencicillin, Gentamicin, Neomycin, Erythromycin, Tetracycline, Cephalexin, Cephaloridine, Cephalothin, Griseofulvin, Chloramphenicol.

**RADIO PHARMACEUTICALS AND CONTRAST MEDIA**

**QUALITY CONTROL OF DRUGS AND PHARMACEUTICALS**
Importance of quality control, significant errors, methods used for quality control, sources of impurities in pharmaceuticals. Limit tests for Arsenic, Chloride, Sulfate, Iron and Heavy metals.

**TEXT BOOKS**
1. Bentley and Driver’s Textbook of Pharmaceutical Chemistry.

**REFERENCES**
3. Indian Pharmacopoeia 1996.

**COURSE DESIGNERS**

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<tr>
<td>1</td>
<td>Dr.M.Kumar</td>
<td>Professor &amp; Head</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:kumarvmcp@yahoo.co.in">kumarvmcp@yahoo.co.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr.S.Alexandar</td>
<td>Assistant Professor</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:alexmpharm@gmail.com">alexmpharm@gmail.com</a></td>
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PREAMBLE
Immunotechnology is a specialized course which deals with biotechnological applications. Immunotechnology deals with immune systems and their components at the cellular and humoral levels. It focuses on gene rearrangement of immunoglobulin genes and T-cell receptor genes. Antigen processing and presentation, cellular responses, innate immunity and tolerance are included in that course. Knowledge on the fundamentals of immunology forms the basis of the course immunotechnology which deals with the practical aspects such as the production and engineering of antibodies, the application of antigens, the design of (recombinant) vaccines, strategies for immune intervention, etc.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To define the immune system and cells and organs involved in the immune response.
2. To discuss immunity and their types.
3. To illustrate various immune responses and their tolerance.
4. To outline the importance of immunological techniques in disease diagnosis and treatment.
5. To produce and purify monoclonal antibodies.

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

- CO1. Underline the importance of immune system.
- CO2. Describe about types of immunity and immunoglobulins.
- CO3. Illustrate how immune regulation is maintained.
- CO4. Develop new techniques related to immunology to treat disease.
- CO5. Evaluate Hybridoma techniques and their application in pharma industries.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I: FUNDAMENTAL ASPECTS OF IMMUNOLOGY

UNIT II: IMMUNITY AND ITS TYPES
Types of immunity, Active and Passive Immunity, Humoral Immunity - B – Lymphocytes and their activation. Structure and function of immunoglobulins, idotypes and anti idiootypic antibodies. Cell mediated Immunity - Thymus derived lymphocytes (T cells) – their ontogeny and types, MHC complex, antigen presenting cells (APC),
mechanisms of T cell activation, macrophages, dendritic cells, langerhans cells, and mechanism of phagocytosis.

**UNIT III: IMMUNE REGULATION AND TOLERANCE**
Complement activation and types and their biological functions, cytokines and their role in immune response, Antigen processing and presentation. Primary and Secondary Immune response; Generation of Humoral Immune Response; Generation of cell mediated Immune response (T cell activation, co-stimulatory signals); Killing mechanisms by CTL and NK cells, Hypersensitivity Types I-IV, Hypersensitivity reactions and treatment.

**UNIT IV: IMMUNOLOGICAL TECHNIQUES**

**UNIT V: IMMUNOTECHNOLOGY**

**TEXT BOOKS**

**REFERENCES**

**COURSE DESIGNERS**

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<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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<tr>
<td>2.</td>
<td>Mrs. J. Blessy Juliet</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:catch.blessy@gmail.com">catch.blessy@gmail.com</a></td>
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The course highlights the importance of Medicinal Chemistry in all our lives and the fascination of working in a field that overlaps the disciples of chemistry, biology, biochemistry, pharmacology etc. It gives brief understanding about drug-receptor interactions, lead discovery, drug design and molecular mechanism by which drug act in the body. The course emphasizes on various drug targets in the body and drug development strategies with mechanism of action of antibacterial agents and concept of drug resistance.

**PREREQUISITE – 17CHBS10 FUNDAMENTALS OF CHEMISTRY**

**COURSE OBJECTIVES**

1. To state the chemical basis of drug action including physicochemical and steric properties of drug.

2. To discuss the classification, chemical nomenclature, generic names and synthesis of various medicinal agents.

3. To describe the structure activity relationship, biochemical/ molecular basis of mechanism of action and uses of drug.

4. To implement corresponding knowledge for the development of biologically and clinically active drugs

5. To compare the basic biological and pharmacological interactions by using both natural products and total synthesis of bioactive molecules.

**COURSE OUTCOMES**

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

| CO1. Define the importance of the physical properties of drugs with respect to the ionization, solubility and efficacy of drugs | Remember |
| CO2. Discuss how drugs are developed and demonstrated the importance of chemistry in the development and application of therapeutic drugs. | Understand |
| CO3. Illustrate how changes in the chemical structure of drugs affect efficacy. | Apply |
| CO4. Practice a working knowledge of chemical structures and nomenclature | Apply |
| CO5. Develop the ability to suggest suitable techniques to synthesis different drug molecules. | Analyse |

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

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S- Strong; M-Medium; L-Low
SYLLABUS
PRINCIPLES OF MEDICINAL CHEMISTRY

DRUGS ACTING ON SYNAPTIC AND NEURO-EFFECTOR JUNCTION SITES
Classification, biochemical/molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties and synthesis of selected drugs belonging to the class of Cholinergics, Anticholinergics, Anticholinesterases and Adrenergics.

DRUGS ACTING ON THE CENTRAL NERVOUS SYSTEM
Classification, molecular basis of mechanism of action, structure activity relationship and synthesis of Hypnotics and Sedatives, Opioid analgesics, Anticonvulsants and Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).

DRUGS ACTING ON CARDIOVASCULAR SYSTEM
Structural basis of mechanism of action, structure activity relationship including physiochemical properties, and synthesis of selected drugs belonging to the class of anti-anginal, vasodilators, calcium channel blockers and cardiac glycosides.

AUTOCOIDS
Synthetic procedures, uses, structure activity relationship including physicochemical properties of the following classes of drugs Antihistamines, Eicosanoids, Analgesic-antipyretics, Anti - inflammatory (non-steroidal) agents.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Dr.S.Anusuya</td>
<td>Associate Professor</td>
<td>Pharmaceutical Engineering</td>
<td><a href="mailto:dr.s.anusuya@vmkvec.edu.in">dr.s.anusuya@vmkvec.edu.in</a></td>
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17PECC13 | PHARMACOLOGY
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**PREAMBLE**
Basic principles of pharmacology, including receptor mechanisms, drug distribution and metabolism, and pharmacokinetics. Lectures, laboratories, and tutorials on the interactions of drugs and biological systems as a basis for rational disease therapy.

**PREREQUISITE -** 17PECC04 HUMAN PHYSIOLOGY

**COURSE OBJECTIVES**
1. Define the various factors that can affect the action of drugs.
2. Discuss the various routes of drug administration with advantages and disadvantages of the various routes.
3. Describe the methods in experimental pharmacology.
4. Outline the importance of rational prescribing of drugs and the concept of essential drugs.
5. Categorize the effects of drugs pertaining to GIT, endocrine system, haemopoietic system and also know the principles of chemotherapy.

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

| CO1. Define what drugs do to the living organisms and how their effects can be applied to therapeutics. | Remember |
| CO2. Discuss about the complete information about the drugs like sources, physico chemical properties, mechanism of action, physiological and biochemical effects. | Understand |
| CO3. Illustrate on the absorption, distribution, metabolism and excretion mechanism along with the adverse effects, clinical uses, interactions, doses, contraindications | Apply |
| CO4. Differentiate the routes of administration of different classes of drugs. | Apply |
| CO5. Examine comprehend the principles of chemotherapy | Analyse |

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

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S- Strong; M-Medium; L-Low
SYLLABUS
INTRODUCTION TO PHARMACOLOGY

CENTRAL NERVOUS SYSTEM
Nerve conduction and transmission in the C.N.S, general anaesthetics, sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants, Psychopharmacological agents – Antipsychotics, antidepressants, neuroleptics, anti-maniacs and hallucinogens, thymoleptics, antiepileptic drugs, Anti-parkinsonism drugs, analgesics, antipyretics, anti-inflammatory (NSIADs) and anti-gout drugs, narcotic analgesics and antagonists, C.N.S. stimulants, drug addiction and drug abuse.

CARDIOVASCULAR SYSTEM AND HAEMOPOIETIC SYSTEM
Cardiac glycosides, anti-hypertensive drugs, anti-anginal and vasodilator drugs including calcium channel blockers and beta adrenergic antagonists, Anti-arrhythmic drugs, antihyperlipidemic drugs, Drugs used in the therapy of shock. Haematinics, Anticoagulants, vitamin K and haemostatic agents, Fibrinolytic and anti-platelet drugs, Blood plasma volume expanders.

GASTROINTESTINAL TRACT, RESPIRATORY TRACT AND URINARY SYSTEM
Antacids, anti-secretory and anti-ulcer drugs, Laxatives and Anti-diarrhoeal drugs, Appetite stimulants and suppressants, Emetics and anti-emetics. Fluid and electrolyte balance, Diuretics and Anti-diuretics, Anti-asthmatic drugs including bronchodilators, anti-tussives and expectorants.

CHEMOTHERAPY
General principles of chemotherapy, Sulfonamides, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, macrolides, Quinolones, fluoroquinolones and other antibiotics. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy and immuno suppressive agents

TEXTBOOKS
1. Satoskar, Pharmacology and Therapeutics, Popular Prakashan Ltd, 2015
5. Mycek M.J., Gerlnet S.B and Perper M.M. Pharmacology, Lippincott’s Illustrated
6. Reviews, Lipincott Company, Philadelphia

REFERENCES
2. Goodman and Gilman’s, The Pharmacological basis of therapeutics.
Agency, Calcutta.

4. B. Lammer, Chronopharmacology

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PREAMBLE
This course enables the student to understand the design, development and manufacturing of sterile
drug dosage forms. This course also focuses towards formulation development and product
manufacture of quality sterile dosage forms that meet or exceed expected good manufacturing practice
requirements.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To describe the principles of parenteral dosage form formulation
2. To execute the concepts involved in the manufacture of sterile products
3. To solve the difficulties associated with drug delivery to ear, ophthalmic and Nasal region
4. To differentiate the use of various additives in sterile formulations.
5. To prepare parenteral based on the guidelines of regulatory bodies.

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

CO1. Describe the principle of manufacturing parenteral products
   Understand

CO2. Illustrate the various strategies involved in manufacturing of sterile products.
   Apply

CO3. Demonstrate drug delivery to ear, nose and ophthalmic organs.
   Apply

CO4. Examine the role of additives in formulation of sterile products.
   Analyse

CO5. Appraise the guidelines formulation, manufacturing, packaging and marketing
   Evaluate
   of sterile products

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC
OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO PARENTERAL PRODUCTS
Pre-formulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous
vehicles, isotonicity and methods of its adjustment. Formulation details, containers and closures and
their selection; Prefilling treatment, washing the container and closers, preparation of solution and
suspension, filling, closing of ampoules, vials, infusion fluids, lyophilization, preparation of sterile
powders, equipment for large scale manufacture and evaluation of parenteral products.

ASEPTIC TECHNIQUES IN PARENTERALS
Aseptic techniques: Source of contamination, methods of prevention, design of aseptic area, laminar
flow bench, air handling units, services and maintenance; Stability evolution of sterile pharmaceutical dosage forms; special precautions on blood products, glandular products, medical sutures, ligatures.

**EAR, NASAL AND OPHTHALMIC DRUG DELIVERY**
Nasal and ocular drug delivery overview, membrane transport processes in the eye, nasal and ocular drug transfer following systemic drug administration, ocular pharmacokinetics and pharmacodynamics; ocular penetration enhancers, corneal collagen shields for ocular drug delivery; the noncorneal route in ocular drug delivery, ocular iontophoresis, mucoadhesive polymers in ophthalmic drug delivery, dendrimers, new experimental therapeutic approaches for degenerative diseases of the retina, gene, oligonucleotide, and ribozyme therapy in the eye.

**FORMULATION ADDITIVES**
Classifications of various additives in sterile formulations; Buffers, density modifiers, isotonicity modifiers; viscosity enhancers, preservatives, irrigations additives.

**PARENTERAL REGULATIONS AND VALIDATIONS**
cGMP regulations of parenteral drugs; Risk assessment and mitigation in aseptic processing; Development challenges and validation of fill and finish processes for biotherapeutics; Excipients for parenteral dosage forms; regulatory considerations and controls; Parenteral products specifications and stability; the management of extractables and leachable in pharmaceutical products; Process analytical technology and rapid microbiological methods; Quality assurance.

**TEXT BOOKS**
1. Pharmaceutical Dosage Forms Parenteral Medications, Third Edition Volume 3, Sandeep Nema, John D. Ludwig, Informa Healthcare is a trading division of Informa UK Ltd

**REFERENCES**
1. Remington’s Pharmaceutical Sciences (RPS).
2. Modern Pharmaceutics by Banker and Gilberts.
3. Theory and Practice of Industrial Pharmacy by Lachman.

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<td><a href="mailto:svmanand@yahoo.com">svmanand@yahoo.com</a></td>
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<td>Dr. R. Margret Chandira</td>
<td>Professor</td>
<td>Pharmaceutics</td>
<td><a href="mailto:mchandira172@gmail.com">mchandira172@gmail.com</a></td>
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PREAMBLE
Downstream processing refers to the recovery and purification of biosynthetic products, particularly pharmaceuticals, from natural sources such as animal or plant tissue or fermentation broth, including the recycling of salvageable components and the proper treatment and disposal of waste. It is an essential step in the manufacture of pharmaceuticals such as antibiotics, hormones (e.g. insulin and humans growth hormone), antibodies (e.g. infliximab and abciximab) and vaccines; antibodies and enzymes used in diagnostics; industrial enzymes; and natural fragrance and flavor compounds.

PREREQUISITE
17PECC08-PHARMACEUTICAL BIOPROCESS ENGINEERING

COURSE OBJECTIVES
1. To implement the basic knowledge of downstream processing
2. To outline the physical methods of separation.
3. To differentiate the isolation of products
4. To distinguish purification methods
5. To justify the importance of formulation and finishing operation

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

CO1. Generalize the various basic processes in downstream processing
CO2. Distinguish the various physical methods of separation
CO3. Appraise the isolation of products
CO4. Categorizes the various purification methods
CO5. Assess the knowledge of formulation and finishing operations

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS

OVERVIEW OF DOWNSTREAM PROCESSING
Introduction to downstream processing - principles characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods- Pretreatment and stabilization of bioproducts- Formulation, Fill and Finish

PHYSICAL METHODS OF SEPARATION
Unit operations for solid-liquid separation – thermal processing- filtration and centrifugation.
### ISOLATION OF PRODUCTS
Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

### PRODUCT PURIFICATION
Chromatography – principles, instruments and practice, adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction, bio affinity and pseudo affinity chromatographic techniques.

### FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS
Crystallization, drying and lyophilization in final product formulation.

### TEXT BOOKS:
4. **Downstream Process Technology: A New Horizon in Biotechnology** Paperback – 2010 by Prasad (Author), Krishna

### REFERENCES:

### COURSE DESIGNERS

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<td>Professor and Head</td>
<td>Chemistry</td>
<td><a href="mailto:Shantht@vmkvec.edu.in">Shantht@vmkvec.edu.in</a></td>
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</table>
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
NIL

COURSE OBJECTIVES
1. To Summarize first law of thermodynamics to identify, formulate and solve engineering problems.
2. To demonstrate the practical implications of thermodynamic law in engineering design.
3. To implement power generation and refrigeration processes.
4. To outline the partial molar property and describe its role in determining the properties of mixtures.
5. To Differentiate the properties of phase and chemical equilibria.

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

CO1. Explain about correlation of mathematics, science and engineering principles for problem solving in process industries. Understand

CO2. Demonstrate the fundamental concepts of thermodynamics to overcome existing industrial problems. Apply

CO3. Differentiate the mixture based on molar property. Apply

CO4. Ability to apply laws of thermodynamics to biological processes Analyze

CO5. Appraise the equilibrium of a system. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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

FUNDAMENTAL CONCEPTS AND FIRST LAW OF THERMODYNAMICS

ENTROPY AND THE SECOND LAW OF THERMODYNAMICS

REFRIGERATION, VAPOR AND COMBINED POWER CYCLES
Refrigeration and liquefaction process, Thermodynamic Potentials, thermodynamic correlation, Maxwell relations, criteria for Equilibria and stability, Clapeyron equation.

MOLAR PROPERTIES OF SOLUTIONS AND MIXTURES
Partial molar properties, ideal and non-ideal solutions, standard states definition and choice, Gibbs-Duhem equation, activity and property change of mixing, excess properties of mixtures.

PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA
Activity coefficient-composition models, thermodynamic consistency of phase equilibria, Chemical Reaction equilibria, Extent of reaction, equilibrium constant and standard free energy change.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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<td><a href="mailto:arthi@vmkvec.edu.in">arthi@vmkvec.edu.in</a></td>
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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 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. Demonstrate safe laboratory practices and handle the equipment safely. Apply
CO2. Prepare solutions and biological buffers. Apply
CO3. Isolate biomolecules from various source. Analyze
CO4. Determine the quality and quantity of biomolecules. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low
SYLLABUS
1. pH measurements and Buffer preparations.

TITRIMETRIC EXPERIMENTS
2. Estimation of Ascorbic acid by Titrimetric method using 2, 6 Dichloro phenol indophenols.
3. Determination of Saponification value of Edible oil
4. Determination of Acid number of Edible oil.
5. Determination of Iodine value of Oil.

BIOCHEMICAL PREPARATIONS
6. Isolation of Chloroplast from Spinach leaves.
7. Cheese Production from Milk.
8. Casein from Milk.
9. Starch from Potato.

REFERENCES:
2. Laboratory Manual.

COURSE DESIGNERS
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<td>2</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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**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. To Demonstrate working principles of microscopy.
2. To Perform the basic techniques to work with cells.
3. To Differentiate the cells by staining techniques.
4. To Categorize the various stages of mitosis.
5. To Differentiate the types of blood cells.

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

- CO1. Demonstrate the basic concepts of sterilization techniques. **Understand**
- CO2. Interpret the behaviour of cells in their microenvironment. **Understand**
- CO3. Analyze scientific work and experimental results in of cell biology. **Analyze**
- CO4. Categorize the cell organelles. **Analyze**
- CO5. Examine physiological processes of cell e.g. cell divisions. **Analyze**

**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**
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### 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. To describe the safe practices in a microbiology laboratory.
2. To perform various cells staining techniques.
3. To demonstrate proper usage, identify the parts/functions of the following microscopes.
4. To perform transfer of living microbes using aseptic technique.
5. To differentiate the microbes enumerated from various environments.

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

1. **CO1. Discuss how microscopy has revealed the structure and function of microorganisms**
   - Understand

2. **CO2. Demonstrate the methods for isolation, subculture, and maintenance of bacterial and fungal specimens**
   - Understand

3. **CO3 Employ the uses of various media and testing protocols with focus on clinical applications.**
   - Apply

4. **CO4. Examine the causes and consequences of microbial evolution and the generation of diversity as well as human impacts on adaptation.**
   - Analyze

5. **CO5. Inspect the evidence of bacterial and fungal metabolism as it relates to identification and control of pathogenic organisms**
   - Analyze

### Mapping with Programme Outcomes and Programme Specific Outcomes

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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 deals with the various physical, physicochemical properties and principle involved in dosage form formulations. This course also provides a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To discuss various physicochemical properties of drug molecules in the designing the dosage forms
2. To perform the formulation of emulsions and suspensions, access the physical stability of the product.
3. To execute the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
4. To compare the rheology of Newtonian and non-Newtonian fluids and to determine the various possible interaction of protein with drugs.
5. To outline the various laws of thermodynamics associated with formulation of dosage forms.

