VINAYAKA MISSION'S RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Faculty of Engineering and Technology

REGULATION 2021

DEPARTMENT OF PHARMACEUTICAL ENGINEERING

Programme

B.E.PHARMACEUTICAL ENGINEERING
Full Time (4 Years)

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM

(Semester I to VIII)

PROGRAMME OUTCOMES

Engineering Graduates will be able to:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
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 engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

Graduating Students of Pharmaceutical Engineering programme will be able to:

PSO1	To identify, formulate, design, analyze 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.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO1	To prepare students to gain the fundamentals and advances in the engineering and pharmaceutical principles and to enhance their skills to solve problems in engineering and technology, thus preparing them for a wide spectrum of career avenues in academia, research, and industries of pharmaceutical, biomedical, biotechnology, business, government and other pharmaceutical pursuits.
PEO2	To facilitate the students to understand simple and complex engineering and management principles, to enhance their communication and technical skills to work successfully as an individual, as a member/leader in a team and to manage projects in multidisciplinary environments.
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

VINAYAKA MISSION'S RESEARCH FOUNDATION DEEMED TO BE UNIVERSITY, SALEM

CURRICULUM FOR REGULATION-2021

Credit Requirement for the Course Categories

DEPARTMENT OF PCE

Sl. No.	Category of Courses	Types of Courses		Suggested Breakupof Credits (min – max)
1.	**A.** Foundation Courses	Humanities and Social Sciences including Management courses		9-12
2.		Basic Science courses		18-25
3.		Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.		18 - 24
4.	**B.** Professional	Core courses		48-54
5.	**C.** Elective Courses	Professional Electives		12
		Industry Designed/ Industry Supported/ Industry Offered/ Industry Sponsored courses		6
		Open Electives	Innovation, Entrepreneurship, Skill Development etc.	6-9
			Emerging Areas like 3D Printing, Artificial Intelligence, Internet of Things etc.	6-9
9.	**D.** Courses for Presentation of technical Skills related to the specialization	Project work		8
		Mini Project		3
		Seminar		1
		Internship in industry or elsewhere		3
13.	****E. Mandatory Courses**	Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Employability Enhancement, NSS, RRC, YRC, Sports and Games, Student Clubs, Unnat Bharat Abhiyan, Swachh Bharat etc.		0Credit course (Minimum 2 courses to be completed)
			Minimum Credits to be earned	160

**** The credits earned in category 'E' Courses will not be counted in CGPA calculation for awarding of the degree.**

B.E. –PHARMACEUTICAL ENGINEERING - SEMESTER I TO VIII									
A. FOUNDATION COURSES									
HUMANITIES AND SCIENCES INCLUDING MANAGEMENT COURSES - CREDITS (9-12)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1	34121H01	TECHNICAL ENGLISH	ENG	FC-HS	3	0	0	3	NIL
2		BUSINESS ENGLISH	ENG	FC-HS	3	0	0	3	NIL
3	34121H81	ENGLISH LANGUAGE LAB	ENG	FC-HS	0	0	4	2	NIL
4		PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT LAB	ENG	FC-HS	0	0	2	1	NIL
5		TOTAL QUALITY MANAGEMENT	MANAG	FC-HS	3	0	0	3	NIL
6		UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY	ENG	FC-HS	3	0	0	3	NIL
BASIC SCIENCES COURSES - CREDITS (18-25)									
1	34121B02	MATHEMATICS FOR BIO-ENGINEERING	MATH	FC-BS	2	1	0	3	Nil
2		BIOSTATISTICS	MATH	FC-BS	2	1	0	3	MATHEMATIS FOR BIO-ENGINEERING
3		NUMERICAL METHODS FOR BIO-ENGINEERS	MATH	FC-BS	2	1	0	3	NIL
4	34121B04	PHYSICAL SCIENCES	PHY & CHEM	FC-BS	4	0	0	4	NIL
5	34121B81	PHYSICAL SCIENCES LAB	PHY & CHEM	FC-BS	0	0	4	2	NIL
6		SMART MATERIALS AND NANOTECHNOLOGY	PHY	FC-BS	3	0	0	3	NIL
7		FUNDAMENTALS OF CHEMISTRY	CHEM	FC-BS	3	0	0	3	NIL
8		FUNDAMENTALS OF BIOCHEMISTRY (THEORY AND PRACTICALS)	BTE	FC-BS	3	0	2	4	NIL
9		FUNDAMENTALS OF MICROBIOLOGY (THEORY AND PRACTICALS)	BTE	FC-BS	2	0	2	3	NIL
10		ENVIRONMENTAL SCIENCES	CHEM	FC-BS	3	0	0	3	NIL
ENGINEERING SCIENCE COURSES INCLUDING WORKSHOP, DRAWING, BASICS OF ELECTRICAL/MECHANICAL/COMPUTER ETC. - CREDITS (18-24)									
1	35021E01	FOUNDATIONS OF COMPUTING AND PROGRAMMING (THEORY AND PRACTICALS)	CSE	FC-ES	2	0	2	3	NIL
2		PYTHON PROGRAMMING (THEORY AND PRACTICALS)	CSE	FC-ES	2	0	2	3	NIL
3		PROGRAMMING FOR PROBLEM SOLVING	CSE	FC-ES	3	0	0	3	NIL

4		BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	EEE & ECE	FC-ES	4	0	0	4	NIL
5		BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	EEE & ECE	FC-ES	0	0	4	2	NIL
6		BASICS OF CIVIL AND MECHANICAL ENGINEERING	CIVIL & MECH	FC-ES	4	0	0	4	NIL
7		ENGINEERING SKILLS PRACTICALS LAB	CIVIL & MECH	FC-ES	0	0	4	2	NIL
8	34421E81	ENGINEERING GRAPHICS AND DESIGN	MECH	FC-ES	0	0	6	3	NIL
9		WORKSHOP PRACTICES	MECH	FC-ES	0	0	4	2	NIL
10	34421E03	MANUFACTURING ENGINEERING FOR PHARMACEUTICAL ENGINEERS	MECH	FC-ES	3	0	0	3	NIL

B. PROFESSIONAL									
CORE COURSES - CREDITS (48-54)									
S. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1	36921C01	HUMAN PHYSIOLOGY(THEORY AND PRACTICALS)	PE	CC	3	0	4	5	Nil
2	36921C02	PHARMACEUTICAL CHEMISTRY	PE	CC	3	0	0	3	Nil
3	36921C81	PHARMACEUTICAL CHEMISTRY LAB	PE	CC	0	0	4	2	Nil
4	36921C03	PHYSICAL PHARMACEUTICS (THEORY AND PRACTICALS)	PE	CC	3	0	2	4	Nil
5	36921C04	UNIT OPERATIONS IN PHARMA INDUSTRIES	PE	CC	3	0	0	3	Nil
6		FLUID MECHANICS AND TRANSFER PROCESSES	PE	CC	3	1	0	4	Nil
7		CHEMICAL ENGINEERING THERMODYNAMICS	PE	CC	3	0	0	3	Nil
8		CHEMICAL ENGINEERING THERMODYNAMICS LAB	PE	CC	0	0	4	2	Nil
9		PHARMACEUTICAL BIOPROCESS ENGINEERING	PE	CC	3	0	0	3	Nil
10		PHARMACEUTICAL BIOPROCESS ENGINEERING LAB	PE	CC	0	0	4	2	Nil
11		MEDICINAL CHEMISTRY	PE	CC	3	0	0	3	FUNDAMENTALS OF CHEMISTRY
12		MEDICINAL CHEMISTRY LAB	PE	CC	0	0	4	2	Nil
13		PHARMACOLOGY AND PHARMACOTHERAPEUTICS	PE	CC	3	0	0	3	HUMAN PHYSIOLOGY
14		PHARMACEUTICAL ANALYSIS	PE	CC	3	0	0	3	Nil

15		PHARMACEUTICAL ANALYSIS LAB	PE	CC	0	0	4	2	Nil
16		INDUSTRIAL PHARMACY - I	PE	CC	3	0	0	3	Nil
17		INDUSTRIAL PHARMACY - II	PE	CC	3	0	0	3	Nil
18		INDUSTRIAL PHARMACY LAB - I	PE	CC	0	0	4	2	Nil
19		INDUSTRIAL PHARMACY LAB - II	PE	CC	0	0	4	2	Nil

C. ELECTIVE COURSES

PROFESSIONAL ELECTIVES - CREDITS (12)

S. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		REGULATORY REQUIREMENTS IN PHARMA INDUSTRIES	PE	EC-PS	3	0	0	3	NIL
2		HERBAL TECHNOLOGY	PE	EC-PS	3	0	0	3	NIL
3		PHARMACEUTICAL PROCESS DESIGN	PE	EC-PS	3	0	0	3	NIL
4		CHEMISTRY OF NATURAL PRODUCTS	PE	EC-PS	3	0	0	3	FUNDAMENTALS OF CHEMISTRY
5		MOLECULAR PATHOGENESIS OF INFECTIOUS DISEASES	PE	EC-PS	3	0	0	3	NIL
6		BIOSIMILARS AND BIOGENERICS	PE	EC-PS	3	0	0	3	NIL
7		SAFETYAND HEALTH MANAGEMENT	PE	EC-PS	3	0	0	3	NIL
8		FUNDAMENTALS OF BIOINFORMATICS	PE	EC-PS	3	0	0	3	NIL
9		COMPUTER AIDED DRUG DESIGN	PE	EC-PS	3	0	0	3	FUNDAMENTALS OF BIOINFORMATICS
10		CELL LINES AND ANIMAL CELL CULTURE	PE	EC-PS	3	0	0	3	NIL
11		BIOPROCESS EQUIPMENT DESIGN	PE	EC-PS	3	0	0	3	NIL
12		INSTRUMENTATION AND PROCESS CONTROL	PE	EC-PS	3	0	0	3	NIL
13		CHEMICAL REACTION ENGINEERING	PE	EC-PS	3	0	0	3	NIL
14		IMMUNOTECHNOLOGY	PE	EC-PS	3	0	0	3	NIL
15		MOLECULAR PHARMACEUTICS	PE	EC-PS	3	0	0	3	NIL
16		ENZYMOLOGY	PE	EC-PS	3	0	0	3	NIL

INDUSTRY DESIGNED/ INDUSTRY SUPPORTED/ INDUSTRY OFFERED/ INDUSTRY SPONSORED COURSES - CREDITS (6)									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1	36921I01	BIOPHARMACEUTICS	KNOVONAT	EC-IE	3	0	0	3	NIL
2	36921I02	CLINICAL RESEARCH	KNOVONAT	EC-IE	3	0	0	3	NIL
3		PHARMACOKINETICS AND PHARMACODYNAMICS	KNOVONAT	EC-IE	3	0	0	3	NIL
4		LEARNING IT ESSENTIALS BY DOING	INFOSYS	EC-IE	3	0	0	3	NIL
5		MOBILE APPLICATION DEVELOPMENT	INFOSYS	EC-IE	3	0	0	3	NIL

OPEN ELECTIVE - INNOVATION ENTREPRENEURSHIP, SKILL DEVELOPMENT ETC. CREDITS (6-9)									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1		INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION	MANAG	OE-IE	3	0	0	3	NIL
2		NEW VENTURE PLANNING AND MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL
3		SOCIAL ENTREPRENEURSHIP	MANAG	OE-IE	3	0	0	3	NIL
4		ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL
5		INTELLECTUAL PROPERTY RIGHTS	MANAG	OE-IE	3	0	0	3	NIL

OPEN ELECTIVE - EMERGING AREAS CREDITS (6-9)									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1		PRINCIPLES OF BIOMEDICAL INSTRUMENTATION	BME	OE-EA	3	0	0	3	Nil
2		BIOSENSORS AND TRANSDUCERS	BME	OE-EA	3	0	0	3	Nil
3		INTRODUCTION TO BIOFUELS	BTE	OE-EA	3	0	0	3	Nil
4		FOOD AND NUTRITION TECHNOLOGY	BTE	OE-EA	3	0	0	3	Nil
5		DISASTER MITIGATION AND MANAGEMENT	CIVIL	OE-EA	3	0	0	3	Nil
6		MUNICIPAL SOLID WASTE MANAGEMENT	CIVIL	OE-EA	3	0	0	3	Nil
7		FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	CSE	OE-EA	3	0	0	3	Nil
8		INTRODUCTION TO INTERNET OF THINGS	CSE	OE-EA	3	0	0	3	Nil
9		DESIGN OF ELECTRONIC EQUIPMENT	ECE	OE-EA	3	0	0	3	Nil
10		INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	ECE	OE-EA	3	0	0	3	Nil
11		GREEN POWER GENERATION SYSTEMS	EEE	OE-EA	3	0	0	3	Nil
12		INDUSTRIAL DRIVES AND AUTOMATION	EEE	OE-EA	3	0	0	3	Nil
13		3D PRINTING AND ITS APPLICATIONS	MECH	OE-EA	3	0	0	3	Nil
14		INDUSTRIAL ROBOTICS	MECH	OE-EA	3	0	0	3	Nil
15		CYBER SECURITY	CSE	OE-EA	3	0	0	3	Nil

CATEGORY D – COURSES FOR PRESENTATION OF TECHNICAL SKILLS									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEG ORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1		PROJECT WORK	PE	PI-P	0	0	16	8	Nil
2		MINI PROJECT	PE	PI-M	0	0	6	3	Nil
3		SEMINAR	PE	PI-S	0	0	2	1	Nil
4		INTERNSHIP	PE	PI-IT	3 WEEKS			3	NIL

E. MANDATORY COURSES INDUCTION TRAINING, INDIAN CONSTITUTION, ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE, EMPLOYABILITY ENHANCEMENT, NSS, RRC, YRC, SPORTS AND GAMES, STUDENT CLUBS, UNNAT BHARAT ABHIYAN, SWACHH BHARAT ETC.									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEG ORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1	34121Z81	YOGA AND MEDITATION	PHED	AC	0	0	2	0	NIL
ANY TWO OF THE FOLLOWING COURSES									
2		GENDER EQUITY AND LAW	LAW	AC	0	0	2	0	NIL
3		ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	GEN	AC	0	0	2	0	NIL
4		INDIAN CONSTITUTION	LAW	AC	0	0	2	0	NIL
5		NCC/NSS/RRC/YRC/ STUDENT CLUBS/UNNAT BHARAT ABHIYAN/SWACTH BHARAT	GEN	AC	0	0	2	0	NIL
6		SPORTS AND GAMES	PHED	AC	0	0	2	0	NIL

SPECIALIZATION – INDUSTRIAL PHARMACY (CREDITS - 15)									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1		COSMETIC TECHNOLOGY	PE	EC-SE	3	0	0	3	NIL
2		VACCINE TECHNOLOGY	PE	EC-SE	3	0	0	3	NIL
3		VALIDATION IN PHARMACEUTICAL INDUSTRIES	PE	EC-SE	3	0	0	3	NIL
4		PHARMACEUTICAL PACKAGING TECHNOLOGY	PE	EC-SE	3	0	0	3	NIL
5		DOWNSTREAM PROCESSING	PE	EC-SE	3	0	0	3	NIL
6		QUALITY CONTROL AND QUALITY ASSURANCE	PE	EC-SE	3	0	0	3	NIL
7		ADVANCED INDUSTRIAL PHARMACY	PE	EC-SE	3	0	0	3	NIL
8		FUNCTIONAL FOODS AND NUTRACEUTICALS	PE	EC-SE	3	0	0	3	NIL
9		NOVEL DRUG DELIVERY SYSTEMS	PE	EC-SE	3	0	0	3	NIL

A. FOUNDATION COURSES

HUMANITIES AND SCIENCES
INCLUDING MANAGEMENT COURSES
CREDITS (9-12)

34121H01	TECHNICAL ENGLISH	Category	L	T	P	Credit
		FC-HS	3	0	0	3

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 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 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, remember and respond to others in different scenario	Remember
CO2. Understand and speak fluently and correctly with correct pronunciation in different situation.	Understand
CO3. To make the students experts in professional writing	Apply
CO4.. To make the students in proficient technical communicator	Apply
CO5 To make the students recognize the role of technical writing in their careers in business, technical and scientific field	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

SELF INTRODUCTION

Self introduction - Simulations using E Materials - Whatsapp, Face book, Hiker, Twitter- Effective Communication with Minimum Words - Interpretation of Images and Films - Identify the different Parts of Speech- Word formation with Prefixes and suffixes -Common Errors in English -Scientific Vocabulary (definition and meaning)– Technical Abbreviations and Acronyms -Listening Skills- Passive and Active listening, Listening to Native Speakers - Characteristics of a good listener.

STRESS

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, New Norms) - Extempore.

SPEAKING SKILLS

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- Interpersonal Skills.

READING SKILLS

English as language of Opportunity and Employability- Impersonal Passive Voice - Conditional Sentences - Technical and Non technical Report Writing (Attend a technical seminar and submit a report) - News Letters and Editing - Skimming-Scanning - How to Improve Reading Speed - Designing Invitations and Poster Preparation – Technical Jargons

TECHNICAL WRITING

Sentence Pattern (SVOCA) - Statement of Comparison - Transcoding (Flow Chart, Bar Chart and Pie Chart) – Informal and Formal letters – Application letter- Resume Writing- Difference among Bio data, Resume and Curriculum Vitae.

TEXTBOOK

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

REFERENCE BOOKS

1. 1. English for Effective Communication, Department of English, VMKV & AVIT, SCM Publishers, 2009.
2. Practical English Usage- Michael Swan (III edition), Oxford University Press
3. Grammar Builder- I, II, III, and Cambridge University Press.

4 Pickett and Laster. Technical English: Writing, Reading and Speaking, New York: Harper and Row Publications, 2002.

Course Designers:

S.No.	Name of the Faculty	Mail ID
1.	Dr. Jennifer G Joseph, Prof. and Head, H&S	jennifer@avit.ac.in
2	Dr.P.Saradha / Associate Professor - English	saradhap@vmkvec.edu.in

	BUSINESS ENGLISH	Category	L	T	P	Credit
		FC-HS	3	0	0	3

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 equip students with employability and job searching skills

COURSE OUTCOMES

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

CO1. Communicate with a range of formal and informal context	Understand
CO2. demonstrate interaction skills and consider how own communication is adjusted in different scenario	Apply
CO3. Use strengthened oral and written skills in the business context	Apply
CO4. Create interest in a topic by exploring thoughts and ideas	Apply
CO5. Have better performance in the art of communication	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Basics of Language and Listening Skills: 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) Jargons- Technical and Business

SPEAKING SKILLS AND READING SKILLS: Extempore**,** Listening to TED Talks and discussion on the topic heard, Speaking activities- pair and group designed by the faculty, Group Discussion-Types of Interviews, Watching Documentary Films and Responding to Questions, Reading Skills-Understanding Ideas and making Inferences-– FAQs –

E - Mail Netiquette - Sample E – mails , Critical Reading-Book Review-Finding Key Information and Shifting Facts from Opinions

CORPORATE COMMUNICATION: What is Corporate Communication? Types of Office communications - Recommendation-Instruction-Check List- Circulars-Inter Office Memo- Minutes of Meeting and Writing Agenda - Discourse Markers - Rearranging Jumbled Sentences

WRITING SKILLS Technical Articles – Written communication Project Proposals-Making Presentations on given Topics -Preparing Power Point Presentations-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

REFERENCE BOOKS

1. Grammar Builder – I, II, III – Cambridge University Press.
2. Technical English – Writing, Reading and Speaking – Pickett and Lester, Harper and Row

Course Designers:

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. Jennifer G Joseph	Professor & Head	English	jennifer@avit.ac.in
2	Dr. P. Saradha	Associate Professor	English	saradhap@vmkvec.edu.in

34121H81	ENGLISH LANGUAGE LAB	Category	L	T	P	Credit
		FC-HS	0	0	4	2

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 improve the oral skills of the students communicate effectively through different activities
4	To understand and apply the telephone etiquette
5	Case study to understand the practical aspects of communication

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	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

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

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

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

wise, Individual. Role Play

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

MODULE V: Case study of Etiquette in different scenario.

Course Designers:

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. Jennifer G Joseph,	Prof. and Head, H&S	English	jennifer@avit.ac.in
2	Dr.P.Saradha	Associate Professor	English	saradhap@vmkvec.edu.in

	PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT LAB	Category	L	T	P	Credit
		FC-HS	0	0	4	2

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 professional with idealistic, practical and moral values.
5	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 and presentation skills to complete given tasks.	Apply
CO3. Speak with clarity and confidence thereby enhancing employability skills of the students.	Apply
CO4. Have balanced value system that can be practiced for enhanced professional life.	Apply
CO5. Improve their vocabulary and use them in appropriate situation	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	**M**	**-**	**-**	**-**	**M**	**M**	**-**	**M**	**S**	**-**	**-**			
CO2	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**S**	**M**	**-**	**-**			
CO3	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**S**	**S**	**-**	**-**			
CO4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**			
CO5	**S**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**S**	**-**	**M**			

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, Barriers and Filters in Listening Skill, Active and Passive listening, exposure to English language through various activities and maintaining a vocabulary dairy improving confidence in Language usage using activities,

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 AND ESSENCE OF SOFT SKILLS: Hard and soft Skills; Feedback Skills; Skills of Effective Speaking; Component of an effective Talk; how to make an effective oral presentation, Time management, Team work skills, Leadership skills, Adaptability and bettering oneself, Persuasion skills.

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

1. The Functional Aspects of Communication Skills, Prajapati Prasad and Rajendra K.Sharma, S. K Kataria& Sons, New Delhi, Rep''nt 2007

REFERENCES

1. Business Communication, Sinha K. K. S. Chand, New Delhi.
2. Business Communication, Asha Kaul, Prentice Hall of India
3. Business Correspondence and Report Writing A Practical Approach to Business and Technical Communication, Sharma, R.C.and Krishna Mohan, Tata Mc Graw – Hill.

Course Designers:

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1.	Dr. Jennifer G Joseph, Prof. and Head	jennifer@avit.ac.in
2.	Dr. P.Saradha, Associate Professor	saradhap@vmkvec.edu.in

	TOTAL QUALITY MANAGEMENT	Category	L	T	P	Credit
		FC-HS	3	0	0	3

PREAMBLE:

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

PREREQUISITE: Not Required

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Understand the importance of quality and TQM at managerial level.	Understand
CO2: Practice the relevant quality improvement tools to implement TQM.	Apply
CO3: Analyse various TQM parameters with help of statistical tools.	Analysing
CO4: Assess various TQM Techniques.	Evaluate
CO5: Practice the Quality Management Systems in a different organization Environment.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION

Concept of Quality and Quality Management - Determinants of quality of product & service - Quality costs – Analysis Techniques for Quality Costs – TQM Principles and Barriers & Implementation –Leadership – Concepts- Role of Top Management- Quality Council – Quality statements: vision, mission, Policy - SMART Goal setting -- Strategic Planning.

TQM PRINCIPLES AND PHILOSOPHIES

Customer satisfaction – Perception of Quality- Customer Complaints - Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment – Teams - Recognition and Reward- Performance Appraisal - Continuous Process Improvement : Deming's Philosophy - Juran's Trilogy - PDSA Cycle- Taguchi Quality Loss Function - 5S principles and 8D methodology - Kaizen - Basic Concepts.

STATISTICAL PROCESS CONTROL (SPC) & PROCESS CAPABILITY

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

TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Benchmarking – Reasons - Process- Quality Function Deployment (QFD) – House of Quality- QFD Process- Benefits- Total Productive Maintenance (TPM) – Concept- Improvement Needs- FMEA – Stages of FMEA - Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

QUALITY SYSTEMS

Introduction to IS/ISO 9004:2000 – quality management systems – Elements- Implementation of Quality System - Documentation- Quality Auditing- ISO 14000 – Concept- Requirements and Benefits.

TEXT BOOKS:

1. Dale H.Besterfiled- et at. - Total Quality Management- PHI-1999. (Indian reprint 2002).
2. Feigenbaum.A.V. "Total Quality Management- McGraw-Hill- 1991.

REFERENCES:

1. James R.Evans & William M.Lidsay - The Management and Control of Quality- (5th Edition) - South-Western (Thomson Learning) - 2002 (ISBN 0-324-06680-5).
2. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd - Oxford. 1989.
3. Narayana V and Sreenivasan - N.S. Quality Management – Concepts and Tasks- New Age International 1996.