COURSE OUTCOMES
After completion of course, student is able to know

CO1. To describe the properties of drug molecule Understand
CO2. To demonstrate the formulation of emulsions and suspensions. Apply
CO3. To illustrate the stability of various formulations. Apply
CO4. To differentiate the rheology of various fluids used in development of various formulations Analyse
CO5. To test the parameters causing effect in the formulation. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

172
SYLLABUS

1. Determination of latent heat, vapor pressure, critical point.
2. Studies on polymorphs, their identification and properties.
3. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
4. Determination of derived properties of powders like density, porosity, compressibility, angle of repose, etc.
5. Determination of surface/interfacial tension, HLB value and critical micellar concentration (CMC) of surfactants.
6. Study of rheological properties of various types of systems using different viscometers.
7. Study of different types of colloids and their properties.
8. Preparation of various types of suspensions and determination of their sedimentation parameters.
10. Studies on different types of complexes and determination of their stability constants.
11. Determination of half-life, rate constant and order of reaction.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Experiments involving tonicity adjustments.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE DESIGNERS

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173
PREAMBLE
The main purpose of the subject is to understand and recognize the anatomical structures and explain the physiological functions of body systems.

PREREQUISITE – NIL

COURSE OBJECTIVES

1. To understand the antigen-antibody and agglutination principle behind blood grouping
2. To estimate the number of different blood cells and haemoglobin in blood
3. To create an awareness of cell counts in an healthy and in a diseases state
4. To estimate human blood pressure

COURSE OUTCOMES

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

CO1. Detect blood group of an individual and capable of explaining the agglutination pattern during testing
CO2. Demonstrate laboratory procedures used to count blood cells
CO3. Evaluate the health of an individual from their blood cell counts
CO4. Validate the blood pressure of an individual.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

1. Determination of bleeding time.
2. Determination of clotting time.
3. Determination of blood grouping.
4. Estimation of haemoglobin content.
5. Determination of RBC count.
6. Determination of WBC count.
7. Determination of pulse rate
8. Determination of heart rate.
9. Determination of blood pressure.
REFERENCE

1. Lab manual

COURSE DESIGNERS

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<tr>
<td>1.</td>
<td>Mr.P.Senniappan</td>
<td>Assistant Professor</td>
<td>Pharmacognosy</td>
<td><a href="mailto:senniappan1979@gmail.com">senniappan1979@gmail.com</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mr.S.Raghu</td>
<td>Assistant Professor</td>
<td>Pharmacology</td>
<td><a href="mailto:sragusrinivasan@gmail.com">sragusrinivasan@gmail.com</a></td>
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**PREAMBLE**
Molecular Biology and Genetic engineering laboratory make undergraduate students to understand and develop basic molecular techniques and give training in the skills involved in rDNA Technology.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**

1. To describe the principle of nucleic acid isolation.
2. To discuss the principle of electrophoretic techniques for analyzing the biomolecules.
3. To demonstrate gene cloning and screening of recombinants.
4. To summarize the knowledge of hybridization of biomolecules.

**COURSE OUTCOMES**

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

- CO1. Exemplify the laboratory techniques used for the isolation of nucleic acids from various sources. Understand
- CO2. Describe core Nucleic acid techniques such as extraction, nucleic acid separations and elution. Understand
- CO3. Illustrate clearly about the gene amplification and methods for analysis of DNA, such as hybridization, restriction analysis and gene expressions. Apply
- CO4. Practice DNA Fingerprinting methods to analyze DNA samples. Apply
- CO5. Examine the Purification of biomolecules by electrophoresis. Analyze

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

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S- Strong; M-Medium; L-Low

**SYLLABUS**

1. Isolation of Genomic DNA
2. Isolation of Plasmid DNA.
3. Isolation of Mitochondrial DNA.
4. Detection of Plasmid DNA by Agarose gel electrophoresis
5. Electroelution of DNA from Agarose gel.
6. SDS Poly Acrylamide Gel Electrophoresis.
7. Restriction digestion of λ DNA.
8. Ligation of DNA.
11. DNA Fingerprinting using Restriction fragment length polymorphism (RFLP)
12. DNA Fingerprinting using Random Amplified Polymorphic DNA (RAPD)
13. Blue White Screening of Recombinants.
14. Blotting techniques – Southern, Western

**REFERENCE BOOKS:**


**COURSE DESIGNERS**

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<tr>
<td>1</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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<tr>
<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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</table>
PREAMBLE
This subject deals with various advanced analytical instrumental techniques for identification, Characterization and quantification of drugs. The course is designed to impart the knowledge in the field of Pharmaceutical analysis. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics are taught to enable the students to understand and apply the principles involved in the determination of different bulk drugs and their formulation. In addition to the theoretical aspects, the basic practical knowledge relevant to the analysis also imparted.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To make students familiar with the principles of modern analytical techniques and it’s application in pharmacy.
2. To familiarize students in use of modern techniques of analysis used in different areas / fields of pharmacy.
3. To give training in use of the technique & its applications in day to day practice.
4. To build on the basics learned at UG level & give latest advances in the area.
5. To give more stress on application-based knowledge than instrumentation based one.
6. To give hands on training on use of as many different instruments as possible.

COURSE OUTCOMES
After completion of course student is able to know

CO1. Recollecting Drugs, Chemicals and Excipients used in Pharma industry
Remember

CO2. Interpretations of the various spectroscopic data
Apply

CO3. Understanding the fundamental principles in analysis.
Understand

CO4. Applying theoretical knowledge and practical skills in using the instruments
Apply

CO5. Concept of modern analytical techniques, which is important for qualitative as well as quantitative analysis of drug substances and drug product.
Understand

CO6. The analysis of various drugs in single and combination dosage forms
Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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178
S- Strong; M-Medium; L-Low

**SYLLABUS**

1. Calibration glassware
2. Calibration of pH meter and pH measurement of various buffers
3. Calibration of UV Spectroscopy
4. Calibration of HPLC
5. Calibration of flourimetry
6. Acid Base Titrations (minimum of 2 experiments)
7. Complexometric Titrations (minimum of 2 experiments)
8. Separation and calculation of Rf values by using paper chromatography, TLC
9. Technique (2-3 experiments)
10. Experiment base on HPLC (Isocratic and gradient) Techniques – (2 experiments)
11. Determination of λ max of different drugs and preparation of calibration curve
12. Estimation of single drug (raw material/ formulations) by UV spectrophotometry. (minimum of 4 experiments)
13. Estimation of multicomponent formulation by UV- Spectrophotometer (minimum of 4 experiments)
14. Identification of different functional groups by IR (amino group, alcoholic group amide, ester, acid group etc).

**TEXT BOOKS:**

3. Spectroscopy by B.K.Sharma

**REFERENCE BOOKS:**

2. Fundamentals of analytical chemistry by Skoog
4. Instrumental methods of analysis by Willard, Merit, Dean, Settle.

**COURSE DESIGNERS**

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<tr>
<td>1</td>
<td>Mr.S.Alexandar</td>
<td>Assistant Professor</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:alexmpharm@gmail.com">alexmpharm@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.M.Kumar</td>
<td>Professor &amp; Head</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:kumarvmcp@yahoo.co.in">kumarvmcp@yahoo.co.in</a></td>
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</table>
PREAMBLE
The course provides the student with the basics of bioreactor technology. It specifically focuses on bioreactor performance and operation and on the kinetics related to microbial growth, product formation, function of enzymes and transfer phenomena.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Interpret the concept of design and procedures to evaluate the performance of the bioreactor in bioprocess.
2. To Perform enzyme immobilization in bioprocess industry.
3. To Demonstrate the media optimization based on the process.
4. To Outline the engineering principles of bioprocesses including characteristics of different microbial cells, enzymes, microbial kinetics, and design considerations.
5. To develop large scale production of a product in bioprocess industry.

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

CO1. Describe the fundamental concepts of bioprocessing; Understand the difference between bioprocesses and chemical processes. Understand
CO2. Illustrate bio catalysis in scaling up the commercial processes using bioreactors Apply
CO3. Demonstrate bioprocesses in a bacterium, fungi or yeast, and their energy metabolism and carbon sources through various parameter Apply
CO4. Develop a Bioprocess design and operation and select suitable the bioreactor for a product. Analyse
CO5. Evaluate, analyse and interpret data from bioprocesses. Evaluate

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S- Strong; M-Medium; L-Low

SYLLABUS
2. Medium optimization – Plackett Burman design, response surface methodology
3. Enzyme kinetics – MicheliisMenton parameter, effect of temperature and pH
4. Enzyme immobilization – Gel entrapment, Cross linking
5. Preparation of bioreactor, Utilities for bioreactor operation
6. Thermal death kinetics
7. Batch sterilization design
10. Estimation of KLa – sulphite oxidation method
11. Estimation of overall heat transfer coefficient

TEXT BOOKS
2. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications

REFERENCES

COURSE DESIGNERS

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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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</tbody>
</table>
PREAMBLE
The subject deals with different analytical methods of organic and inorganic compounds in pharmaceutical industries.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To outline the presence and limitations of impurities in the pharmaceutical substances
2. To explain different identification tests for various chemical compounds
3. To implement different preparation and standardization methods
4. To understand the principles of different assays and to inculcate the ability to apply this for quantitative analysis of various drugs
5. To understand the principles of conductometric and potentiometric titrations and finding the normality of a solution using these electro analytical methods
6. To outline the presence and limitations of impurities in the pharmaceutical substances

COURSE OUTCOMES
After completion of course student is able to know

CO1. Ability to test different impurities and their limits in drugs Remember
CO2. Understanding the principles in different identification tests Understand
CO3. Preparing and standardizing different reagents Apply
CO4. Understanding the principles of various titrations and applying them for quantitative analysis of drugs/compounds Apply
CO5. Estimating the normality by different electro-analytical methods Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

1. Limit tests for
   Chlorides and Sulphates, Iron, Heavy metals, Lead, Arsenic

2. Identification test
   Magnesium hydroxide, Ferrous sulphate, Sodium bicarbonate, Calcium gluconate, Copper sulphate

3. Preparation and standardization of
   Sodium hydroxide, Sulphuric acid, Sodium thiosulphate, Potassium permanganate, ceramic ammonium sulphate

4. Assay for the following compounds along with standardization of titrants
   a) Ammonium chloride by Acid base titration
   b) Ferrous sulphate by Cerimetry
   c) Copper sulphate by Iodometry
   d) Calcium gluconate by Complexometry
   e) Hydrogen peroxide by Permanganometry
   f) Sodium benzoate by non-aqueous titration
   g) Sodium Chloride by Precipitation titration

5. Test for purity
   a) Swelling power of bentonite
   b) Neutralizing capacity of aluminium hydroxide gel
   c) Determination of potassium iodate and iodine in potassium iodide

6. Determination of Normality by electro-analytical methods
   a) Conductometric titration of strong acid against strong base.
   b) Conductometric titration of strong acid and weak acid against strong base.
   c) Potentiometric titration of strong acid against strong base.

7. Preparation of inorganic pharmaceuticals
   Boric acid, Potash alum, Ferrous sulphate

REFERENCE BOOKS:
2. A.I.Vogel, Text Book of Quantitative Inorganic analysis.
4. M.L.Schroff, Inorganic Pharmaceutical chemistry
5. Bentley and Drivers, Text Book of Pharmaceutical chemistry
6. Anand and Chatwal, Inorganic Pharmaceutical chemistry

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<td>Assistant Professor</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:alexmpharm@gmail.com">alexmpharm@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Dr.M.Kumar</td>
<td>Professor &amp; Head</td>
<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:kumarvmcp@yahoo.co.in">kumarvmcp@yahoo.co.in</a></td>
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</table>
PREAMBLE
The main aim of the medicinal chemistry is to provide advances in the method of drug designing and chemical synthesis. It is a stimulating field which has the scientific principles applied for the research of new pharmaceuticals. Pharmacology is the introduction of basic concepts and investigation aspects of function and effects of drug. Combination of these course will distribute an effective knowledge about the synthesis, mechanism of transportation and target action of drug.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To recognize the correlation between pharmacology of a disease and its mitigation or cure.
2. To interpret the chemistry of drugs with respect to their pharmacological activity.
3. To implement the chemical synthesis and structural activity relationship of different class of drugs
4. To outline the mechanism pathways of different class of medicinal compounds
5. To construct the various diagnostic methods for the disease

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

CO1. Identify the synthetic outlines require for drugs synthesis
   Remember

CO2. Interpret various animal handling techniques and preparation of pharmaceutical solutions
   Understand

CO3. Illustrate the pharmacological effects in different in-vitro, in-situ, in-vivo, in-silico organ systems
   Apply

CO4. Evaluate the mode of drug administration and their effects
   Analyse

CO5. Test the antiparasitic, anticancer and anti-inflammatory properties of the drug
   Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
PART-I: Medicinal chemistry
1. Study on stereo-chemistry of some selected drugs with models and in-silico viewer
3. Synthesis of antimicrobial drugs and its analysis (Eg. Hexamethylenetetramine)
4. Synthesis of anticonvulsant drugs involving minimal steps (Eg. Phenytoin) and its analysis.
5. Synthesis of sulphonamide drugs (Eg. Suphacetamide) and its analysis
6. Synthesis of anthelmintic drugs and its analysis (Eg. Benzimidazoles)
7. Synthesis of antiseptic organic compounds (Eg. Iodoform) and its analysis

PART-II: Pharmacology Experiments

1. Evaluation of pyrogens by in vitro LAL test (Limulus amebocyte lysate) test
2. Bioassay experiments - study of effects of various drugs on isolated frogs tissues (heart, muscle etc.,) e.g Ach, adrenaline, effect of adrenergic and cholinergic blockers, effect of ions (through audiovisual demonstration)
3. Introduction to humane handling of animals for research (Eg. Mice, Rats, Jirds/Gerbils, rabbits)
4. Study of physiological salt solutions and laboratory appliances used in experimental pharmacology.
5. Routes of drug administration in animal models (through audiovisual demonstration)
6. Experiments to study analgesic/anti-inflammatory effects of drugs
7. Experiments to study local/general anaesthetic effects of drugs
8. Experiments to study antiparasitic drugs (in-vitro in-vivo methods using nematodes)
9. Experiments to study anticancer drugs by cytotoxic assay (MTT assay)

TEXT BOOKS

REFERENCE BOOKS

PART I
1. Wilson and Gisvold’s Text book of Organic, Medicinal and Pharmaceutical Chemistry,
4. Indian Pharmacopoeia

PART II
4. Pharmacological experiments on intact preparations by Churchill Livingstone.
5. Clinical pharmacology by Molmon and Morrelli.

COURSE DESIGNERS

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<td>Pharmaceutical Chemistry</td>
<td><a href="mailto:kumarvmcp@yahoo.co.in">kumarvmcp@yahoo.co.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mr. S. Raghu</td>
<td>Assistant Professor</td>
<td>Pharmacology</td>
<td><a href="mailto:sragusrinivasan@gmail.com">sragusrinivasan@gmail.com</a></td>
</tr>
</tbody>
</table>
PREAMBLE
This course provides the knowledge on the theory and problems involved in incorporating chemicals into stable dosage forms suitable for human medication. It also describes the basics of the appropriate handling, use of various dosage forms and illustrate important physical principles, and will develop basic manipulative skills.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To interpret the accurate and rapid measurements of material on a prescription balance
2. To express an appropriate dosage form for a given route of drug administration.
3. To outline the combination and formulation of raw materials into acceptable dosage forms.

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1. Recognize the formulation aspects of different dosage forms
CO2. Discuss different pharmaceutical calculation involved in formulation
CO3. Employ different types of dosage forms
CO4. Appraise the importance of good formulation for effectiveness
CO5. Evaluate various prepared dosage forms for standards.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

SYLLABUS
1. Preparation of solutions.
2. Preparation of syrups.
3. Preparation of lotions.
4. Preparation of liniments.
5. Preparation of ointments with different classes of bases.
6. Preparation of creams.
7. Preparation of pastes.
8. Preparation of suspensions.
11. Preparation of tablets from wet & dry granules.
REFERENCES:
1. Howard C. Ansel, Pharmaceutical Calculations. 15th edition,

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<tr>
<td>2</td>
<td>Dr.S.Anusuya</td>
<td>Associate Professor</td>
<td>Pharmaceutical Engineering</td>
<td><a href="mailto:dr.s.anusuya@vmkvec.edu.in">dr.s.anusuya@vmkvec.edu.in</a></td>
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</table>
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 learn chemical engineering principles and their practical applications in the areas of mass transfer, reaction engineering and particle mechanics.
2. To analyze and design chemical processes that span molecular to macroscopic scales.
3. To determine different coefficients and factors involved in fluid flow.
4. To construct the governing equations for designing and analyzing heat transfer equipment.

COURSE OUTCOMES
After completion of course student is able to know

CO1. Characterize particles and perform size analysis
CO2. Evaluate the constants for crushing
CO3. Design and operate filtration equipments
CO4. Analyze Solid liquid separation in industrial equipment based on settling, density and centrifugal force.
CO5. Calibrate flow meters
CO6. Determine minimum fluidization velocity in a fluidized bed

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. Pressure drop in pipes and packed columns.
6. Distillation in packed column.
7. Liquid – liquid equilibria in extraction.
8. Solid liquid extraction
9. Adsorption equilibrium.
10. Determination of Screen effectiveness.
11. Sedimentation.
12. Mechanical equivalent of heat – heat, work and the first law of thermodynamics.
13. Calorimetry – heat capacities, heat of formation, Hess’s law

TEXT BOOKS:

REFERENCE BOOKS:

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CATEGORY ‘C’

ELECTIVE COURSES

PROGRAMME SPECIFIC ELECTIVES

12-15 CREDITS

GENERAL
PREAMBLE
This course lead to the new era of medicine and health in which the food industry has become a research oriented sector. It plays a significant role in modifying and maintaining normal physiological functions of healthy human beings.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Discuss the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
2. To Describe the role of Nutraceuticals and functional food in health and disease.
3. To Implement the biochemical functions and physiological effects and their comprehensive in health optimization.
4. To Outline the industry and consumer roles involved in the growing field.
5. To Organize and appreciate The Commercial Aspects of Nutraceuticals.

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

CO1. Discuss about Nutraceuticals in different food sources
Understand

CO2. Illustrate about their significances in treating the infectious diseases.
Understand

CO3. Demonstrate about the adverse effects of antioxidants
Apply

CO4. Examine the mechanism of action of some important phytochemicals and zoochemicals as nutraceuticals and their role in health and diseases.
Analyse

CO5. Develop the compounds with pharmacological, toxicological properties and regulatory requirements.
Analyse

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S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits. Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

ROLE IN HEALTH AND DISEASE
The health benefit of - soy protein, spirulina, tea, olive oil, plant sterols, broccoli, omega3 fattyacid and eicosanoids. nutraceuticals and functional foods in gastrointestinal disorder, cancer, CVD, diabetic mellitus, HIV and dental disease; importance and function of probiotic, prebiotic and symbiotic and their applications, functional foods and immune competence; role and use inobesity and nervous system disorders.

ASSESSMENT OF ANTIOXIDANT ACTIVITY
In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different invitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimizing phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, carotenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals— stability, analytical and labelling issues.

SAFETY ISSUES
Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues- International and national

TEXT BOOKS:
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006

REFERENCES:
1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

COURSE DESIGNERS

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<tr>
<td>2</td>
<td>Mrs.G.Athi</td>
<td>Asst Prof</td>
<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 covers the chemical process industries and explains the synthesis, formulation and importance of fine chemicals, industrial manufacture, flow diagram, properties and uses of fine chemicals.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Discuss the basic fundamentals of fine chemicals and bulk drugs.
2. To Explain the basic concepts and principles in designing of equipment for various unit operations
3. To Implement the knowledge of various parameters involved in the formulation and development of various dosage forms
4. To Demonstrate about the plant design, production techniques and process chemistry involved in the drug industry.
5. To Categorize the concept of the pharmaceutical industrial manufacturing practices, quality attributes of pharmacy products

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

CO1. Describe the basic concept of fine chemicals and bulk drugs
Understand

CO2. Demonstrate on plant design, process development and chemical hazards in fine Chemical and bulk drug industry.
Understand

CO3. Employ kinetics, thermodynamics and plant construction materials for the production of bulk drugs and fine chemicals
Apply

CO4. Utilize various parameters involved in the formulation and development of various dosage forms
Apply

CO5. Infer the quality aspects and good manufacturing practices in pharmaceutical industry.
Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION OF FINE CHEMICALS AND BULK DRUGS
Characteristic features of fine chemicals manufacture, Concept of fine and Bulk drugs and their manufacture, Evolution of process, Process selection: process profile analysis, Factors influencing Process choice: cleaner and safer technologies, Research and development strategies in pharmaceutical industries, Basic drug formulation, Radiopharmaceuticals

UNIT PROCESSES

PRODUCTION PLANTS
Types of production plants-Dedicated, multipurpose and mixed plants, Equipments in multipurpose plants-Reactors, filters, centrifuges, driers, extractors and evaporators, Production cost- capital investment costs, operating costs, Designing of batch plants-production planning and scheduling, Principles of good manufacturing practices.

BASE CHEMICALS, DRUG INTERMEDIATES AND FINE CHEMICAL PRODUCTION

BULK DRUGS
Raw Materials, Production Techniques, Reaction Flow Sheet, Equipments, Utilities for the production of drugs below – Paracetamol, Aspirin, Ibuprofen, Diazepam, Darvon, Niacinamide, Chloramphenicol and Erythromycin, Antimicrobial agent

TEXT BOOKS:

REFERENCES:
1. Rawlins E.A, Bentleys Text Book of Pharmaceutics, A.I.T.B.S.Publisher& Distributors, Delhi, 1996.

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PREAMBLE
The evaluation of any organisations' health and safety programs is an integral part of any inspection. In order to assist in conducting a thorough evaluation there are four basic elements that every worksite should have in place to protect members of the organisation from occupational hazards. These four points are 1. Management commitment and employee involvement 2. Worksite analysis 3. Hazard prevention and control 4. Health and safety training. Effective implementation of the health and safety program must be focused during the evaluation. Evaluation includes analysis about comprehensiveness of program, safety rules specified, measures enforced when rules are not followed, status about personal protective equipment, members participation encouraged, etc.

PREREQUISITE
NIL

COURSE OBJECTIVES
1 To Define the concepts and methods of safety.
2 To Explain In detail about safety audit and its importance.
3 To Outline importance of investigation and reporting about accident.
4 To Distinguish between biological and ergonomical hazards.
5 To Assess about occupational health and toxicology in work environment.

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

CO1. Recall the concepts and methods of safety and its important in work environment. Remember
CO2. Describe in detail about the importance of safety and significance of safety audit. Understand
CO3. Estimate in detail about the consequence of accident and to prepare report on the accident. Analyse
CO4. Inspect and distinguish among biological hazards and psychological andphysiological hazards in working environment. Analyse
CO5. Estimate in detail about work related health and toxicology in working environment. Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
CONCEPTS AND TECHNIQUES

SAFETY AUDIT – INTRODUCTION
Components of safety audit, types of audit, audit methodology, non conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor.

ACCIDENT INVESTIGATION AND REPORTING

BIOLOGICAL AND ERGONOMICAL HAZARDS
Classification of Biohazardous agents – examples, bacterial agents, rickettsia and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program- animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders – carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries.

OCCUPATIONAL HEALTH AND TOXICITY
Concept and spectrum of health - functional units and activities of occupational health services, preemployment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems

TEXT BOOKS

REFERENCES
2. Relevant India Acts and Rules, Government of India.

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

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

| CO1 | Recall about infection, sample collection, transport and the data. | Remember |
| CO2 | Explain about the most appropriate infectious agent. | Understand |
| CO3 | Demonstrate the microorganism have an indispensable role in disease diagnosis | Apply |
| CO4 | Appraise the genomic knowledge. | Analyse |
| CO5 | Choose the tool for disease diagnosis. | Evaluate |
| CO6 | Plan diagnostics based on the bio-safety aspects | Create |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low
SYLLABUS
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 Publishers

REFERENCES:

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</table>
**PREAMBLE**
Polymers are materials of very high molecular weight that are found to have multifarious applications in our modern society. They usually consist of several structural units bound together by covalent bonds. Polymers are obtained through the chemical reaction of small molecular compounds called monomers. In order to form polymers, monomers either have reactive functional groups or double (or triple) bonds whose reaction provides the necessary linkages between repeat units. Polymeric materials usually have high strength, possess a glass transition temperature, exhibit rubber elasticity, and have high viscosity as melts and solutions. Polymers are used in synthesis of biomaterials which are used to treat patients.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**
1. To State the basic concepts of polymer.
2. To Explain the mechanism of polymerization.
3. To Discuss the mechanism of copolymerization.
4. To Compare the molecular weight polymer.
5. To Assess the reactions of polymers.

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

| CO1 | Recall the knowledge in the concepts of polymers, their Classifications and nomenclature. | Remember |
| CO2 | Discuss the mechanism and kinetics of free radical cationic and anionic polymerization. | Understand |
| CO3 | Recognise the mechanism and kinetics of copolymer free radical thesynthesis techniques for polymer. | Understand |
| CO4 | Estimate the molecular weight of the polymer and understand thetechniques used for determination. | Analyse |
| CO5 | Evaluate the degradation mechanism of polymers and chemical reaction of polymers. | Evaluate |

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**SYLLABUS**

**BASIC CONCEPTS OF POLYMER**

**POLYMERIZATION MECHANISM**

**COPOLYMERIZATION MECHANISM**

**POLYMER MOLECULAR WEIGHT**
Molecular weight- Molecular weight averages - Molecular weight distribution - Unidispersity, polydispersity. Degree of polymerization. Molecular weight determination - Basic concepts of end group analysis, colligative properties, osmametry, light scattering, and gel permeation chromatography - Viscosity of polymers solutions.

**REACTIONS OF POLYMERS**

**TEXT BOOKS:**


**REFERENCES**


**COURSE DESIGNERS**

<table>
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<th>S.No.</th>
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<tr>
<td>1</td>
<td>Mr.N.Jawahar</td>
<td>Assist prof</td>
<td>Biotechnology</td>
<td><a href="mailto:jawahar@vmkvec.edu.in">jawahar@vmkvec.edu.in</a></td>
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PREAMBLE
On completion of the course, students will gain knowledge on various issues related to Creativity, Innovation, Planning, Quality, Evaluation, Patents for the development of a new product. This course also helps to develop leadership qualities and creative thinking capability in Engineering Product Development.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Express creativity and problem-solving method
2. To implement innovative approach to issues.
3. To Execute their skills in project selection
5. To outline the design, testing & quality standards in developing a Pharmaceutical product.

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

- CO1. Explain the need, process and factors of creative thinking and innovation in new product development.
  - Understand

- CO2. Demonstrate the fundamentals of project selection and evaluation.
  - Apply

- CO3. Generalize the new product planning
  - Apply

- CO4. Develop a new product based on the requirement.
  - Analyze

- CO5. Appraise the new product development process.
  - Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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

INTRODUCTION
The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

PROJECT SELECTION AND EVALUATION
Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques)

NEW PRODUCT PLANNING
Design of prototype - testing - quality standards - marketing research - introducing new products

NEW PRODUCT DEVELOPMENT

MODEL PREPARATION & EVALUATION
Creative design - Model Preparation - Testing - Cost evaluation - Patent application

TEXT BOOKS:

REFERENCES:

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<tr>
<td>1.</td>
<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>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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</table>
### 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

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<tr>
<td>1</td>
<td>Define the basis of Bioinformatics in the biological field</td>
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<td>Explains the <em>in-silico</em> analysis of biological queries using mathematical and statistical techniques.</td>
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<td>3</td>
<td>Implement the Bioinformatics software and tools based on its applications</td>
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<td>4</td>
<td>Construct the phylogenetic tree based on the biological information and queries using bioinformatics tools.</td>
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<td>5</td>
<td>Develop bioinformatics tools in various fields like medicine, agriculture etc.,</td>
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### COURSE OUTCOMES

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

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<tr>
<td>CO1. Relate the basics of computer science and interdisciplinary subjects related to Bioinformatics</td>
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<td>CO2. Demonstrate the importance of biological databases and their significance in Biotechnology</td>
<td>Understand</td>
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<td>CO3. Operate the various tools and software which can be adopted in different fields of Biotechnology</td>
<td>Apply</td>
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<td>CO4. Measure the significance of evolutionary traits using Bioinformatics tools and software</td>
<td>Evaluate</td>
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<td>CO5. Validate the various bioinformatics tools in different fields</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 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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<tr>
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<td>Professor</td>
<td>Biotechnology</td>
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<tr>
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<td><a href="mailto:jawahar@vmkvec.edu.in">jawahar@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
This course will enable the students about the physical and chemical properties of formulated drug molecule and the effects produced by the drug to the biological system. It also helps to identify the movement of drug within the body.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Recognize the important parameters involved in drug administration and its principles in living systems.
2. To Demonstrate the various process of elimination of drug in the biological system.
3. To Outline the physico-chemical properties and the effect of drug.
4. To Distinguish the methods of administration and the action of the bioactive molecule.
5. To Assess the dosage with the movement of drug within the body.

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

CO1. Explain the various factors influencing the drug disposition, various pharmacokinetic parameters.

CO2. Design and interpret the bioavailability and bioequivalence of dosage forms.

CO3. Identify the factors affecting the rate of drug absorption.

CO4. Examine the activity of drug in varying modes of administration.

CO5. Estimate the parameters influencing the dosage and pharmacokinetics.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
DRUG ABSORPTION AND DISTRIBUTION

ELIMINATION

**BIOAVAILABILITY AND BIOEQUIVALENCENCE**
Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro - in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

**PHARMACOKINETICS**
Introduction to Pharmacokinetics, Pharmacokinetic models, One compartment open model- Intravenous Bolus Injection – Intravenous infusion - Extra vascular administrations. Determination of pharmacokinetics parameters and their significance - Absorption Rate Constant (ka), Elimination Rate Constant (K) & Elimination Hal-life (t½), AUC, C max and tmax. Apparent Volume of Distribution (Vd) & Renal Clearance (Q).

**MULTIPLE DOSAGE REGIMENS AND NONLINEAR PHARMACOKINETICS**

**TEXT BOOKS**

**REFERENCES**

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<tr>
<td>1</td>
<td>Dr.S.Anusuya</td>
<td>Associate professor</td>
<td>Pharmaceutical Engineering</td>
<td><a href="mailto:dr.s.anusuya@vmkvec.edu.in">dr.s.anusuya@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Mrs.G.Arthi</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td>arthi@@vmkvec.edu.in</td>
</tr>
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</table>
PREAMBLE
To acquire knowledge on the preparation and standardization of herbal preparation and also give exposure to various methods of extraction, preparation, and purification of herbal extracts.

PREREQUISITE
NIL

COURSE OBJECTIVES

1. To List the plant kingdom, classification & source of crude drugs, taxonomy of medicinal plants and medicinal plant families.
2. To Discuss the Phyto-chemical screening techniques and able to identify the Phyto-constituents of plants.
3. To Implement fundamental principles on cultivation, collection processing and evaluation of medicinal plants.
4. To Categorise the biomedicine, pharmacology, herbal preparations, history, clinical assessment, safety, and plant identification and wild crafting.
5. To Generate integrate knowledge of raw materials, formulation, and herbal pharmacy for product development purposes.

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

| CO1. Recall extraction techniques used for herbal drugs. | Remember |
| CO2. Recognize the history and present status of herbs in cosmetics and the techniques of incorporation of herbal extracts | Understand |
| CO3. Demonstrate the ability to critically analyse herbal research and contribute to the current body of herbal literature | Apply |
| CO4. Develop basic techniques for standardization of extracts and their screening methods. | Analyse |
| CO5. Evaluate ontraditional knowledge to bridge the gap of evidenced based data to make rational decisions in developing safe and effective herbal products. | Evaluate |

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INDIAN SYSTEMS OF MEDICINE**


**In-vitro CULTURE OF MEDICINAL PLANTS**

Requirements – Setting up a tissue culture lab – Basic laboratory procedure – Processing of plant tissue culture – Growth profile – Growth measurement – Plant tissue culture methods – Callus culture – Types of tissue culture – Tissue culture of medicinal plants – Applications of plant tissue culture.

**EXTRACTION, ISOLATION AND ANALYSIS OF PHYTO PHARMACEUTICALS**

Traditional and modern extraction technique : Successive solvent extraction - Super critical fluid extraction – Steam distillation – Head space techniques – Sepbox – General extraction process : Carbohydrates – Proteins – Alkaloids – Glycosides. Isolation and purification of phytochemicals: Quinine from cinchona, vincristine from Vinca, sennoside from senna, Euginol from clove oil.

**SCREENING METHODS FOR HERBAL DRUGS**


**STANDARDIZATION AND CONSERVATION OF HERBAL DRUGS**


**TEXT BOOKS :**

3. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. of India, New Delhi, 2001.

**REFERENCES :**


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<td><a href="mailto:ramapriya@vmkvec.edu.in">ramapriya@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
The students will be able to understand the main classes of natural products and their distinctive pharmacological effects. It further gives a proper understanding about the extraction, isolation, chemical tests and medicinal properties of various alkaloids and vitamins. This would enable the students to learn the chemistry, synthesis and structural elucidation of natural products.

PREREQUISITE
17CHBS10 - FUNDAMENTALS OF CHEMISTRY

COURSE OBJECTIVES

1. To Explain the chemistry and medicinal importance of natural compounds as lead molecules for new drug discovery.
2. To Discuss about the classification, isolation, purification and structural characterization of simple constituents from natural source.
3. To Interpret general method of structural elucidation of compounds of natural origin.
4. To Outline the medicinal and pharmaceutical uses of vitamins and flavonoids.
5. To Develop theoretical knowledge of students in the chemistry of natural products and to explore this knowledge for practical applications.

COURSE OUTCOMES

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

CO1. Explain the chemistry of carbohydrates, heterocyclic compounds, amino acids, proteins and nucleic acids. Understand

CO2. Describe the fundamentals of terpenoids, alkaloids, vitamins, lipids and steroids. Understand

CO3. Summarize the biosynthesis, biological activity and stereochemistry of pharmaceutical products. Apply

CO4. Classify natural products based on their structure, occurrence and biosynthetic pathways. Apply

CO5. Categorise terpenes and steroids based on their types and structure. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
STRUCTURAL CHARACTERISATION OF NATURAL PRODUCTS
Chemical and spectral approaches to simple molecules of natural origin. Identification of natural products by chromatographic and spectroscopic methods and application of I.R., N.M.R. and
Mass Spectroscopy in the structural elucidation of organic compounds.

**GLYCOSIDES**
Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, medicinal properties and structural elucidation of sennosides, cardenolides and bufadienolides, digoxin and digitoxin, scillaren A and ouabain.

**ALKALOIDS**
Classification, chemistry, general methods of extraction, isolation, chemical tests, and structural elucidation of pyridine alkaloids, tropane alkaloids, quinoline and iso-quinoline alkaloids, phenanthrene alkaloids, indole alkaloids, imidazole alkaloids, alkaloid amines, glycoalkaloids and Xanthene alkaloids.

**FLAVONOIDS**
Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, medicinal properties and structural elucidation of flavonoids, quercetin.

**TERPENES**
Terpenes—special isoprene rule, mono, diterpenes, triterpenoids and sesquiterpenes and structural elucidation of citral, carvone, menthol and camphor; Steroids – cholesterol, colour reactions of steroids, stigmasterol, β-sitosterol, bile acids, ergosterol, diosgenin, solasodine and hecogenin.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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PREAMBLE
The aim of this course is to provide knowledge about basics, manufacturing and regulatory affairs associated with bio generics and biosimilars. It also offers knowledge in characterization of bio generics and biosimilars using analytical methods and presumptions of therapeuticequivalence along with case studies.

PREREQUISITE
NIL

COURSE OBJECTIVES
1 To define bio generics and biosimilars along with their regulatory affairs.
2 To explain about production and current market value of bio generics and biosimilars
3 To perform characterization of biosimilars using various analytical methods.
4 To outline various immune reactions associated with biopharmaceuticals.
5 To check stability of biosimilars

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

CO1. To recognize the difference between bio generics and biosimilars Remember
CO2. To describe regulations in production and marketing of bio generics and biosimilars Understand
CO3. To illustrate various methods of characterization of biosimilars. Apply
CO4. To examine adverse immune reactions of biopharmaceuticals. Analyse
CO5. To validate the stability of follow on biologics Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

BIOGENERICS INTRODUCTION
Definition: Generics and its advantages; Biogenetics and Biosimilars; Why biosimilars are not (bio) generics? The advent of Biosimilars; The role of patents in the drug industry; Proteinbasedbiopharmaceuticals; Manufacturing processes; Global market; International Non-
proprietary names (INN) nomenclature system biosimilars regulation (EU position, US pathways, Government initiatives)

BIOSIMILARS AND ITS SCENARIO
Approved follow-on proteins/Biosimilars; Characteristics of high selling peptides and proteins; Products with expired patents; Challenging originator’s patents; Target products for FOB (follow-on-biologicals)/Biosimilars development peptides; Recombinant non-glycosylated proteins; Recombinant glycosylated proteins; Industries dealing with bio generics and its market value; World scenario; Indian scenario

CHARACTERIZATION OF BIOSIMILARS
Approaches to the characterization of biosimilars; Problems in characterizing biologics (Types of biologic, Peptides, Non-glycosylated proteins, Glycosylated proteins, Monoclonal antibodies); Equivalence issues; Post-translational modifications; Effect of micro heterogeneity; Pharmacokinetics; Pharmacodynamics; and Clinical efficacy; Analytical methods for the characterization of biosimilars (Chromatography, Protein sequencing, Mass spectrometry, UV absorption, Circular dichroism, X-ray techniques, Nuclear magnetic resonance, Electrophoresis, Western blotting, Bioassays, ELISA, Immunoprecipitation and other procedures)

IMMUNOGENECITY OF BIOPHARMACEUTICALS
Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing to immunogenicity (product-related factors, host-related factors); Consequence of immunogenicity to biopharmaceuticals; Measurement of immunogenicity

STABILITY ANALYSIS AND CASE STUDIES OF BIOLOGICS

TEXT BOOKS

REFERENCES

COURSE DESIGNERS

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PREAMBLE
Pharmacogenomics involves the study of the relationship between an individual’s genetic makeup and his or her response to a drug. Pharmacogenetics, a component of pharmacogenomics, is the study of the relationship between a single gene and its response to a drug.

PREREQUISITE
17BTEC03 PRINCIPLES OF BIOINFORMATICS

COURSE OBJECTIVES
1. Discuss about the basic knowledge about pharmacogenomics and drug design using genomic applications for drug action and toxicity.
2. Perform how individualization of drug therapy can be achieved based on a person’s genetic makeup while reducing unwanted drug effects.
3. Outline the Pharmacogenomics studies on how genetic differences between individuals can affect responses to various drugs.
4. Formulate on medicine skills acquired by the student and his action in different pathologies
5. Develop acquire knowledge about the influence of genetic alterations on the therapeutic effect and adverse reactions of the drugs, from a perspective of individualized therapy.

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

CO1. Recognize the effect of genetic differences between individuals in the outcome of drug therapy and in drug efficacy and toxicity.  
Remember

CO2. Describe the role of single nucleotide polymorphism as a biomarker for the prediction of risk, therapeutic response and prognosis of malignancies.
Understand

CO3. Utilize and manage the new genomics based tools as they become available as well as make best treatment choices.
Understand

CO4. Examine the applications of genomics principles in drug action and toxicology
Analyze

CO5. Validation of case studies related to pharmacogenomics
Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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SYLLABUS

PHARMACOGENOMICS AND PERSONALIZED MEDICINE
Pharmacogenetics- Roots of pharmacogenomics and it is not just pharmacogenomics, Genetic drug response profiles, the effect of drugs on Gene expression, pharmacogenomics in drug discovery and drug development. Concept of individualized drug therapy, Drivers and the promise of personalized medicine, Strategies for application of pharmacogenomics to customize therapy, Barriers.