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	Mail ID

1	A. Mani	Associate Professor	Management Studies	mani@vmkvec.edu.in
2	Dr. V. Sheela Mary	Associate Professor	Management Studies	sheelamary@avit.ac.in

Course Code	Course Title	Category	L	T	P	C
	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY	**FC-HS**	**3**	**0**	**0**	**3**

Course Objectives:

1. Development of a holistic perspective based on self- exploration

2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

UNIT I Introduction

Value Education, Definition, Concept and Need for Value Education-Content and Process of -basic guidelines for Value Education -Self exploration - Happiness and Prosperity as parts of Value Education.

UNIT II Understanding Harmony in the Human Being

Harmony in Myself-Understanding human being as a co-existence of the sentient 'I' and the material 'Body'-Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. -Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I'-Understanding the harmony of I with the Body-Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT III Understanding Harmony in the Family and Society

Harmony in Human-Human Relationship -meaning of Justice - Trust and Respect -Difference between intention and competence- respect and differentiation; the other salient values in relationship 4.Understanding the harmony in the society - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals –Gratitude

UNIT IV Understanding Harmony in the Nature and Existence

Whole existence as Coexistence -.Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature-Holistic perception of harmony at all levels of existence.

UNIT V Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values -.Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order- Competence in professional ethics

Total Hours : 45 Hours

Text Book

1.Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

COURSE DESIGNERS				
S.NO	**COURSE INSTRUCTOR**	**DESIGNATION**	**NAME OF THE INSTITUTION**	**MAIL ID**
1	Dr.S.P.Sangeetha	Vice Principal(Academics)	AVIT	sangeetha@avit.ac.in
2	Dr.Jennifer G Joseph	HoD-H&S	AVIT	Jennifer@avit.a.cin

BASIC SCIENCE COURSES

34121B02	MATHEMATICS FOR BIO-ENGINEERING	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

Matrices have found to be of great utility in many branches of engineering applications. Many physical laws and relations can be expressed mathematically in the form of differential equations. Statistical methods are important tools which provide the engineers with both descriptive and analytical methods for dealing with the variability in observed data. This course offers the knowledge of solving optimization problems, to develop skills and knowledge of standard concepts in ordinary differential equations, to analyze Statistical data and draw conclusion from those analyses.

PREREQUISITE

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COURSE OBJECTIVES

1	To recall the advanced matrix knowledge to Engineering problems
2	To improve their ability in solving geometrical applications of differential calculus problems and integral calculus.
3	To enable the students to solve ordinary differential equations.
4	To describes the characteristic of the entire group of data and choose the best central tendency and variability statistic for different levels of measurement
5	To compute and interpret the correlation and regression coefficients that arise in engineering problems

COURSE OUTCOMES

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

CO1. Apply the matrix operations, including inverses and determinants	Apply
CO2. Apply the concept of differentiation in functions of single and several variables.	Apply
CO3. Apply knowledge of Ordinary differential equations in biological processes.	Apply
CO4. Analyze statistical data using measures of central tendency, dispersion and location for grouped and ungrouped data cases.	Apply
CO5. Apply the concept of correlation and regression in computational biology.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	--	--	--	--	M	--	--	--	L	--	--	--

CO2	S	M	L	--	--	--	--	M	--	--	--	L	--	--	--
CO3	S	M	M	L	--	--	--	M	--	--	--	M	--	--	--
CO4	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--
CO5	S	M	M	L	--	--	--	M	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

MATRICES:
Basic properties of Matrices – Inverse – Characteristic Equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley-Hamilton theorem (Without proof)

DIFFERENTIAL CALCULUS & INTEGRATION:
Ordinary Differentiation – Basic Concepts – Slope –Second order derivates – Partial Differentiation– Maxima and Minima of a function of two variables.
Concept of integration-Integration of Rational and Trigonometric functions – Substitutions – Integration by parts.

ORDINARY DIFFERENTIAL EQUATIONS:
Formation of differential equations – Solution of first order equation – Variable separable, Solution of Linear differential equation of the form $\frac{dy}{dx} + Py = Q$

DESCRIPTIVE STATISTICS:
Frequency distribution – Measure of Central Tendency – Mean, Median, Mode – Measures of Dispersion – Skewness, Kurtosis and Moments.

CORRELATION AND REGRESSION ANALYSIS:
Correlation – Methods of Correlation – Rank Correlation – Regression – Regression equation – Multiple and Partial Correlation –Multiple Correlation coefficients – Partial Correlation coefficients.

TEXT BOOKS:

1. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
2. S.P. Gupta, "Statistical Methods", 34th Edition, Sultan Chand & Sons Publishers (2006).

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt Ltd.,

Singapore (2012).
2. S.C. Gupta and V.K. Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, New Delhi (2015).

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S. Punitha	Asso. Professor	Mathematics	punitha@vmkvec.edu.in
2	Dr. S. Gayathri	Asst. Professor	Mathematics	gayathri@avit.ac.in

	BIOSTATISTICS (Statistical table permitted for Examination)	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

The Biological data come from a wide range of sources, including genomic studies, experiments with cells and organisms, and clinical trials. Statistical methods are important tools which provide the engineers with both descriptive and analytical methods for dealing with the variability in observed data. It introduces students to cognitive learning in statistics and develops skills on analyzing the data by using different tests and designing the experiments with several factors. Statistical Quality control is a method of quality control which employs statistical methods to monitor and control a process and ensure the process operates efficiently, producing more specification-conforming product.

PREREQUISITE - 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 and random variables with respect to how they are applied to statistical data.
3	To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample.
4	To get exposed to the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
5	To understand the concept of Quality control and the use of operating characteristic (OC) curves in Acceptance sampling.

COURSE OUTCOMES

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

CO1. Plan a statistical data investigation in the biosciences and related fields, and propose a method for data collection and analysis. Identify and recognize the appropriate sample survey design for related problems	Apply
CO2. Apply probability rules and probability models to solve problems and translate real-world problems into probability models. .	Apply
CO3. Apply the concepts of large/small sample tests into real life problems	Apply
CO4. Interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations.	Apply
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

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOSTATISTICS:

Statistics – Collection of data – Primary & Secondary Data – Classification & Tabulation of data – Diagrammatic and Graphical representation of data – Sampling – Methods of Sampling – Random and Non-Random Sampling – Limitations of sampling.

PROBABILITY AND RANDOM VARIABLES

Probability concepts - Conditional probability – Baye's theorem - Random variables – Discrete and continuous random variables – Expectation – Variance – Standard Distribution – Binomial, Poisson, Normal (Problems only)

TESTING OF HYPOTHESIS:

Sampling distributions – Statistical hypothesis – Testing of hypothesis for mean, variance, and proportions for large and Small Samples (Z, t and F test) – Chi-square Tests for Goodness of fit – independence of attributes.

DESIGN OF EXPERIMENTS:

Analysis of Variance – One Way Classification – Two Way Classification – Completely Randomized Design – Randomized Block Design – Latin Square Design.

STATISTICAL QUALITY CONTROL:

Introduction – Process control – Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

TEXT BOOKS:

1. S.P. Gupta, "Statistical Methods", Sultan Chand & Sons, New Delhi, 45th Revised Edition (2017).
2. P.N. Arora, P.K. Malhan, "Biostatistics", Himalaya Publishing House (2010).

REFERENCES:

1. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi (2015).
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition (2007).

COURSE DESIGNERS

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1	Dr. P. Sasikala	Professor	Mathematics	sasikala@vmkvec.edu.in
2	Dr. S. Gayathri	Asst. Professor	Mathematics	gayathri@avit.ac.in

	NUMERICAL METHODS FOR BIO-ENGINEERING	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

This course provides an introduction to the basic concepts and techniques of numerical solution of algebraic equation, system of algebraic equation, numerical solution of differentiation, integration, interpolations and applications to engineering, and science areas and develops problem solving skills with both theoretical and numerical oriented problems

PREREQUISITE

Mathematics for Bio -Engineering

COURSE OBJECTIVES

1	To familiar with numerical solution of equations
2	To be get exposed to finite differences and interpolation
3	To be thorough with the numerical Differentiation and integration
4	To find numerical solutions of ordinary differential equations
5	To curve fit data using several types of curves.

COURSE OUTCOMES

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

CO1. Solve the system of linear algebraic equations and single non linear equations arising in the field of Engineering.	Apply
CO2. Apply methods to find intermediate numerical value & polynomial of numerical data.	Apply
CO3. Apply methods to find integration, derivatives of one and two variable functions.	Apply
CO4. Solve the initial value problems using single step and multistep methods.	Apply
CO5. Compute and interpret the method of least squares	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

SOLUTION OF LINEAR EQUATIONS:

Method of false position, Newton-Raphson method for single variable, Solutions of a linear system by Gauss

Elimination, Gauss-Jordan, Jacobian and Gauss- Seidel methods

INTERPOLATION AND APPROXIMATION: Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling's and Bessel's).

NUMERICAL INTEGRATION AND DIFFERENTIATION

: Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both1/3rd and 3/8th) rules.

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:

Euler's method -Euler's modified method -Taylor's method and Runge-Kutta method for 4th order -Multistep methods -Milne's and Adams' methods.

CURVE FITTING

Curve fitting by method of least squares and method of moments - Fitting of a straight line - a parabola and Curves of the form $y=ae^{bx}$, $y=ab^{x}$, $y=ax^{b}$.

TEXT BOOKS:

1. Dr.B.S.Grewal, "Numerical Methods in Engineering & Science", Khanna Publishers (2007).
2. S.K Gupta, "Numerical Methods for Engineers", New Age International Pvt. Ltd. Publishers (2015).

REFERENCES:

1. Joe D. Hoffman, Steven Frankel, "Numerical Methods for Engineers and Scientists", 3rd Edition, Tata Mc-Graw Hill.(New York) (2015).
2. T. Veerarajan, T. Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2004).

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. M.Vijayarakavan	Asso.Prof	Mathematics	vijayarakavan@vmkvec.edu.in
2	Dr. S. Gayathri	Asst. Professor	Mathematics	gayathri@avit.ac.in

34121B04	PHYSICAL SCIENCES - Part A: ENGINEERING PHYSICS	Category	L	T	P	Credit
		FC-BS	2	0	0	2

PREAMBLE

Engineering Physics is the study of advanced physics concepts and their applications in various technological and engineering domains. Understanding the concepts of laser, types of lasers, the propagation of light through fibers, applications of optical fibers in communication, production and applications of ultrasonics will help an engineer to analyze, design and to fabricate various conceptual based devices.

PREREQUISITE : NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Understand the principles laser, fiber optics and ultrasonics	Understand
CO2. Understand the construction of laser, fiber optic and ultrasonic equipments	Understand
CO3. Demonstrate the working of laser, fiber optic and ultrasonic based components and devices	Apply
CO4. Interpret the potential applications of laser, fiber optics and ultrasonics in various fields	Apply
CO5. Differentiate the working modes of various types of laser, fiber optic and ultrasonic devices.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Unit: I **9 hours**

LASERS: Laser characteristics - Stimulated Emission – Population Inversion - Einstein coefficients – Lasing action – Types of Laser – Nd:YAG laser, CO2 laser, GaAs laser – Applications of Laser – Holography – construction and reconstruction of a hologram.

Unit: II **9 hours**

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

Unit: III **9 hours**

ULTRASONICS: Ultrasonic production: Magnetostriction and piezo electric methods – Determination of velocity of ultrasonic waves (acoustic grating) – Applications of ultrasonics

TEXT BOOKS

1. Engineering Physics, compiled by Department of Physics, Vinayaka Mission's Research Foundation (Deemed to be University), Salem.

2. Palanisamy P. K., Engineering Physics, Scientific Publishers, 2011.

3. Avadhanulu M. N., Kshirsagar P. G., Arun Murthy T. V. S., A Textbook of Engineering Physics, S. Chand Publishing, 2018.

REFERENCE BOOKS

1. Beiser, Arthur, Concepts of Modern Physics, 5th Edition, McGraw-Hill, 2009.

2. Halliday.D, Resnick.R, Walker.J, Fundamentals of Physics, Wiley & sons, 2013.

3. Gaur R. K. and Gupta S. L., Engineering Physics, DhanpatRai publishers, New Delhi, 2012.

4. Srivastava S. K., Laser Systems and Applications 3rd Edition, New Age International (P) Ltd Publishers, 2019.

5. Ajoy Ghatak, Thyagarajan K., Introduction To Fiber Optics, Cambridge India, 2013.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. C. SENTHIL KUMAR	PROFESSOR	PHYSICS	senthilkumarc@vmkvec.edu.in
2	Dr. R. SETHUPATHI	ASSOCIATE PROFESSSOR	PHYSICS	sethupathi@vmkvec.edu.in

34121B04	PHYSICAL SCIENCES PART-B - ENGINEERING CHEMISTRY	Category	L	T	P	Credit
		FC-BS	2	0	0	2

PREAMBLE

The objective of this course is to better understand the basic concepts of chemistry and its applications in diverse engineering domains. It also imparts knowledge on the properties of water and its treatment methods, Electrochemistry, corrosion and batteries, properties of fuel and combustion. This course also provides an idea to select the material for various engineering applications and their characterization.

PREREQUISITE NIL

COURSE OBJECTIVES

1	To Provide the knowledge on water treatment.
2	To explain about the importance of electrochemistry, mechanism of different corrosion and principle and working of batteries.
3	To explain different types of fuel, properties and its important features.

COURSE OUTCOMES

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

CO1.	Estimate the hardness of water Apply and Identify suitable water treatment methods.	Apply
CO2.	Describe terms involved in electrochemistry, the control methods of corrosion and working of energy storage devices.	Analyse
CO3.	Understand the quality of fuels from its properties and the important features of fuels	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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

S- Strong; M-Medium; L-Low

Syllabus

UNIT – I: WATER TECHNOLOGY 9hrs

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA. Boiler troubles - Treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning). External treatment – Ion exchange process, zeolite process – Domestic water treatment - desalination of brackish water – Reverse Osmosis and Electrodialysis.

UNIT – II: ELECTROCHEMISTRY, CORROSION AND BATTERIES 9hrs

Electrochemistry: Electrode potential - Nernst equation – Electrodes (SHE, Calomel and Glass) - Galvanic cell- Electrochemical cell representation - EMF series and its significance. Corrosion – Definition causes and effects, Classification, Types of corrosion- dry corrosion, Wet corrosion, Factors influencing rate of corrosion, Corrosion control methods – Sacrificial anode method and impressed current cathodic method.

Batteries: Terminology- Daniel cell – Dry cell - Lead-acid accumulator- Nickel-Cadmium batteries, Lithium batteries: Li/SOCl2 cell - Li/I2 cell- Lithium ion batteries. Fuel cells: Hydrogen-oxygen fuel cell, Solid oxide fuel

cell (SOFC)

UNIT – III FUELS AND COMBUSTION **9hrs**

Fuels: Introduction – classification of fuels – coal – analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – petroleum – manufacture of synthetic petrol (Bergius process). Knocking – octane number – cetane number – natural gas – compressed natural gas (CNG). Liquefied petroleum gases (LPG) – power alcohol and biodiesel. Combustion of fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – ignition temperature – spontaneous ignition temperature – explosive range – flue gas analysis (ORSAT Method).

TEXTBOOK

1. Engineering Chemistry by Jain and Jain, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2017
2. A text book of Engineering Chemistry by S.S. Dara, S.Chand & company Ltd., New Delhi
3. A text book of Engineering Chemistry by Shashi Chawla, Edition 2012 Dhanpatrai & Co., New Delhi.

REFERENCES

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, 3rd Edition, McGraw Hill, 1980
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins, Julio de Paula, 8th Edition, Oxford University press, 2007
4. Engineering Chemistry by Dr. A. Ravikrishnan, Sri Krishna Publications, Chennai.

Course Designers:

Name of the Faculty	Mail ID
Dr. A.R. Sasieekumar	sasieekhumar@vmkvec.edu.in
Dr. R. Nagalakshmi	nagalakshmi.chemistry@avit.ac.in

34121B81	PHYSICAL SCIENCES LAB PART A – REAL AND VIRTUAL LAB IN PHYSICS	Category	L	T	P	Credit
		FC-BS	0	0	2	1

PREAMBLE

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

PREREQUISITE

NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Young's modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser
6. Wavelength of spectral lines – grating – Spectrometer

7. Thickness of a wire - Air wedge Method
8. Thermal conductivity of a bad conductor - Lee's disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer

LAB MANUAL

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

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. C. SENTHIL KUMAR	PROFESSOR	PHYSICS	senthilkumarc@vmkvec.edu.in
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34121B81	PHYSICAL SCIENCES PART B - ENGINEERING CHEMISTRY LAB	Category	L	T	P	Credit
		FC-BS	0	0	2	1

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

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

S- Strong; M-Medium; L-Low

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.

COURSE DESIGNERS

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	SMART MATERIALS AND NANOTECHNOLOGY	Category	L	T	P	C
	Total Contact Hours: 45	FC-BS	3	0	0	3
	Prerequisite: Physical Sciences – Engineering Physics					

Preamble:

This syllabus enables the students to learn the applications of smart materials and uses of various smart engineering devices. The syllabus also discusses about the nanomaterials, their unique properties and applications in various fields.

Course Objectives:		
1	Gain the knowledge about the concepts of smart systems and various smart materials.	
2	Realize about the smart sensor materials which are used for Industrial Applications.	
3	Understand about the Industrial application oriented Smart materials' Actuators.	
4	To learn the properties and classifications and importance of Nanomaterials	
5	Understand the characteristic features of materials at nanoscale and their potential applications	
COS	**Course Outcomes:** On the successful completion of the course, students will	
CO1	Learn the smart-properties of various functional materials	Learn
CO2	understand the applications of different smart materials as sensors	Understand
CO3	understand the applications of different smart materials as actuators	Understand
CO4	Gather knowledge on unique properties of nanomaterials	Learn
CO5	Use of Nanomaterials for industrial applications	Acquire
CO6	Gain knowledge about nanomaterials in health care industry	

Mapping with Programme Outcomes and Programme Specific Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	POS1	POS2	POS3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	S	S	S	M	-	-	-	-	-	-	S	-	-	-
CO3	S	M	S	S	-	-	-	-	-	-	-	S	-	-	-
CO4	S	S	S	S	M	-	-	-	-	-	-	S	-	-	-
CO5	S	S	S	S	-	-	-	-	-	-	-	S	-	-	-
CO6	S	M	M	S	M	-	-	-	-	-	-	S	-	-	-

S – strong, M- Medium, L - Low

Syllabus

UNIT: I 9 Hours

Overview of Smart Materials: Introduction to Smart materials –piezoelectric materials – piezoelectricity – magnetostriction materials – magnetostriction effect– shape memory alloys (SMA) – photoelastic materials – photoelasticity.

UNIT: II 9 Hours

Smart material based sensors: Introduction to sensing technology - electric and magnetosrictive sensors - SMA based sensors - Infrared sensors – stress analysis by photoelastic sensors- Industrial Applications of smart sensors: Accelerometer and Biological DNA sensors.

UNIT: III 9 Hours

Smart Materials For Actuators: Introduction to smart actuators - piezoelectric actuators - magnetostrictive actuators - SMA based actuators - polymeric and carbon nanotubes based low power actuators –Industrial Applications: robotic artificial muscles , materials for bone substitutes and tissue replacement implants - smart polymeric materials for skin engineering

UNIT: IV 9 Hours

Materials in Nanoscale: Historical development of nanomaterials - Unit and dimensions - Classifications of nanomaterials - quantum dots, nanowires, ultra-thin films, nanoparticles, multilayered materials. Length Scales involved and effect on properties: mechanical, electronic, optical, magnetic and thermal properties.

UNIT: V 9 Hours

Selected Applications of Nanomaterials: Medical diagnostics – nanomedicine – targeted drug delivery – Biosensors; Information storage – nanocomputer – molecular switch – single electron transistors; design and fabrication of MEMS and NEMS devices.

TEXT BOOKS

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2015.
2. Fundamental of Smart Materials, Editor: Mohsen Shahinpoor, RSC Publishers 2020
3. Charles P. Poole, Jr. and Frank J Ownes, "Introduction to Nanoscience and Nanotechnology", Wiley-Interscience Inc., Publication, 1st Edition, 2020.
4. Smart Material Systems And Mems Design And Development Methodologies by Vijay K Varadan, WILEY INDIA 2014.

REFERENCE BOOKS

1. Pillai S.O., Solid State Physics, 9th Edition, New Age International (P) Ltd., Publishers, 2020.
2. William D. Callister Jr., David G. Rethwisch., Materials Science and Engineering: An Introduction, 10th Edition, Wiley Publisher, 2018.
3. Nanotechnology, Second eition, M. A. Shah and K. A. Shah, Wiley Publishers 2019.
4. Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep, CRC Press, 2009.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. B. DHANALAKSHMI	Asso. Professor	Physics	Dhanalakshmi.phy@avit.ac.in
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3	Dr. R. N. VISWANATH	Professor	Physics	rnviswanath@avit.ac.in

	FUNDAMENTALS OF CHEMISTRY	Category	L	T	P	Credit
		FC (BS)	3	0	0	3

PREAMBLE

Fundamentals of Chemistry provide a detailed understanding of the fundamental principles behind the Atomic structure, chemical bonding, stereoisomerism, and reaction mechanisms of the chemical compounds such as aliphatic, aromatic and heterocyclic compounds.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To explain the periodic properties of elements , types of bonding , Valence bond and Molecular orbital theory
2	To describe the fundamental concepts in stereochemistry & its significance
3	To summarize aliphatic compounds & its reaction mechanism
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 understand

CO1. Gain the knowledge about the periodic properties of elements and different types of bonding involved in chemical reactions	Remember
CO2. Understand the types of stereoisomerism & its importance	Understand
CO3. Acquire the basic knowledge on aliphatic compounds and its important reactions of aliphatic compounds	Understand
CO4. Demonstrate the structure and important reactions of aromatic compounds	Understand
CO5. Discuss the heterocyclic compounds with heteroatom N, O and S	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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

S- Strong; M-Medium; L-Low

Syllabus

UNIT- I ATOMIC STRUCTURE AND CHEMICAL BONDING 9hrs

Classification of elements – General characteristics of s, p, d and f- Block elements – Periodicity of properties- Definition and Periodicity of Atomic radii and Ionic radii, Ionization potential, Electron affinity and Electronegativity- Ionic bond & Covalent bond:- Conditions for the formation of ionic and covalent bond - General properties, Hydrogen bonding:-types, examples and effect on properties - Valence Bond theory – Molecular Orbital theory:– molecular orbital diagrams of diatomic and simple polyatomic molecules N2, O2 and their ions; HCl, BeF2.

UNIT- II STEREOCHEMISTRY 9hrs

Introduction, definition, Optical activity, specific rotation, asymmetric centre, chirality, achiral molecules, Elements of symmetry, resolution of racemic mixtures, Walden inversion - Asymmetry synthesis, specification of R-S notations - Optically activity of compounds without asymmetric carbon atoms: Allenes, spirenes and biphenyl compounds - Geometrical Isomerism: Definition with example, designation of Cis-trans and E-Z notation with examples, Geometrical isomerization of Maleic acid and fumaric acids, aldoximes and ketoximes, Determination of configuration of geometrical isomers.

UNIT- III CHEMISTRY OF ALIPHATIC COMPOUNDS 9hrs

Alkanes , Alkenes and Alkynes : Preparation and reactions (Any four for each case) - Ethers- Preparation and properties of diethyl ether and vinyl ether - Carbonyl Compounds (Aldehydes, Acids and Ketones)- general methods of preparation and properties - Amines- Classification of amines, preparation and Properties of aliphatic amines - Nitro compounds- Preparation and properties of nitro methane, nitroso methane. Reactive intermediates - carbocations, carbanions, carbenes. Reaction mechanisms - SN1, SN2, E1 and E2

UNIT- IV CHEMISTRY OF AROMATIC COMPOUNDS 9hrs

Nomenclature – structure and stability of benzene – Aromaticity and Huckel's rule - General methods of preparation of benzene – Reaction and Mechanism of electrophilic aromatic substitutions- examples of electrophilic aromatic substitution reactions – nitration- sulphonation- halogenation- Friedel-Crafts alkylation and acylation - reduction- orientation and reactivity of substituted benzenes- ortho/para ratio- synthesis of substituted benzenes using arene diazonium salts- nucleophilic aromatic substitutions- benzyne. Polynuclear aromatic hydrocarbons – preparation, properties and uses of naphthalene- anthracene and phenanthrene.