HUMAN GENOME
Expressed sequence Tags (EST) and computational biology, Microbial genomics, computational analysis of whole genomes, computational genome analysis, Genomic differences that affect the outcome of host pathogen interactions, Protein coding genes, repeat elements, genome duplication, analysis of proteome, DNA variation, Biological complexity. Single nucleotide polymorphisms (SNP’s) in Pharmacogenomics - approaches, number and types of SNPs, Study design for analysis, Analytical issues, Development of markers.

ASSOCIATION STUDIES IN PHARMACOGENOMICS
Viability and Adverse drug reaction in drug response, Multiple inherited genetic factors influence the outcome of drug treatments, Association studies in pharmacogenomics, Strategies for pharmacogenomics Association studies, Benefits of Pharmacogenomics in Drug R & D.

GENOMICS APPLICATIONS FOR DRUG ACTION, TOXICITY AND DESIGN
Platform technologies and Pharmaceutical process, its applications to the pharmaceutical industry, Understanding biology and diseases, Target identification and validation, Drug candidate identification and optimization, safety and toxicology studies. The need of protein structure information, protein structure and variation in drug targets—the scale of problem, Mutation of drug targets leading to change in the ligand binding pocket.

PHARMACOGENOMICS – CASE STUDIES

TEXT BOOKS:

REFERENCES:
2005.

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**PREAMBLE**

This course helps the students in getting exposed to methods of extraction, preparation, and purification of herbal extracts. To acquire knowledge on the preparation and standardization of herbal preparation. They will expose to various research institutions of natural products.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

1. To Recognize the functional targets and chemistry of active groups.
2. To Summarize the knowledge about the linkers and cleavable reagent systems.
3. To Illustrate about the bioconjugate Reagents.
4. To Outline about enzyme, nucleic acid modification and its application in bioconjugation.
5. To Design and develop the synthetic polymers.

**COURSE OUTCOMES**

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

| CO1. Recall active groups of various chemical reactions and targets of the functional groups. | Remember |
| CO2. Discuss about joining of two molecules to form a hybrid conjugate with the help of linkers. | Understand |
| CO3. Demonstrate the antibody modification and conjugation. | Apply |
| CO4. Develop the immunotoxin conjugation techniques. | Analyse |
| CO5. Asses the novel methods for the mild and site-specific derivatization of proteins, DNA, RNA, and carbohydrate developed for application such as ligand discovery, disease diagnosis and high-throughput screening. | Evaluate |

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

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

FUNCTIONAL TARGETS

CHEMISTRY OF ACIVE GROUPS
Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photo reactive chemical reactions.

BIOCONJUGATE REAGENTS

ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION
Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleicacids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

BIOCONJUGATE APLICATIONS

TEXT BOOKS AND REFERENCES :

COURSE DESIGNERS

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PREAMBLE
This course provides exploratory awareness to play a role of entry level design engineer in engineering environment. It contributes an impression towards new product development methodologies and marketing of a product.

PREREQUISITE
NIL

COURSE OBJECTIVES

1  To Explain the global trends and development methodologies of various types of products and services.
2  To Implement product management plan for a new product based on the type of the product and development methodology.
3  To Outline the requirements for new product development and convert them into design specification.
4  To Organize system modelling and their interfaces and arrive at the optimum systems specification and characteristics.
5  To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the End of Life support activities for engineering customer.

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

CO1. Discuss on how to formulate a product and analyse a problem in an industrial process.  Understand
CO2. Operate on specific problems independently or as part of a team.  Apply
CO3. Appraise the Product Development process in industries.  Analyse
CO4. Develop system modelling for a particular process.  Analyse
CO5. Validate a project from start to finish.  Evaluate

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S- Strong; M-Medium; L-Low

SYLLABUS
FUNDAMENTALS OF PRODUCT DEVELOPMENT
and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management.

**REQUIREMENTS AND SYSTEM DESIGN**


**DESIGN AND TESTING**


**SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT**


**BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY**


**TEXT BOOKS**

1. Book specially prepared by NASSCOM as per the MoU.

**REFERENCES:**


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PREAMBLE
This course enriches the students with drug safety related to the collection, detection, assessment, monitoring and prevention of adverse effects with pharmaceutical products. It focuses on adverse drug reaction on the biological system and plays a key role in industrial development and testing of new medications.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To compare the development and global scenario of pharmacovigilance and their establishment in an organization.
2. To develop the skills of classifying drugs, diseases and adverse drug reactions.
3. To compare the methods of pharmacovigilance.
4. To distinguish the statistical methods for the evaluation of drug molecule.
5. To check and formulate the regulatory aspects of bioactive molecule.

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

CO1. Explain adverse drug reaction in proper format. Understand
CO2. Illustrate the data generated during pharmacovigilance study Apply
CO3. Correlate the regulatory requirements of different countries. Analyse
CO4. Predict the phases of clinical trials and pharmacovigilance Analyse
CO5. Evaluate the pharmacokinetics and pharmacodynamics of the drug Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO PHARMACOVIGILANCE
SOURCES OF DATA
Anatomical, therapeutic and chemical classification of drugs - International classification of diseases - Daily defined doses - International Nonproprietary Names for drugs - Drug dictionaries and coding in pharmacovigilance - WHO adverse reaction terminologies - MedDRA and Standardised MedDRA queries - WHO drug dictionary - Eudravigilance medicinal product dictionary Information resources in pharmacovigilance - Basic drug information resources - Specialised resources for ADRs Establishing pharmacovigilance programme - Pre-clinical studies-Human volunteer studies - Clinical trials - Post-marketing surveillance - Systematic reviews and meta-analysis

PHARMACOVIGILANCE METHODS

STATISTICAL METHODS FOR EVALUATING MEDICATION SAFETY DATA
Safety data generation - Pre clinical phase - Clinical phase - Post approval phase. ICH Guidelines for Pharmacovigilance - Organization and objectives of ICH - Expeditied reporting - Individual case safety reports - Periodic safety update reports - Post approval expedited reporting – Pharmacovigilance planning - Good clinical practice in pharmacovigilance studies.

PHARMACOGENOMICS OF ADVERSE DRUG REACTIONS
Drug safety evaluation in special population - Pediatrics - Pregnancy and lactation – Geriatrics. CIOMS - CIOMS Working Groups - CIOMS Form. CDSCO (India) and Pharmacovigilance - D&C Act and Schedule Y - Differences in Indian and global pharmacovigilance requirements.

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS
<table>
<thead>
<tr>
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<tr>
<td>1.</td>
<td>R.Subashini</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:subashini@vmkvec.edu.in">subashini@vmkvec.edu.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>
</tr>
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</table>
# Preamble
Chemical reaction engineering course covers the basic concepts of types of reactions, variable affecting the rate of reaction, predicting the rate equations for different types of reactions and also to study about different reactor systems, deriving the performance equations and predicting the rate equations in chemical reaction engineering system.

# Prerequisite
NIL

## Course Objectives

<table>
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<tr>
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<th>To Define chemical reactors and reaction systems.</th>
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<td>To Discuss about biodiversity in marine environment and their resources</td>
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<td>To Outline the conversion and yield for chemical reactions.</td>
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<td>To Develop the appropriate selection technique for intended problem.</td>
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<td>To Learn conceptual design of separation processes and design of equipment involved.</td>
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</table>

## Course Outcomes

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

| CO1 | Recall the algorithm that allows the student to solve chemical engineering through logic rather than memorization. | Remember |
| CO2 | Describe the steps in a catalytic mechanism and how those about deriving a rate law, mechanism and rate limiting step that are consistent with experimental data. | Understand |
| CO3 | Calculate the reaction order and specific reaction rate from experimental data. | Analyse |
| CO4 | Assess the separation system for multi component mixtures. | Evaluate |
| CO5 | Design separation system for the effective solution of intended problem. | Create |

## Mapping with Programme Outcomes and Programme Specific Outcomes

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

CHEMICAL KINETICS
Introduction to chemical kinetics, rate equation, concentration dependent term of a rate equation: single and multiple reaction. Elementary and non- elementary reactions. Molecularity and order, theories of reaction rate and temperature dependency.

IDEAL REACTORS

SINGLE AND MULTIPLE REACTIONS
Design for single reaction: size comparison of single reactors, multiple reactor system, pfrin series/ parallel, equal size mfrin series, Recycle reactor, introduction to multiple reactions, qualitative analysis of product distribution.

NON-IDEAL REACTORS
Residence time distribution as a factor performance, residence time function and relationship between them in reactor, basic models for non ideal reactor like dispersion model, tanks in series model.

HETEROGENEOUS REACTIONS

TEXTBOOKS

REFERENCES

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>R. Ramapriya</td>
<td>Assistant professor</td>
<td>Biotechnology</td>
<td><a href="mailto:ramapriya@vmkvec.edu.in">ramapriya@vmkvec.edu.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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</table>
PREAMBLE
Regulatory Toxicology encompasses the collection, processing and evaluation of epidemiological as well as experimental toxicology data to permit toxicologically based decisions directed towards the protection of health against harmful effects of chemical substances. Furthermore, Regulatory Toxicology supports the development of standard protocols and new testing methods in order to continuously improve the scientific basis for decision-making processes.

PREREQUISITE
NIL

COURSE OBJECTIVES
1 To Recognize the international, and national regulatory processes concerning chemical risk assessment in humans, biomaterials and medical devices.
2 To Discuss about how to develop awareness of how toxicology is applied in real world regulatory situations.
3 To Explain the complexities and competing interests that are part of the regulatory decision making.
4 To Classify the methods used to evaluate risk and produce safety guidelines, including laboratory testing, epidemiological studies.
5 To Outline the product regulations and produce alternative strategies for challenges in the future.

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

CO1. Define the general principles in toxicological risk assessment, both ecotoxicology and human toxicology. Remember

CO2. Explain the safety testing strategies, legal regulations and alternative options in toxicology. Understand

CO3. Tell the basic principles of current, cutting-edge knowledge in environmental and human health toxicology. Understand

CO4. Demonstrate an understanding of legal, regulatory, and ethical considerations relating to toxicology within the broader societal context. Apply

CO5. Categorise different testing strategies and alternatives for societal needs. Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION
Regression aspects and strategy in medical device and biomaterials safety evaluation. Regulations affecting cosmetic and over-the-counter drug products.

REGULATIONS GOVERNING TOXICOLOGY
Aim and mission, working areas, regulatory process in toxicology, quality assurance in regulatory toxicology, toxicological risk assessment.

TOXICOLOGY AND DRUG PRODUCT REGULATIONS
Introduction, aspects of the IND / NDA process, toxicology and other issues, pediatric drug products, drug combinations, excipients and reformulations, conclusions.

TOXICOGENEOMICS, GENETIC TOXICOLOGY AND REGULATORY POLICY
Microarrays in toxicology, proteomics and metabolomics, case examples, toxicogenomics in regulatory environment. Initiation of genetic toxicology testing, EPA GENE TOX (Phase I and II), ICPEMC, NTP, Genetic toxicology technologies and concepts. Influence of genetic toxicology research on regulatory policy, future role in safety testing strategies.

ALTERNATIVES IN TOXICOLOGY
Introduction, Societal need for information about toxic chemicals, evolution of alternatives in toxicology, human science and animal welfare, assessing alternatives, challenges and future.

TEXT BOOKS:
2. Ian Dewhurst, Regulatory Toxicology in the European Union, Royal Society of Chemistry, 2017

REFERENCES:

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<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:catch.blessy@gmail.com">catch.blessy@gmail.com</a></td>
</tr>
<tr>
<td>2</td>
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</table>
PREAMBLE
Transport Phenomena deals with the balanced knowledge of movement of different physical quantities such as momentum, energy and mass in any chemical or mechanical process with the fundamental equations and laws of various types of transport.

PREREQUISITE
17PECC16- CHEMICAL ENGINEERING THERMODYNAMICS

COURSE OBJECTIVES
1. To understand different types of fluids, flow characteristics and mathematical models applied to actual situations.
2. To understand the mechanisms of fluids in motion under different conditions.
3. To employ heat, mass and momentum transfer analysis.
4. To apply the concepts in analyzing industrial problems with appropriate assumptions and boundary conditions.
5. To analyze various transport processes with understanding of solution approximation methods and their limitations.

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

CO1. Identify overall balances for conservation of momentum, energy and mass. Understand
CO2. Review the analogies among momentum, heat and mass transfer. Understand
CO3. Employ the appropriate equations of change to obtain preferred summaries for velocity, temperature and concentration. Apply
CO4. Utilize information obtained from balance equations solutions to obtain Engineering quantities of interest. Apply
CO5. Predict and correlate appropriate macroscopic balances for conservation of momentum, energy and mass. Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
TRANSPORT PHENOMENA BY MOLECULAR MOTION
Importance of Transport Phenomena; Analogous nature of Transfer Process; Conservation Laws;
Continuous Concept, Field, Reference Frames, Substantial Derivative and Boundary Conditions; Methods of Analysis; Differential, Integral and Experimental Methods.

**ONE DIMENSIONAL MOMENTUM TRANSPORT**
Shell Momentum balances, boundary conditions, velocity profiles, average velocity, momentum flux at the surfaces, of Newtonian and non-Newtonian for flow of a falling film, flow through circular tube, slits, flow through an Annulus, Adjacent flow of two Immiscible fluids. Equations of Change (Isothermal), equation of continuity, equation of motion, equation of energy (isothermal) their applications in fluid flow problems.

**ONE DIMENSIONAL HEAT TRANSPORT**

**ONE DIMENSIONAL MASS TRANSPORT**
Equation of Molecular Mass Transport, Molecular Diffusion in Gases, Equimolar Counter Diffusion, Diffusion of A through Non-Diffusing B, Mass and Molar Transport by Convection: Mass and Molar Concentrations, Mass Average and Molar Average Velocity, Molecular Mass and Molar Fluxes, Convective Mass and Molar Fluxes.

**TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW**
Turbulence phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface. Analogies between transport processes.

**TEXT BOOKS:**

**REFERENCES:**

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<tr>
<td>1</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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</table>
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 modeling
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 modeling concepts Remember
CO2. Classify molecular mechanisms behind energy minimization problems Understand
CO3. Illustrate the models to study the molecular dynamics Understand
CO4. Compare molecular dynamics with drug designing concepts Apply
CO5. Design new techniques for the discovery of drugs Apply

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

COURSE DESIGNERS

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<td>1</td>
<td>G. Karthiga Devi</td>
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<td>Biotechnology</td>
<td><a href="mailto:karthigadevi@avit.ac.in">karthigadevi@avit.ac.in</a></td>
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PREAMBLE
This course enables the students to know about the various issues related to Creativity, Innovation and Product development.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To describe the various factors and technology involve for the product development.
2. To implement the selection criteria and technology for formation of new product.
3. To outline the aspects of IPR.
4. To develop the model or prototype to produce a new product.
5. To produce the prototype to obtain the patent for the developed product.

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

CO1. Explain the process of technical innovation
Understand

CO2. Practice the various aspects of Creativity and Innovation for New Product Development
Apply

CO3. Develop the objectives of Product Selection and Evaluation
Analyse

CO4. Test and evaluate the new technology developed to obtain the yield.
Evaluate

CO5. Formulate a new product in the laboratory
Create

SYLLABUS

INTRODUCTION
The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

PROJECT SELECTION AND EVALUATION
Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques)
NEW PRODUCT DEVELOPMENT

NEW PRODUCT PLANNING
Design of prototype - testing - quality standards - marketing research - introducing new products.

LABORATORY
Creative design - Model Preparation - Testing - cost evaluation - Patent application

TEXT BOOKS:

REFERENCES:

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<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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PREAMBLE
To familiarize the students with concepts of process dynamics and control leading to control system design. This course also introduces dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To Discuss the basic principles of instrumentation.
2. To Demonstrate the process mechanism involved in open loop system.
3. To Perform feedback control process.
4. To Construct frequency response for both feedback and non-feedback system.
5. To Outline advanced control system over different process in pharmaceutical industry.

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

CO1. Describe the basic principles & importance of process control in industrial process plants.
Understand

CO2. Generalize the required instrumentation and final elements to ensure that well-tuned control is achieved.
Apply

CO3. Illustrate the importance and application of good instrumentation for the efficient design of process control loops for process engineering plants
Apply

CO4. Demonstrate stability, frequency response, and other characteristics relevant to process control.
Apply

CO5. Develop design and operate process control systems to industrial process.
Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
INSTRUMENTATION
Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

OPEN LOOP SYSTEMS
Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and
their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

**CLOSED LOOP SYSTEMS**
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.

**FREQUENCY RESPONSE**
Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, bode diagram, stability criterion, tuning of controller settings.

**ADVANCED CONTROL SYSTEMS**
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

**TEXT BOOKS**

**REFERENCES**

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PREAMBLE
This course will upgrade the knowledge of students in health-care which determines the safety and effectiveness of medications, devices, diagnostic products and treatments for human beings. It can used for the prevention, treatment of a diseases and their documents. Those documents responsible for the evaluation of quality of the research to which is to be submitted for the regulatory bodies.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To explain the drug development process and their validation through statistical analysis.
2. To implement the regulations of various regulatory bodies.
3. To organize the data obtained from the clinical research.
4. To differentiate the advance modules applied in the field of research.
5. To assess the various modules of regulations and safety.

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

- CO1. Demonstrate the steps for developing a drug through various process. Understand
- CO2. Operate the research based on the requirements of regulatory bodies. Apply
- CO3. Examine the data from the research modules. Analyse
- CO4. Develop and test the process involved in the research laboratories Analyse
- CO5. Validate the regulations and safety module of the research Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
DRUG DEVELOPMENT MODULE
Drug development overview, Phases of clinical research, Pre-clinical (Non-clinical) development. Discovery and selection of compounds, Toxicology, Pharmacology Clinical Development programmes; Basics of clinical research statistics

CLINICAL RESEARCH MODULE
Understanding the evolving role of the Clinical Trial Administrator (CTA)/Clinical Project Assistant (CPA); Good Clinical Practice (GCP) and international harmonization. Case Report Forms; Protocols;
Informed Consent; Ethics Committees / Institutional Boards. Role of the Sponsor including the Clinical Research Associate/Monitor.

**CLINICAL RESEARCH MODULE II**
Clinical trial set up; Trial Master Files and study filling. Data Management. Review of the EU Clinical Trial Directive; How to prepare for Regulatory Inspections or Audit; Fraud in clinical Research

**ADVANCED CLINICAL RESEARCH MODULE**
Project Management; How to develop a proactive approach to supporting clinical trials Building a Successful working relationship with your manager(s) and the rest of the clinical research team; Team effectiveness: working as an effective clinical research team; Working in partnership with CROs. Legal aspects of clinical research; Laboratory tests Communication skills, Cross-cultural communication with other offices and departments internationally. Time management and optimizing your effectiveness

**REGULATORY AFFAIRS AND SAFETY MODULE**
Regulatory requirements for international clinical research - Regulatory requirements for Biotechnology products, medical devices and veterinary products; Health economics; Safety reporting; Responding to drug safety alerts Post marketing surveillance

**TEXT BOOKS:**

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PREAMBLE
To introduce the concepts, underlie the mechanical and biological properties of synthetic and natural biomaterials and tissue engineering principles and scaffolding techniques. The main purpose of the subject is to understand about biomaterials, stem cell therapy and molecular therapy and how it can be applied to clinical use.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To state the concepts of stress and strain, and the parameters used to characterize the physical bulk and surface properties of materials.
2. To discuss the composition, structure and mechanical properties of the main classes of biomaterials—metals, ceramics, polymers, composites and the body tissues.
3. To generalize scaffold characteristics and design methodologies, cell seeding, biofunctionalization, bioreactors.
4. To detect the biomaterials are used to fabricate devices for clinical use.
5. To design a biomaterial system considering the main issues of biocompatibility including toxicity.

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

CO1. Recall the biological requirement for designed tissue engineering systems. Remember

CO2. Describe and the developments of biomaterials forregenerative therapies and tissue engineering. Understand

CO3. Initiate the role of tissue engineering and stem cell therapy in organogenesis. Apply

CO4. Develop the fabricate multicomponent biomaterials using advanced manufacturing technologies including 3D printing. Analyse

CO5. Design scaffolds for growing biological materials. Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

INTRODUCTION
Introduction to tissue engineering: Basic definition-current scope - cell numbers and growth rates measurement of cell characteristics –morphology- number-viability- motility and functions. Measurement of tissue characteristics appearance- cellular component-ECM component physical properties.

TISSUE ARCHITECTURE
Tissue types and Tissue components, Tissue repair and Engineering -wound healing and sequence of events - Cell-Matrix- Cell-Cell Interactions - telomeres and Self renewal- Control of cell migration in tissue engineering.

BIOMATERIALS
Biomaterials: Properties of biomaterials-Surface, bulk, mechanical and biological- Scaffolds &tissue engineering - Types of biomaterials-biological and synthetic materials- Biopolymers-Applications – Modifications - Role of Nanotechnology.

BASIC BIOLOGY OF STEM CELLS

CLINICAL APPLICATIONS

TEXT BOOKS:

REFERENCES:

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<td><a href="mailto:ramapriya@vmkvec.edu.in">ramapriya@vmkvec.edu.in</a></td>
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</table>
This course covers the principles of Pharmacoeconomics, introduce the fundamental topics and define the terminology used in pharmacoeconomic research. Also, it aims to impart knowledge on basic concepts, assumptions, terminology, and methods associated with Pharmacoeconomics and health related outcomes, and when should be appropriate Pharmacoeconomic model should be applied for a health care regimen.

**PREREQUISITE**
NIL

**COURSE OBJECTIVES**

1. To Define the fundamental principles of Pharmacoeconomics.
2. To Describe the Pharmacoeconomic decision analysis methods and its applications.
3. To Explain the current Pharmacoeconomic methods and issues.
4. To Classify the steps for conducting a pharmacoeconomic analysis.
5. To Outline relevant cost and consequences associated with pharmacy products and services.

**COURSE OUTCOMES**

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<td>Define the principles and tools of pharmacoeconomics.</td>
<td>Identify the role of economic evaluation in decision making and health policy.</td>
<td>Employ economic evaluation and health technology assessment to genetic tests.</td>
<td>Demonstrate a simple decision analysis model.</td>
<td>Compare and contrast the different methods for economic evaluation in healthcare.</td>
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<td>Remember</td>
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<td>Apply</td>
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**SYLLABUS**

**INTRODUCTION TO PHARMACOECONOMICS**
Definition, history of Pharmacoeconomics, Need of Pharmacoeconomic studies in healthcare system. Cost categorization and resources for cost estimation: Direct costs. Indirect costs. Intangible costs.

**OUTCOMES AND MEASUREMENTS OF PHARMACOECONOMICS**
Types of outcomes: Clinical outcome, Economic outcomes, Humanistic outcomes; Quality Adjusted Life Years, Disability Adjusted Life Years Incremental Cost Effective Ratio, Average Cost Effective
Ratio. Person Time, Willingness To Pay, Time Trade Off and Discounting.

PHARMACOECONOMIC EVALUATIONS
Definition, Steps involved, Applications, Advantages and disadvantages of the following Pharmacoeconomic models: Cost Minimization Analysis (CMA), Cost Benefit Analysis (CBA), Cost Effective Analysis (CEA) and Cost Utility Analysis (CUA).

HEALTH RELATED QUALITY OF LIFE: HEALTH STATUS MEASURES
Definitions, HRQoL measures versus utility measures, domains of health status, assessing HRQoL instruments, Pharmacoeconomics and HRQoL measures, preference based classification system, patient – reported outcomes.

APPLICATIONS
Decision Analysis and Decision tree, Sensitivity analysis, Markov Modeling, Software used in Pharmacoeconomic analysis, Applications of Pharmacoeconomics.

TEXT BOOKS:

REFERENCES:
2. Graker and Dennis, Pharmacoeconomics And Outcomes, Amer College of Clinical Pharmacy, 2003

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CATEGORY ‘C’

SPECIALIZATION

ELECTIVES

PROGRAMME SPECIFIC

12-15 CREDITS
**17PESE01 NOVEL DRUG DELIVERY SYSTEMS**

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**PREAMBLE**

This course is designed to impart basic knowledge on the area of novel drug delivery systems, controlled drug delivery systems including oral, transdermal, targeted delivery such as Liposomes and Nanoparticles.

**PREREQUISITE** - NIL

**COURSE OBJECTIVES**

1. To discuss various approaches for development of novel drug delivery systems
2. To demonstrate the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation
3. To compare the design, evaluation and application related to oral, parenteral, transdermal, implants, bioadhesives and targeted drug delivery systems

**COURSE OUTCOMES**

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

| CO1. Recognise the importance of delivery systems. | Remember |
| CO2. Understand the concepts and applications of Novel Drug Delivery Systems. | Understand |
| CO3. Apply knowledge in developing various novel formulations as per requirements. | Apply |
| CO4. Analyze various evaluation parameters for oral, parenteral, topical etc. drug delivery systems. | Analyze |
| CO5. Formulate industrially feasible, cost effective strategy for development of new dosage forms | Create |

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**POLYMERS**

Polymers used in controlled drug delivery modules – Classification – Advantages and disadvantages of polymers – Polymerization mechanisms – Degradation mechanism – Polymer characterization.

**SUSTAINED RELEASE DRUG DELIVERY SYSTEMS**

Physicochemical and biological properties of drugs – Oral dosage forms – Diffusion systems –
Systems utilizing dissolution – Osmotic systems – Ion exchange resins.

**TARGETED DRUG DELIVERY SYSTEM**

**MODULE FOR GASTRO INTESTINAL TRACTS**
Approaches to increase gastric retention – Factors affecting gastric retention – Formulation development of floating drug delivery system – Expanding systems – Systems for colon specific delivery – Targeting approaches to colon.

**MUCOADHESIVE DRUG DELIVERY SYSTEMS**

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

<table>
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<th>S.No.</th>
<th>Name of the Faculty</th>
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<tr>
<td>1</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>
</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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</table>
PREAMBLE
The course gives extensive training in Cosmetic Formulation, Manufacturing, Analysis and Marketing. Industrial training and Educational tour are two essential components of the course. The focus of this scientific, hard-back, reference manual is to provide Formulators, Chemists, Heads of Research and Development at the forefront of Product Development, with concise comprehensive information on the latest raw materials, laboratory procedures, and testing methods available worldwide. Job opportunists available in the areas of Production/Marketing/R and D in cosmetic companies.

PREREQUISITE
NIL

COURSE OBJECTIVES
1 To Define the significance of cosmetic.
2 To Compose and Discuss about emulsions.
3 To Demonstrate the preparation of suspensions.
4 To Outline the interfacial phenomena in cosmetic.
5 To Produce drugs in solubilized form.

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

CO1. Recall the significance of cosmetic. Remember
CO2. Summarize the importance of emulsions. Understand
CO3. Illustrate the preparation of suspensions. Apply
CO4. Examine the interfacial phenomena in cosmetic. Analyse
CO5. Evaluate the formation of solubilized drugs. Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

COSMETICS

EMULSIONS
Electrical theories of stabilization of emulsions, assessment and prediction of emulsion shelf life, equations, involved in emulsion stability stress conditions and physical parameters employed to evaluate emulsion stability, prevention of interaction between preservatives and emulsion ingredients like surface active agents hydrophilic polymers, suspended particles packaging materials etc. Predication of preservative’s efficiency. Production, equipments, Industrial processing and large-scale manufacture.

SUSPENSIONS
Floculated and non-floculated suspensions, selection of wetting suspending and dispensing agents, preparation and stability. equipments, industrial processing and large-scale manufacturing.

INTERFACIAL PHENOMENA
Liquid – Liquid interface: Insoluble monolayers, surface pressure, surface potential, surface rheology and their measurement, structure and state of monolayers, mixed monolayers, Macromolecular films, Biological membranes, Liquid-solid interface, detailed study of wetting, detergency and water repellency.

SOLUBLIZATION
Surface Active agents, Micelle formation, factors affecting micelle formation and physical methods of investigation of micellar solutions. Theory and mechanism of solubilization.

TEXT BOOKS

REFERENCES

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<tr>
<td>1.</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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<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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</table>
PREAMBLE
This course provides a basic understanding of the validation process as required by the Food and Drug Administration of the United States for drugs manufactured in the United States and all imported drugs. The main purpose of the subject is to understand about validation and how it can be applied to industry and thus to improve the quality of the products. The subject covers the complete information about validation, types, methodology and application.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To define calibration, qualification and validation.
2. To discuss the validation of sterilization, lyophilisation and solid dosages forms.
3. To demonstrate the process of pharmaceutical packaging and quality control.
4. To outline the analytical methods for estimation of drugs.
5. To validation of equipment’s employed in the manufacture of pharmaceuticals.

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

CO1. List the regulatory basics for process validation and outline the prospective validation. Remember

CO2. Explain the GMP regulation regarding the utilities Pharmaceutical manufacturing. understand

CO3. Illustrate the importance of impurity and the procedure for determination of expirydate. Apply

CO4. Examine the process of validation and quality assurance. Analyse

CO5. Assess the environmental impact of an industrial process. Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
DRUGS AND COSMETICS ACT AND GMP FOR API
and labelling–Storage Distribution.

**IMPURITIES IN DRUG SUBSTANCES AND DRUG PRODUCTS**
Definition of impurities–Validation and impurity issue related to manufacturing – Processing of drug substances – Enantiomers as impurities – Polymorphs as unwanted components.

**CLEANING PROCEDURE IN API MANUFACTURING FACILITIES**
Regulatory requirements–Multiple vs dedicated equipment– Unique nature of API–Multiple level approach to cleaning–Nature of contaminants–Selection of a worst case–Cleaning techniques – Sampling – Analytical methods – Limits and acceptance criteria, documentation.

**STABILITY TESTING**
Reasons for stability testing–Modes of degradation –Shelf lives and expiration dates– Possible strategies to improve shelf lives–Stability testing of new drug substances and products (Q1A)– Photostability testing of new substances and products(Q1B)–Validation on analytical Procedures(Q2A).

**PROCESS VALIDATION**
Process validation as a quality assurance tool-General QA tools, purpose of process validation, Qualification activities, Process validation activities. Prospective process validation-O rganization, documentation, product development, development of manufacturing capability, full scale production development, defining experimental programs, experimental design and analysis.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<tr>
<td>1</td>
<td>R.Ramapriya</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:ramapriya@vmkvec.edu.in">ramapriya@vmkvec.edu.in</a></td>
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PREAMBLE
The pharmaceutical process design is a systematic approach to development that begins with predefined objectives and emphasizes product and process understanding and process control, based on sound science and quality risk management. It is emerging to enhance the assurance of safe, effective drug supply to the consumer, and also offers promise to significantly improve manufacturing quality performance.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To recognize meaningful product quality specifications that are based on clinical performance.
2. To discuss on process capability and product variability.
3. To summarize how to reduce defects by enhancing product and process design, understanding, and control.
4. To implement new technologies in product development and manufacturing efficiencies.
5. To outline root cause analysis and postapproval change management.

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

CO1. Recognize the opportunities and constraints of the drug development process.  
CO2. Describe a process for manufacturing a desired product or parallel products.  
CO3. Identify a variety of processing alternatives for manufacturing a desired product.  
CO4. Operate different techniques for complex process simulation.  
CO5. Validate process design by taking regulatory requirements into consideration.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS
EVOLUTION OF PROCESS DESIGN AND MANAGEMENT

FIVE PROCESS ELEMENTS
Man: The Mind of the Process, Machine: The Voice of the Process, Method: The Techniques of

**EFFECTIVE PHARMACEUTICAL PROCESS DESIGN AND MANAGEMENT**

**KEY ELEMENTS OF QUALITY BY DESIGN**
Target product profile, Target product quality profile, Design and development of product, Design of experiments - Comparative experiments, Screening experiments, Response surface Modeling, Regression Modeling; Common experimental designs, Risk assessments.

**PROCESS ANALYTICAL TECHNOLOGY**
Introduction, Process analytical technology tools; Multivariate tools for design, data acquisition, and analysis, Process analyzers, Process control tools, Continuous improvement and knowledge management tools, Critical quality attributes, Control strategy, Product lifecycle management and continual improvement, Change management system.

**TEXT BOOKS:**

**REFERENCES:**

**COURSE DESIGNERS**

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<tr>
<td>1.</td>
<td>J. Blessy Juliet</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:catch.blessy@gmail.com">catch.blessy@gmail.com</a></td>
</tr>
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</table>
“Quality by Design” (QbD) gaining much attention among pharmaceutical industries for maintaining quality. It serves as a bridge between industry and drug regulatory authorities to move towards a scientific, risk based, holistic and proactive approach for development of pharmaceutical product. It mainly covers designing and developing formulations and manufacturing processes to ensure predefined product quality.

PREREQUISITE
NIL

COURSE OBJECTIVES

1. Summarize the principles of the QbD approach in pharmaceutical development and manufacturing
2. Demonstrate basic knowledge of risk management, Design of Experiments (DoE) and Process Analytical Technology (PAT)
3. Demonstrate basic knowledge of how the QbD approach can be applied in design space and further in the regulatory framework
4. Categorize on basic risk analysis and experiment with design techniques using practical case studies
5. Plan and implement a basic DoE approach, Suggest a QbD approach for constructing a design space

COURSE OUTCOMES

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

CO1. Describe the origins and need for QbD for pharmaceutical products, and the objectives for current QbD practices

CO2. Illustrate the overall logic and flow of the QbD development process, including the use and application of the various tools applied.

CO3. Development and use of Quality Target Product Profiles (QTPPs), and definition and verification of Critical Quality Attributes (CQAs), Critical Material Attributes (CMAs) and Critical Process Parameters (CPPs)

CO4. Validate facets of statistical design of experiments (DOEs), e.g., screening designs, response surfaces and optimization, transfer functions

CO5. Design Space and its application: process control, lifecycle management, understanding design space limits “edges”. Development and optimization of process control strategies, including real-time release testing.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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**SYLLABUS**

**INTRODUCTION TO QUALITY BY DESIGN**
Science and Risk Based Approaches, QbD Terminology, QbD Framework, QbD Application and Benefits, Regulatory aspects, Overview of ICH, Start QRM Process, Risk Assessment, Risk Control, Risk Review, Risk Management Tools, Practical Examples of Use for QbD, Pre-work, Scoring Meeting, FMECA Tool, Risk Score, Detectability Score.

**DEVELOPMENT AND MANUFACTURE OF DRUG PRODUCT**
Applying QbD to Pharmaceutical Drug Product Development, Product Design Intent and the Target Product Profile (TPP), The Quality Target Product Profile (QTPP), Identifying the Critical Quality Attributes (CQAs), Product Design and Identifying the Critical Material Attributes (CMAs), Process Design and Identifying the Critical Process Parameters (CPPs), Product and Process Optimisation

**DESIGN OF EXPERIMENTS**

**MULTIVARIATE DATA ANALYSIS (MVDA)**
Principal Component Analysis (PCA), PCA Case Study: Raw Material Characterization using Particle Size Distribution Curves, Dataset Description, Fitting a PCA Model to the Training Set Batches, Classification of the Test Set Batches, Added Value from DoE to Select Spanning Batches.

**ANALYTICAL METHOD DESIGN**
Comparison of the Traditional Approach and the Enhanced QbD Approach, Details of the Enhanced QbD Approach, Defining Method Requirements, Designing and Developing the Method, Understanding the Impact of Method Parameters on Performance, Defining the Method Control Strategy and Validating the Method, Monitoring Routine Method Performance for Continual Improvement

**TEXT BOOKS**

**REFERENCES**:

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<tr>
<td>1</td>
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<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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### QUALITY ASSURANCE

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#### PREAMBLE

This course imparts knowledge on various legal regulations and governing bodies involved in the trade and practice of pharmaceutical and biopharmaceutical industries. It also enriches beginners in the practice of GMP, biosafety and ethical guidelines.

#### PREREQUISITE

NIL

#### COURSE OBJECTIVES

1. To Interpret various pharmacopeia and drug regulatory aspects.
2. To Perform regulatory aspects in pharmaceutical manufacturing.
3. To Execute the process of patenting.
4. To Outline the quality guidelines for pharmaceutical products.
5. To check the accuracy of the instrument.

#### COURSE OUTCOMES

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

- **CO1.** Describe drug regulatory affairs in India and at International level. 
  - Understand
- **CO2.** Illustrate pharmaceutical industry manufacturing practices and regulatory aspects of the products.
  - Apply
- **CO3.** Initiate the process of patenting.
  - Apply
- **CO4.** Develop the quality guidelines followed for pharmaceutical products and few of the aspects involved in document preparation for pharmaceutical product registration.
  - Analyse
- **CO5.** Validate the accuracy and efficiency of the instrument
  - Evaluate

#### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

#### SYLLABUS

**PHARMACOPOEIA AND INTRODUCTION TO DRUGS & COSMETICS ACT**

- Descriptions & Monographs; Standards & Specifications; Testing of Drugs; Various Countries Pharmacopoeias; Indian, British, U.S, European, Japan. Definitions, Forms, Licenses; Schedules, New Schedule M, Schedule Y.

**REGULATORY ASPECTS**

- Pharmaceuticals: Bulk drug manufacture; Personnel, Buildings and Facilities, Process Equipment, Documentation and Records, Materials Management, Production and In-Process Controls, Packaging and Identification Labelling of API’s and Intermediates, Storage and distribution, –Biotechnology
derived products; Principles, Personnel, Premises and equipment, Animal quarters and care, production, labelling, Lot processing records and distribution records, quality assurance and quality control.

INTELLECTUAL PROPERTY RIGHTS AND ETHICAL ISSUES IN PATENTINGLIFE FORMS
What are patents, know-how, copyright, trademark, service mark, design, Conditions for patentability; Indian Patent Act; Opposition and Infringements of patents; Case study on patenting indigenous products (e.g. Neem, turmeric), DNA, Microbes, Transgenic Plants and Animals Industrial property, TRIPS, WTO, treaties, Budapest Convention. Application process for a patent and the post application process.

cGMPS & REGULATORY RECORDS-SITE MASTER FILE, DRUG MASTER FILE, DRUG DOSSIERS
cGMP concepts – Development, Manufacturing Record, Analytical & Process Validation, Equipment & utility Qualification and Calibration, Personnel procedures; Regulatory bodies & requirements - Indian FDA, WHO GMP; U.S. FDA, U.K. MCA, Australian TGA, Japanese PMDA. Drug dossier contents - CTD (CMC section) & data.

CALIBRATION AND VALIDATION IN PHARMACEUTICAL INDUSTRY
Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation. Warehousing: Good warehousing practice, materials management

TEXT BOOKS

REFERENCES
5. Indian Pharmacopeia, 2014.

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PREAMBLE
This course is designed to promote high quality research advancing the understanding of pharmaceutics at the molecular level while providing a forum for research among the fields of physical and pharmaceutical chemistry, biochemistry, molecular and cell biology and materials science focused on drug delivery.

PREREQUISITE- NIL

COURSE OBJECTIVES
1 To recognize various approaches for development of novel drug delivery systems
2 To discuss the criteria for selection of drugs and polymers for novel drug delivery
3 To outline the formulation and evaluation of novel drug delivery systems.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to
CO1. Underline the mechanism of drug actions at cellular and molecular level. Remember
CO2. Choose various approaches for development of novel drug delivery systems. Understand
CO3. Generalize the criteria for selection of drugs and polymers for the development of NTDS. Apply
CO4. Appraise the different formulation techniques for novel drug delivery. Analyze
CO5. Examine the formulation and evaluation of novel drug delivery systems. Analyze

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S- Strong; M-Medium; L-Low

SYLLABUS
TARGETED DRUG DELIVERY SYSTEMS
Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery.