UNIT- V CHEMISTRY OF HETEROCYCLIC COMPOUNDS 9hrs

Definition, Classification and nomenclature of heterocyclic compounds, structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom and fused systems; Synthesis of Furan, Pyrrole (Paal-Knorr synthesis), Thiophene, Pyridine (Hantzsch synthesis); Indole (Fischer synthesis); Quinoline and isoquinoline (Skraup synthesis and Bischler-Napieralski synthesis); Electrophilic substitution reactions of pyrrole and pyridine.

Text Book

1. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, A Textbook of Organic Chemistry, 2nd Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi, 2004.
2. R.T. Morrison and R. N.Boyd, Organic Chemistry, 6th edition, Prentice-Hall of India Ltd, New Delhi, 1992.
3. A Textbook of Organic Chemistry, Arun Bahl, B.S. Bahl, 22nd Edition. Publisher: S Chand .
4. Jerry March, Advanced Organic Chemistry, 5 th Edition, John Wiley and Sons, New York, 2004

Reference Book

1. Organic Chemistry, I.L.FINAR. 5th Edition. (Volume I & II) Pearson Publisher
2. Organic Reactions Stereochemistry and Mechanism P. S. Kalsi. 4th Edition. New Age International Publishers.
3. F.A.Carey, Organic Chemistry, 3rd edition, Tata-McGraw Hill Publications, New Delhi,

1999.

4. B.Y.Paula, Organic Chemistry, 3rd edition, Pearson Education Inc, Singapore, 2002

Course Designers:

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	FUNDAMENTALS OF BIOCHEMISTRY (THEORY & PRACTICALS)	Category	L	T	P	Credit
		FC (BS)	3	0	2	4

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 and its associated diseases.

PRERQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Recall the Definitions, classification, properties and structure of carbohydrates, lipids, amino acids and protein	Remember
CO2. Discuss the biological importance of biomolecules and its nutritional value.	Understand
CO3. Identify about the structures of amino acids, proteins and Nucleic acids.	Understand
CO4. Prepare solutions and biological buffers	Apply
CO5. Determine the quality and quantity of biomolecules	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PS O3
CO1	M	-	L	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CO4	S	M	M	S	M	L	-	-	-	-	-	L	S	-	-
CO5	S	M	M	S	M	M	-	-	-	-	-	L	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

CARBOHYDRATE AND LIPIDS

Biological importance, Nomenclature and Definition, Classification and Properties of Monosaccharides, Formulation of monosaccharides, Disaccharides, Oligosccharides and Polysaccharides (Homopolysaccharides and Heteropolysaccharides). Biological importance, Definition and Classification. Fattyacids: classification,

nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, Triacylglycerols: nomenclature, physical properties, chemical properties.

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).

NUCLEIC ACIDS

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

PRACTICAL'S

1. pH measurements and Buffer preparations.

TITRIMETRIC EXPERIMENTS

2. Determination of Saponification value of Edible oil
3. Determination of Iodine value of Oil
4. Determination of Acid number of Edible oils.
5. Titration curves of Amino acids

BIOCHEMICAL PREPARATIONS

6. Estimation of chlorophyll from plant material.
7. Detection of adulteration of Milk
8. Casein from Milk.
9. Starch from Potato.
10. Determination of Total Oil Content by Soxhlet Method.

TEXT BOOKS

1. "Fundamentals of Biochemistry", Jain J.L., Sunjay Jain and Nitin Jain., S.Chand& Company Ltd., 6th Edition, 2005.
2. Fundamentals of Biochemistry, Jain J.L., Sunjay Jain and Nitin Jain., S.Chand& Company Ltd., 6th Edition, 2005.

REFERENCES:

1. "Text Book of Biochemistry for Medical Students", Ambika Shanmugham, Lippincott Williams & Wilkins, 7th Edition, 2012.
2. "Biochemistry", Rastogi S.C. Mc. Graw-Hill Publishing Company Ltd, 6th Edition, 2007.
3. "Principles of Biochemistry", David L. Nelson and Michael M. Cox, W. H. Freeman and Company, 4th Edition, 2005.
4. "Text book of Biochemistry", Sathyanarayana U and Chakrapani U., Uppala Author Publishers Interlinks, 3rd Edition, 2006.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.Anandakumar	Assistant Professor	Biotechnology	anandakumars@vmkvec.edu.in
2				

	FUNDAMENTALS OF MICROBIOLOGY (THEORY & PRACTICALS)	Category	L	T	P	Credit
		FC-BS	2	0	2	3

PREAMBLE

Microbiology deals with the study of microbes. It will cover a wide spectrum of classification, cellular organization and characteristics of microscopic organisms, diseases caused and beneficial effects, environmental damage or stress. Microbiologists often use cutting-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms. Knowledge of these principles will enable students to understand how they react under different conditions and how they cause different diseases.

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	Describe the safe practices in a microbiology laboratory and handling method of glass wares and instruments.
5	Perform transfer of living microbes using aseptic technique.

COURSE OUTCOMES

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

CO1. Explain about historical perspective of microbiology and its developments	Understand
CO2.Describe the fundamental structure, functions of a cell and the control of microbes using physical and chemical methods	Understand
CO3. Demonstrate the microbial nutritional requirements for growth	Apply
CO4. Experiment with microscope to reveal the structure and function of microorganisms	Apply
CO5. Identify the methods for isolation, subculture, and maintenance of bacterial and fungal specimens	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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.

PRACTICE

SYLLABUS

1. Sterilization techniques and handling method of glass wares and instruments
2. Culture Media Preparations
   a. Broth media
   b. Agar
3. Culturing of Micro organisms
   a. Pure Culture techniques b. Streak plate c. Pour plate
4. Quantification of microorganisms Microscopy
   a. Serial dilution and plating
5. Preservation of Bacterial Culture

TEXT BOOKS:

1. Pelzar, M.J., Chan, E.C. S and Krieg, N.R. 1993.Microbiology. Tata McGraw Hill Edition. New Delhi. India.
2. Ananthanarayan and Jayaram Paniker, 1999. Text Book of Microbiology. Orient Longman Publishers.

REFERENCES:

1. Talaro, K., Talaro A. Cassida Pelza and Reid, 1993. Foundation in Microbiology. W.C. Brown Publishers.
2. Prescott, Harley and Klen, 2003. Microbiology. McGraw Hill Publications. 5th Edn.
3. Frazier, W.S. and Weshoff, D.C., 1988. Food Microbiology, 4th Edn., McGraw Hill Book Co., New York.
4. George, J.B., 1987. Basic Food Microbiology. CBS Publishers and Distributors.
5. Cappuccino, J. G. and Sherman, N., 1999. Microbiology: A laboratory Manual. 4th Edition, Addison - Wesley.
6. Collee, J. G., et al., 1996. Mackie and McCartney Practical Medical Microbiology. 4th Edition, Churchill Livingstone.
7. Sundararaj, T., 2007. Microbiology laboratory manual. A swathy Sunndararaj.

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Ms.M.Sobana	Assistant Professor	Biotechnology	sobanam@vmkvec.edu.in
2	Dr.R.Balachandar	Assistant Professor G-II	Biotechnology	Balachandar.biotech@avit.ac.in

	ENVIRONMENTAL SCIENCES (Common to All Branches)	Category	L	T	P	Credit
		FC-BS	3	0	0	3

Environmental science is an interdisciplinary field that integrates physical, chemical, biological, and atmospheric sciences. Environmental studies deals with the human relations to the environment and societal problems and conserving the environment for the future. Environmental engineering focuses on the various issues of environment and its management for sustainable development by improving the environmental quality in every aspect.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To inculcate the knowledge of significance of environmental studies and conservation of the natural resources.
2	To acquire knowledge of ecosystem, biodiversity, it's threats and the need for conservation
3	To gain knowledge about environmental pollution, it's sources, effects and control measures
4	To familiarize the legal provisions and the national and international concern for the protection of environment
5	To be aware of the population on human health and environment, role of technology in monitoring human health and environment.

COURSE OUTCOMES

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

CO1. Understand the importance of environment and alternate energy resources	Understand
CO2. Initiate the awareness and recognize the social responsibility in ecosystem and biodiversity conservation	Apply
CO3. To develop technologies to analyse the air, water and soil pollution and solve the problems	Apply
CO4. To evaluate the social issues and apply suitable environmental regulations for a sustainable development	Evaluate
CO5. To identify and analyse the urban problems, population on human health and environment	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT –I ENVIRONMENT AND NATURAL RESOURCES 6 hrs

Environment - Definition, scope & importance - Public awareness- Forest resources- Use and over-exploitation, deforestation, case studies- Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, Agriculture- effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, Scope & role of engineers in conservation of natural resources.

UNIT –II ECOSYSTEMS AND BIO – DIVERSITY 6 hrs

Ecosystem - Definition, structure and function - Food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest and Aquatic ecosystems – pond and sea, Introduction to biodiversity, Levels of biodiversity: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –India as a mega-diversity nation – hot-spots of biodiversity –Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT –III ENVIRONMENTAL POLLUTION 6 hrs

Pollution - Definition, causes, effects and control measures of Air, Water and Land pollution, Solid waste- solid waste Management,–Disaster management: Floods, earthquake, cyclone, landslides and tsunamis - Clean technology options, Low Carbon Life Style.

UNIT-IV SOCIAL ISSUES AND ENVIRONMENT 6 hrs

Sustainable Development- Water conservation – rain water harvesting, watershed management -Resettlement and rehabilitation of people , case studies –Climate change - Global warming - Acid rain - Ozone depletion- Environment Protection Act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act- Pollution Control Board-central and state pollution control boards.

UNIT-V HUMAN POPULATION AND ENVIRONMENT 6 hrs

Population – Population growth & Population Explosion –Family welfare programme - Environment & human health - Human rights – Value education –AIDS/HIV, Role of information technology in environment and human health.

TEXT BOOK

1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.
2. Erach Bharucha "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India
3. Benny Joseph “Environmental Science and Engineering”, Tata Mc Graw- Hill, New Delhi

REFERENCES:

1.Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.
2. Anubha Kaushik and C.P Kaushik “Perspectives of Environmental Studies”, New age international publishers.
3. Trivedi R.K. “Handbook of Environmental Laws", Rules, Guidelines,Compliances and Standards Vol I & II, Enviromedia.
4. Environmental Science and Engineering by Dr. J. Meenambal, MJP Publication, Chennai Gilbert M. Masters: Introduction to Environmental Engineering and Science , Pearson EducationPvtLtd., II Edition, ISBN 81-297-0277-0,2004.
5. Miller T.G.Jr. Environmental Science Wads worth Publishing. Co.
6. Townsend C. Harper J. and Michael Begon, Essentials of Ecology, Blackwell Science.

COURSE DESIGNERS

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ENGINEERING SCIENCE COURSES

INCLUDING WORKSHOP, DRAWING, BASICS OF ELECTRICAL/MECHANICAL/COMPUTER ETC.

CREDITS (18-24)

35021E01	FOUNDATIONS OF COMPUTING AND PROGRAMMING (THEORY AND PRACTICAL)	Category	L	T	P	Credit
		FC-ES	2	0	2	3

PREAMBLE

This course aims to provide the fundamental concepts of Computer operations like hardware and software installation, and emphasizing principles programming languages. Studying the fundamentals database languages, commands and internet basics.

PRERQUISITE – Nil

COURSE OBJECTIVES

1.	To provide basic knowledge of hardware components of computers and classifications.
2.	To introduce and demonstrate various Operating System functions and software. Software application packages.
3.	To study Principles of programming and applications of programming.
4.	To learn about various Database Management Systems languages and commands used.
5.	To learn basics of Internet and Web services.

COURSE OUTCOMES

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

CO1. To understand the Basic knowledge on computer hardware and its functions.	Understand
CO2. To get knowledge of Fundamentals of various Operating System functions and soft wares.	Understand
CO3.To Understand the principles of programming and categories of programming languages.	Apply
CO4.To demonstrates Database Management Systems languages and their classifications.	Apply
CO5.To understands and demonstrates the Internet Basics.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to computers:

Computer – Characteristics of computers -Generations of computers- Types of Computers- Block diagram of a computer – Components of a computer system –Hardware and software definitions – Categories of software – Booting.

Software applications:
Office Automation: Application Packages – Word processing (MS Word) – Spread sheet (MS Excel) – Presentation (MS PowerPoint).
Lab Component-Ms Word,,Ms Excel,Ms powerpoint.

Introduction to programming
Problems Solving Techniques - Program Development Cycle – Algorithm Development – Flow chart generation –Programming Constructs (Sequential, Decision-Making, Iteration) – Types and generation of programming Languages**.**

Fundamentals of Operating System and DBMS :
Operating Systems: Introduction, Functions of an operating System, types of Operating Systems
Introduction to Database Management Systems- -File system vs DBMS, Database applications, Database users, Introduction to SQL, Classification of SQL:DDL, DML, DCL, TCL
Lab Component- DDL, DML, DCL, TCL constraints

Internet Basics
Introduction, Features of Internet, Internet application, Services of Internet
Basics of HTML – Applications of HTML – HTML Fonts – anchor tag and its attributes – Using images in HTML programs – list tag - Table tag .

Lab Component -HTML programs
TEXT BOOKS:

1. "Essentials of Computer Science and Engineering", Department of Computer Sciences, VMKVEC, Salem, Anuradha Publishers, 2017.
2. J. Glenn Brookshear,"Computer Science: An Overview", Addision-Wesley, Twelfth Edition, 2014

REFERENCES:

1. "Concepts of programming language" Concepts of Programming Languages Eleventh Edition GLOBAL Edition Robert W. Sebesta, 2019.
2. Knuth D.E., "The Art of computer programming Vol 1: Fundamental Algorithms", 3rd Edition, Addison Wesley, 2011

COURSE DESIGNERS

Name of the Faculty	Designation	Department	Mail ID
K.Karthik	Assistant Professor	CSE	karthik@avit.ac.in
Mrs.T.Geetha	Assistant Professor	CSE	geetha@vmkvec.edu.in

	PYTHON PROGRAMMING (THEORY AND PRACTICALS)	CATEGORY	L	T	P	CREDIT
		FC-ES	2	0	2	3

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

PRERQUISITE :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 and file concepts.

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.	Understand
CO2. Apply the different methods involved in List, String, Tuples and Dictionary.	Apply
CO3. Design solutions for complex programs using decision making and looping statements.	Apply.
CO4.Apply the function programs with all the concepts like lambda and recursion.	Apply.
CO5. Compute the exception handling programs, file concept programs and understand the concepts .	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction to python-Advantages of python programming-Tokens-Variables-Input/output methods-Data types-Operators

DATA STRUCTURES

Strings-Lists-Tuples-Dictionaries-Sets

CONTROL STATEMENTS

Flow Control-Selection control Structure- iterative control structures.

FUNCTIONS

Introduction-Declaration of function-Types of function-Types of Arguments-parameters-recursion and lambda function

FILE HANDLING AND EXCEPTION HANDLING

FILES:Open,read ,write, append ,close,tell and seek method,.Exception Handling:errors and exceptions-Raising exceptions-user defined exception

LIST OF EXPERIMENTS

1. Write a program to sum of series of N natural numbers
2. Write a program to calculate simple interest.
3. Write a program to generate Fibonacci series using for loop
4. Write a program to calculate factorial using while loop
5. Write a program to find the greatest of three numbers using if condition
6. Write a program for finding the roots of a given quadratic equation using conditional control statements
7. Write a program to find the greatest of three numbers using conditional operator
8. Write a program to compute matrix multiplication using the concept of arrays
9. Write a program to implement recursive function
10. Write a program to read and write data using file concepts

TEXT BOOKS:

1. Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", 2st Edition, O'Reilly Media, 2019.
2. Programming With Python- II 'Himalaya Publishing House Pvt Ltd, 2018.
3. "Dive Into Python3" by Mark Pilgrim, 2012

REFERENCES:

1. Mark Lutz, "Learning Python", 6th Edition, O'Reilly Media, 2014.
2. David Beazley, Brian K. Jones, "Python Cookbook", 3rd Edition, O'Reilly Media, 2015.
3. Mark Lutz, "Python Pocket Reference", 6th Edition, O'Reilly Media, 2015.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr. K.Karthik	Assistant Professor	CSE	karthik@avit.ac.in
2	Dr.V.Amirthalingam	Assistant Professor	CSE	amirthalingam@vmkvec.edu.in

	PROGRAMMING FOR PROBLEM SOLVING	Category	L	T	P	Credit
		FC-ES	3	0	0	3

PREAMBLE

The course is designed to introduce basic problem solving and program design skills that are used to create computer programs. It gives engineering students an introduction to programming and developing analytical skills to use in their subsequent course work and professional development. This course focuses on problem solving, algorithm development, top-down design, modular programming, debugging and testing using the programming constructs like flow-control, looping, iteration and recursion. It presents several techniques using computers to solve problems, including the use of program design strategies and tools, common algorithms used in computer program and elementary programming techniques.

PREREQUISITE–NIL

COURSEOBJECTIVES

1.	To gain basic knowledge about simple algorithms for arithmetic and logical problems.
2.	To learn how to write a program, syntax and logical errors.
3.	To understand how to decompose a problem into functions and synthesize a complete program.

COURSEOUTCOMES

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

CO1: Formulate simple algorithms for arithmetic and logical problems.	Understand
CO2: Test and execute the programs and correct syntax and logical errors	Apply
CO3: Implement conditional branching, iteration and recursion.	Apply
CO4: Decompose a problem into functions and synthesize a complete program.	Analze
CO5: Use arrays, pointers, strings and structures to formulate algorithms and programs	Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: INTRODUCTION

Computer system: components of a computer system-computing environments-computer languages, creating and running programs, Algorithms, flowcharts- Introduction to C language: basic structure of programs, process of compiling and running program, -tokens, keywords, identifiers, constants, strings, special symbols, variables, data types-I/O statements

UNIT – II: OPERATORS, EXPRESSIONS AND CONTROL STRUCTURES

Operators and expressions: Operators- arithmetic- relational and logical- assignment operators- increment and decrement operators,-bitwise and conditional operators-special operators- operator precedence and associativity- evaluation of expressions-type conversions in expressions- Control structures: Decision statements: if and switch statement- Loop control statements: while, for and do while loops- jump statements- break-continue-goto statements.

UNIT – III: ARRAYS AND FUNCTIONS

Arrays: One dimensional array-declaration and initialization of one dimensional arrays- two dimensional arrays-initialization and accessing- multidimensional arrays- Basic Algorithms: Searching- Basic Sorting Algorithms-Functions: User defined and built-in Functions- Parameter passing in functions-call by value-Passing arrays to functions-call by reference,-Recursion-Example programs, such as Finding Factorial, Fibonacci series

UNIT – IV: STRINGS AND POINTERS

Strings: Arrays of characters- variable length character strings-inputting character strings-character library functions-string handling functions- Pointers: Pointer basics- pointer arithmetic-pointers to pointers-generic pointers-array of Pointers- functions returning pointers,-Dynamic memory allocation

UNIT – V: STRUCTURES AND FILE HANDLING

Structures and unions: Structure definition- initialization- accessing structures,-nested structures,-arrays of structures-structures and functions- unions- typedef- enumerations.-File handling :command line arguments- File modes- basic file operations read,-write and append

TEXTBOOKS

1. Schaum's Outline of Programming with C by Byron Gottfried , McGraw-Hill

REFERENCES

1. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
2. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.

Course Designers:

S.No.	Name of the Faculty	Designation	Department	MailID
1.	Mrs.R.Shobana	Assistant Professor	CSE	shobana@avit.ac.in
2.	Mr.B.Sundaramurthy	Assistant Professor	CSE	sundaramurthy@vmkvec.edu.in

	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING A. BASIC ELECTRICAL ENGINEERING	Category	L	T	P	Credit
		FC-ES	2	0	0	2

PREAMBLE

It is a preliminary course which highlights the basic concepts and outline of Electrical engineering. The concepts discussed herein are projected to deliver explanation on basic electrical engineering for beginners of all engineering graduates.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To explain the basic laws used in Electrical circuits and various types of measuring instruments.
2	To explain the different components and function of electrical dc and ac machines.
3	To understand the fundamentals of safety procedures, Earthing and Power system.

COURSE OUTCOMES

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

CO1: Explain the electrical quantities and basic laws of electrical engineering.	Remember
CO2: Demonstrate Ohm's and Faraday's Law.	Apply
CO3: Describe the basic concepts of measuring instruments.	Understand
CO4: Explain the operation of electrical machineries and its applications.	Understand
CO5: Explain the electrical safety and protective devices.	Understand
CO6: Compare the various types electrical power generation systems by application of conventional and non-conventional sources.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	M	L	-	-	-	L	M	L	S	M	L
CO2	S	M	M	L	M	-	-	-	S	M	M	L	S	L	-
CO3	S	M	M	M	M	-	-	-	-	L	M	L	S	M	L
CO4	S	M	L	L	M	L	-	-	-	L	M	L	S	L	-
CO5	S	M	L	-	M	S	-	-	-	L	L	L	-	-	-
CO6	S	M	-	-	M	L	S	L	-	L	L	L	M	L	M

S- Strong; M-Medium; L-Low

SYLLABUS
ELECTRICAL CIRCUITS AND MEASUREMENTS

Electrical quantities - Charge, Electric potential, current, power and Energy, Passive components (RLC)- Fundamental laws of electric circuits-steady solution of DC circuits - Introduction to AC circuits- Sinusoidal steady state analysis-Power and Power factor – Single phase and Three phase balanced circuits - Classification of Instruments-Operating Principles of indicating instruments.

ELECTRICAL MACHINES

Faraday's Law, Construction, Principle of operation, Basic Equation and Applications of DC & AC Generators and Motors - Single Phase Transformer, Single phase and Three phase Induction Motor.

ELECTRICAL SAFETY AND INTRODUCTION TO POWER SYSTEM

Protection & Safety - Hazards of electricity - shock, burns, arc-blast, Thermal Radiation, explosions, fires, effects of electricity on the human body. Electrical safety practices, Protection devices.

Types of Generating stations, Transmission types & Distribution system (levels of voltage and power ratings)- Simple layout of generation, transmission and distribution of power.

TEXT BOOKS:

1. Metha.V.K, Rohit Metha, "Basic Electrical Engineering", Fifth Edition, Chand. S&Co, 2012.
2. Kothari.D.P and Nagrath.I. J, "Basic Electrical Engineering", Second Edition, Tata McGraw-Hill, 2009.
3. R.K.Rajput , "Basic Electrical and Electronics Engineering", Second Edition, Laxmi Publication, 2012.

REFERENCE BOOKS:

1. Smarajt Ghosh, "Fundamentals of Electrical & Electronics Engineering", Second Edition, PHI Learning, 2007.

COURSE DESIGNERS

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1	Dr. R. Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in
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	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING B. BASIC ELECTRONICS ENGINEERING	Category	L	T	P	Credit
		FC-ES	2	0	0	2

PREAMBLE

The course aims to impart fundamental knowledge on electronics components, digital logics and communication engineering concepts. The course begins with classification of various active and passive components, diodes and transistors. It enables the student to design small digital logics like multiplexer, de-multiplexer, encoder, decoder circuits, etc. It crafts the students to get expertise in modern communication systems.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To learn and identify various active and passive components and their working principles.
2	To understand the number conversion systems and working Principles of logic gates.
3	To learn the digital logic principles and realize adders, multiplexer, etc.,
4	To understand the application-oriented concepts in the Various communication systems.

COURSE OUTCOMES

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

CO1. Interpret working principle and application of various active and passive electronic components like resistors, capacitors, inductors, diodes and transistors.	Understand
CO2. Construct the rectifier, Clipper, Clamper, regulator circuits and explore their operations.	Apply
CO3. Execute number system conversions and compute several digital logic operations.	Apply
CO4. Design adders, Multiplexer, De-Multiplexer, Encoder, Decoder circuits for given data input.	Apply
CO5. Expose the working principles of modern technologies in developing application-oriented gadgets like the UHD, OLED, HDR and various communication systems.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

SEMICONDUCTOR DEVICES

Passive and Active Components - Resistors, Inductors, Capacitors- Intrinsic Semiconductor, Extrinsic Semiconductor, Energy band diagram- Conductor, insulator, semiconductor, Characteristics of PN Junction Diode - Zener Diode and its Characteristics - Half wave and Full wave Rectifiers, Voltage Regulation- Simple wave shaping circuits- Clipper, Clamper. Bipolar Junction Transistor, JFET, MOSFET & UJT.