TARGETING METHODS

MICRO CAPSULES / MICRO SPHERES
Types, preparation and evaluation, Monoclonal Antibodies; preparation and application,
preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.

**PULMONARY DRUG DELIVERY SYSTEMS**
Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.

**NUCLEIC ACID BASED THERAPEUTIC DELIVERY SYSTEM**

**TEXT BOOKS**

**REFERENCES**
1. Schreier H., Drug Targeting Technology Physical, Chemical and Biological Methods, Marcel Dekker, New York.

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PREAMBLE
Advanced industrial pharmacy includes manufacturing, development, marketing and distribution of drug products including quality assurance of these activities. This course relates to different functions in pharmaceutical industry and having contact areas with engineering and economics. Industrial pharmacy which involves developing the professional roles of pharmacists. Disease-state management, Clinical interventions, recommendation to change and/or add a drug to a patient's pharmacotherapy, dosage adjustments, Professional development, Pharmaceutical care, Extemporaneous pharmaceutical compounding, Patient care, Drug abuse prevention, Incompatibility, Drug discovery and evaluation, Community Pharmacy etc.,

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To define the components of drug to be developed by Pre-formulation studies.
2. To prepare report of materials require to produce specific drug.
3. To demonstrate production of drug and perform Scale-up process.
4. To outline formulations of pharmaceutical products.
5. Design and develop Production planning and control system.

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1. Record the components needed to produce various drugs. Remember
CO2. Summarize the materials require to produce specific drug. Understand
CO3. Employ knowledge to perform Scale-up operations. Apply
CO4. Develop know how on product formulations in pharmaceuticals. Analyse
CO5. Appraise design of Production planning and control system. Evaluate

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S- Strong; M-Medium; L-Low

SYLLABUS
PREFORMULATION STUDIES

INVENTORY AND MATERIAL MANAGEMENT
Costs in inventory, inventory categories - special considerations, selective inventory control, reorder quantity methods and EOQ, inventory models, safety stock - stock out, lead time - reorder time methods. Materials - quality and quantity, value analysis, purchasing - centralized and decentralized, stores management.
PILOT PLANT SCALE UP TECHNIQUES
significance, pilot study of some important dosage forms such as tablets, capsules and liquid orals, discussion on important parameters such as formula, equipments, product uniformity and stability, raw material process and physical layouts, personnel requirements and reporting responsibilities.

EXCIPIENTS IN PHARMACEUTICAL FORMULATIONS
Introduction to excipients and their importance in pharmaceutical industry; requirement of excipients, classification and properties of excipients, specialized type of excipients used in tablets such as directly compressible excipients and super-disintegrants; surfactants and hydrocolloids in disperse systems, taste masking excipients, colors, flavours, sweetening agents, gel and film forming agents, solubilizers etc. and their quality control.

PRODUCTION PLANNING & CONTROL AND DOCUMENTATION
Production scheduling, forecasting, vendor development, capacity assessment (plant, machines, human resources), production management, production organization, objectives and policies. Productivity, management and cost controls. Entrepreneurship and project management: Creativity, innovation entrepreneurship & project management.

TEXT BOOKS

REFERENCES

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<tr>
<td>1.</td>
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<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
Novel Drug Delivery Systems practical course trains the students on skills of designing and preparation of various novel drug delivery systems. This course also deals with the evaluation of controlled drug delivery systems.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To describe the various novel drug delivery systems and their preparations.
2. To compare the study of drug release through various biological membranes.
3. To summarize knowledge on filing of various regulatory agencies.

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

CO1. Demonstrate the skills on advanced techniques adopted in preparation and evaluation of various novel drug delivery systems. Understand

CO2. Review the product development and filing to various regulatory agencies. Understand

CO3. Illustrate the study of drug permeation through various biological membranes. Apply

CO4. Examine various novel drug delivery systems. Analyze

CO5. Evaluate nanomaterials, microspheres, liposomes and other controlled release systems for standards. Evaluate

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S- Strong; M-Medium; L-Low

SYLLABUS
1. Formulation and evaluation of egg albumin microspheres by single emulsion technique
2. Formulation and evaluation of microspheres by emulsion solvent evaporation method
3. Formulation and evaluation of microcapsules through coacervation phase separation by solvent evaporation method
4. Formulation and evaluation of solid dispersion by fusion method
5. Formulation and evaluation of solid dispersion by melting point solvent technique
6. Preparation and evaluation of magnetic microsphere
7. Formulation and evaluation of transdermal films
8. Formulation and evaluation of sustained release matrix tablets
9. Comparison of in vitro release studies of marketed sustained release tablets
10. In vitro release studies of marketed enteric coated tablets
11. Demonstration of various techniques like fluidized bed processing, spray drying, freeze drying etc

REFERENCES:

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PREAMBLE
A cosmetic for a consumer means a substance for improving appearance superficially. A cosmetic for a consumer means a substance for improving appearance superficially. Cosmetic technology laboratory gives an extensive training in cosmetic formulation, manufacture, analysis and application of cosmetics. This course gives complete knowledge about everything related to cosmetics.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To define the Preparation of various types of Emulsions.
2. To explain the formulation of suspensions
3. To demonstrate physical and chemical properties of ingredients used in Cosmetics
4. Outline the importance of suspensions.
5. To develop various type of cosmetic without side effects.

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

CO1. Recall the knowledge of Preparation of various types of Emulsions. Remember
CO2. Describe the formulation of suspensions and its significance Understand
CO3. Illustrate the role of additives in cosmetic products. Apply
CO4. Develop novel techniques to improve performance of suspensions. Analyze
CO5. Design and develop new combinations of components to formulate effective cosmetic products. Create

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S- Strong; M-Medium; L-Low

SYLLABUS
Develop and formulate the following cosmetic products
1. Various types of Emulsions
2. Suspension
3. Talcum powder & compact powders
4. Lipsticks
5. Shampoos
6. Colorants
7. Tooth paste & powder
8. Nail lacquers
9. Aerosol
10. Shaving cream
11. Aftershave lotions
12. Soaps

TEXT BOOKS

REFERENCES

COURSE DESIGNERS

<table>
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<tr>
<td>1.</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>
</tr>
<tr>
<td>2.</td>
<td>Ms.C.Vanathi</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:vanathi@vmkvec.edu.in">vanathi@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
The main purpose of the subject is to understand about validation and how it can be applied to industry and thus to improve the quality of the products.

PREREQUISITE – NIL

COURSE OBJECTIVES
1. To Explain the importance of calibration to be performed for the instruments.
2. To Describe the various validation aspects that have to be carried out in the industry.
3. To Outline the quality control tests for various drugs.
4. To Categorise the basic arrangements for process estimation of drugs.
5. To Develop knowledge on how drugs are estimated using different equipments.

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

CO1. Describe the concepts of calibration, qualification and validation. Understand
CO2. Demonstrate the estimation of drugs by Spectrophotometry, fluorimetry and flame photometry. Understand
CO3. Test the stability and effect of pH on the solubility of drug. Analyse
CO4. Develop quality control tests for the estimation of drugs. Analyse
CO5. Validate pre formulation studies for tablets and parenterals. Evaluate

SYLLABUS
1. Analysis of Pharmacopoeial compounds in bulk and their formulations (tablet/ capsules/semisolids) by UV Vis spectrophotometer.
2. Simultaneous estimation of multi-drug component containing formulations by UV Spectrophotometry.
3. Estimation of riboflavin/quinine sulphate by fluorimetry.
4. Estimation of sodium/potassium by flame photometry.
5. Case studies on
   a) Total Quality Management
   b) Six Sigma
   c) Change Management/ Change control. Deviations
   d) Out of Specifications (OOS)
   e) Out of Trend (OOT)
   f) Corrective & Preventive Actions (CAPA)
   g) Deviations
7. Estimation of process capability.
8. In process and finished product quality control tests for tablets, capsules, parenterals and semisolid dosage forms.
11. To carry out pre formulation study for tablets, parenterals.
12. To study the effect of pH on the solubility of drugs.

REFERENCE
   1. Lab manual

COURSE DESIGNERS

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<td>1.</td>
<td>J.Blessy Juliet</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:catch.blessy@gmail.com">catch.blessy@gmail.com</a></td>
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CATEGORY ‘C’

OPEN ELECTIVE COURSES

6 - 9 CREDITS
17CSCC02 | OBJECT ORIENTED PROGRAMMING | Category | L | T | P | Credit
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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 implement the concepts of object oriented programming.
2. To learn the syntax and semantics of C++ programming language.
3. To design C++ classes for code reuse, Constructors and member functions.
4. To learn how inheritance and virtual function implement dynamic binding with polymorphism.
5. To learn and implement the concepts of Templates and Exception handling.

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. Apply

CO2. Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism. Apply

CO3. Construct object-oriented programs for a given application by using constructors. Apply

CO4. Develop object-oriented applications that can handle exceptions. Apply

CO5. Construct object-oriented applications for a given scenario to persist data using files and object-serialization. Apply

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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<tbody>
<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.B.Sundaramurthy</td>
<td>Associate Professor</td>
<td>CSE</td>
<td><a href="mailto:sundaramurthy@vmkvec.edu.in">sundaramurthy@vmkvec.edu.in</a></td>
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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
Operating Systems Concepts

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. Apply the concepts of operating system to an evolution of operating systems and identify the features specific to operating systems.

CO2. Apply 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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<td>Dr. Nitisha Aggarwal</td>
<td>Associate Professor</td>
<td>CSE</td>
<td><a href="mailto:nitishaaggarwal@avit.ac.in">nitishaaggarwal@avit.ac.in</a></td>
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<tr>
<td>2</td>
<td>Dr.S.SenthilKumar</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:senthikumars@vmkvec.edu.in">senthikumars@vmkvec.edu.in</a></td>
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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
Basic programming Knowledge

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
Object oriented programming concepts – objects – classes – methods and messages – abstraction and

ARRAYS, STRINGS & OBJECTS

EVENTS & GRAPHICS PROGRAMMING

SWING & GENERIC PROGRAMMING

THREADS & SOCKET PROGRAMMING

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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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 understand the 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

CO2: Able to apply cloud computing concepts in real time

CO3: Able to develop cloud computing projects

CO4: Able to apply cloud services

CO5: Able to collaborate cloud services with other applications

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

UNIT - I   INTRODUCTION

UNIT - II   DEVELOPING CLOUD SERVICES

UNIT - III   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.

UNIT - IV   USING CLOUD SERVICES

UNIT - V   COLLABORATING ONLINE

TEXT BOOKS

REFERENCES

COURSE DESIGNERS
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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>
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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

CO1: Able to Understand basics in cyber security

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

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

UNIT - I INTRODUCTION
Network and security concepts – basic cryptography – Symmetric encryption – Public key Encryption –
Principles.

UNIT - II ATTACKER TECHNIQUES
Antiforensics – Tunneling techniques – Fraud Techniques - Threat Infrastructure.

UNIT - III EXPLOITATION
Techniques to gain a foot hold – Misdirection, Reconnaissance, and disruption methods.

UNIT - IV MALICIOUS CODE
Self Replication Malicious code – Evading Detection and Elevating privileges – Stealing Information and
Exploitation.

UNIT - V DEFENSE AND ANALYSIS TECHNIQUES
Memory Forensics – Honeypots – Malicious code naming – Automated malicious code analysis systems –
Intrusion detection systems – Defense special file investigation tools.

TEXT BOOKS
Francis Group, 2011.

REFERENCES

COURSE DESIGNERS

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</tbody>
</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  Analysis

CO3: To understand the UNIX system structure, system calls  Remember

CO4: To understand UNIX segmentation, scheduling, paging  Understand

**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>R.Kamatchi Priya</td>
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<tr>
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<td><a href="mailto:Amirthalingam@vmkvec.edu.in">Amirthalingam@vmkvec.edu.in</a></td>
</tr>
</tbody>
</table>
PREAMBLE
To understand and learn the scripting languages with design of web applications, and maintenance and evaluation of web design management.

PREREQUISITE
Web Technology

COURSE OBJECTIVES
1. To learn the concepts of Web design patterns and page design
2. To understand and learn the scripting languages with design of web applications
3. To learn the maintenance and evaluation of web design management

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

CO1: To familiarize decision support systems and their characteristics Understand
CO2: To study about Intelligent DSS and applications of DSS Apply
CO3: To learn the technologies related to decision support systems Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

283
SYLLABUS

SITE ORGANIZATION AND NAVIGATION

ELEMENTS OF PAGEdesign

SCRIPTING LANGUAGES AND ANIMATION USING FLASH

PRE-PRODUCTION MANAGEMENT

PRODUCTION, MAINTENANCE AND EVALUATION

TEXT BOOKS

REFERENCES

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<tr>
<td>2</td>
<td>Dr.M.Nithya</td>
<td>Professor</td>
<td>CSE</td>
<td><a href="mailto:Nithya@vmkvec.edu.in">Nithya@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
The purpose of this course is to introduce Python, a remarkably powerful dynamic programming language to write code for different operating systems along with application domain. Python has evolved on more popular and powerful open source programming tool.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To provide basic knowledge on Python programming concepts.
2. To introduce different methods in list, string, tuple, dictionary and sets.
3. To compute different programs using python control statements.
4. To learn about different functions in python.
5. To compute the exception handling functions, file concepts and CSV and JSON.

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

CO1. Learn python statements, comments and indentation, tokens, input and output methods using various example programs.
    Remember and Understand

CO2. Learn the different methods involved in List, String, Tuples and Dictionary.
    Apply

CO3. Design solutions for complex programs using decision making and looping statements.
    Understand and Apply.

CO4. Develop the function programs with all the concepts like lambda, decorators and generators.
    Understand, Apply and analyze.

CO5. Compute the exception handling programs, file concept programs and understand the concepts of CSV and JSON.
    Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

UNIT-1 INTRODUCTION
Introduction to python-Advantages of python programming-Tokens-Variables-Input/output methods-Data types-Operators

UNIT-2 DATA STRUCTURES
Strings-Lists-Tuples-Dictionaries-Sets

UNIT-3 CONTROL STATEMENTS
Flow Control-Selection control Structure-if-if-else-if-elif-else-Nested if iterative control structures-while loop, for loop and range.
UNIT-4 FUNCTIONS
Declaration-Types of Arguments-Fixed arguments, variable arguments, keyword arguments and keyword variable arguments-Recursions-Anonymous functions: lambda- Decorators and Generators.

UNIT-5 EXCEPTION HANDLING
Exception Handling-Regular Expression-Calendars and clock files:File input/output operations-Dictionary operations-Reading and writing in structured files:CSV and JSON.

TEXT BOOKS:
3. “Dive Into Python” by Mark Pilgrim

REFERENCES:

COURSE DESIGNERS

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<tr>
<td>2</td>
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<td>Computer science and engineering</td>
<td><a href="mailto:srividhya@avit.ac.in">srividhya@avit.ac.in</a></td>
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<tr>
<td>3</td>
<td>Mrs.T.Geetha</td>
<td>Assistant Professor</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 fundamentals of web applications and its modeling
Understand

CO2. To understand and learn the scripting languages with design of web applications.
Understand

CO3. To understand the networking concept internet protocols, network routing
Understand

CO4. Analyze the process of mobile communication and network technologies
Analyze

CO5. Build simple interactive applications, database applications and multimedia applications.
Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

Fundamentals of Computer architecture-introduction-organization of a small computer
Central Processing Unit - Execution cycle – Instruction categories – measure of CPU performance
Memory – Input/output devices - BUS-addressing modes. System Software – Assemblers – Loaders
and linkers – Compilers and interpreters
Operating system – introduction – memory management schemes Process management Scheduling
– threads.
Problem solving with algorithms- Programming styles – Coding Standards and Best practices -
Introduction to C -Programming Testing and Debugging. Code reviews -System Development
Methodologies – Software development Models -User interface Design – introduction – The process
– Elements of UI design & reports.

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

Objected oriented concepts – object oriented programming -UML Class Diagrams– relationship –
Inheritance – Abstract classes – polymorphism-Object Oriented Design methodology - Common
Base class -Alice Tool – Application of OOC using Alice tool.

Client server computing - Internetworking – Computer Networks – Working with TCP/IP – IP
address – Sub netting – DNS – VPN – proxy servers World Wide Web – Components of web
application - browsers and Web Servers

REFERENCES
3. Dromey R.G., How to solve it by Computers, PHI, 1994
8. Alfred V Aho, John E Hopcroft, Jeffrey D Ullman, Design and Analysis of Computer Algorithms,
Addison Wesley Publishing Co., 1998
editions, 1991
10. Brad J Cox, Andrew J.Novobilski, Object – Oriented Programming – An evolutionary approach,
Addison – Wesley, 1991

Course Designers:

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<tr>
<td>1.</td>
<td>Dr.K.Sasikala</td>
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<td><a href="mailto:sasikalak@vmkvec.edu.in">sasikalak@vmkvec.edu.in</a></td>
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<tr>
<td>2</td>
<td>Mr. R. Bharanidharan</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:bharanidharan@vmkvec.edu.in">bharanidharan@vmkvec.edu.in</a></td>
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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.

PREREQUISITE – 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. Be exposed to technology and business trends impacting mobile applications
   Understand

CO2. Understanding enterprise scale requirements of mobile applications
   Understand

CO3. Be competent with the characterization and architecture of mobile applications
   Apply

CO4. Familiarize in the Graphics used for Android application development
   Apply

CO5. Be competent with designing and developing mobile applications using one application development framework.
   Apply

CO6. Test the developed app and publish in
   Apply

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>
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<th>S.No.</th>
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<tr>
<td>1.</td>
<td>Mr. M. Annamalai</td>
<td>Assistant Professor</td>
<td>CSE</td>
<td><a href="mailto:annamalaim@vmkvec.edu.in">annamalaim@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2.</td>
<td>Mr. R. Bharanidharan</td>
<td>Assistant Professor</td>
<td>CSE</td>
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</table>
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. Describe the role of microbes in food spoilage and food preservation Understand

CO3. Summarize all food processing methods and demonstrate its application in food product preparation Understand

CO4. Illustrate the modern methods to modify foods using biotechnology. Apply

CO5. Demonstrate packing methods, materials and factors affecting food packing. Apply

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 SPOILAGE AND PRESERVATION
Spoilage of foods and Shelf –life-Milk and milk products, meat and meat products. Factors influencing food spoilage. Methods of food preservation-Pickling, salting, drying, freezing,
refrigeration, use of food additives and irradiation.

**PROCESSING OF FOODS**

**INDUSTRIALIZATION/ MODERN FOOD PRESEERVATION**
Pasteurization, Vacuum packing, food additives, irradiation, bio preservation, Modified atmosphere packing, cryopreservation.

**PACKAGING AND QUALITY TESTING**

**TEXT BOOKS**
2. Sivashankar.B.Food processing Preservation, Prenlice Hall of India.Pvt.Ltd.2002

**REFERENCE BOOKS**

**COURSE DESIGNERS**

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<tr>
<td>1</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>
</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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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. To recall the epidemiology of diseases caused by pests in plant and animals Remember

CO2. Discuss about the common plant pathogens in agriculture. Understand

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

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

CO5. Validate the different samplings methods and monitoring protocol Evaluate

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:

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<tr>
<td>1</td>
<td>Dr. S. Vinoth</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:vinoth@avit.ac.in">vinoth@avit.ac.in</a></td>
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<tr>
<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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</table>
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. List and classify the different wastes in environment 

CO2. Describe about the general waste management methods 

CO3. Illustrate the waste treatment using enzymes 

CO4. Demonstrate the basics of enzyme immobilization process 

CO5. Appraise different method of biodegradation of waste using enzymes

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

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.

COURSE DESIGNERS

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<tr>
<td>1</td>
<td>Dr. A. Nirmala</td>
<td>Assistant professor (Gr-II)</td>
<td>Biotechnology</td>
<td><a href="mailto:nimmi_aruna@yahoo.com">nimmi_aruna@yahoo.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Ms.R. Subashini</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:subashini@vmkvec.ac.in">subashini@vmkvec.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: 17BMCC08 - DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – I

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. Gain adequate knowledge in properties of light
CO2. Getting idea about various instruments used in photonics
CO3. Apply LASER in medical field for diagnosis and therapeutic
CO4. Construct hologram
CO5. Image optical tomogram.