DIGITAL FUNDAMENTALS

Number Systems – Binary, Octal, Decimal and Hexa-Decimal – Gray Code- Conversion from one to another – Logic Gates and its characteristics – AND, OR, NOT, XOR, Universal Gates – Adders, Multiplexer, De Multiplexer, Encoder, Decoder – Memories.

COMMUNICATION AND ADVANCED GADGETS

Modulation and Demodulation – AM, FM, PM ,PCM,DM– RADAR – Satellite Communication – Mobile Communication, Optical communication, Microwave communication. LED, HD, UHD, OLED, HDR & Beyond, Smart Phones – Block diagrams Only.

TEXT BOOKS:

1. R.K. Rajput, "Basic Electrical and Electronics Engineering", Laxmi Publications, Second Edition, 2012.
2. Dr.P.Selvam, Dr.R.Devarajan, Dr.A.Nagappan, Dr.T.Muthumanickam and Dr.T.Sheela,"Basic Electrical and Electronics Engineering", Department of EEE & ECE, Faculty of Engineering & Technology, VMRFDU, Anuradha Agencies, 2018.
3. Edward Hughes, "Electrical and Electronics Technology", Pearson Education Limited, Ninth Edition, 2005.

REFERENCES:

1. John Kennedy, "Electronics Communication System", Tata McGraw Hill, 2003.

COURSE DESIGNERS

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	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB A. BASIC ELECTRICAL ENGINEERING	Category	L	T	P	Credit
		FC-ES	0	0	2	1

PREAMBLE

It is a laboratory course which familiarizes the basic electrical wiring, measurement of electrical quantities and various types of earthing methods.

PRERQUISITE – NIL

COURSE OBJECTIVES

1	To learn the residential wiring and various types of electrical wiring.
2	To measure the various electrical quantities.
3	To know the necessity and types of earthing and measurement of earth resistance.

COURSE OUTCOMES

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

CO 1: Implement the various types of electrical wiring.	Apply
CO 2: Measure the fundamental parameters of AC circuits.	Analyze
CO 3: Measure the earth resistance of various electrical machineries.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Types of wiring, Joints and Measurement of resistance to earth of an electrical equipment.

REFERENCES

1. Laboratory Reference Manual.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in
2	Dr. G. Ramakrishnaprabu	Associate Professor	EEE/VMKVEC	ramakrishnaprabu@vmkvec.edu.in
3	Ms. D. Saranya	Assistant Professor (Gr-II)	EEE/AVIT	dsaranya@avit.ac.in
4	Mr. S. Prakash	Assistant Professor (Gr-II)	EEE/AVIT	sprakash@avit.ac.in

	ENGINEERING SKILLS PRACTICES LAB PART B - BASIC ELECTRONICS ENGINEERING	Category	L	T	P	Credit
		FC-ES	0	0	2	2

PREAMBLE

This course is to provide a practical knowledge in Basic Electronics Engineering. It starts with familiarization of electronic components and electronic equipments. It enables the students to construct and test simple electronic projects

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To familiarize the electronic components, basic electronic equipments and soldering techniques.
2	To study the characteristics of Diodes, BJT and FET.
3	To understand the principles of various digital logic gates.
4	To understand the concept of basic modulation techniques

COURSE OUTCOMES

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

CO1. Familiarize with the fundamentals of soldering techniques.	Understand
CO2. Construct experiments for PN and Zener diode characteristics also determine diode forward and reverse resistance	Apply
CO3. Construct clipper and clamper circuit and verify their voltage levels	Apply
CO4. Construct and justify operation simple voltage regulator for given Zener diode	Apply
CO5. Verify the truth tables and characteristics of logic gates (AND, OR, NOT, NAND, NOR, XOR).	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

Syllabus

LIST OF EXPERIMENTS

1. Practicing of Soldering and Desoldering.
2. Characteristics of PN junction Diode and find the forward and reverse resistance

3.Construct and Study simple clipper and clamper circuits
4. Characteristics of Zener diode and determine the break down voltage and diode resistance
5.Construct and Study simple voltage regulator using zener diode
6. Verification of Logic Gates.
7. Find the characteristics of AND ,NOR,NOT gate
8. Construct and Study simple voltage regulator using zener diode.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
2	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in
3	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
4	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	A-BASICS OF CIVIL ENGINEERING	Category	L	T	P	Credit
		FC-ES	2	0	0	2

Preamble: Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

Prerequisite –NIL

Course Objective

1	To create a fundamental base of concepts used in Civil engineering.
2	Describe the importance, objectives and principles of surveying.

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

CO1.	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.	Understand
CO2.	Explain different types of buildings, building components, building materials and building construction	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	M	L	-	-	-	-	-			
CO2	S	-	-	-	-	M	L	-	-	-	-	-			

S- Strong; M-Medium; L-Low

Syllabus

Surveying:

Introduction, Basic Definitions (Surveying, levelling, Plans, Maps, Scales), Introduction to divisions of surveying, Classification of surveying, Fundamental principles of surveying, Measurement in Surveying ,Phases of Surveying

Construction Materials:

types, uses, properties and importance of Civil Engineering materials like, Rocks, Bricks, Cement, Timber, Sand, Concrete, steel

Elements of Building Construction:

Planning: General Requirement of Building, Elementary principles and basic requirements of a building Planning, Importance of Planning, Layout of residential & industrial buildings ,Introduction to Plan, Elevation & Section of Residential Building Construction: Classification of buildings based upon occupancy ,Types of Structures, Design Loads acting on the structure, Elements of building drawing, Introduction to building byelaws, Section of Wall Through Door & Window

Text Books

1	Basic Civil and Mechanical Engineering, School of Mechanical Engineering Sciences, VMU, Salem

Reference Books

1	Civil Engg. Drawing by S. C. Rangwala Publication Charotar Pub. House Anand
2	Surveying Vol .I & II by Dr. B. C. Punamia Publication Laxmi Publication Delhi
3	Engineering Material, Author : Dr. S.C. Rangwala, Publisher: Charotar Pub. House
4	Building Construction, Author : Dr. B. C. Punamia, Publisher: Laxmi Pub. Delhi

Course Designers

S.No	Faculty Name	Designation	Department / Name of	Email id

			the College	
1	C.Kathirvel	Associate Professor	Civil / VMKVEC	kathirvel@vmkvec.edu.in

	B-BASICS OF MECHANICAL ENGINEERING	Category	L	T	P	Credit
		FC-ES	2	0	0	2

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 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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	L	L	M	-	-	-	-	-	M	L	-	-
CO2	S	M	L	L	L	M	-	-	-	-	-	M	L	-	-

S- Strong; M-Medium; L-Low

Syllabus

FOUNDRY AND WELDING

Foundry: Introduction to Casting - Types, Pattern- Definition, Function. Foundry tools. Green Sand Moulding application.

Welding: Introduction to welding, Classification – Gas welding, Arc Welding, TIG, MIG, Plasma – Definitions. Arc Welding - Methods and Mechanisms – Applications.

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

1	Basic Civil and Mechanical Engineering, School of Mechanical Engineering Sciences, VMU, Salem

Reference Books

1	Dan B Marghitu, Mechanical Engineer's Handbook, Academic Press, Auburn University, Alabama.
2	K.Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai
3	N R. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida
4	T J Prabu, Basic Mechanical Engineering, SCITECH Publications, Chennai

Course Designers

S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	Dr. Sanjay Singh	Professor	Mech / VMKVEC	sanjay@vmkvec.edu.in

	A-BASICS OF CIVIL ENGINEERING LAB	Category	L	T	P	Credit
		FC-ES	0	0	2	1

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 Objective

1	To create a fundamental base of concepts used in Civil engineering.
2	Describe the importance, objectives and principles of surveying.

Course Outcomes: On 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

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	S	M	L	L	M	M	L	-	L	L	-	-			
CO2	S	M	L	L	M	M	L	S	M	M	M	M	L		

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 Books

1	Basic civil engineering Lab Manual by Department of Civil Engineering, VMRF.

Course Designers

S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	C.Kathirvel	Associate Professor	Civil / VMKVEC	kathirvel@vmkvec.edu.in

	ENGINEERING SKILLS PRACTICE LAB B. BASIC MECHANICAL ENGINEERING	Category	L	T	P	Credit
		FC-ES	0	0	4	2

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

CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CO1	S	-	L	-	-	-	-	-	M	-	-	-	L	-	-
CO2	S	-	L	-	-	-	-	-	M	-	-	-	L	-	-
CO3	S	-	-	-	-	-	-	-	-	-	-	-	L	-	-
CO4	S	-	L	-	-	-	-	-	M	-	-	-	L	-	-

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				
S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	V K Krishnan	Associate Professor	Mech / VMKVEC	vkkrishnan@vmkvec.edu.in
2	S. Duraithilagar	Associate Professor	Mech / VMKVEC	sduraithilagar@vmkvec.edu.in

34421E81	ENGINEERING GRAPHICS AND DESIGN	Category	L	T	P	Credit
		FC-ES	0	0	6	3

Preamble

Engineering Graphics is referred as language of engineers. An engineer needs to understand the physical geometry of any object through its orthographic or pictorial projections. The knowledge on engineering graphics is essential in proposing new product through drawings and interpreting data from existing drawings. This course deals with orthographic and pictorial projections, sectional views and development of surfaces.

Prerequisite

NIL

Course Objective

1	To implement the orthographic projections of points, straight lines, plane surfaces and solids.
2	To construct the orthographic projections of sectioned solids and true shape of the sections.
3	To develop lateral surfaces of the uncut and cut solids.
4	To draw the pictorial projections (isometric and perspective) of simple solids.
5	To draw the orthographic views from the given pictorial view.

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

CO1.	Execute in the form of drawing of the orthographic projections of points, straight lines, plane surfaces and solids.	Apply
CO2.	Demonstrate in the form of drawing of the orthographic projections of sectioned solids and true shape of the sections.	Apply
CO3.	Develop lateral surfaces of the solid section and cut section of solids.	Apply
CO4.	Draw the pictorial projections (isometric and perspective) of simple solids.	Apply
CO5.	Draw the orthographic views from the given pictorial view.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

PLANE CURVES AND DIMENSIONING

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Dimensioning. Projection of points.

PROJECTION OF SOLIDS

Projection of lines, Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to any one reference plane by change of position method.
SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES Sectioning of above solids in simple vertical position by cutting planes inclined to any one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids like Prisms, pyramids, cylinders and cones.
ORTHOGRAPHIC VIEWS AND ISOMETRIC VIEWS – First angle projection – layout views – Representation of Three Dimensional objects -multiple views from pictorial views of objects. Principles of isometric View – isometric scale – Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones.
INTRODUCTION TO AUTO CAD Introduction to Auto CAD- Basic introduction and operational instructions of various commands in AutoCAD. Limit System- Tolerance, Limits, Deviation, Actual Deviation, Upper Deviation, Lower Deviation, Allowance. Preparation of manual parts drawing and assembled sectional views from orthographic part drawings,

Text Books	
1	Natarajan K V, “Engineering Graphics”, Tata McGraw-Hill Publishing Company Ltd. New Delhi.
2	K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International Private Limited.
3	K.R.Gopalakrishna“Engineering Drawing” (Vol. I & II), Subhas Publications, 2014.
4	Bhatt-N.D.-"Machine Drawing"-Published by R.C.Patel- Chartstar Book Stall-Anand- India- 2003
Reference Books	
1	N.D. Bhat and V.M. Panchal, Engineering Graphics, Charotar Publishers 2013
2	E. Finkelstein, “AutoCAD 2007 Bible”, Wiley Publishing Inc., 2007
3	R.K. Dhawan, “A text book of Engineering Drawing”, S. Chand Publishers, Delhi,2010.
4	DhananjayA.Jolhe, “Engineering Drawing with an Introduction to AutoCAD”, Tata McGraw Hill Publishing Company Limited, 2008.
5	G.S. Phull and H.S.Sandhu, “Engineering Graphics”, Wiley Publications, 2014.

Course Designers

S.No	Faculty Name	Designation	Dept / College	Email id
1	Dr. S.Venkatesan	Professor	Mech / VMKVEC	venkatesan@vmkvec.edu.in
2	Dr. N.Rajan	Professor	Mech / VMKVEC	rajan@vmkvec.edu.in

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute	Duriation
1.	Engineering Graphics and Design	Prof. Naresh Varma Datla, Prof. S. R. Kale	IIT Delhi	12 weeks
2.	Engineering Drawing	Robi, P.S.	IIT Guwahati	12 weeks
3.	Engineering Drawing and Computer Graphics	Prof. Rajaram Lakkaraju	IIT Kharagpur	12 weeks

	WORKSHOP PRACTICES	Category	L	T	P	Credit
		FC-ES	0	0	4	2

Preamble

Workshop practices is fundamental to the development of any engineering product. This course is intended to expose engineering students to different types of manufacturing/ fabrication processes. It deals with machine, fitting, carpentry, foundry, smithy 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	Exposure to the students with hands on experience on various basic engineering practices in Engineering.
2	To have a study and hands-on-exercise on plumbing and carpentry components.
3	To have a practice on gas welding, foundry operations and fitting

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

CO1.	Upon completion of this laboratory course, students will be able to fabricate components with their own hands.	Apply
CO2.	Examine the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	Apply
CO3.	Assembling different components, they will be able to produce small devices of their interest.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CO1	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-
CO2	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-
CO3	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

Syllabus

Course Contents

1. Manufacturing Methods - machining and joining methods.
2. Fitting operations
3. Carpentry.
4. Casting.
5. Tin Smithy

Lectures & videos

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods

Fitting operations & power tools Carpentry

Metal casting

Welding (arc welding & gas welding)

Work Shop Practice

1. Facing, Turning, Step Turning, Drilling, Surface finish –Machine Shop
2. L and V Fitting - Fitting Shop
3. Single piece and Split piece pattern - Foundry
4. Half- Lap Joint and Dove Tail Joint - Carpentry
5. Lap Joint, Butt Joint and T Joint – Welding
6. Open Scoop, Rectangle Tray – Tin Smithy

Text Books				
1	**WORKSHOP/MANUFACTURING PRACTICES, MANUAL**			
Reference Books				
1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I and Vol. II , Media promoters and publishers private limited, Mumbai			
2	Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House.			
3	NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida.			
4	K.Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai.			
Experiments be performed through Virtual Labs				
1	Welding shop	http://mmcoep. vlabs.ac.in/LaserSpotWelding/Theory.html?domain= Mechanical%20Engineering&lab=Welcome%20to%2 0Micro ma chining %20laboratory		
2	*Casting*	http://fabcoep. vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Eng ineering&lab=Welcome%20to%20FAB%20laboratory		
Course Designers				
S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	T.Raja	Asso. Prof	Mech / VMKVEC	rajat@vmkvec.edu.in
2				

34421E03	MANUFACTURING ENGINEERING FOR PHARMACEUTICAL ENGINEERS	Category	L	T	P	Credit
		FC-ES	3	0	0	3

Preamble

This course provides an introduction to Basic Manufacturing Engineering for Pharmaceutical Engineers with a focus casting, welding, forming process, Sheet metal working and plastic Engineering and also provides knowledge on the working, advantages, limitations and applications of various machining processes. Machine tools are power driven machine for making products of a given shape, size and accuracy by removing metal from the metal block

Prerequisite : NIL

Course Objective

1	To identify and explain manufacturing concepts
2	To understand the manufacturing process of conventional and special casting process of foundry technology
3	To impart the knowledge of various types welding process in metal joining processes.
4	To apply fundamentals of metal cutting processes and cutting tools.
5	To apply the knowledge of different operations on special machines and various types of work holding devices
6	To impart the knowledge of various metal forming processes.
7	To know the working principles of the various unconventional, conventional machining operations and also metal forming processes

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

CO1.	Discuss the concept of manufacturing concepts and new technologies used in industry.	Understand
CO2.	Explain the working principles of various metal casting processes and to identify the defects and interpret causes in the product of metal casting processes.	Understand
CO3.	Discuss the working principles of various metal joining processes and machines/equipments used and Select the suitable joining methods for fabrication/ assembly of products.	Understand
CO4.	Understand the chip formation for different cutting forces and cutting tool life.	Understand
CO5.	Understand the working principle and operations of Shaper, Milling, Drilling and boring Machines	Understand
CO6.	Apply the concepts of various metal forming processes	Apply
CO7.	Examine the working principle of various conventional machine tools, work and unconventional manufacturing processes.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	S	-	-	-	-	-	-	-	-	-	M	-	-
CO2	S	M	S	-	-	-	-	-	-	-	-	-	M	-	-
CO3	S	M	S	-	-	-	-	-	-	-	-	-	M	-	-
CO4	S	L	S	L	-	-	-	-	-	-	-	M	M	-	-
CO5	S	L	S	L	-	-	-	-	-	-	-	M	M	-	-
CO6	S	L	S	L	-	-	-	-	-	-	-	M	M	-	-

CO7	S	L	S	L	-	-	-	-	-	-	-	M	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MANUFACTURING

Manufacturing – Role of Manufacturing in the development of a country - classification of manufacturing processes.

CASTING

Fundamentals of metal casting – Types of patterns – sand mold making –different casting techniques – types of furnaces – Defects in castings – Testing and inspection of castings.

JOINING PROCESSES

Classification of welding processes - Principles of Oxy-acetylene gas welding-A.C metal arc welding- Resistance welding- Submerged arc welding- tungsten inert gas welding- metal inert gas welding- plasma arc welding- thermit welding- electron beam welding- laser beam welding, and identify defects in welding process - Soldering and brazing.

FUNDAMENTALS OF METAL CUTTING & CUTTING TOOLS

Basics of metal cutting: Mechanism of chip formation (orthogonal and oblique cutting)-Chip thickness ratio-Velocity ratio-Merchant circle diagram- Types of chips- Basics of cutting tools: Characteristics, Cutting tool materials, properties and applications -Tool life: Taylor's equation-Variables affecting tool life and Tool wear. Tool wear and Causes.

MACHINING PROCESSES

Introduction, Classification, working principle, operations performed: Lathe, Shaper, Planner, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. Super finishing processes: Lapping, Honing, Super finishing, Polishing & Buffing.

METAL FORMING PROCESSES

Cold and hot working of metals – Bulk metal forming- Sheet metal forming- High Energy Rate Forming processes: Explosive forming- Electro hydraulic forming – Electromagnetic forming.

ADVANCED MANUFACTURING TECHNOLOGY

Need and Classification of Additive Manufacturing Technology - Product development and Materials for Additive Manufacturing Technology – Tooling - Applications.

Text Books

1. Fundamental of Modern Manufacturing : Mikell P.Groover
2. A Text Book of Production Technology (Manufacturing Processes) : S. Chand.

Reference Books

1. Serope Kalpajian, Steven R.Schmid, “Manufacturing Processes for Engineering Materials”, 4/e, Pearson Education, Inc. 2007.
2. Jain. R. K.,and S.C. Gupta, “Production Technology”, 16th Edition, Khanna Publishers, 2001
3. E. Paul Degarmo, J.T. Black, and Ronald A. Konser, ‘Materials and Processes in Manufacturing’, 5th Edition, Prentice Hall India Ltd., 1997.
4. P. N. Rao, Manufacturing Technology (Volume 1) – Foundry, Forging and Welding, 4th Edition, Tata McGraw Hill Education, New Delhi, 2013.
5. Mikell P. Groover, Fundamentals of Modern Manufacturing Materials, Processes and Systems, Publishers: Wiley India, 2012.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration

1	Manufacturing Process Technology I & II	Prof. Shantanu Bhattacharya	IIT Kanpur	12 weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	R.Jayaraman	Associate Professor	MECH/VMKVEC	jayaramanr@vmkvec.edu.in
2	C.Thangavel	Associate Professor	MECH/VMKVEC	thangavel@vmkvec.edu.in
3	M.Saravanan		MECH/AVIT	saravanan@avit.ac.in

CORE COURSES
CREDITS (48-54)

B. PROFESSIONAL

36921C01	HUMAN PHYSIOLOGY (THEORY AND PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	4	5

PREAMBLE

The course aims to, develop an understanding about the structure (gross and histology) and functions of various organs of the human body; describe the various homeostatic mechanisms and their imbalances of various systems; identify the various tissues and organs of the different systems of the human body and appreciate coordinated working pattern of different organs of each system

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define the significance of anatomy and physiology
2	To develop an understanding about the structure and functions of various organs of the human body
3	To describe the various organs of the human body;
4	To demonstrate the various homeostatic mechanisms and their imbalances of various systems
5	To identify the various tissues and organs of the different systems of the human body

COURSE OUTCOMES

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

CO1. Recall the basics of anatomy and physiology	Remember
CO2. Discuss the importance of structure and organs of human body.	Understand
CO3. Sketch the significance associated with different organs.	Apply
CO4. Distinguish one organ system from the other and their significance.	Analyse
CO5. Investigate the composition and functions of the organ systems.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

FOUNDATIONS OF PHYSIOLOGY, HOMEOSTASIS

Organization of the Human Body, Chemical Foundations – Atoms, Ions, Molecules, Bonds, Solutions, Classes of organic molecules; Physical Foundations – Morphology of the cell (plasma membrane, nucleus, cell organelles). Elementary tissues of the human body: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics, Cellular Transport – Intracellular movement, Intercellular movement, Movement of molecules across the plasma membrane.

NERVOUS 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, gallbladder, pancreas; the renal system structure – Anatomy and physiology kidney; structure of the nephron and network of blood capillaries, urinary tract, formation of urine, concentration of urine; regulation of acid base balance

CARDIOVASCULAR AND RESPIRATORY SYSTEM

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

ENDOCRINE AND REPRODUCTIVE SYSTEM

Anatomy and physiology of Pituitary, thyroid, parathyroid, adrenal and pancreatic hormones and disorders of these glands, endocrine control of growth and metabolism; pineal, thymus, testes, ovaries, structure and physiology of reproductive systems, sex hormones, physiology of fertilization, menstruation, menopause, spermatogenesis and oogenesis, pregnancy and parturition and clinical disorders

PRACTICALS

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.
10. Erythrocyte sedimentation rate – Westergrens method.

TEXT BOOKS

1. Waugh, Anne and Allison Grant, "Ross and Wilson Anatomy and Physiology in Health and Illness", X Edition, Churchill – Livingstone / Elsevier), 2006.
2. Ganong, W.F., "Review of Medical Physiology", XXIV Edition (A Lange Medical book series) McGraw – Hill (International Ed.) 2014.
3. Khurana, Indu, "A Textbook of Medical Physiology" Elsevier, 2006.
4. Johnson, L.R., "Essential Medical Physiology", III Edition, Academic Press /Elsevier), 2003.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr S.Anusuya	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in
2.	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

36921C02	PHARMACEUTICAL CHEMISTRY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The students will 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 radio-pharmaceutics.
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 and the function of antioxidant.	Understand
CO2. Summarize the function of antimicrobials and astringents, Sulphur and its compounds.	Understand
CO3. Illustrate the mechanism of action of antibiotics and their side effects and the functions of GI agents and topical agents.	Understand & Apply
CO4. Examine the use of radiopharmaceuticals in drug formulation and diagnostics.	Analyse
CO5. Appraise the quality of a pharmaceutical product.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

ACIDS, BASES, BUFFERS AND ANTIOXIDANTS

Acids, Bases, Buffers - Boric acid, Hydrochloric acid, Strong Ammonium hydroxide, Sodium hydroxide and official buffers. Antioxidants- Hypophosphorous acid, Sulphur dioxide, Sodium bisulphite, Sodium meta-bisulphite, Sodium thiosulphate, Nitrogen and Sodium nitrite.

ANTIMICROBIALS, SULPHUR AND ITS COMPOUNDS, ASTRINGENTS

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 , GASTRO INTENSTINAL AGENTS AND TOPICAL AGENTS

Antibiotics: Benzyl penicillin, Phenoxy methyl penicillin, Ampicillin, Gentamicin, Neomycin, Erythromycin, Tetracycline, Cephalexin, Chloramphenicol. Gastrointestinal agents: Acidifying agents - Dilute hydrochloric acid, Antacid - Aluminium phosphate. Topical agents- calamine.