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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</table>
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 an 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.** Explain about the implementation of optical fibers in telemetry system. **Understand**

**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
Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system-
Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry
standards.

ELECTRICAL TELEMERTRY
and Pulse systems – Example of a landline telemetry system.

RADIO TELEMETRY SYSTEM
Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM,
Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods –
Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a
radiotelemetry system.

OPTICAL TELEMERTRY SYSTEM
Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in
fiber– optic device development – Example of an optical telemetry System.

APPLICATION OF BIOTELEMERTRY
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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**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**

1. To use the basic concepts of transducers, electrodes and its classification.
2. To determine the recording of biological components.
3. To employ the knowledge in electrochemical and optical biosensors.
4. To outline the various biological components using biosensors.

**COURSE OUTCOMES**

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

- **CO1.** Respond the working principles of transducers.
- **CO2.** Explain the various types of electrodes.
- **CO3.** Utilize various FET sensors for recording of biological components.
- **CO4.** Distinguish various biosensors like electrochemical and optical biosensors.
- **CO5.** Analyze the biological components using biosensors in various applications.

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

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S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION:** General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

**TRANSUDCERS:** 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: Bananatrode, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

TEXT BOOKS:

REFERENCES:

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303
PREAMBLE
To enable the students to acquire knowledge about the principles and applications of MEMS & Nanotechnology in Biomedical Industry.

PREREQUISITE – NIL

COURSE OBJECTIVES

1. To understand the working principle of MEMS & Microsystems.
2. To understand the working of MOEMS Technology.
3. To give an insight to the microfluidic systems.
4. To give an insight to the Bio-MEMS & its application in healthcare.
5. To study about the biomedical Nanotechnology & its application in research domain.

COURSE OUTCOMES

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

**CO6.** Introduces the concepts of microfluidic systems. **Understand**

**CO7.** Introduce about the Basics of working of MOEMS Technology. **Understand**

**CO8.** Explain the working principle of MEMS & Microsystems. **Understand**

**CO9.** Analyze the nanomaterial in various biomedical applications. **Analyze**

**CO10.** Evaluate about the biomedical Nanotechnology & its application in research domain. **Evaluate**

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

MEMS & MICROSYSTEM

MEMS with Microactuation – Micro-accelerators.

**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**
Microfluidics - Introduction and Fluid Properties, Applications of MFS-Fluid Actuation Methods - Electrophoresis, Dielectrophoresis, Electrowetting, Optoelectrowetting, Electro osmosis Flow,
  ElectrothermalFlow, Thermocapillary Effect – Microfluidic Channel – Microdispenser – Microneedle - Microfilter

**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 MRI Imaging, Nano-devices in biomedical applications.

**TEXT BOOKS:**

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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

CO11. Understand the necessary steps to take an idea to a prototype. Understand
CO12. Utilize fundamental design principles, machine elements, manufacturing and assembly techniques. Apply
CO13. Identify and incorporate basic risk management concepts into the Quality Management System. Analyze
CO14. Identify the Medical Device Regulatory Framework for any given country based upon device type. Analyze
CO15. Create potential regulatory pathway. Create

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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:

COURSE DESIGNERS

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<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>Mr. R.Pathamuth</td>
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<td>BME</td>
<td><a href="mailto:pathamuthu@avit.ac.in">pathamuthu@avit.ac.in</a></td>
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<td><a href="mailto:ezhilan@vmkvec.edu.in">ezhilan@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
To learn the fundamental concepts of medical image acquisition and understand how to apply the image processing techniques for various medical images.

PREREQUISITE: 17BMCC08 - BIOMEDICAL SIGNAL PROCESSING

COURSE OBJECTIVES
1. To learn the image fundamentals and mathematical transforms necessary for image processing.
2. To study the various image enhancement techniques.
3. To study about the various segmentation techniques applied to Medical Images.
4. To gain knowledge about the basic concepts of image compression procedures.
5. To apply various image restoration procedures in Medical images.

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

| CO1. Define the general terminology of digital image processing. | Understanding |
| CO2. Identify the need for image transforms and their types both in spatial and frequency domain. | Analysis |
| CO3. Identify different types of image segmentation and apply restoration techniques. | Analysis |
| CO4. Describe image compression models and learn image compression techniques. | Apply |
| CO5. Understanding and apply various methodologies for image segmentation. | Apply |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

DIGITAL IMAGE FUNDAMENTALS

IMAGE ENHANCEMENT
Basic gray level transformation, Histogram processing, Smoothening by spatial filters – Sharpening by spatial filters, Smoothening- frequency domain filters, Sharpening - frequency domain filters, Color image Processing- color models – Pseudo color image processing – Color Image Transformation – Smoothening – Sharpening

IMAGE SEGMENTATION AND OBJECT RECOGNITION
Edge detection- Marr Hidreth edge detector - Canny edge detector, Thresholding foundation – Basic global thresholding – Basic Adaptive thresholding, Region Based segmentation, Watershed segmentation algorithm, Patterns and pattern classes, Recognition based on decision theoretic methods – matching, Optimum statistical classifiers

IMAGE COMPRESSION

IMAGE RESTORATION AND RECONSTRUCTION OF MEDICAL IMAGES
Image degradation models, Algebraic approach to restoration, inverse filtering, Least mean square filter, Image reconstruction from projections – Radon transforms - Filter back projection algorithm – Fourier reconstruction of MRI Images

TEXT BOOKS:

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<td>3</td>
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309
**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. To get Educated on the students to understand the medical ethics. **Understand**

CO2. To Introduce about the Basics of Medical Standards. **Understand**

CO3. To introduce the concepts of Medicine and drug related acts. **Understand**

CO4. To get familiarize about drugs and cosmetics standards. **Analyze**

CO5. To Evaluate about the various medical Laws. **Evaluate**

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

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

Medicine and Medical Ethics

MEDICAL STANDARDS

MEDICINE AND DRUGS ACTS

DRUGS AND COSMETICS STANDARDS
Medicinal and Toilet preparations (Excise duties) Act and rules, Drugs Price control order, Shops & Establishments Act, Sales promotion employees (conditions of service) Act.

MEDICAL ACT

TEXT BOOKS

REFERENCES

COURSE DESIGNERS

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<td>BME</td>
<td><a href="mailto:muthukannan@avit.ac.in">muthukannan@avit.ac.in</a></td>
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</table>
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. Understand

CO2: Describe the major categories of waste. Understand

CO3: Characterize the components and chemical and physical properties of medical waste. Analyze

CO4: Summarize requirements for hazardous waste generation, transportation, treatment, storage, and disposal. Understand

CO5: Describe waste collection, recycling, and materials recovery techniques for MSW. Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low
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

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<td>2</td>
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<tr>
<td>3</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
1 To impart the knowledge about the Home Medicare in various clinical application.
2 To make the students understand the active control trials in the evaluation of new treatments.
3 To impart the knowledge about Legal issues and Health policies related to Biosciences.
4 To study the minimally invasive device and technique used in medical devices.
5 To get knowledge about the advances in healthcare technologies and wireless technology related to healthcare system.

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

CO16. Explain the system description of different therapeutic equipments. Understand
CO17. Describe the system description of different diagnostic equipments. Understand
CO18. Outline the ethical and regulatory guidance. Apply
CO19. Investigate healthcare technologies and wireless technology related to healthcare system. Analyze
CO20. Summarize the organization and the need for home medicare system. Evaluate

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:

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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
Co2. To Study the on site Storage & Processing
Co3. To study about the collection & transfer the waste
Co4. To Study the process of off site processing
Co5. To know about the solid waste disposal

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

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.


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.


TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

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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 work offers the basic knowledge on various sources of air pollutants and their possible effects on local, regional and global environment
Apply

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:

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<td>CIVIL</td>
<td><a href="mailto:subhajaya85@gmail.com">subhajaya85@gmail.com</a></td>
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</table>
PREAMBLE
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

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S- Strong; M-Medium; L-Low

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>J.KarthickRajan</td>
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<td><a href="mailto:Karthickrajan078@gmail.com">Karthickrajan078@gmail.com</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 guidelines 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

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S- Strong; M-Medium; L-Low

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:**

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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.
CO2. Outline the various data acquisition systems and collection methods for remote sensing data information and storage
CO3. Apply knowledge of satellites on various Civil Engineering applications.
CO4. Utilize the various data input methods for mapping
CO5. Creation of data models using remote sensing techniques and GPS

SYLLABUS
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.
forest fire risk zone mapping.


**TEXT BOOKS:**

**REFERENCES:**

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PREAMBLE
To introduce the fundamentals of PV & WIND technologies and Converters used in renewable energy technologies and its lead to understand a modern control techniques to monitor wind turbine systems.

PREREQUISITE-NIL

COURSE OBJECTIVES

1. To learn about PV technology principles.
2. To learn economical and environmental merits of solar energy for variety applications.
3. To learn modern wind turbine control & monitoring.
4. To learn various power converters in the field of renewable energy technologies.
5. To study and analyse different types of Power converters for Renewable energy conversion.

COURSE OUTCOMES

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

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<th>CO1</th>
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<tr>
<td>CO2</td>
<td>Applications of PV technology.</td>
<td>Apply</td>
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<tr>
<td>CO3</td>
<td>Design the solar power plant.</td>
<td>Apply</td>
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<tr>
<td>CO4</td>
<td>Understand modern wind turbines and its control.</td>
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<tr>
<td>CO5</td>
<td>Analyze various power converters to select for particular application.</td>
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MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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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
Solar: Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) - Boost and

TEXT BOOK

REFERENCES

COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Faculty</th>
<th>Designation</th>
<th>Department</th>
<th>e-Mail ID</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>P. LOGANATHAN</td>
<td>Assistant Professor</td>
<td>EEE</td>
<td><a href="mailto:loganathan@vmkvec.edu.in">loganathan@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>R. SATHISH</td>
<td>Assistant Professor</td>
<td>EEE</td>
<td><a href="mailto:sathish@vmkvec.edu.in">sathish@vmkvec.edu.in</a></td>
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</table>
PREAMBLE
To 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
1. To study basic concepts of scientific programming using SCILAB.
2. To learn about the Basics of Program of SCILAB and related Mathematical Applications.
3. Analyze the concepts of Program of SCILAB.
4. To understand the different tools in SCILAB and ODE, DAE
5. To apply a software program to Electrical circuits and solve the simulation based solutions.

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. | Understand |
| CO2 | Understand the need for simulation/implementation for the verification of mathematical functions. | Understand and Analyze |
| CO3 | Implement simple mathematical functions/equations in numerical computing environment such as SCILAB. | Create |
| CO4 | Interpret and visualize simple mathematical functions and operations thereon using plots/display. | Analyze and Apply |
| CO5 | Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools | Analyze and Create |

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES
**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

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</tr>
</tbody>
</table>
Non Conventional resources include solar energy, wind, falling water, the heat of the earth (geothermal), plant materials (biomass), waves, ocean currents, temperature differences in the oceans and the energy of the tides. Non Conventional energy technologies produce power, heat or mechanical energy by converting those resources either to electricity or to motive power. It concerned with development of the national grid system will focus on those resources that have established themselves commercially and are cost effective for on grid applications. Such commercial technologies include hydroelectric power, solar energy, fuels derived from biomass, wind energy and geothermal energy. Wave, ocean current, ocean thermal and other technologies that are in the research or early commercial stage, as well as non-electric Non Conventional energy technologies, such as solar water heaters and geothermal heat pumps, are also based on Non Conventional resources, but outside the scope of this Manual.

**COURSE OBJECTIVES**

1. To learn about PV technology principles.
2. To learn economical and environmental merits of solar energy for variety applications.
3. To learn modern wind turbine control & monitoring.
4. To learn various power converters in the field of renewable energy technologies.
5. To study and analyse different types of Power converters for Renewable energy conversion

**COURSE OUTCOMES**

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

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<tbody>
<tr>
<td>CO2</td>
<td>Learn the Flat Plate and Concentrating Collectors, Classification of Concentrating Collectors</td>
<td>Analyse</td>
</tr>
<tr>
<td>CO3</td>
<td>Learn the Wind Energy, Horizontal and Vertical Access Wind Mills, Bio Conversion</td>
<td>Analyse</td>
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</table>
INTRODUCTION
Statistics on conventional energy sources, Classification of Energy Resources, Definition Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES. - Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources

SOLAR ENERGY CONCEPT

WIND ENERGY CONCEPT

GEOTHERMAL AND BIOMASS ENERGY
Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features Atmospheric exhaust and condensing, exhaust
types of conventional steam turbines. Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

**TODAL AND WAVE ENERGY**
Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, Operational of small cycle experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems.

**TEXT BOOK**

**REFERENCES**
1. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 2004

**COURSE DESIGNERS**

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<td><a href="mailto:sathish@vmkvec.edu.in">sathish@vmkvec.edu.in</a></td>
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</table>
In recent years, MEMS have revolutionized the semiconductor industry, with sensors being a particularly buoyant sector. Smart MEMS and Sensor Systems presents readers with the means to understand, evaluate, appreciate and participate in the development of the field, from a unique systems perspective. The combination of MEMS and integrated intelligence has been put forward as a disruptive technology. The full potential of this technology is only evident when it is used to construct very large pervasive sensing systems.

**PREREQUISITE - NIL**

**COURSE OBJECTIVES**

1. Understand the fundamental concept of MEMS and their relevance to current industry/scientific needs
2. Gain the physical knowledge underlying the operation principles and design of microsystems;
3. Build an understanding of microscale physics for use in designing MEMS applications
4. Understand the basic principles of MEMS sensors and actuators (mechanical, electrical, piezoresistive, piezoelectric, thermal, microfluidic)
5. Design the process flow of a basic MEMS device, such as an inertia sensor (accelerometer), given a fabrication process description.

**COURSE OUTCOMES**

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

CO1. Knowledge on the basics of MEMS and mechanics for MEMS Design

CO2. Ability to apply the basic knowledge of MEMS in different fields

CO3. Apply the MEMS for different applications.

CO4. Use concepts in common methods for converting a physical parameter into an electrical quantity

CO5. Locate different type of sensors used in real life applications and paraphrase their importance

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

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<th>COS</th>
<th>CO1</th>
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</table>

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


MECHANICS FOR MEMS DESIGN  Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

MEMS APPLICATION  Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

INTRODUCTION AND DISPLACEMENT MEASUREMENT  Sensors - Basic requirements of a sensors-Classification of sensors- Static and Dynamic characteristics of sensors- Displacement Sensors- Linear and Rotary displacement sensors-Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder, Photoelectric sensor, Hall Effect Sensor.


Text Books

Reference Books

COURSE DESIGNERS
1. Mrs. A. Malarvizhi  malar.ece06@gmail.com
Preamble
To introduce the students the concepts behind machine vision and object recognition techniques.

Prerequisite
NIL

Course Objectives

<p>| | | | |</p>
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<tr>
<td>1</td>
<td>To understand the fundamental of digital image processing</td>
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<tr>
<td>2</td>
<td>To understand the concepts of edge detection, segmentation and texture analysis</td>
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<tr>
<td>3</td>
<td>To understand the concepts of image analysis</td>
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<td>4</td>
<td>To understand the concepts of 3D vision and motion</td>
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<tr>
<td>5</td>
<td>To get introduced to the concepts behind pattern recognition schemes</td>
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Course Outcomes
On successful completion of the course, the students will be able to

<table>
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<th>CO</th>
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<tbody>
<tr>
<td>1</td>
<td>Understand the basic operation of imaging techniques in the computers</td>
<td>Remember and Understand</td>
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<tr>
<td>2</td>
<td>Analyze the basic processing techniques of image processing</td>
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<tr>
<td>3</td>
<td>Study and analyze the pattern of computer understandings of structures.</td>
<td>Evaluate</td>
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<td>4</td>
<td>Understand and study the 3D create new standards for securing the data</td>
<td>Create</td>
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<tr>
<td>5</td>
<td>Evaluate the various real time computer vision systems.</td>
<td>Evaluate</td>
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</table>

Mapping with Programme Outcomes and Programme Specific Outcomes

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</tbody>
</table>

S – Strong; M – Medium; L – Low

Syllabus

UNIT – I - LOW LEVEL VISION – INTRODUCTION TO IMAGE PROCESSING

Fundamental steps in digital image processing – Components of an image processing system – Image sampling and quantization – Basic relationships between pixels – Basic intensity transformation functions – Fundamentals of spatial filtering – Basics of filtering in frequency domain – Filtering in spatial and frequency domains.
UNIT – II: LOW LEVEL VISION - EDGE DETECTION, SEGMENTATION & TEXTURE
Thresholding Techniques, Edge Detection, Corner and Interest Point Detection, Mathematical Morphology, Texture.

UNIT – III: INTERMEDIATE LEVEL VISION
Binary Shape Analysis, Boundary Pattern Analysis, Line Detection, Circle and Ellipse Detection, the Hough Transform and Its Nature, Pattern Matching Techniques.

UNIT – IV: 3D VISION AND MOTION
The Three-Dimensional World, Tackling the Perspective n-point Problem, Invariants and Perspective, Image Transformations and Camera Calibration, Motion.

UNIT – V: REAL TIME PATTERN RECOGNITION SYSTEMS
Image Acquisition, Real-Time Hardware and Systems Design Considerations.

Text Books

Reference Books

Course Designers:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Faculty</th>
<th>Mail ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P. Subramanian</td>
<td><a href="mailto:subramanian@avit.ac.in">subramanian@avit.ac.in</a></td>
</tr>
</tbody>
</table>
Preamble
To study and understand the Composition and Development in Alternate Fuels

Prerequisite
Nil

Course Objectives

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Course Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Understand the importance of Biochemistry</td>
<td>2. Select suitable production technology for Cellulases</td>
</tr>
<tr>
<td>3. Identify the standards and quality control measures to be followed for bioethanol production</td>
<td>4. Understand the various Composition of Bio Diesel</td>
</tr>
<tr>
<td>5. Understand the various Development in Alternate Fuels</td>
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</tbody>
</table>

Course Outcomes:
After Successful completion of this course, the students will be able to:

<table>
<thead>
<tr>
<th>CO</th>
<th>Identify potential biomass sources for renewable energy generation.</th>
<th>Understand</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Understand the production process for lipid based biofuels.</td>
<td>Understand</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the production process of biomethane and biohydrogen</td>
<td>Understand</td>
</tr>
<tr>
<td>CO4</td>
<td>Differentiate first and second generation biofuels</td>
<td>Understand</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the bio production of gases</td>
<td>Understand</td>
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</tbody>
</table>

Mapping with Programme Outcomes and Programme Specific Outcomes

<table>
<thead>
<tr>
<th>COs</th>
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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

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

**TEXT BOOK:**


**REFERENCES:**


**Course Designers:**

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<tr>
<td>1</td>
<td>T.Raja</td>
<td>Associate Professor</td>
<td>Auto / VMKVEC</td>
<td><a href="mailto:rajat@vmkvec.edu.in">rajat@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>R. Prabhakar</td>
<td>Associate Professor</td>
<td>Auto / VMKVEC</td>
<td><a href="mailto:prabhakar@vmkvec.edu.in">prabhakar@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>3</td>
<td>M.Saravana Kumar</td>
<td>Associate Professor</td>
<td>Mechanical, AVIT</td>
<td><a href="mailto:saravanakumar@avit.ac.in">saravanakumar@avit.ac.in</a></td>
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</table>
NEW GENERATION AND HYBRID VEHICLES

17ATEC02

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</table>

**Preamble**
To teach the students about the new generation and hybrid vehicles

**Prerequisite**
Nil

**Course Objectives**

1. To understand the hybrid vehicles.
2. To understand the power system and new generation vehicles.
3. To understand the vehicle operation and control.
4. To study about vehicle automated tracks.
5. To study automotive suspension, brakes, aerodynamics and safety.