RADIO PHARMACEUTICALS AND CONTRAST MEDIA

Radio activity-Alpha; Beta and Gamma Radiations, Biological effects of radiations, Measurement of radio activity, G.M. Counter, Radio isotopes-their uses, Storage and precautions with special reference to the official preparations. Radio opaque contrast media-Barium sulfate.

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.
2. Inorganic Medicinal and Pharmaceutical Chemistry by J.H. Block, E.B. Roche, T.O.Soine and C.O.Wilson.
3. Roger's Inorganic Pharmaceutical Chemistry by T.O.Soine and C.O.Wilson.
4. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake Vol. I.
5. Pharmaceutical Chemistry by M.L. Schroff.

REFERENCES

1. Mohammed Ali, Pharmaceutical Chemistry-I (Inorganic),1st edition,CBS.
2. Daniel Lednicer, The Organic Chemistry of Drug Synthesis, Hardcover, Good 2007, Wiley-Interscience.
3. Indian Pharmacopoeia 1996.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

36921C81	PHARMACEUTICAL CHEMISTRY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The subject deals with different analytical methods of organic and inorganic compounds in pharmaceutical industries.

PRERQUISITE - 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	Apply
CO5. Estimating the normality by different electro-analytical methods	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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 Permanganomaetry

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:

1. A.H.Bockett and J.B.Stenlake's Practical Pharmaceutical chemistry Vol I and II. Stahlone Press of University of London, 4th Edition.

2. A.I.Vogel, Text Book of Quantitative Inorganic analysis.
3. P.Gundu Rao, Inorganic Pharmaceutical chemistry, 3rd Edition
4. M.L.Schroff, Inorganic Pharmaceutical chemistry
5. Bentley and Drivers, Text Book of Pharmaceutical chemistry
6. Anand and Chatwal, Inorganic Pharmaceutical chemistry

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in
2.	Dr.P.David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

36921C03	PHYSICAL PHARMACEUTICS (THEORY AND PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

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.

PRERQUISITE - 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. Describe the properties of drug molecules in the dosage form design	Understand
CO2. Demonstrate the formulation of emulsions and suspensions.	Apply
CO3. Illustrate the stability of various formulations.	Apply
CO4. Differentiate the rheology of various fluids used in development of various formulations.	Analyse
CO5. Analyze the effects of different properties of molecules in drug formulation and action	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO11	PO1 2	PSO1	PSO2	PSO3
CO1	M	L	-	-	-	-	-	-	-	L	L	-	L	L	-
CO2	M	-	M	M	-	-	-	-	M	M	L	-	M	M	-
CO3	M	-	M	M	-	-	-	-	M	M	L	-	M	M	-
CO4	M	L	-	L	-	-	-	-	L	L	-	-	M	-	-
CO5	L	-	L	-	-	-	-	-	-	-	-	L	-	-	M

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

Suspensions, interfacial properties of suspended particles. Formulation of suspensions, emulsions and theories of emulsification. Physical stability of emulsions, preservation of emulsions, rheologic properties of emulsions. Liquid interfaces, adsorption at liquid interfaces, adsorption at solid interfaces, Electrical properties of interfaces, surface tension and its determination, classification of surfactants.

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.

Diffusion, Dissolution, Complexation & Protein Binding

Definitions, Steady state diffusion, Procedures and apparatus for diffusion, dissolution and drug release, factors affecting dissolution,Metal-complexes, organic molecular complexes, inclusion compounds, methods of analysis of complexes, crystalline structures of complexes and thermodynamic basis of stability constants, complexation, protein binding and drug action.

Micromeritics & Rheology

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.

PRACTICALS

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.
9. Preparation and stability studies of emulsions.
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

1. Manavalan, R. and Ramasamy. C. "Physical Pharmaceutics" 2nd Ed., Vignesh Publishers,2015.
2. C.V.S. Subrahmanyam, Text book of physical pharmaceutics, 3rdEdn.,Vallabh prakashan,2015.
3. Hadkar. U. B., Physical Pharmacy, Nirali Prakashan; 12th edition, 2017.

REFERENCES

1. Alfred N. Martin, Patrick J. Sinko, Martin's Physical Pharmacy and PharmaceuticalSciences: Physical Chemical and Biopharmaceutical Principles in the PharmaceuticalSciences, sixth edition, Lippincott Williams & Wilkins, 2011.
2. David B. Troy, Paul Beringer, Remington: The science and practice of pharmacy, 21stEdition, Lippincott Williams and Wilkins, 2006
3. Humphrey Moynihan and Abinacrean "Physicochemical Basis of Pharmaceuticals" OxfordUniversity Press, 2009.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.R.Durgasree	Assistant Professor	Pharmaceutical engineering	durgashree@vmkvec.edu.in
2	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

36921C04	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 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

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

S- Strong; M-Medium; L-Low

SYLLABUS

SIZE REDUCTION & SEPARATION

Properties and characterization of particulate solids —Analysis and technical methods for size determination of powders - Size reduction equipment – Principles, construction, working, uses, merits and demerits of -

hammer mill, ball mill, fluid energy mill, edge runner mill, end runner mill. Separation equipments - uses, merits and demerits of sieve shaker, cyclone separator, air separator, bag filter, elutriation tank.

CRYSTALLIZATION

Characters of crystals like purity, size, shape, geometry, forms, size and its factors - Solubility curves- Super saturation theory and its limitations- nucleation mechanism and crystal growth. Crystallizers- Principles, construction, working, uses, merits and demerits of agitated batch crystallizer, swenson walker crystallizer, krystal crystallizer, vacuum crystallizer. Caking of crystals and its prevention.

FILTRATION AND CENTRIFUGATION

Theory of filtration, filter aids, filter media- Factors affecting filtration- Principles, construction, working, uses, merits and demerits of plate & frame filter, filter leaf, rotary drum filter, meta filter, cartridge filter, membrane filters and seidtz filter. Principles of centrifugation- Uses, merits and demerits of perforated basket centrifuge, non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

MIXING AND DISTILLATION

Mixing of powdered materials – Mechanism of random mixing and interactive mixing. Sampling techniques, size and mixing indices. Factors affecting the mixing process. Principles, construction, working, uses, merits and demerits of double cone blender, twin shell blender, ribbon blender, sigma blade mixer, planetary mixers, propellers, turbines, paddles &silverson emulsifier. Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

EVAPORATION AND DRYING

Theory of evaporation, Factors influencing evaporation. Principles, construction, working, uses, merits and demerits of - Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator. Theory of drying, mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. Principles, construction, working, uses, merits and demerits of - Tray dryer, drum dryer, spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

TEXT BOOKS

1. McCabe WL, Smith J.C and Harriott “Unit operations of Chemical Engineering” McGraw Hill International Book Co. London 2004.
2. GirishK.Jani, “Pharmaceutical Engineering I, Unit Operation I” B.S.ShahPrakashan, India, 2006.
3. Cooper and Gunn's Tutorial Pharmacy, Edited by SJ Carter, CBS Publishers, New Delhi,2005.

REFERENCES:

1. Badger, W.L and Banchero, J.T "Introduction to Chemical Engineering" Tata McGrawHill,2002

2. Coulson, J.M. and Richardson, J.F." Chemical Engineering" 3rd Edition, Butterworth Heinemann Publication, 2001.

3. K. Sambamurthy, Pharmaceutical Engineering New Age International (P) Ltd., Publishers, New Delhi, 1998.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1.	Ms.R.Durgasree	Assistant Professor	Pharmaceutical engineering	durgashree@vmkvec.edu.in
2.	Mr.A.Arunagiri	Assistant Professor	Pharmaceutical engineering	arunagiri@vmkvec.edu.in

NEW	FLUID MECHANICS AND TRANSFER PROCESSES	Category	L	T	P	Credit
			3	1	0	4

PREAMBLE

This is an introductory course in different mode of heat and mass transfer and also fluid mechanics. 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 understand the basic properties of fluids and fluid flow measurements
2	To understand stress – strain relationship and bernoulli's equation
3	To understand different modes of heat transfer operations
4	To analyze the performance of heat exchanger and outline the applications
5	To understand the basics of mass transfer principles

COURSE OUTCOMES

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

CO1. Understand the basic properties of fluids and fluid flow measurements	Understand
CO2.Understand stress – strain relationship and bernoulli's equation	Understand
CO3. Ability to differentiate different modes of heat transfer operations	Apply
CO4. Ability to apply the basics of mass transfer principles	Apply
CO5. Analyse the performance of heat exchanger and outline the applications	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

FLUID MECHANICS

Fluid definition- compressible, in compressible fluids, Newtonian and Non-newtonian fluids, Fluid Dynamics – equation of continuity – Bernoulli's equation – press loss in straight pipes – in fittings – expansion and contraction losses (applied to Newtonian Fluids only) Fluid flow measurement, Orifice, venture &Rotameter for Newtonian fluids.

FLUID FLOW

Laminar and turbulent flow – Basic equations of fluid flow, – Shear – Stress relationships, Operational principles of different types of pumps, compressors and valves, friction factor and its calculation in 25 laminar and turbulent flow

HEAT TRANSFER – CONDUCTION & CONVECTION

Conduction – Fourier's fundamental equation – thermal conductivity and thermalresistance - linear heat flow – heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and sphere – extended surfaces (fins) — solving problems in heat transferby conduction.

Newton Rikhman's law – film coefficient of heat transfer - convection – free and forced convection-dimensional analysis and its application – factors affecting the heat transfer coefficient in free and forced convection heat transfer – overall heat transfer coefficient - solving problems in heattransfer by convection.

RADIATION &HEAT EXCHANGERS

Heat exchangers – parallel, counter and cross flow – Logarithmic Mean Temperature Difference – overall coefficient of heat transfer – tube in tube heat exchanger, shell and tube heat exchanger, double pipe heat exchanger – applications of heat exchangers.

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-absorbingmedia - solving problems in heat transfer by radiation.

MASS TRANSFER

Fick's law of diffusion – Analogy with momentum and heat transfer, diffusivities of gases and liquids, diffusion in binary mixtures, Interphase mass transfer – Film theory of mass transfer, determination of volumetric mass transfer coefficient – Overview of separation operations with examples, ideal stage concept – Mass transfer equipment – Distillation, liquid extraction, gas absorption, drying.

TEXT BOOKS

1. Bellaney, P.L. “Thermal Engineering”. Khanna Publishers, New Delhi, 2001
1. Geankoplis C.J. “Transport Process and Unit Operations”. Prentice-Hall of India PrivateLimited, New Delhi, 1999
2. Frank M. White, Fluid Mechanics, 4th edition, McGraw-Hill Publishing, 2011

REFERENCES

1. Jacob and Hawkins. “Elements of Heat Transfer”.John Willey and Sons Inc. New York,1983.
2. EcKert, E.R.G. “Heat and Mass Transfer”. McGraw Hill Book Co., New York, 1981.
3. Holman, E.P. “Heat Transfer”. McGraw-Hill Publishing Co. New Delhi, 2001.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1.	Mr.A.Arunagiri	Assistant Professor	Pharmaceutical engineering	arunagiri@vmkvec.edu.in
2.	Ms. R. Durgasree	Assistant Professor	Pharmaceutical engineering	durgashree@vmkvec.edu.in

	CHEMICAL ENGINEERING THERMODYNAMICS	Category	L	T	P	Credit
		CC	3	0	0	3

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

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

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTAL CONCEPTS AND FIRST LAW OF THERMODYNAMICS

Scope of thermodynamics – Basic concepts – Thermodynamic system – State and equilibrium – Process and cycles – Temperature and zeroth law of thermodynamics –Properties of pure substances – First law of thermodynamics – First law analysis of closed systems and control volumes and its application.

ENTROPY AND THE SECOND LAW OF THERMODYNAMICS

The Clausius inequality – Entropy – Causes of entropy change – Entropy change of Pure substances – Thermal energy reservoirs – Heat engines – Perpetual motion machines –Reversible and irreversible processes – The Carnot cycle and principles – The Carnot Heat engine– The second law efficiency – Second law analysis of open and closed systems.

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:

1. Smith, J.M. and Van Ness, “Introduction to Engineering Thermodynamics”, 5thEdition, McGraw Hill, 1996.

2. Narayanan, K.V., “A Text Book of Chemical Engineering Thermodynamics”, Prentice Hall of India, 2002.

REFERENCES:

1. Stanley I. Sandler, “Chemical, Biochemical and Engineering Thermodynamics”, John-Wiley, 4thedition, 2006

2. Hougen and Watson, “Chemical Process Principles” Vol. II, CBS Publishers, 2002.

3. Kyle, “Chemical and Process Thermodynamics”, 2nd Edition, Prentice Hall of India, 2000.

4. Rao,Y.V.C., “Chemical Engineering Thermodynamics”, Universities Press, 1997.

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1.	Ms.R.Durgasree	Assistant Professor	Pharmaceutical engineering	durgashree@vmkvec.edu.in
2.	Mr.A.Arunagiri	Assistant Professor	Pharmaceutical engineering	arunagiri@vmkvec.edu.in

	CHEMICAL ENGINEERING THERMODYNAMICS LAB	CATEGORY	L	T	P	Credit
		CC	0	0	4	2

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	M	L	-	-	-	-	-	-	-	S	L	L
CO2	M	M	M	M	L	-	-	-	-	-	-	-	S	L	L
CO3	M	M	S	M	M	-	-	-	-	-	-	-	S	L	L
CO4	M	M	M	S	L	-	-	-	-	-	-	-	S	L	L
CO5	M	M	M	S	M	-	-	-	-	-	-	-	S	L	L
CO6	M	M	M	M	L	-	-	-	-	-	-	-	S	L	L

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:

1. M. D. Koretsky, Engineering and Chemical Thermodynamics, John Wiley & Sons, 20132.

REFERENCE BOOKS:

1. N. de Nevers, Physical and Chemical Equilibrium for Chemical Engineers, 2nd Ed., Wiley, 2012.
2. J. W. Tester and M. Modell, Thermodynamics and Its Applications, 3rd Ed., Prentice Hall, 1997.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.R.Durgasree	Assistant Professor	Pharmaceutical engineering	durgashree@vmkvec.edu.in
2	Mr.A.Arunagiri	Assistant Professor	Pharmaceutical engineering	arunagiri@vmkvec.edu.in

	PHARMACEUTICAL BIOPROCESS ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The subject provides knowledge involving basic principle of fermentation process, bioreactor design, scale up and recombinant protein production along with case studies, to help the students understand fermentation processes involved in Pharmaceutical Industries.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To impart knowledge on design and operation of fermentation processes with all its prerequisites.
2	To impart knowledge on design and operation of fermentation processes with all its prerequisites.
3	To demonstrate the structured model of bioprocess
4	To organize a bioreactor in CSTR model
5	To develop an understanding of concepts in efficient separation of biomolecules

COURSE OUTCOMES

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

CO1. Impart knowledge on design and operation of fermentation processes with all its prerequisites.	Understand
CO2. Impart knowledge on design and operation of fermentation processes with all its prerequisites.	Apply
CO3. Demonstrate the structured model of bioprocess	Apply
CO4. Organize a bioreactor in CSTR model	Analyse
CO5. Develop an understanding of concepts in efficient separation of biomolecules	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

METABOLIC STOICHIOMETRY AND ENERGETICS

Outline of Stoichiometry and energetics – Growth yields, Growth yields based on total energy and ATP generation – Conservation of mass principles - Carbon and oxygen balances, ATP generation during growth –

Relationship between substrate consumption, growth, respiration and noncellular products – Growth energetics of aerobic and anaerobic process

MICROBIAL GROWTH, KINETICS, MAINTENANCE AND PRODUCT FORMATION

Establishment of growth kinetic equations for batch, fed batch and continuous culture – Basic unstructured kinetic models of growth and product substrate utilization – Negative biokinetic rates – Multisubstrate kinetics – Mixed population kinetics - Kinetic models for microbial product formation - Kinetic model equations for inhibition by substrates and products.

STRUCTURED MODELS

Structured models for growth and product formation – Compartmental and metabolic models – Mechanistic models - Product formation kinetics – Gaden's and Deindoerfer's classifications – Chemically and genetically structured models – Kinetics models of heterogenous bioprocesses – Biofilm kinetics, Unstructured models of pellet growth – Considerations for the production of r-DNA products.

BIOREACTOR DESIGN & CONSTRUCTION

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.

DOWNSTREAM PROCESSING AND CASE STUDIES

Characteristics of biological materials: pre-treatment methods; Separation of cell mass: centrifugation, clarification and filtration ; Different methods of cell disruption; Advantages; Disadvantages; Solid shear method and liquid shear method; Different concentration methods: evaporation, distillation, crystallization, evaporation, SCFE, solvent extraction, phase separation, drying-Case studies on Production of penicillin, recombinant Insulin. Case studies should deal with strain improvement, medium design, reactor design & process optimization

TEXT BOOKS

1. Michael L. Shuler and Fikret Kargi, Bioprocess Engineering, Basic Concept, 2nd Edition, Prentice Hall PTR, 2002.
2. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications

REFERENCES

1. Anton Moser, "Bioprocess Technology, Kinetics and Reactors",Springer Verlag.
2. James E. Bailey & David F. Ollis, Biochemical Engineering Fundamentals, McGraw Hill.
3. James M. Lee, Biochemical Engineering, PHI, USA.
4. Atkinson, Handbook of Bioreactors,Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Decker Inc.

5. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.				
COURSE DESIGNERS				
S. No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Mr. Arunagiri A	Assistant Professor	Pharmaceutical Engineering	arunagiri@vmkvec.edu.in

	PHARMACEUTICAL BIOPROCESS ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

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 thebioreactor 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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Enzyme kinetics – Determination of Michaelis - Menten parameters

2. Enzyme activity – Effect of Temperature and Deactivation Kinetics

3. Enzyme activity – Effect of pH

4. Enzyme inhibition kinetics

5. Enzyme immobilization – Gel entrapment

6. Enzyme immobilization –Cross-linking

7. Enzymatic conversion in Packed bed Column

8. Growth of Bacteria – Estimation of Biomass, Calculation of Specific Growth Rate, Yield Coefficient

9. Optimization by Plackett Burman Design

10. Optimization by Response Surface Methodology

TEXT BOOKS

1. Michael L. Shuler and FikretKargi, Bioprocess Engineering, Basic Concept, 2nd Edition, Prentice Hall PTR, 2002.
2. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications

REFERENCES

1. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2ndEdition, McGraw – Hill, 1988.
2. Lee, James M. "Biochemical Engineering", PHI, U.S.A.Stanbury, P.F. etal.
3. Principles of Fermentation Technology", 2ndEdition, Butterworth – Heinemann /Elsevier, 1995.
4. El-Mansi, E.M.T. etal., "Fermentation Microbiology and Biotechnology", II Edition,CRC /Taylor & Francis, 2007.
5. Peppler, H.J. and D. Perlman "Microbial Technology" (vol. I Microbial Processes and Vol. I Fermentation Technology)" 2nd Edition, Academic Press / Elsevier, 2004Inc.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. A. Arunagiri	Assistant Professor	Pharmaceutical Engineering	arunagiri@vmkvec.edu.in

	MEDICINAL CHEMISTRY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

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 – 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. Recall 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

COS	PO1	PO2	PO	PO	PO	PO	PO	PO	PO9	PO1	PO1	PO1	PSO	PSO	PSO3
CO1	L	L	L	L	-	-	-	-	-	L	-	-	L	-	-
CO2	M	M	M	M	-	-	-	L	-	-	-	-	L	-	-
CO3	S	S	S	S	-	-	-	-	-	-	-	-	L	-	-
CO4	M	M	M	M	M	-	-	-	-	-	-	-	M	-	-
CO5	L	L	L	L	S	-	-	-	-	M	-	-	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

PRINCIPLES OF MEDICINAL CHEMISTRY

Physicochemical properties in relation to biological action: Ionization, Drug distribution and pKa values and their relation to drug transport, hydrogen bonding, redox potential, surface activity and chelation. Steric properties of drugs: optical and geometrical isomerism. Functional group and their effects of on drug action: steric effect, concept of isosterism, bioisosterism, homologs and analogs.

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, Adrenergics, ganglionic blockers and neuromuscular blockers.

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 AND RENAL 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, cardiac glycosides, anti-arrthymic agents, anti-hyperlipidemic agents, anti-platelet inhibitors, anti-coagulants and anti-thrombolytics ; diuretics and anti-diuretics

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:

1. AshutoshKar, Medicinal Chemistry, 6th Edition, New Age International (P) Ltd. Publishers, New Delhi 2015.
2. Graham L. Patrick, An introduction to Medicinal Chemistry, 6thEdition, Oxford University Press, 2017.
3. Ilango, K. and Valentina, P., "Text book of Medicinal Chemistry", Vol.1, 1stEdition, Keerthi Publishers, 2007.

REFERENCES:

1. Donald J. Abraham, Burger's Medicinal Chemistry and Drug Discovery, Vol V, 6th Edition, John Wiley and Sons, Inc.,2003.
2. William O Foye, Thomas L Lemke, David A Williams Foye's Principles of Medicinal Chemistry, 7th Edition, Wolters Kluwer Health Adis (ESP) Publisher, 2012.

3. Indian Pharmacopoeia, Vol-I, 7th Edition, Published by Indian Pharmacopoeia Commission India, 2014.				
COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Ms.R.Jaisri	Assistant professor	Biotechnology	jaishri.vmkvec@vmrf.edu.in
2	Dr.P.David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	MEDICINAL CHEMISTRY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

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. The course will distribute an effective knowledge about the synthesis of drug.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To recognize the correlation between medicinal chemistry of a drug and its cure.
2	To interpret the chemistry of drugs with respect to their 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 methods for the drug analysis

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 the preparation of pharmaceutical solutions	Understand
CO3. Illustrate the effects in different methods of drug synthesis	Apply
CO4. Evaluate the drug synthesized and their effects	Analyse
CO5. Test the purity and qualiy of the synthesized drug	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO	PO3	PO4	PO5	PO6	PO7	P	PO9	PO10	PO11	PO12	PSO	PSO2	PSO3
CO1	-	-	L	L	-	L	L	L	-	-	-	L	-	-	-
CO2	M	M	L	M	-	-	M	L	-	-	-	L	M	-	-
CO3	-	-	S	S	-	-	-	L	-	-	-	-	-	-	-
CO4	L	L	-	-	-	S	-	S	-	S	-	-	-	-	-
CO5	L	L	-	-	S	M	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Study on stereo-chemistry of some selected drugs with models and in-silico viewer
2. Synthesis of anti-inflammatory/analgesic and its analysis (Eg. Paracetamol, aspirin).
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

TEXT BOOKS

1. A Text Book of Medicinal Chemistry Vol. I and II by Surendra N. Pandeya, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10.
1. Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.

REFERENCE BOOKS

1. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry,
2. Lippincott-Raven Publishers-New York, Philadelphia.
3. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.
4. Indian Pharmacopoeia

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S. ANUSUYA	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in
2.	Dr DAVID ANNARAJ P	Assistant Professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	PHARMACOLOGY AND PHARMACOTHERAPEUTICS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To provide advanced knowledge in detail on the pharmacology of drugs and toxicology. 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 - HUMAN PHYSIOLOGY

COURSE OBJECTIVES

1	To define the various factors that can affect the action of drugs and Discuss the various routes of drug administration with advantages and disadvantages of the various routes and the basic principles of toxicology.
2	To categorize the effects of drugs pertaining to Nervous System and the concept of essential drugs.
3	To assort the effects of drugs pertaining to haemopoietic system and CVS and the concept of essential drugs.
4	To classify the effects of drugs pertaining to GIT, Respiratory System & Excretory System and the concept of essential drugs.
5	To study the Brief outline of the importance of rational prescribing of drugs and also know the principles of chemotherapy.

COURSE OUTCOMES

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

CO1.Discuss about the complete information of drugs in pharmacology and toxicology.	Understand
CO2.Define what drugs do to the living organisms and how their effects can be applied to therapeutics.	Apply
CO3.Understand the systemic effect of drug action on human body with typical examples of drugs.	Apply
CO4.Describe the systemic effect of drug action on human body and their physiological functions.	Apply
CO5.Examine the principles of chemotherapy and how their effects can be applied to therapeutics.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO1	L	L	-	-	L	-	-	-	-	-	-	-	L	-	M
CO2	-	M	-	L	-	-	-	L	-	-	-	-	L	-	L
CO3	-	M	-	L	L	-		L	-	-	-	-	L	-	L
CO4	-	M	-	L	L	-	-	L	-	-	-	-	L	-	L
CO5	M	M	M	M	M	-	-	-	-	-	-	-	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO PHARMACOLOGY AND TOXICOLOGY

Sources of drugs, dosage forms and routes of drug administration, pharmacodynamics. Combined effect of drugs, factors modifying drug action, tolerance and dependence. Basic and clinical pharmacokinetics. Adverse drug reactions.

Drug interactions, Bioassay of drugs and biological standardization, Overview of drug discovery and development.Definition of poison, general principles of treatment of poisoning, Heavy metals and heavy metal antagonists, OECD guidelines for testing acute, sub-acute, and chronic toxicity, genotoxicity, carcinogenicity, teratogenicity and mutagenicity of drugs and chemicals.

PHARMACOLOGY OF DRUGS ACTING ON NERVOUS SYSTEM

Nerve conduction/transmission in the C.N.S, general anaesthetics, sedatives, hypnotics, Psychopharmacological agents – Antipsychotics, antidepressants, neuroleptics, antipyretics, anti-inflammatory (NSIADs) and anti-gout drugs, narcotic analgesics and antagonists, C.N.S. stimulants, drug addiction and drug abuse. Neurotransmitters: dopamine, 5-HT, excitatory amino acids, GABA, glycine, cannabinoids, melatonin etc; Neurotransmitters receptors, their agonist and antagonists. Neuromodulators, neuromediators and transporters.

PHARMACOLOGY OF DRUGS ACTING ON HAEMOPOIETIC SYSTEM AND CARDIOVASCULAR SYSTEM

Haematinics, Anticoagulants, vitamin K and haemostatic agents, Fibrinolytic and anti-platelet drugs, Blood plasma volume expanders. Histamine, 5-hydroxytryptamine, Prostaglandins and their antagonists, cardiac glycosides and other drugs for congestive heart failure, anti-arrythmatic, anti-anginal, anti-ischemic, and anti hypertensive drugs.

PHARMACOLOGY OF DRUGS ACTING ON GASTROINTESTINAL TRACT, RESPIRATORY SYSTEM AND EXCRETORY SYSTEM

Antacids, anti-secretory and anti-ulcer drugs, Laxatives and Anti-diarrhoeal drugs, Appetite stimulants and suppressants, Emetics and anti-emetics. Anti-asthmatic drugs including bronchodilators, leukotriene inhibitors, anti-tussives and expectorants, Respiratory stimulants. Histamine and anti histamine.Diuretics and Antidiuretics, Urinary Antiseptics, Cholinergics and Anti –Cholinergics, Acidifiers and Alkalanizers.

CHEMOTHERAPY

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

TEXTBOOKS

1. Goodman and Gilman's, "The Pharmacological Basis of Therapeutics".12th Edition, 2010.
2. Katzung, B.G., Trevor AJ. Basic and Clinical Pharmacology, Prentice Hall International. 12thEdition, 2011.
3. Tripathi, K.D. Medical Pharmacology, VIIth edition, 2013.
4. Kulkarni S K, Handbook of Experimental Pharmacology, 4th Edition, 2012.
5. Rang, M.P, Dale M.M, Reter J.M- Pharmacology.8th Edition, 2016.
6. Satoskar, "Pharmacology and Pharmacotherapeutics", 24th Edition, 2015. 6. Tripathi, K.D. "Medical Pharmacology", 7th Edition, 2016

REFERENCES

1. Goodman and Gilman's, "The Pharmacological Basis of Therapeutics".12th Edition, 2010.
2. Katzung, B.G., Trevor AJ. Basic and Clinical Pharmacology, Prentice Hall International. 12thEdition, 2011.
3. Tripathi, K.D. Medical Pharmacology, VIIth edition, 2013.
4. Kulkarni S K, Handbook of Experimental Pharmacology, 4th Edition, 2012.
5. Rang, M.P, Dale M.M, Reter J.M- Pharmacology.8th Edition, 2016.
6. 5. Satoskar, "Pharmacology and Pharmacotherapeutics", 24th Edition, 2015. 6. Tripathi, K.D. "Medical Pharmacology", 7th Edition, 2016

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	PHARMACEUTICAL ANALYSIS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To provide the student with a basic understanding of the format of the pharmacopoeial monograph and the major physical and instrumental methods used in the monographs to specify standards, the scope, advantages and disadvantages together with a brief account of the regulatory framework such as The Drugs and Cosmetics Act 1940 and an introduction to the ICH Guidelines.

PRERQUISITE NIL

COURSE OBJECTIVES

1	To discuss about the principles of modern analytical techniques 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 the usage of various spectroscopic techniques
5	To give participatory training on the utilities diverse Chromatographic procedure.

COURSE OUTCOMES

After completion of course student is able to know

CO1. Develops ability to handle the modern analytical instruments like UV/Vis, Mass spectroscopy and HPLC.	Understand
CO2. Develops ability to involve in phytochemical and biological standardization of pharmaceutical products.	Apply
CO3. Develops ability to handle the modern analytical instruments like IR, NMR	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. Develops ability to involve in phytochemical and biological standardization of pharmaceutical products.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
CO1	M	L	L	L	-	-	-	-	-	-	-	M	M	M	M
CO2	M	M	M	M	M	-	-	-	-	-	-	S	S	M	M
CO3	S	S	S	L	L	-	-	-	-	-	-	L	M	-	M
CO4	M	M	M	M	M	-	-	-	-	-	-	S	M	M	M
CO5	S	M	L	M	M	-	-	-	-	-	-	S	M	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

UV-VISIBLE SPECTROSCOPY

Theory of atomic and molecular spectra, Electronic transitions, Beer and Lambert's law, Derivation and deviations, Chromophores, Auxochromes, Spectral shifts, Solvent effect on absorption spectra. Instrumentation - Sources of radiation, wavelength selectors, sample cells, Detectors Barrier layer cell, Photo tube, PMT, PDA detectors; Applications in pharmaceuticals.

ATOMIC ABSORPTION SPECTROSCOPY

Principles, Instrumentation, Operation – single and double beam spectroscopy; sampling technique – Detection limit, Difference between Atomic absorption spectroscopy and Flame spectroscopy; Applications in pharmaceuticals.

ELECTROCHEMICAL , IR AND NMR SPECTROSCOPY

Potentiometry, Conductometry, Polarography, Colorimetry and Flourimetry .Principles of vibrational spectroscopy – Instrumentation and sampling techniques – Applications in pharmaceutical sciences – NMR principles – Instrumentation – Applications in pharmaceuticals.

THERMAL AND X-RAY DIFFRACTION METHODS

Thermogravimetry, Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC). 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.

MASS SPECTROMETRY AND CHROMATOGRAPHIC METHODS

Basic principles, instrumentation and ionization methods; atmospheric pressure ionization (API), chemical ionization (CI), electron impact ionization (EI), fast atom bombardment (FAB), matrix assisted laser desorption ionization (MALDI), time of flight (TOF); Applications in pharmaceuticals. Chromatography and its types: principle, theory, instrumentation, solvents system, packing materials and applications.

TEXT BOOKS

1. A. H. Beckett & J. B. Stenlake, "Practical Pharmaceutical Chemistry", Part II, 4th Edition, Bloomsbury Academic, 2001.
2. Hobert H. Willard, "Instrumental Methods of Analysis", 7th Edition, CBS Publishers & Distributors, 2004.
3. B.K. Sharma, "Instrumental Method of Chemical Analysis", Krishna's Education Publishers, 2014.
4. P. D. Sethi, "HPTLC: High Performance Thin Layer Chromatography: Quantitative Analysis of Pharmaceutical Formulations", 1st edition, CBS, 2013.

REFERENCES

1. Robert M. Silverstein, Francis X .Webster , David J. Kiemle, David L. Bryce, Spectriometric identification

of Organic Compounds", 8th Edition, Wiley, 2014.

2. Mendham J, "Vogel's Text Book of Quantitative Chemical Analysis", 6th Edition, Pearson Education 2009.
3. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, "Principles of Instrumental Analysis", 7th Edition, Brooks Cole, 2017.
4. William Kemp, "Organic Spectroscopy" W.H. Freeman, New York, 3rd Edition, 2011.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya@vmkvec.edu.in
2.	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	PHARMACEUTICAL ANALYSIS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

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.

PRERQUISITE

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 basedone.
6	To give hands on training on use of as many different instruments aspossible.

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 aswell 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

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	L	L	-	-	-	-	-	-	-	-	-
CO2	M	S	M	S	M	L	-	-	-	-	-	-	-	-	-
CO3	S	M	M	S	M	M	-	-	-	-	-	-	-	-	-
CO4	S	S	S	M	M	M	-	-	-	-	-	-	-	-	-
CO5	S	M	M	L	L	L	-	-	-	-	-	-	-	-	-
CO6	M	M	S	M	S	M	-	-	-	-	-	-	-	-	-

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:

1. Text book of pharmaceutical analysis by S.Ravishankar.
2. Instrumental methods of chemical analysis by Chatwal. K, Anand, 5th edition.
3. Spectroscopy by B.K.Sharma

REFERENCE BOOKS:

1. Spectrometric identification of organic compounds by Silverstein, Webster.
2. Fundamentals of analytical chemistry by Skoog
3. Organic spectroscopy by Y.R.Sharma.
4. Instrumental methods of analysis by Willard, Merit, Dean, Settle.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in
2.	Dr.P.David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	INDUSTRIAL PHARMACY–I	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course is designed to impart a fundamental knowledge and to provide the concepts of various parameters involved in the formulation anddevelopment 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.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To impart the knowledge on the principles of solid and semisolid dosage forms formulation anddevelopment.
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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	M	L	L	L	-	L	-	-	-	-	-	-	L	-	-
CO2	M	L	L	L	-	L	-	-	-	-	-	-	L	-	-
CO3	S	M	M	M	L	-	-	-	-	-	-	-	S	L	-
CO4	S	M	M	M	L	-	-	-	-	-	-	-	M	L	-
CO5	S	M	S	-	M	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

PREFORMULATION CRITERIA

Study of physical /physicochemical properties of drugs like physical form, particle size, shape,density, wetting, dielectric constant, solubility, dissolution, organoleptic propertiesand their effect on formulation, stability and bioavailability. Study of chemical properties of drugs likehydrolysis, oxidation, reduction, racemisation, polymerization etc., and their influence onformulation.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.

ADDITIVES AND EXCEPIENTS

Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers,disintegrants, lubricants, glidants and antiadherents, Surfactants and Colors in Tablets, Swellable and Rigid Matrices – Controlled Release Matrices with Cellulose Ethers, Carrageenan in Solid Dosage Form Design, Direct Compression and the Role of Filler-binders.

SOLID DOSAGE FORMS

TABLETS

a. Introduction, ideal characteristics of tablets, classification of tablets, Excipients, Formulation of tablets, granulation methods , process of compression, effect of friction, force – volume relationships in compression (Heckel's plot), tablet manufacturing techniques, Equipments and machinery for small and large scale tablet manufacturing, processing problems.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. Quality control tests: In process and finished product tests

CAPSULES

a. Capsule: Introduction & Types

b. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells, size of capsules, formulation of hard gelatin capsules, capsule filling & manufacturing defects. In process and

final product quality control tests for capsules.

c. Soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications

d. Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

SEMISOLID DOSAGE FORMS AND DISPERSIONS

Properties of semisolid dosage form, Types: ointments, creams, paste, gels, suppositories., advantages and disadvantages.Mechanisms of drug penetration, factor influencing penetration.Semisolid bases and their selection. General formulation of semisolids, manufacturing procedure, evaluation and packaging.

TEXT BOOKS

1. Lachman, Leon et al. "The Theory and Practice of Industrial Pharmacy" III Ed., VarghesePublishing House, 1987.
2. Larry L. Augsburger, Stephen W. Hoag, Pharmaceutical dosage forms: tablets, vol 3, rational design and formulation, Informa health care USA, Inc, 2008 III edition
3. Aulton, Michael E. "Pharmaceutics: The Science of Dosage Form Design" II Ed., hurchill Living stone, 2002.
4. Allen, Loyd V. et al. "Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems" IX Ed., Wolters Kluver/LippinCott Williams & Wilkins, 2011.
5. H. A. Liberman,, L. Lachman, and J. B. Schwartz: Pharmaceutical dosage forms: Tablets, Vol.1,2 and 3, II Edition Marcel Dekker, 1989.
6. Marcel Dekker, Drug stability- Principles and practice by Cartensen & C.J.Rhodes, 3rd Edition, series, Vol 107.

REFERENCES

1. Remington's Pharmaceutical Sciences, A. R. Gennaro Mac Pub. Co. Easton, Pennsylvania1990.
2. Indian Pharmacopoiea, British Pharmacopoiea, United States Pharmacopoiea
3. Boca Raton, Coated Pharmaceutical Dosage Forms, K. H. Bauer, CRC Press,. Med Pharm.
4. G. C. Cole, Pharmaceutical Coating Technology, New York,
5. Ridgway. K, Hard Capsules, Pharmaceutical Press. London.

COURSE DESIGNERS

S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr. P. David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in
2	Mrs. Pillai Divya U	Assistant Professor	Pharmaceutical Engineering	pillaidivyau@vmkvec.edu.in

	INDUSTRIAL PHARMACY-II	Category	L	T	P	Credit
		CC	3	0	0	3

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.

PRERQUISITE - 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 learn the techniques to overcome the challenges associated with drug 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 sterileproducts.	Apply
CO3. Demonstrate drug delivery to ear, nose and ophthalmic organs.	Apply
CO4. Examine the challenges in formulating a drug in various dosage forms	Analyse
CO5. Appraise the guidelines formulation, manufacturing, packaging and marketing of sterile products	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

CO5	-	-	-	-	L	S	L	S	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

LIQUID DOSAGE FORMS

Monophasic liquids: Definitions & preparations of syrups, 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.

INTRODUCTION TO PARENTERAL PRODUCTS

Pre-formulation factors, routes of administration, water for injection, pyrogenicity, non-aqueousvehicles, isotonicity and methods of its adjustment. Formulation details, containers and closuresand their selection; Prefilling treatment, washing the container and closers, preparation of solution and suspension, filling, closing of ampoules, vials, infusion fluids, lyophilization, preparation ofsterile 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, muco adhesive 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 CHALLENGES

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

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
2. Lachman, Leon et al. “The Theory and Practice of Industrial Pharmacy” III Ed., Varghese Publishing House, 1987.
3. Aulton, Michael E. “Pharmaceutics: The Science of Dosage Form Design” II Ed., Churchill Livingstone, 2002.
4. Ophthalmic Drug Delivery Systems Second Edition, Revised and Expanded, Ashim K. Mitra,
5. 2003 Marcel Dekker
6. Allen, Loyd V. et al. “Ansel’s Pharmaceutical Dosage Forms and Drug Delivery Systems”

REFERENCES

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

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. V. Muruganantham	Associate Professor	Pharmaceutics	svmanand@yahoo.com
2	Dr.R.MargretChandira	Professor	Pharmaceutics	mchandira172@gmail.com

	INDUSTRIAL PHARMACY LAB-I	Category	L	T	P	Credit
		CC	0	0	4	2

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 get familiarize with different solid and semisolid dosage forms
2	To aware about different bases in semisolid formulations.
3	To outline the significance of physical and chemical factors which affect drug formulation.

COURSE OUTCOMES

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

CO1. Recognize the formulation aspects of semisolid dosage forms	Understand
CO2. Discuss different pharmaceutical calculation involved in formulation	Understand
CO3. Employ the concept of wet granulation in tablet preparation	Apply
CO4. Iluustrate the differences between different semisolid dosage forms	Analyze
CO5. Evaluate the stability of ointments and creams	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Preparation of tablets - wet granulation method
2. Preparation of tablets - dry granulation method
3. Preparation of capsules
4. Preparation of powders
5. Preparation of ointments
6. Preparation of creams
7. Preparation of pastes
8. Preparation of gels

9. Preparation of suppositories

REFERENCES:

1. Howard C. Ansel , Pharmaceutical Calculations. 15th edition,
2. Howard C. Ansel, Nicholas G. Popovich and Lloyd V. Allen, Pharmaceutical Dosage Forms and Drug Delivery Systems, , Jr. 9th Edition, 2009.
3. Thompson J.E , A Practical Guide to Contemporary Pharmacy Practice, 1998.
4. Remington's Pharmaceutical Sciences, 20th Edition, 2000.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
2	Dr.S.Anusuya	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in

	INDUSTRIAL PHARMACY LAB-II	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

This course provides the knowledge on the theory and problems involved inincorporating 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 get familiarize with different liquid dosage forms
2	To aware about different aseptic conditions to be maintained in parentral formulation.
3	To outline the significance of suspension and emulsions in drug formulations.

COURSE OUTCOMES

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

CO1. Recognize the formulation aspects of streile dosage forms	Understand
CO2. Discuss different pharmaceutical calculation involved in formulation	Understand
CO3. Employ the concept of emulsion in drug formulations	Apply
CO4. Iluustrate the osmotic pressure of opthalmic formulations	Analyze
CO5. Evaluate the stability of emulsions.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Preparation of monophasic liquid dosage forms:
   For internal use – drops, solutions, syrups, elixirs, linctus, mixture, injections
   For external use - gargles, mouthwash, eye drops, nasal drops, ear drops, lotion, liniments
2. Preparation and evaluation of biphasic liquid dosage forms: suspensions & emulsions –both o/w and w/o types

REFERENCES

1. Howard C. Ansel , Pharmaceutical Calculations. 15th edition,
2. Howard C. Ansel, Nicholas G. Popovich and Lloyd V. Allen, Pharmaceutical Dosage Forms and Drug Delivery Systems, , Jr. 9th Edition, 2009.
3. Thompson J.E, A Practical Guide to Contemporary Pharmacy Practice, 1998.
4. Remington's Pharmaceutical Sciences, 20th Edition, 2000.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in
2	Dr.S.Anusuya	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in

C. ELECTIVE COURSES

PROFESSIONAL ELECTIVES
CREDITS (12)

	REGULATORY REQUIREMENTS IN PHARMA INDUSTRIES	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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

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

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 assuranceand quality control.

INTELLECTUAL PROPERTY RIGHTS

Patent system – Different types of patents – Filing process of application for patent – Infringementof patents – The patent rules 2003 as amended by the patents (amendment) rules 2016.

ICH GUIDELINES

Quality guidelines – Impurities in new drug substances (Q3A(R2)) – Impurities in newdrugproducts(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

1. C.V.Subbrahmanyam&J.Thimmasetty, Pharmaceutical regulatory affairs, 1st Edn.,VallabhPrakashan, New Delhi, 2012.

2. Willig, H., Tuckeman, M.M. and Hitchings, W.S., "Good Manufacturing Practices forPharmaceuticals", 5th Edition, Marcel Dekker Drugs and the Pharmaceutical Sciences, byCRC Press, New York, 2000.

3. N Udupa, Krishnamurthy Bhat, A Concise Textbook of Drug Regulatory Affairs, ManipalUniversity Press (MUP); First Edition, 2015.

REFERENCES

1. Ira R. Berry,The Pharmaceutical Regulatory Process, marcel dekker Series: Drugs and the Pharmaceutical Sciences, by CRC Press, NewYork, 2004.

2. Mindy J. Allport-Settle, Current Good Manufacturing Practices: Pharmaceutical, Biologics,and Medical Device Regulations and Guidance Documents Concise Reference, Pharmalogika Inc., USA, 2009.

3. Sharma, P.P., "How to Practice GMPs", 3rd Edition, Vandana Publications, 2006.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in
2	Ms. R. Jaishri	Assistant professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	HERBAL TECHNOLOGY	Category	L	T	P	C
		EC-PS	3	0	0	3

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-constitutes 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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INDIAN SYSTEMS OF MEDICINE

Introduction, basic principles and treatment modalities of Ayurveda – Unani – Homeopathy –Siddha – naturopathy- Introduction and streams of Yoga. Asanas, Pranayama, Meditations and relaxation technique. Classification of herbs - Harvesting – Post harvesting – Conditions of storage- seasonal and geographical variation.

In-vitro CULTURE OF MEDICINAL PLANTS

Requirements – Setting up a tissue culture lab – Basic laboratory procedure – Processing of plat 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

Screening methods for anti-fertility agents – Antidiabetic drugs – Antianginal drugs – Diuretic – Analgesic activity – Antipyretic activity – Anticancer activity –Evaluation of hepatoprotective agents – anticonvulsive- Antiulcer drugs.

STANDARDIZATION AND CONSERVATION OF HERBAL DRUGS

Importance of standardization – Problems involved in the standardization of herbs- Standardization of single drugs and compound formulations – WHO guidelines for the quality assessment herbal drugs– Estimation of parameter limits used for standardization – Conservation strategies of medicinal plants – Conservation types – Government policies for protecting the traditional knowledge.

TEXT BOOKS

1. Agarwal, S.S. and Paridhavi, M., "Herbal Drug Technology" Universities Press (India) Private Limited, 2007.
2. Wallis, T.E., "Textbook of Pharmacognosy" 5th Edition, CBS Publishers and Distributors, 2005.
3. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. Of India, New Delhi, 2001.
4. Yoga- The Science of Holistic Living by V.K.Yoga, Vivekananda Yoga Prakashna Publishing, Bangalore, 2005.
5. Quality Control Methods for medicinal plant material, WHO Geneva, 1998.

REFERENCES

1. Evans, W.C., “Trease and Evans Pharmacognosy” 15th Edition, Elsevier Health Sciences,2001.
2. Pulok K. Mukherjee., “Quality control of Herbal Drugs” Reprint edn, Business Horizons, New Delhi, 2012.
3. Daniel, M., “Herbal Technology : Concepts and Advances” Satish Serial Publishing House, 2008.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya@vmkvec.edu.in

	PHARMACEUTICAL PROCESS DESIGN	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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 post approval change management.

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

EVOLUTION OF PROCESS DESIGN AND MANAGEMENT

Introduction, Universal Principles of Process, Revolutionary Thinkers on Process, Language and Boundaries, Artisan heritage.

FIVE PROCESS ELEMENTS

Man: The Mind of the Process, Machine: The Voice of the Process, Method: The Techniques of Process Control, Materials: The Life-Blood of the Process, Environment.

EFFECTIVE PHARMACEUTICAL PROCESS DESIGN AND MANAGEMENT

Changing the Way We Think, Cause and Effect: Getting to the Root Cause, Corrective Action and Preventive Action, Process-Driven Quality Systems, Statistics and Decision Boundaries: Data Certainty, Problem-Solving Tools and Techniques, Reducing Risk: The New Paradigm, Customers, Process Integrated Accounting.

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:

1. Kate McCormick,D. Wylie McVay Jr, Pharmaceutical Process Design and Management, Routledge; 1 edition, 2016.

REFERENCES:

1. Kannissery Pramod, M. Abu Tahir, Naseem A. Charoo, Shahid H. Ansari, and Javed Ali: Pharmaceutical product development: A quality by design approach, International journal of pharmaceutical investigation, 2016.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. A. Arunagiri	Assistant professor	Pharmaceutical	arunagiri@vmkvec.edu.in

			engineering	

	CHEMISTRY OF NATURAL PRODUCTS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The students will understand the main classes of natural products and their distinctive pharmacological effects. It further gives a proper understanding about extraction, isolation, chemical tests and medicinal properties of various alkaloids and vitamins. This would enable the students to learn the chemistry, synthesis and structural elucidationof natural products.

PREREQUISITE - Fundamentals of Chemistry

COURSE OBJECTIVES

1	To explain the chemistry and medicinal importance of natural compounds as lead moleculesfor 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 flavanoids.
5	To develop theoretical knowledge of students in the chemistry of natural productsand to explore Thisknowledge 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. Identify natural products using various chromatographic and spectroscopic methods.	Apply
CO5. Demonstrate various methods to test the activity of natural products	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO	PO	PO	PO4	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
CO1	M	L	L	L	-	-	-	-	-	-	-	L	-	-	M
CO2	M	L	L	L	-	-	-	-	-	-	-	L	-	-	M
CO3	S	M	M	M	M	-	-	-	-	-	-	L	M	M	-
CO4	S	S	M	S	S	-	-	-	-	-	-	M	M	M	M
CO5	S	S	M	S	S	-	-	-	-	-	-	M	M	M	M

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

1. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.
2. Organic Chemistry of Natural Products (Vol.-1 & 2) by GurdeepChatwal.
3. Organic Chemistry (Vol.-2) by I.L. Finar.