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

<table>
<thead>
<tr>
<th>CO1. Ability to understand the importance of Hybrid vehicle</th>
<th>Understand</th>
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<tbody>
<tr>
<td>CO2. Student Should be able to understand about GBS</td>
<td>Understand</td>
</tr>
<tr>
<td>CO3. Student should get knowledge of vehicle speed control by EGM</td>
<td>Understand</td>
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**Mapping with Programme Outcomes and Programme Specific Outcomes**

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S- Strong; M-Medium; L-Low
INTRODUCTION
Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic track vehicles, fuel cells vehicles.

POWER SYSTRM AND NEW GENERATION VEHICLES
Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems

VEHICLE OPERATION AND CONTROL
Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed

VEHICLE AUTOMATED TRACKS
Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.

SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY
Air suspension – Closed loop suspension, compensated suspension, anti-skid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

TEXT BOOK:

REFERENCES:
1. Light weight electric for hybrid vehicle design.
2. Advance hybrid vehicle power transmission, SAE.

Course Designers:

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<td>1</td>
<td>T.Raja</td>
<td>Associate Professor</td>
<td>Auto / VMKVEC</td>
<td><a href="mailto:rajat@vmkvec.edu.in">rajat@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>R. Prabhakar</td>
<td>Associate Professor</td>
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<td><a href="mailto:prabhakar@vmkvec.edu.in">prabhakar@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>3</td>
<td>B. Samuvel Michael</td>
<td>Asso. Prof. - II</td>
<td>Mechanical, AVIT</td>
<td><a href="mailto:samuvelmichael@avit.ac.in">samuvelmichael@avit.ac.in</a></td>
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Preamble
To enrich the student with additional value based knowledge and skills on sport based Unmanned Aerial Vehicle systems.

Prerequisite
NIL

Course Objectives
1. To know briefly the History of unmanned aerial vehicles and its types.
2. To understand the basic aspects involved in development of UAV.
3. To apply the knowledge in modeling and control of small unmanned vehicles.
4. To modify the existing flight control systems for rotorcraft UAV.
5. To design a new system for efficient operation.

Course Outcomes
In the successful completion of the course, students will be able to

| CO1. | Define principles of operation and label components of unmanned aerial vehicles. | Remember |
| CO2. | Explain working of vehicles used as aerial vehicles. | Understand |
| CO3. | Employ analytical skills to design a new system. | Apply |
| CO4. | Categorise the structure and estimate reliability of operations. | Analyze |
| CO5. | Evaluate and modify the system with up gradation of performance. | Evaluate |
| CO6. | Formulate and design a new modified vehicle with optimum resources. | Create |

Mapping with Programme Outcomes and Programme Specific Outcomes

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S- Strong; M-Medium; L-Low

Syllabus

UNIT – I  INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS


UNIT – II  ASPECTS OF UNMANNED AIRCRAFT SYSTEMS
Involvement of different aspects in the development of UAV-aerodynamic configurations -Aspects of airframe design- Stealth design, payload types, communication, navigations & guidance systems, control & stability, launch, recovery and support systems, reliability design.

UNIT – III  |  MODELING AND CONTROL HELICOPTER MODEL
---|---
Modeling and control of small and miniature unmanned helicopters –single rotor helicopter design – coaxial rotor helicopter design - autonomous control of a mini quad-rotor vehicle using LQG controllers – linearization and identification of helicopter model.

UNIT – IV  |  UNMANNED AERIAL VEHICLE DESIGN MODELING & CONTROL
---|---
Development of autonomous quad tilt wing – advanced flight control systems for rotorcraft UAV and MAV – mathematical modeling and non-linear control of VTOL aerial vehicles.

UNIT – V  |  DEPLOYMENT OF UAS/UAV SYSTEMS
---|---
Only application point of view of various UAS roles played in civil, defense applications –vision based navigation company trails- certification of UAS/UAV/MAV systems.

TEXT BOOK:

REFERENCES:
2. Elizabeth Bone, Christopher Bolkcom, *Unmanned Aerial Vehicles*, Novinka Books, United Kingdom 2004

Course Designers:
<table>
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<tr>
<td>1</td>
<td>Senthil kumar M</td>
<td><a href="mailto:senthil@vmkvec.edu.in">senthil@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>2</td>
<td>R.Gowri Shankar</td>
<td><a href="mailto:gowrishankar@vmkvec.edu.in">gowrishankar@vmkvec.edu.in</a></td>
</tr>
<tr>
<td>3</td>
<td>Sanjay Singh</td>
<td><a href="mailto:sanjay@vmkvec.edu.in">sanjay@vmkvec.edu.in</a></td>
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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 understand the factory automation and integration
2. To learn about hydraulics/pneumatics circuits
3. To understand the various design of pneumatic and electro-pneumatic circuits
4. To learn about PLC and its applications
5. To understand the automation in transfer machines & assembly.

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

CO1. Understand need and scope of industrial automation

CO2. Understand the basics and need for implementation hydraulic and pneumatic systems.

CO3. Design of pneumatic and electro-pneumatic circuits

CO4. Know about PLC and its applications

CO5. Understand the basics of automatic transfer machines & assembly automation

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

INTRODUCTION TO HYDRAULICS/PNEUMATICS


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

2. Deppert, W. and Stoll, K., Pneumatic Control, Vogel Verlag, Wurzburg, Germany.

Course Designers

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<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>
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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
NIL

COURSE OBJECTIVES

1. To detail on the hydrogen production methodologies, possible applications and various storage options.
2. To discuss on the working of a typical fuel cell, its types and to elaborate on its thermodynamics and kinetics.
3. To analyze the cost effectiveness and eco-friendliness of Fuel Cells.
4. To make students understand the different fuel cells and their applications.
5. To enable students to understand the economics of fuel cells.

COURSE OUTCOMES

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

CO1. Know the hydrogen production methodologies and various storage options

CO2. Know the working of fuel cell and its types with thermodynamic performance.

CO3. Understand the cost effectiveness and eco-friendliness of fuel cells.

CO4. Know the different types of fuel cells and their applications.

CO5. Understand the economics of fuel cells.

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>SHIVAKUMAR N</td>
<td>Asst. Prof. - II</td>
<td>Mechanical, AVIT</td>
<td><a href="mailto:shiva.thermal@gmail.com">shiva.thermal@gmail.com</a></td>
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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 energy conversion to waste.

**Prerequisite - NIL**

**Course Objective**

1. To understand the waste and waste processes.
2. To understand waste treatment and disposal.
3. To apply how to convert waste to energy from thermo chemical conversion.
4. To apply how to 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. Explained types of waste and source of waste
- CO2. Understand various waste treatment and disposal
- 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. Analysis 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**
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

<table>
<thead>
<tr>
<th>No</th>
<th>Author(s)</th>
<th>Title</th>
<th>Publisher</th>
</tr>
</thead>
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Reference Books

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Course Designers

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<td>1</td>
<td>R.CHANDRASEKAR</td>
<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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</table>
### Preamble
To disseminate the technologies for utilizing bio-energy and its manifold benefits compared to conventional fossil fuels.

### Prerequisite - NIL

### Course Objective

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<tr>
<td>1.</td>
<td>To provide the students the sources of biomass.</td>
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<td>2.</td>
<td>To make understand the students on different processes of biomethanation.</td>
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<td>3.</td>
<td>To study the combustion of bio fuels,</td>
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<td>4.</td>
<td>To study the gasification methods of biomass.</td>
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<td>5.</td>
<td>To provide the students on liquefied biofuels.</td>
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### Course Outcomes: On the successful completion of the course, students will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>To gain the knowledge of the basic concepts of Biomass preparation and also fuel assessments.</th>
<th>Understand</th>
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<td>CO2</td>
<td>To obtain the methods of biogas production and biogas plants.</td>
<td>Understand</td>
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<tr>
<td>CO3</td>
<td>To apply the concepts of combustion processes and fuel handling systems.</td>
<td>Apply</td>
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<tr>
<td>CO4</td>
<td>To apply the techniques for preparation of biogases and coals.</td>
<td>Apply</td>
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<tr>
<td>CO5</td>
<td>To apply the techniques for preparation of biodiesels from vegetables.</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

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 CARBONISATION

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>1</td>
<td>R.Mahesh</td>
<td>Assistant Professor(Gr-II)</td>
<td>Mechanical/AVIT</td>
<td><a href="mailto:mahesh@avit.ac.in">mahesh@avit.ac.in</a></td>
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CATEGORY ‘D’

PROJECT
(9 CREDITS)

&

INTERNSHIP + INDUSTRY ELECTIVES COURSES
(9 CREDITS)

TOTAL – 18 CREDITS
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CATEGORY ‘D’

INTERNERSHIP
+
INDUSTRY ELECTIVES

9 CREDITS
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PREAMBLE
This course will enrich the students about the elimination of communicable diseases with the sufficient levels of persons in the community. The public health officials have mandated vaccination and monitoring of the safety of vaccines during clinical trials. Also, the various types of preparation of vaccine for the disease. It can be done by using the computational tools for the production of vaccine through various technologies.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To define and to provide scientific basics of the life processes at the molecular level
2. To explain the structure, function and inter-relationships of bio-molecules and their deviation
3. To perform the various research to design the vaccine for interpreting and solving clinical problems.
4. To differentiate the various tools for the design of vaccine.
5. To check the developed vaccine for quality control and animal testing for marketing.

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

CO1. Recognize the immunological concepts in vaccinology
Remember

CO2. Describe the preparation and types of vaccines.
Understand

CO3. Illustrate a design and demonstrate the action of vaccine through research
Apply

CO4. Examine the computational tools for the design of vaccine
Analyze

CO5. Test the vaccine, regulatory aspects of vaccine and to commercialisation
Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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</table>

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

IMMUNOLOGICAL CONCEPTS IN VACCINOLOGY
Short history of vaccination, requirements for induction of immunity, Epitopes, linear and conformational epitopes, characterisation and location of APC, MHC and immunogenicity, Rationale vaccine design based on clinical requirements: Hypersensitivity, Immunity to Infection, Autoimmunity, Transplantation, Tumor immunology, immunodeficiency, mechanism of adjuvant action, Scope of future vaccine strategies

CLASSIFICATION OF VACCINES AND ITS PREPARATIONS
Active and passive immunization; Viral/bacterial/parasite vaccine differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein-based vaccines, plant-based vaccines, edible vaccines, reverse vaccinology, combination vaccines, therapeutic vaccines; Peptide vaccines, conjugate vaccines; Antibody genes and antibody engineering- chimeric and hybrid monoclonal antibodies; Catalytic antibodies and generation of immunoglobulin gene libraries, Transfusion of immunocompetent cells; Cell based vaccines

VACCINE RESEARCH AND DESIGN
Fundamental research to rational vaccine design, Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens, Fundamentals of Immune recognition, implications for manipulating the T-Cell repertoire, Targeting Dendritic cells; a rational approach for Vaccine development , Cellular basis of T- Cell memory, Rational design of new vectors, CpG adjuvant activity, Transcutaneous immunisation, Vaccination studies and recent advances in Malaria, Tuberculosis , HIV

COMPUTATIONAL TOOLS FOR VACCINE DESIGN
Antigen Sequence analysis, Epitope Mapping, Predictions of Immunogenic peptides of T-Cell and B-Cells. Prediction of HLA binding peptides, Comparative Genomics as a tool for vaccine design, introduction to online epitope databases

ANIMAL TESTING, COMMERCIALISATION, QUALITY CONTROL
Quality control and regulations in vaccine research, In-vitro experimental validations for predictions of vaccines by software, Animal testing, Rational design to clinical trials, Large scale production, Commercialisation, ethics.

TEXTBOOKS
359

REFERENCES


COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Faculty</th>
<th>Designation</th>
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<tr>
<td>1</td>
<td>R.Subhasini</td>
<td>Assistant Professor</td>
<td>BTE</td>
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</table>
### PREAMBLE
Pharmaceutical packaging course covers all important aspects of the packing process and their associated Good Manufacturing Practice (GMP) and pharmaceutical quality system (PQS) challenges. This includes selection of suitable components, pack design, pack security and design/control of packing processes.

### PREREQUISITE
NIL

### COURSE OBJECTIVES

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<td>1</td>
<td>To list on different packaging materials and their selection, uses control and impact on product stability.</td>
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<td>2</td>
<td>To explain the concept, Formulation, evaluation and packaging of various semisolid dosage forms</td>
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<td>3</td>
<td>To perform the collection, processing and storage of biological products like blood and plasma substitutes.</td>
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<td>4</td>
<td>To categories the regulatory aspects of tablet, vial and bottle packaging.</td>
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<td>5</td>
<td>To check Packaging operations and their risks and control.</td>
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### COURSE OUTCOMES

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

<table>
<thead>
<tr>
<th>CO1</th>
<th>Relate the concepts of quality control and quality assurance during entire manufacturing practices.</th>
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<td>CO2</td>
<td>Explain the pharmacopoeia testing, defects and stability of blister and strip packaging materials.</td>
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<tr>
<td>CO3</td>
<td>Demonstrate sterilization of packaging materials used in parenteral, ophthalmic and aerosols as per their legal requirement.</td>
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<td>CO4</td>
<td>Develop new concepts in pharmaceutical packaging and their control.</td>
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<tr>
<td>CO5</td>
<td>Estimate the different samplings methods.</td>
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#### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

### SYLLABUS

**PHARMACEUTICAL PACKAGING**

Introduction of packaging - classification of packaging - packaging essential requirements functions
of packaging - importance / significance of pharma packaging - main packaging materials - ideal package material properties.

**PRIMARY PACKAGING MATERIAL**

**SOLID DOSAGE FORM PACKAGING**

**LIQUID FORMULATION AND STERILE PRODUCT PACKAGING**
Liquid Formulation - Factors influencing selection of liquid filling machinery - balanced and unbalanced constant level filling – volumetric – gravimetric - level sensing - time fill - peristaltic and overflow liquid filling machinery. Sterile product packaging- various types of containers used for sterile products like ampoules – vials - bottles for I.V. fluid, etc. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine.

**QUALITY CONTROL AND REGULATIONS OF PACKAGING MATERIALS**

**TEXT BOOKS:**


**REFERENCES:**


**COURSE DESIGNERS**

<table>
<thead>
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<td>R.Ramapriya</td>
<td>Assistant Professor</td>
<td>Biotechnology</td>
<td><a href="mailto:ramapriya@vmkvec.edu.in">ramapriya@vmkvec.edu.in</a></td>
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<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
This course enables the students to know about the requirements for the good manufacturing practices currently followed in pharmaceutical industry, requirements related to Factories Acts and Rules, which is a Central Act, regulation related to water and air pollution and the regulation for handling and storage of inflammable materials etc.

PREREQUISITE
NIL

COURSE OBJECTIVES
1. To develop the knowledge on various legal regulations and governing bodies involved in the trade and practice of pharmaceutical and biopharmaceutical industries.
2. To enrich beginners in the principles involved in the practice of GMP, biosafety and ethical guidelines.
3. To prepare the documents for applying the patents.
4. To guidelines for validation process in the industry.
5. To document the results for the audit.

COURSE OUTCOMES
After the successful completion of the course, learner will be able to
CO1. Recognize the concepts of quality control in pharma industries. Remember
CO2. Discuss the pharmaceutical industry manufacturing practices and regulatory aspects of pharmacy products Understand
CO3. Demonstrate the process of patenting activities Apply
CO4. Test the guidelines and analytical procedures for the methodology Analyze
CO5. Validate the quality guidelines followed for pharmaceutical products and few of the aspects involved in document preparation for pharmaceutical product registration Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

REGULATORY CONCEPTS
Quality assurance – Quality control – Practice of cGMP – Schedule M – USFDA.

REGULATORY ASPECTS
Pharmaceuticals: Bulk drug manufacture; Personnel, Buildings and Facilities, Process Equipment, Documentation and Records, Materials Management, Production and In-Process Controls, Packaging and Identification Labelling of API’s and Intermediates, Storage and distribution, – Biotechnology derived products; Principles, Personnel, Premises and equipments, Animal quarters and care, production, labelling, Lot processing records and distribution records, quality assurance and quality control.

INTELLECTUAL PROPERTY RIGHTS

ICH GUIDELINES
Quality guidelines – Impurities in new drug substances (Q3A(R2)) – Impurities in newdrug products(Q3B(R2)) – Validation of analytical procedures text and methodology (Q2 (R1)).

QUALITY AUDIT AND SELF INSPECTIONS
SOPs – Documentation – Loan license auditing – Common technical documentation (CTD) – Drug

TEXT BOOKS:

REFERENCES:

COURSE DESIGNERS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Faculty</th>
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<th>Mail ID</th>
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<tbody>
<tr>
<td>1</td>
<td>R.Subhasini</td>
<td>Assistant Professor</td>
<td>BTE</td>
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</tbody>
</table>
PREAMBLE
Waste management are the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process.

PREREQUISITE - NIL

COURSE OBJECTIVES

1. To state the basic knowledge on waste management
2. To discuss about the principle and properties of waste
3. To demonstrate the minimization of waste in Industries
4. To outline the handling and transport of waste in Industries
5. To develop the modern techniques for waste dispose

COURSE OUTCOMES

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

CO1. Recall the characterisation of waste in society
     Remember

CO2. Discuss the benefits and life cycle of waste
     Understand

CO3. Illustrate the waste minimizing technique in Industries
     Apply

CO4. Inspect the transport of waste in developing countries
     Analyse

CO5. Measure the resource efficiency of waste
     Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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S- Strong; M-Medium; L-Low

SYLLABUS

GENERATION AND CHARACTERISTICS OF WASTE
Types and characteristics of wastes- Domestic, Industry, Commercial, Agriculture, and Health care centre and e-waste.

PRINCIPLES OF WASTE MANAGEMENT
WASTE MINIMIZATION AND MONITORING
Waste minimization techniques in the developed and developing countries. Waste minimization techniques adopted in few industries-Sugar, Paper, Textile, Leather, Breweries and Pharmaceuticals.

WASTE HANDLING AND TRANSPORT
Methods of waste handling, transport and disposal in various sectors of waste generation- Sugar, Paper, Textile, Leather, Breweries, health care centre and Pharmaceuticals

RESOURCE RECOVERY
Methods of resource 3 recovery- 3Rs, Landfills, Biological reprocessing, Energy recovery. Modern techniques of disposal- Incineration, Pyrolysis

TEXT BOOK:

REFERENCE BOOKS:

COURSE DESIGNERS

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<tr>
<td>1</td>
<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>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>
PREAMBLE
The objective of this course is to teach principles of cost estimation, feasibility analysis, management, organization and quality control that will enable the students to perform as efficient managers.

PREREQUISITE - NIL

COURSE OBJECTIVES
1. To state the basics of measurement techniques involved in organization management
2. To describe the cost and budget analysis for building a process
3. To outline the analysis of project based on profitability/loss
4. To develop the concept of accounting based on the performance and growth
5. To assess the importance of economic balance

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

<table>
<thead>
<tr>
<th>CO1</th>
<th>Recall the basic information about cost and asset of accounting</th>
<th>Remember</th>
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<tr>
<td>CO2</td>
<td>Describe the time value of money and project feasibility</td>
<td>Understand</td>
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<td>CO3</td>
<td>Analyses the alternative investment methods</td>
<td>Analyze</td>
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<td>CO4</td>
<td>Assess the importance of financial ratios and rate of return</td>
<td>Evaluate</td>
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<tr>
<td>CO5</td>
<td>Validate the sensitivity and risks involved in the process plant</td>
<td>Evaluate</td>
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SYLLABUS

PRINCIPLES OF MANAGEMENT AND ORGANISATION
Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations. Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

INVESTMENT COSTS AND COST ESTIMATION
Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, capital budgeting and project feasibility.
PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT
Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE
Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth

ECONOMIC BALANCE
Economic decisions in Chemical Plant - Economics of size - Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer

TEXT BOOK:

REFERENCE BOOKS:

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<td>Assistant Professor</td>
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<td><a href="mailto:devigk19@gmail.com">devigk19@gmail.com</a></td>
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