REFERENCES

1. Wallis, T.E. Textbook of Pharmacognosy, 5th Edition, CBS Publishers,2005.
2. Pharmacognosy by Brady and Tyler.E.
3. Pharmacognosy by G.E. Trease&W.C.Evans.

COURSE DESIGNERS				
S. No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya@vmkvec.edu.in

	MOLECULAR PATHOGENESIS OF INFECTIOUS DISEASES	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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.

PRERQUISITE- NIL

COURSE OBJECTIVES

1	To understand about the microbial toxins and modern molecular pathogenesis.
2	Toknow about the host pathogen interaction and identifying virulence factors
3	To control pathogens by modern approaches.

COURSE OUTCOMES

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

CO1. Describe the basic concepts of Host pathogen interactions at the level of cellular and molecular networks.	Understand
CO2. Differentiate the Host- Defense mechanism against Pathogens and Pathogenic Strategies.	Understand
CO3. Diagnosis of diseases through the examination of molecules.	Apply
CO4. Applying the principles of host-pathogen interactions in virulence assays.	Apply
CO5.Examine the modern therapeutic strategies on various pathogens.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW AND HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES

Historical perspective - discovery of microscope, Louis Pasteur’s contributions, Robert Koch’s

postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

MOLECULAR PATHOGENESIS - I (WITH SPECIFIC EXAMPLES)

Virulence, virulence factors, virulence- associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio Cholerae: Cholera toxin, coregulatedpili, filamentous phage, survival E.coli pathogens: EnterotoxigenicE.coli (ETEC), labile & stable toxins, Entero- pathogenic E.coli (EPEC), type III secretion, cytoskeletal changes, intimate attachment; EnterohaemerrohogicE.coli (EHEC), mechanism of bloody diarrhoea and Hemolytic Uremic Syndrome, EnteroaggregativeE.coli (EAEC).

MOLECULAR PATHOGENESIS – II (WITH SPECIFIC EXAMPLES)

Shigella: Entry, macrophage apoptosis,induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory response, tissue damage Plasmodium: Life cycle, erythrocyte stages, transport mechanism and processes to support the rapidly growing schizont, parasitiparous vacuoles, and knob protein transport, Antimalarials based on transport processes.

EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses. Influenza virus: Intracellular stages, Neuraminidase &Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

APPROACHES TO CONTROL PATHOGENS

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno& DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TEXT BOOKS:

1. Iglewski B.H and Clark V.L " Molecular basis of Bacterial Pathogenesis ", Academic Press, 1990.
2. Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.

REFERENCES:

1. Peter Williams, Julian Ketley& George Salmond, "Methods in Microbiology : Bacterial Pathogenesis, Vol. 27", Academic Press, 1998.
2. Recent reviews in Infect. Immun., Mol. Microbiol., Biochem. J., EMBO etc
3. Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A Human Perspective", McGraw Hill, 3rd Edition, 2001.
4. Brenda B. Wilson, Abigail A. Salyers, Dixie D. Witt, Malcolm E. Winkler, "Bacterial Pathogenesis", ASM press, 3rd Edition, 2011.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	BIOSIMILARS AND BIOGENERICS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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 the applications 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& applications.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	-	-	L	L	-	L	L	L	-	-	-	L	-	-	-
CO2	M	M	L	M	-	-	M	L	-	-	-	L	-	-	-
CO3	-	-	S	S	-	-	-	L	-	-	-	-	-	-	L
CO4	L	L	-	-	-	S	-	S	-	S	-	-	M	-	-
CO5	L	L	-	-	S	M	-	-	-	-	-	-	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

BIOGENERICS INTRODUCTION

Definition: Generics and its advantages; Biogenerics and Biosimilars; Why biosimilars arenot (bio) generics; The advent of Biosimilars; The role of patents in the drug industry;Protein-based biopharmaceuticals; Manufacturing processes; Global market; InternationalNon-proprietary Names (INN) nomenclature system biosimilars regulation (EU position, USpathways, Government initiatives)

BIOSIMILARS AND ITS SCENARIO

Approved follow-on proteins/Biosimilars; Characteristics of highselling peptides and proteins,; Products with expired patents; Challenging originator's patents; Target productsfor FOB (followon biological)/Biosimilarsdevelopment peptides; Recombinantnonglycosylated proteins; Recombinant glycosylated proteins; Industries dealing withbiogenerics 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, Monoclonalantibodies); Equivalence issues; Post-translational modifications; Effect ofmicro-heterogeneity; Pharmacokinetics; Pharmacodynamics; and Clinical efficacy; Analyticalmethods for the characterization of biosimilars (Chromatography, Protein sequencing, Massspectrometry, UV absorption, Circular dichroism, X-ray techniques, Nuclear magneticresonance, Electrophoresis, Western blotting, Bioassays, ELISA, Immunoprecipitation andother procedures)

IMMUNOGENECITY OF BIOPHARMACEUTICALS

Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing toimmunogenicity (product-related factors, host-related factors), Consequence ofimmunogenicity to biopharmaceuticals; Measurement of immunogenicity

BIOSIMILARS AND BIOGENERICS APPLICATIONS

Applications:Erythropoietin, Insulin, Somatotropin, Interleukin-2, Interferon Granulocyte macrophage-CSF, DNase, Factor VIIa, Factor IX, Factor VIII, Activated protein C, Tissue plasminogen activator, Monoclonal antibodies etc.

TEXT BOOKS

1. Niazi, Sarfaraz K. "Handbook of Biogeneric Therapeutic Proteins: Regulatory,Manufacturing, Testing, and Patent Issues". CRC Press, 2006.

2. Ho, Reedney J. Y., MiloGibaldi. “Biotechnology & Biopharmaceuticals TransformingProteins and Genes into Drugs”.

REFERENCES

1. Niazi, Sarfaraz K. “Handbook of Biogeneric Therapeutic Proteins: Regulatory,Manufacturing, Testing, and Patent Issues”. CRC Press, 2006.

2. Ho, Reedney J. Y., MiloGibaldi. “Biotechnology & Biopharmaceuticals TransformingProteins and Genes into Drugs”.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	SAFETY AND HEALTH MANAGEMENT	CATEGORY	L	T	P	CREDIT
		EC-PS	3	0	0	3

PREAMBLE

The evaluation of any organisations' health and safety programs is an integral part of any inspection. Evaluation includes analysis about comprehensiveness of program, safety rules specified, accident prevention strategies, measures enforced when rules are not followed, status about personal protective equipment, members participation etc.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To recall the elements and policy of safety and its important in work environment.
2	To be acquainted with the use of personal protective equipments (PPE)
3	To recognise principles of accidents prevention
4	To identify major accident control in industry.
5	To familiarise with Process Safety Management (PSM) as per OSHA

COURSE OUTCOMES

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

CO1.Recall the elements and policy of safety and its important in work environment.	Remember
CO2. Be acquainted with the use of personal protective equipments (PPE)	Understand
CO3. Recognise principles of accidents prevention.	Analyse
CO4. Identify major accident control in industry.	Analyse
CO5. Familiarise with Process Safety Management (PSM) as per OSHA	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

CO 4	L	M	M	M	L	M	M	L	-	L	-	L	-	-	L
CO 5	L	L	L	L	L	S	L	-	L	L	-	M	-	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

ELEMENTS AND POLICY OF SAFETY

Key elements of a safety and Health Management System- Policy & commitment, Planning, Implementation and Operation, Measuring Performance, Auditing and Reviewing performance Initial Safety and health Management System, Safety and health Management System model, safety and Health policy- Developing a workplace Safety and Health Policy.

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 Mucoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of theneck- back injuries.

THEORIES AND PRINCIPLES OF ACCIDENT CAUSATION

Definition: Incident, accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error, oversight, mistakes. The effect of accident, unsafe act, unsafe condition, unpredictable performance, Human factors contributing to accidents - causes for unsafe acts. Causes of accidents, Types of accidents, accident statistics, Cost of accident, Direct and indirect cost of an accident, accident/ incident reporting, accident Investigation report.

PERSONAL PROTECTIVE EQUIPMENTS (PPE)

Need for personal protection equipment, selection, applicable standards, and supply, use, care andmaintenance respiratory and non-respiratory personal protective equipment. Respiratory personal Protective devices: Classification of respiratory personal protective devices, selection of respiratory personal protective devices. Non-respiratory personal protective devices: Head protection, Ear protection. Face and eye protection, hand

protection, foot protection, body protection.

MONITORING FOR SAFETY, HEALTH AND ENVIRONMENT

Occupational Health and Environment Safety Management System, ILO and EPA Standards. Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene.

TEXT BOOKS

1. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
2. Lees, F.P., "Loss Prevention in Process Industries" Butterworth publications, London, 2nd edition, 1990.
3. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982.

REFERENCES

1. R. K. Jain and Sunil S. Rao , Industrial Safety , Health and Environment Management Systems, Khanna publishers, New Delhi (2006)
2. Slote. L, Handbook of Occupational Safety and Health, John Willey and Sons, New York .
3. Jeanne Mager Stellman, Encyclopedia of Occupational Health and Safety (ILO) Ms. Irma Jourdan publication

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. A. Arunagiri	Assistant Professor	Pharmaceutical Engineering	arunagiri@vmkvec.edu.in

	FUNDAMENTALS OF BIOINFORMATICS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The course highlights the importance of Bioinformatics in all our lives and the fascination of working in a field that overlaps the disciplines of biology and computer science. It gives brief understanding about biological databases and their applications in drug design (both structure based drug design and ligand based drug design). The course emphasizes on various software applications useful for biologists and different drug development strategies.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To state the different biological databases available and their various utilities
2	To discuss the applications of the various databases and software which find their utility in drug discovery
3	To describe the algorithms and their basics behind the bioinformatics software.
4	To implement corresponding knowledge for the screening of biologically and clinically active drugs
5	To compare the basic biological knowledge with some programming basics and using them for screening of bioactive molecules.

COURSE OUTCOMES

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

CO1. Define the importance of biological databases with respect to the nucleic acids, proteins and drugs	Understand
CO2. Describe how drugs can bescreened from a database and their applications.	Understand
CO3. Sketch the information could be retrieved from databases which are effective in drug discovery.	Apply
CO4. Discover the template structure required for homology modeling using BLAST	Apply
CO5. Conclude the reliability of the protein structure predicted through modeling	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO1	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO3
CO	L	L	L	L	-	-	-	-	-	L	-	-	L	-	-
CO	M	M	M	M	-	-	-	L	-	-	-	-	L	-	-
CO	S	S	S	S	-	-	-	-	-	-	-	-	L	-	-
CO	M	M	M	M	M	-	-	-	-	-	-	-	M	-	-
CO	L	L	L	L	S	-	-	-	-	M	-	-	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

BIOLOGICAL DATABASES

Introduction to Bioinformatics and Computational Biology, Biological sequences, Biologicaldatabases, Nucleic acid Sequence databases, Protein Sequence databases, structural databases, Primary and secondary databases, Composite databases, Genome specific databases. Data file formats.

SEQUENCE ALIGNMENT

Introduction to sequencealignment & its significance, Types – Global and local, Pairwise sequence alignment andMultiple sequence alignment. Pairwise alignment- Scoring matrices – PAM, BLOSUM. BLAST, PSI BLAST and PHI BLAST, FASTA.

ALGORITHMS FOR SEQUENCE ALIGNMENT

Dynamic programming algorithm for sequence alignment – Global and local alignment, Needleman and Wunsch algorithm, Smith Waterman algorithm. Multiple sequence alignment,ClustalW. Database Searches - BLAST, FASTA, PSI-BLAST, PHI-BLAST.

PROTEIN STRUCTURE

Protein structure –Primary, secondary and tertiary structures, Aminoacids –types, propensity. Ramachandran plot. Motifs, pattern, signatures.Secondary structure prediction methods. Protein tertiary structure, Protein tertiary structure prediction methods - Homology modeling, Ab initio approaches, Threading. Structural classification. Critical Assessment of Structure Prediction (CASP), Molecular docking principles and applications.

PHYLOGENETICS

Introduction to phylogenetics, Phylogenetic tree and its types, Phylogenetic tree prediction methods - Distance method, Maximum parimony method, Maximum likelihood method, UPGMA, Neighbour joining. Tools & softwares for Phylogentic tree.

TEXT BOOKS

1. Arthur K. Lesk, “Introduction to Bioinformatics”, Oxford University Press, 4th edition,2014
2. Dan Gusfield, Algorithms on Strings, Trees and Sequences”, Cambridge UniversityPress, 1999.
3. R.Durbin, S.Eddy, A.Krogh and G.Mitchison, “Biological Sequence Analysis Probabilistic

Models of proteins and nucleic acids", Cambridge University Press,2013.

4. David W. Mount, "Bioinformatics Sequence and Genome Analysis",Cold Spring Harbor Laboratory Press, 2nd Edition, 2004.

REFERENCES

1. M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Academic Press, 2010
2. D.E. Krane and M.L. Raymer, Fundamental concepts of bioinformatics, Pearson Education Inc. 2006

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in
2	Ms.R.Jaisri	Assistant professor	Pharmaceutical Engineering	jaishri.vmkvec@vmrf.edu.in

	COMPUTER AIDED DRUG DESIGN	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The course highlights the importance of drug design using software programs and the fascination of working in a field that overlaps the disciples of chemistry, biology, pharmacy etc. It gives brief understanding about drug-receptor interactions, lead discovery and drug design. The course emphasizes on various programs available s tools for drug design and aid in the process of drug development

PREREQUISITE – Fundamentals of Bioinformatics

COURSE OBJECTIVES

1	To state the basics of drug design including physicochemical and steric properties of drug.
2	To discuss the chemical structures and importance of various medicinal agents.
3	To describe the structure activity relationship, biochemical/ molecular basis of mechanism of action.
4	To implement corresponding knowledge for the design of biologically and clinically active drugs computationally
5	To compare the basic biological and pharmacological interactions of different drugs and further studies leading to design of pharmacophore.

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 certain design strategies for different drug	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO1	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO3
CO	M	M	M	M	-	-	-	-	-	L	-	-	L	-	-

CO	M	M	M	M	-	-	-	L	-	-	-	-	L	-	-
CO	M	M	M	M	-	-	-	-	-	-	-	-	L	-	-
CO	M	M	M	M	M	-	-	-	-	-	-	-	M	-	-
CO	L	L	L	L	S	-	-	-	-	M	-	-	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

Drug Discovery

Drug discovery-Strategies and historical developments - Introduction –conventional strategies to drug discovery-molecular mimetic- first and second generation rational approach-Rational drug design-assessment of drug activity.

Pharmacophore in Drug Designing

Pharmacophore – Definition, identification of Pharmacophore features, Pharmacophore modeling-Structure based Pharmacophore modeling, Ligand based Pharmacophore modeling, Pharmacophore Mapping, Pharmacophore based Screening. Conformational search in pharmacophore mapping. Softwares in Pharmacophore modeling and screening

Molecular Modeling, Docking and Screening

Molecular Modeling: Modeling simple molecules. Docking: Intro, Types: Rigid docking, flexible docking, Blind docking, Scoring functions, Docking algorithms. Energy Minimization Methods, comparison between local, global minimum conformation. Virtual screening. Docking and screening softwares – Autodock, Autodock vina.

Molecular Dynamic Simulations

Introduction to Molecular Dynamic Simulations – Force Field, Energy Minimisation, MDS steps: Topology, Solvation, Adding ions, Energy minimization, equilibration, Production of MD run and Analyse results, MDS softwares – GROMACS, AMBER, CHARMM

QSAR

QSAR- Introduction, History and development. SAR versus QSAR, QSAR descriptors. QSAR Model - construction, validation, application. Multidimensional QSAR. Types- 2D QSAR to 6D QSAR. 3D QSAR approaches - COMFA, COMSIA.

TEXT BOOKS

1. Patrick Bultinck , Hans De Winter , Wilfried Langenaeker, Jan P. Tollenare, Computational Medicinal Chemistry for Drug Discovery 1st Edition Marcel Dekker Inc. 2004,
2. Andrew R. Leach Molecular Modeling Principles and Applications (2nd Ed.). Prentice

Hall ,2009
3. Cohen, N.C. “Guide Book on Molecular Modeling in Drug Design”, Academic Press / Elsevier, 2006
4. Eliel, E.L. “StereoChemistry of Organic Compounds”, John Wiley, 1994.

REFERENCES:

1. Frenkel, Dean and Berend Smith “Understanding Molecular Simulation: From Algorithms to Applications”, 2nd Edition Academic Press, 2002.
2. Lee, Mike S. “Integrated Strategies for Drug Discovery using Mass Spectrometry”John Wiley – Interscience, 2005.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.R.Jaisri	Assistant professor	Biotechnology	jaishri.vmkvec@vmrf.edu.in
2	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	CELL LINES AND ANIMAL CELL CULTURE	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

This course provides the basics of cell culture which is one of the major tools for studying the normal physiology and biochemistry of cells, effects of drugs and toxic compounds on cells.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To provide the fundamentals of cell lines and their cultivation
2	To recollect the fundamentals behind animal cell culture
3	To demonstrate the characteristics of stem cells and cloning
4	To apply the micromanipulation technology on embryo's and in-vitro fertilization
5	To apparaise the molecular diagnostic of animal diseases and Transgenic animal production

COURSE OUTCOMES

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

CO1. Understanding the fundamentals of cell lines and their cultivation	Understand
CO2. Understanding the basics of animal cell culture	Understand
CO3. Apply stem cells and cloning techniques for therapeutic applications	Apply
CO4. Apply the micromanipulation technology on embryo's and in-vitro fertilization	Apply
CO5. Analyzing the causes of animal diseases	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

CELL LINES

Culturing of cells– Primary and secondary cell lines – Genetics of cultured cells – Scaling up in suspension –Monolayer culture – Bio-reactors used for animal cell culture –Roller bottle culture– Bioreactor process control – Stirred animal cell culture –Air-lift fermentor, Chemostat/Turbidostat– Cell lines and their applications.

ANIMAL CELL CULTURE

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell

cultures, their maintenance and preservation; various types of cultures suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.

STEM CELL AND CLONING

Characteristics of ES cells –Types of stem Cells – ES cell research–In vitro derivation of gametes – Maintenance of stem cells in culture and applications – Somatic cell nuclear transfer –Gene expression of pluripotent cells –Cellular reprogramming –Induced pluripotency– Cloning techniques in animals and therapeutic cloning.

MICROMANIPULATION OF EMBRYO'S

Micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

ANIMAL DISEASES AND THEIR DIAGNOSIS

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, in-situ hybridization; northern and southern blotting; RFLP.

TEXT BOOKS:

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. Text Book Of Animal Biotechnology. Akshara Printers, 1997.
3. R.Ian Freshney Culture of Animal ceas, A Manual of basic technique 4th Edition 2002.

REFERENCES:

1. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press, 2000

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr. A. Arunagiri	Assistant Professor	Pharmaceutical Engineering	arunagiri@vmkvec.edu.in
2	Ms. S. Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya@vmkvec.edu.in

	BIOPROCESS EQUIPMENT DESIGN	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The course aims to deal with process and mechanical design, engineering drawing of various equipments.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To design the plant layout, selection and fabrication of plant process equipments.
2	To discuss the fundamental principles and design layout of Heat exchanger, Condensor and Reboilers
3	To discuss design consideration of equipments like Evaporators, Cooling towers etc.
4	To design Absorption, Extraction and distillation column
5	To discuss the designing of pressure vessels, Storage vessels and Bioreactors.

COURSE OUTCOMES

After completion of course, student will be able to,

CO1. Apply the skills in thermal design of heat transfer equipment like shell and tube, double pipe heat exchangers and evaporators, and assessing thermal efficiency of the above equipment in practice.	Apply
CO2. Outline general design considerations of Evaporator, Dryers etc.	Apply
CO3. Apply the concepts involved in phase separation and design of distillation, Extraction and absorption columns.	Apply
CO4. Acquire knowledge for designing the process equipment and important parameters of plant layout	Analyse
CO5. Examine and analyse the maximum safe operating parameters for pressure vessels and mechanical specifications of Storage vessels and Bioreactors	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO	PO	PO	PO	PO	PO	PO	PO	PO9	PO1	PO11	PO1	PSO1	PSO	PSO3
CO1	M	M	L	L	L	L	S	-	-	-	M	L	-	M	L
CO2	M	L	M	M	L	L	S	S	-	-	-	M	L	M	M
CO3	M	L	M	M	L	L	S	S	-	-	-	M	L	M	M
CO4	L	M	M	M	M	L	M	M	-	-	M	-	M	S	-
CO5	L	M	L	L	-	-	L	S	L	M	M	-	M	L	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO PLANT LAYOUTS

Design of Plant Layout- Pipelines and Pipe Layouts- Schematics and Presentation Materials of Construction and Selection of process equipment

FUNDAMENTALS OF DESIGN EQUATIONS AND DRAWING

Fundamental principles-general design equations and drawing considerations of Heat Exchangers-Condensers-reboilers.

DESIGN CONSIDERATIONS OF EQUIPMENTS

General design and drawing considerations of Cooling Tower, cooling coil, evaporators, Dryers, economic evaluation.

PROCESS EQUIPMENT DESIGN

Process equipment design of Absorption column, Distillation Column, bubble cap tray column, Extraction Column, Adsorption column.

BIOREACTOR AND FERMENTOR DESIGN

Packed Bed Reactors, Plug flow reactor, Continuous stirred tank reactor, Pressure Vessel, Storage Vessel and Fermenter.

TEXT BOOKS:

1. Green D. W., "Perry's Chemical Engineer's Handbook", 8th Edition McGraw Hill, 2007
2. M. V. Joshi and V. V. Mahajan, "Process Equipment Design", 3rd Edition, MacMillan India Ltd., 1996.

REFERENCES:

1. 1. Baranan, C.R., "Rules of Thumb for Chemical Engineers", Gulf Publishing Co, Texas, 1996.
2. R. K. Sinnott, "Coulson & Richardson's Chemical Engineering", Vol. 6, Butterworth Heinemann, Oxford, 1996.
3. Dawande, S. D., "Process Design of Equipments", 4th Edition, Central Techno Publications, Nagpur, 2005.
4. Coulson and Richardson's., "Chemical Engineering Design - Volume 6", Pergamon; 2nd edition,1991

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.R.Durga Shree	Assistant Professor	Pharmaceutical Engineering	durgashree@vmkvec.edu.in

	INSTRUMENTATION AND PROCESS CONTROL	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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

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

S- Strong; M-Medium; L-Low

SYLLABUS

INSTRUMENTATION

Principles of measurements and classification of process instruments, measurement oftemperature,

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

1. Stephanopoulos, G., "Chemical Process Control ", Prentice Hall of India, 2003.
2. Coughnowr, D., "Process Systems Analysis and Control ", 2nd Edn., McGraw Hill, New York, 1991.

REFERENCES

1. Marlin, T. E., "Process Control ", 2nd Edn, McGraw Hill, New York, 2000.
2. Smith, C. A. and Corripio, A. B., "Principles and Practice of Automatic Process Control", 2nd Edn., John Wiley, New York, 1997.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Ms.R.Durga Shree	Assistant Professor	Pharmaceutical Engineering	durgashree@vmkvec.edu.in

	CHEMICAL REACTION ENGINEERING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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

1	To Define chemical reactors and reaction systems.
2	To Discuss about biodiversity in marine environment and their resources
3	To Outline the conversion and yield for chemical reactions.
4	To Develop the appropriate selection technique for intended problem.
5	To Learn conceptual design of separation processes and design of equipment involved.

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

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

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.

IDEALREACTORS

Batch Reactor–Constant Volume, Variablevolumebatch reactor-Batch Reactor data for typical reactions–integral and differential method of analysis. Performance Equations for Single Batch reactor, Ideal CSTR, Ideal PFR.

SINGLEANDMULTIPLEREACTIONS

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-IDEALREACTORS

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.

HETEROGENEOUSREACTIONS

Fluid particle reactions: selection of a model, unreacted core models for spherical particles, determination of the rate controlling step. Catalyst preparation, surface area and pore volume measurements: promoters, poisons.

TEXTBOOKS

1. Octave Levenspiel, Chemical Reaction Engineering, John Wiley and sons. 3rd Edition, 1999.
2. Gavhane K.A., Chemical Reaction Engineering – I, Nirali Prakashan Publishers, 2009.

REFERENCES

1. Foggler H.S., Elements of chemical reaction engineering, Prentice Hall Publishing Co. 4th Edition, 2006.
2. Smith J.M., Chemical Engineering Kinetics, McGraw-Hill Inc 2003.
3. Narayanan, K.V., 2001. A Text Book of Chemical Engineering Thermodynamics, Prentice Hall India.
4. Smith, J.M., Van Ness, H.C. and Abbot, M.M., 2001. Chemical Engineering Thermodynamics. 6th Edn., McGraw- Hill.
5. Irving J. Dunn and Zurich, 2003. Biological Reaction Engineering. John Wiley and Sons.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Durga Shree	Assistant Professor	Pharmaceutical Engineering	durgashree@vmkvec.edu.in
2	Dr. P. David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	IMMUNOTECHNOLOGY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

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 understand the structure, functions and integration of immune system
2	To explain the antigen-antibody interactions that offers defense mechanism
3	To demonstrate about regulations of immune system
4	To relate the therapeutic techniques in immunotechnology
5	To practice immune techniques.

COURSE OUTCOMES

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

CO1. Understand the importance of immune system.	Understand
CO2. Describe about types of immunity and immunoglobulins	Understand
CO3. Illustrate how immune regulation is maintained	Apply
CO4. Relate the various techniques of therapeutically significant monoclonal and engineered antibodies production	Apply
CO5. Analyze different types of immunoglobulins	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTAL ASPECTS, ANTIGEN, ANTIBODIES AND IMMUNE RESPONSES

Cells and organs of the immune system and their development – Primary and secondary lymphoid organs – Antigen, Antibody – Structure, Production of antibodies – Polyclonal, monoclonal – Hybridoma technology. Antibody – Isolation, identification, Validation and their use. Engineered antibodies – Catalytic antibodies, idiotypic antibodies, plantibodies – Combinatorial libraries for antibody isolation. Humoral immune response – Cell mediated immune responses- Homeostasis in immune system – Complement.

IMMUNITY AND ITS TYPES

Types of immunity, Active and Passive Immunity, Humoral Immunity - B – Lymphocytes and their activation. Structure and function of immunoglobulins, idiotypes and anti idiotypic 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.

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.

IMMUNOLOGICAL TECHNIQUES

Affinity and Avidity; Principles of Precipitation, Agglutination reactions, Immunodiffusion, Immunoelectrophoresis, principles and application of ELISA, ELISPOT, Western Blotting, Immunofluorescence, Flow cytometry and Immunoelectron Microscopy, complement fixation, Widal test, VDRL test, immunoblot analysis. Immunohistochemistry, Radio Immuno Assay, chemiluminescence assay.

IMMUNOTHERAPY

Cancer immunotheraphy and Immunosuprressive therapy – Cytokine therapy – Immunoglobulin therapy: Replacement and immunomodulators – Gene transfer techniques for immunological diseases- Gene therapy for childhood immunological diseases.

TEXT BOOKS

1. Lydyard, P. M., Whelan, A. and Fanger, M. W., 2003. Instant Notes in Immunology. Viva Books Private Limited, 2nd Edition.
2. Talwar, G. P., and Gupta, S. K., 1992. A Handbook of Practical and Clinical Immunology. CBS Publications, Volume I and II.
3. Weir, D. M., 1990. Practical Immunology. Blackwell Scientific Publications, Oxford.

REFERENCES

1. Judith A. Owen, Jenni Punt and Sharon Stranford, “Kuby Immunology”, W.H. Freeman and Company, 7th Edition, 2013.
2. Gerd-Rudiger Burmester, Antonio Pezzutto and Jurgen Wirth, “Color Atlas of Immunology”, Thieme Medical Publishers, 1st Edition, 2003.
3. Emily P. Wen, Ronald Ellis and Narahari S. Pujar, “Vaccine Development and Manufacturing” Wiley, 1st Edition, 2014.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya@vmkvec.edu.in

	MOLECULAR PHARMACEUTICS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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.

PRERQUISITE- 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. Discuss the mechanism of drug actions at cellular and molecular level.	Understand
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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
CO	M	M	M	M	L	L	M	L	M	L	L	L	S	S	-
CO	M	M	M	M	L	L	M	L	M	L	L	L	S	-	-
CO	S	S	S	S	L	L	M	L	M	L	L	L	S	-	-
CO	M	M	M	M	M	M	S	-	S	-	S	M	S	S	M
CO	M	M	M	M	M	M	S	-	S	-	S	M	S	S	M

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

Introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.

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

Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and non-viral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. Knowledge of therapeutic antisense molecules and aptamers as drugs of future.

TEXT BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.
3. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997, (reprint in 2001).

REFERENCES

1. Schreier H., Drug Targeting Technology Physical, Chemical and Biological Methods, Marcel Dekker, New York.
2. Roland A., Particulate Carriers: Therapeutic Applications, Marcel Dekker, New York.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	ENZYMOLOGY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

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 different classes of enzymes and their characteristics
2	To generalize enzyme inhibition with examples
3	To illustrate mechanism and kinetics of enzyme action
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 enzymes and elaborate the characteristics of enzymes.	Understand
CO2. Demonstrate the mechanism of enzyme inhibition and enzyme immobilization.	Understand
CO3. Exemplify fundamental knowledge about enzyme kinetics and mechanism of enzyme action	Understand
CO4. Illustrate about the regulation and mechanism of enzymes in cells.	Apply
CO5. Conclude the applications of various enzymes in industries & its clinical use.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

General introduction and historic background- General Terminology, Nomenclature and Classification of Enzymes. Criteria of purity of enzymes- Specific activity. Enzyme units-Katal and IU. Enzyme activity- chemical nature of enzymes. Protein nature of enzymes and Non protein enzymes- Ribozymes and DNAzymes. Metalloenzymes and metal activated enzymes. Coenzymes and Cofactors- Prosthetic group, coenzymes involved in different metabolic pathways. Classification of coenzymes. Isozymes, Abzymes, Synzyme.

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

Factors affecting the enzyme activity- Concentration, pH and temperature. Kinetics of a single-substrate enzyme catalyzed reaction, Michealis-Menten Equation, Km, Vmax, L.B Plot, Turnover number, Kcat. Kinetics of Enzyme Inhibition. Kinetics Allosteric enzymes.

ENZYME REGULATION

Feedback Regulation, Allosteric Regulation, Reversible Covalent Modification and Proteolytic Activation. Organization of enzymes in the cell. Enzymes in the cell, localization, compartmentation of metabolic pathways, enzymes in membranes, concentrations. Mechanisms of enzyme degradation, lysosomal and nonlysosomal pathways, examples.

INDUSTRIAL AND CLINICAL USES OF ENZYMES (APPLIED ENZYMOLOGY)

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:

1. Bhatt S.M, 2014.Enzymology and Enzyme Technology. S Chand & Company, Bengaluru, Karnataka.
2. T. Devasena, 2010. Enzymology, Oxford University Press, Oxford, United Kingdom.
3. Trevor Palmer, 2008. Enzymes: Biochemistry, biotechnology and clinical chemistry. East West Press, Horwood.
4. Zubay, G. L., 1998. Biochemistry, McGraw-Hill Companies, Dubuque, 4thEdn.
5. Bailey and Ollis, D.F..2017. Biochemical Engineering Fundamentals. McGraw Hill. New York. 2nd Edn.

REFERENCES:

1. M. Y. Khan & Farha Khan, 2015.Principles of Enzyme Technology. PHI Learning.
2. Butterworth, 1995. Technological Applications of Biocatalysts. BIOTOL Series.
3. Cornish-Bowden, A., 1996. Analysis of Enzyme Kinetic Data. Oxford University Press.
4. Wiseman, A., Blakeborough, N. and Dunnill, P., 1981. Enzymatic and Nonenzymatic catalysis. Vol. 5, Ellis and Harwood, UK
5. Wiseman, A. Topics in Enzyme and Fermentation Biotechnology. Vol.5 Ellis and Harwood, UK.
6. Kolot, F.B. 1998 Immobilized Microbial Systems, Principles, Techniques and Industrial applications. R.R Krieger Publications.

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mr. A. Arunagiri	Assistant professor	Pharmaceutical Engineering	Arunagiri@vmkvec.edu.in
2	Dr.S.Anusuya	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in

INDUSTRY DESIGNED/ INDUSTRY SUPPORTED/ INDUSTRY OFFERED/ INDUSTRY SPONSORED COURSES

CREDITS (6)

	BIOPHARMACEUTICS	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

This course will enable the students to know about both the pharmacokinetic and dynamic principles of drug action. It also elaborates different dosage forms and drug delivery systems.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To outline the various routes of administration, drug absorption and distribution
2	To understand the process of drug metabolism and excretion
3	To demonstrate the types of dosage forms
4	To compare the pharmacokinetic models and to infer the volume of distribution of drug in human body
5	To understand the relationship between biologics and biosimilars

COURSE OUTCOMES

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

CO1: Outline the various routes of administration, drug absorption and distribution	Understand
CO2: Understand the process of drug metabolism and excretion	Understand
CO3: Use Michaelis-Menton kinetics in drug metabolism	Apply
CO4: Compare different pharmacokinetic models	Analyse
CO5: Compare bioavailability of a drug when it is formulated in different dosage form	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to biopharmaceuticals

Introduction to biotechnology and biopharmaceuticals, historical perspective of pharmaceutical biotechnology, process of transforming new molecular entities into drugs, current trends in drug development, biotechnology industry perspective on drug development.

Drug Development process

Drug discovery approaches, modulatory effects, binding strength, effective and inhibitory concentration, side effects, ADME, Lipinski rule, action of drugs on humans, pharmacokinetics,

pharmacodynamics, routes of drug administrations, patenting, phases of clinical studies, design and conduct of clinical trials, case studies of drug discovery.

Biopharmaceutical technologies

Role of manufacturing process, process evaluation, drug substance manufacturing, drug product manufacturing, cell banking, expression systems, batch and continuous processes, sterility and sterile technology, raw material and processing aids, purification of product, formulation and filling, labelling and packaging, product analytics, quality criteria of analytical methods, process analytics, validation of analytical methods.

Quality assurance and quality control

Fundamental of quality assurance, benefits, structure of quality management, documentation, audits, quality assurance in manufacturing, measures to cross contamination and product confusion, equipment qualification, process validation, product release, product recall.

Regulatory bodies

Field of pharmaceutical laws, authorities, institutions and their regulation, drug approval steps and processes, FDA, EMEA, German, Japanese and Indian regulatory bodies.

TEXT BOOKS

1. Rosenbaum, S. E. "Basic Pharmacokinetics and Pharmacodynamics: An Integrated Textbook and Computer Simulations", 2nd Edition, John Wiley & Sons, 2016.
2. Brahmankar, D.M. and Jaiswal, S.B. "Biopharmaceutics and Pharmacokinetics: a Treatise", 3rd Edition, Vallabh Prakashan, 2015.
3. Chatwal, G.R. "Biopharmaceutics and Pharmacokinetics", 2ndEdition, Himalaya Publishing House, 2014.

REFERENCES

1. Biopharmaceuticals: Biochemistry and Biotechnology by Gary Walsh, Publisher: Wiley-Blackwell, ISBN10: 0470843276
2. Manufacturing of Pharmaceutical Proteins (from technology to Economy) by Dr.-Ing. Stefan Behme, Wiley-VCH Verlag GmbH & Co. ISBN 978-3-527-32444-6
3. Biochemistry by Lubert Stryer, W.H.Freemanand Company. ISBN 13:978-1-4292-7635-1

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Organization	Mail ID
1	Mr. P. Jeyaprakash	Managing Director	Konovonat	jpknovonat15@gmail.com

	CLINICAL RESEARCH	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

Clinical research is a study which deals with new drugs which are tested in human volunteers after it successfully passes in vivo and in vitro evaluations. This course also elaborates the documents to be maintained during the study which are essential for evaluating the quality of research which is to be submitted for the regulatory bodies for approval. The students will acquire knowledge in all aspect of clinical trials, management and ethical standards required to conduct clinical trials.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To learn the different types and designs of clinical trials, requirements for conducting clinical trials, an opportunity to conceptualize, conduct, manage and report clinical trials.
2	To get familiarize with the conceptualizing, designing, conducting, managing and documenting the clinical trials
3	To learn the clinical trial management and to gain knowledge with ethical principles for the new insights in the field of clinical research
4	To develop drug safety data in pre-clinical and the basis of informed consent and maintaining the quality control standards in clinical research
5	To focus on the global scenario of pharmacovigilance in different methods that can be used to generate safety data and maintenance of reporting in clinical trials

COURSE OUTCOMES

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

CO1. Outline the regulatory requirements for conducting clinical trials and demonstrate the types of clinical trial designs	Understand
CO2. Illustrate the responsibilities of key players involved in clinical trials and execute safety	Apply
CO3. Apply the Project Management and ethical principles for conducting clinical research	Apply
CO4. Assess the details about Informed Consent and validate the regulations and safety and their assessment	Analyze

CO5. Explain the principles of pharmacovigilance and Examine new adverse drug reactions	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CLINICAL TRIALS - TYPES, DESIGN AND PRACTICES

Fundamentals of clinical trials; Clinical trials in practice; Experimental Study - Randomized Control Trial and Non Randomized Control Trial, Single blinded and double blinded studies, Observation Study: Cohort, Case Control, Cross sectional Clinical Trial Studies. Reporting and reviewing clinical trials; Legislation and good clinical practice; Origin and Principles of the International Committee on Harmonisation (ICH)-GCP and guidelines – Good Clinical Practice - Ethical Committee: Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant - Schedule Y.

REGULATIONS AND DOCUMENTATION OF CLINICAL TRIALS

Drug development and trial planning - pre-study requirements for clinical trials; Regulatory approvals for clinical trials - WHO, FDA, EMEA, CDSCO, ICMR and their regulatory terminologies; Consort statement; Trial responsibilities and protocols - roles and responsibilities of investigators, sponsors and others; Requirements of clinical trials protocols; Guidelines to the preparation of documents and protocol, Investigator Brochure, Case Report Forms, Clinical Study Report, Clinical Trial Monitoring - Safety Monitoring in CT.

MANAGEMENT AND ETHICS OF CLINICAL TRIALS

Project management in clinical trials - principles of project management; Application in clinical trial management; Risk assessment; Research ethics and Bioethics - Principles of research ethics; Ethical issues in clinical trials; Ethical committee system including a historical overview; Introduction to ethical codes and conduct; Introduction to animal ethics; Animal rights and use of animals in the advancement of medical technology; Introduction to laws and regulation regarding use of animals in

research.

INFORMED CONSENT & QUALITY CONTROL IN CLINICAL TRIALS

Informed Consent and data protection- the principles of informed consent; Consent processes; Data protection; Legislation and its application; Data management – Introduction to trial master files and essential documents; Data management. Quality assurance and governance - quality control in clinical trials; Monitoring and audit; Inspections; Research governance; Trial closure and pitfalls-trial closure; Reporting and legal requirements; Common pitfalls in clinical trial management.

PHARMACOVIGILANCE AND ADR REPORTING

Roles & responsibilities and Guidelines in Pharmacovigilance, Significance of safety monitoring, Establishing pharmacovigilance centres, National programmes related to pharmacovigilance. Adverse Drug Reactions: Types, Regulatory terminologies, Detection and reporting methods, Severity and seriousness assessment, Predictability and preventability assessment. Spontaneous reporting system and Reporting to regulatory authorities & ADR Management.

TEXT BOOKS

1. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
2. A textbook of Clinical Pharmacy Practice: Essential Concepts and Skills. Second Edition, 2012, University Press
3. Central Drugs Standard Control Organization- Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
4. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice. E6; May 1996.230
5. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
6. Textbook of Pharmacovigilance: Concept and Practice. G. P. Mohanta and P. K. Manna. 2016, Pharma Med Press.

REFERENCE

1. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
2. Handbook of clinical Research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone.

3. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
4. Blaisdell, Peter, “Twenty – First Century Pharmaceutical Development”, Interpharm Press, 2001.
5. Gad, Shayne C. “Drug Safety Evaluation”, John –Wiley & Sons, 2002.
6. Lee, Chi-Jen; etal., “Clinical Trials or Drugs and Biopharmaceuticals.” CRC / Taylor &Francis, 2011.
7. Matoren, Gary M. “The Clinical Research Process in the Pharmaceutical Industry.”Marcel Dekker, 1984.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Organization	Mail ID
1.	Mr.P.Jeyaprakash	Managing Director	Knovonat	jpknovonat15@gmail.com

	PHARMACOKINETICS AND PHARMACODYNAMICS	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

This course will enable the students to know about both the pharmacokinetic and dynamic principles of drug action. It also elaborates different dosage forms and drug delivery systems.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To outline the various routes of administration, drug absorption and distribution
2	To understand the process of drug metabolism and excretion
3	To demonstrate the types of dosage forms
4	To compare the pharmacokinetic models and to infer the volume of distribution of drug in human body
5	To understand the relationship between biologics and biosimilars

COURSE OUTCOMES

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

CO1: Outline the various routes of administration, drug absorption and distribution	Understand
CO2: Understand the process of drug metabolism and excretion	Understand
CO3: Apply Michaelis-Menton kinetics in drug metabolism	Apply
CO4: Compare different pharmacokinetic models	Analyse
CO5: Compare bioavailability of a drug when it is formulated in different dosage form	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS ON DRUG ABSORPTION AND DISTRIBUTION

Definitions, various routes of administration with advantages/disadvantages, bioavailability concepts in drug absorption and distribution, theories of drug dissolution, drug partition hypothesis, permeability and distribution of drugs, perfusion rate and volume of distribution, protein binding of drugs, kinetics of drug binding, various factors that affect drug absorption and distribution, drug interactions in the level of drug absorption and distribution.

FUNDAMENTALS ON DRUG METABOLISM AND EXCRETION

Biotransformation of drugs, pathways and enzymes of drug metabolism, Phase I and Phase II, drugs excretion – renal and non-renal routes, various factors that affect drug metabolism and excretion, prodrugs, drug interactions in the level of drug metabolism and excretion, bioavailability concepts in drug metabolism and excretion.

PHARMACOKINETIC INVESTIGATION AND EVALUATION

Concept of therapeutic concentration, time-profile, rates and various order of reactions (first, zero, mixed), Michaelis-Menton kinetics, differential equations for a simple pharmacokinetic models, compartment models (one, two, multi, open models), definition and calculation of parameters such as drug half-life, of Drugs, Volume of Distribution, and bioavailability (AUC) and their application to compartment models and kinetics of IV Bolus administration, comparison between bioavailability and bioequivalence.

PHARMACODYNAMIC FUNDAMENTALS

Definitions – agonist/antagonist, antagonism as a mechanism of drug action, classification of antagonists, drug-receptor interactions, factors affecting drug-target interactions, law of mass action applied to drugs, quantifying drug-target interactions: dose-response relationships - graded dose and quantal dose-responses; molecular mechanisms mediating drug action, receptor coupling and transduction mechanisms, intracellular transduction mechanisms, second messenger systems, amplification of drug responses, factors modifying drug responses.

APPLICATION OF PD/PK PRINCIPLES IN DOSAGE FORM DEVELOPMENT

Regimens for dosage form design, concentration response relationships, individualization therapeutics, classification of controlled release formulations and novel drug delivery (oral, parenteral, trans-dermal, ophthalmic and intrauterine) systems, bioavailability testing of novel release formulations.

TEXT BOOKS

1. Rosenbaum, S. E. "Basic Pharmacokinetics and Pharmacodynamics: An Integrated Textbook and Computer Simulations", 2nd Edition, John Wiley & Sons, 2016.
2. Brahmankar, D.M. and Jaiswal, S.B. "Biopharmaceutics and Pharmacokinetics: a Treatise", 3rd Edition, Vallabh Prakashan, 2015.
3. Chatwal, G.R. "Biopharmaceutics and Pharmacokinetics", 2ndEdition, Himalaya Publishing House, 2014.
4. Brahmankar, D.M., "Biopharmaceutical and Pharmacokinetics:A Treatise", VallabhPrakashan, 1995.
5. Notari, R.E., "Biopharmaceutics and Clinical Pharmacokinetics: An Introduction", 4thEdition, MarcellDeckker, 2005

REFERENCES

1. Shargel, L and Andrew, B.C. Yu. "Applied Biopharmaceutics & Pharmacokinetics", 7th

Edition, The McGraw-Hill Companies, Inc, 2016.
2. Gibaldi, M. "Biopharmaceutics & Clinical Pharmacokinetics", 4th Edition, Pharma Book Syndicate, 2016.
3. Jambhekar, S.S. and Philip,J. B. "Basic Pharmacokinetics" 2nd Edition, Pharmaceutical Press, 2012.
4. Schoenwald, R.D., "Pharmacokinetics in Drug Discovery and Development", CRC Press,2002.
5. Oliver Kayser, Rainer H. Müller, "Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications", Wiley-VCH publications

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr. P. Jeyaprakash	Managing Director	Konovonat	jpknovonat15@gmail.com

	LEARNING IT ESSENTIALS BY DOING	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

The proposed elective course exposes the non-CS/IT students to IT Essentials. The core modules of this Elective includes programming , Database and web Technology amongst other related topics. This course refers to the basic tools and technologies for the right type of website development and enable student to create simple web applications

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To learn about the essentials of Information Technology
2	To get an idea about the scripting languages.
3	To get an idea about the internet protocols

COURSE OUTCOMES

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

CO1 Understand the networking concept internet protocols, network routing	Understand
CO2. Understand the fundamentals of web applications and its modeling	Understand
CO3. Understand and learn the scripting languages with design of web applications	Understand
CO4. Analyze the process of mobile communication and network technologies	Analyze
CO5. Build simple interactive applications, database applications and multimedia applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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
URL – HTML – HTTP protocol – Web Applications - Application servers – Web Security.

REFERENCES

1. Andrew S. Tanenbaum, Structured Computer Organization, PHI, 3rd ed., 1991
2. Silberschatz and Galvin, Operating System Concepts, 4th ed., Addision-Wesley, 1995
3. Dromey R.G., How to solve it by Computers, PHI, 1994
4. Kernighan, Ritchie, ANSI C language PHI,1992
5. Wilbert O. Galitz, Essential Guide to User Interface Design, John Wiley, 1997
6. Alex Berson, Client server Architecture, Mc Grew Hill International, 1994
7. Rojer Pressman, Software Engineering-A Practitioners approach, McGraw Hill, 5th ed., 2001
8. Alfred V Aho, John E Hopcroft, Jeffrey D Ullman, Design and Analysis of Computer Algorithms, Addison Wesley Publishing Co., 1998
9. Henry F Korth, Abraham Silberschatz, Database System Concept, 2nd ed. McGraw-Hill International editions, 1991
10. Brad J Cox, Andrew J.Novobilski, Object – Oriented Programming – An evolutionary approach, Addison – Wesley, 1991

Course Designers:

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.K.Sasikala	Associate Professor	CSE	sasikalak@vmkvec.edu.in
2.	Mr. K.Karthik	Assistant Professor	CSE	karthik@avit.ac.in

	MOBILE APPLICATION DEVELOPMENT	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

In this modern era almost every hands has a handheld devices. Each handheld device have the computing capability to meet the half the needs of user such as banking, browsing, education and emergency etc. It is a must for a computer engineer to have some basic knowledge about the handheld devices platform and its supporting software development. This course will give adequate knowledge in developing a mobile applications for different such as Android, iOS, Windows.

PRE REQUISITE – NIL

COURSE OBJECTIVES

1.	Understand system requirements for mobile applications
2.	Generate suitable design using specific mobile development frameworks
3.	Generate mobile application design
4.	Implement the design using specific mobile development frameworks
5.	Deploy the mobile applications in marketplace for distribution

COURSE OUTCOMES

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

CO1. Expose to technology and business trends impacting mobile applications	Understand
CO2.Understand enterprise scale requirements of mobile applications	Understand
CO3. Familiarize in the Graphics used for Android application development	Apply
CO4. Competent with the characterization and architecture of mobile applications	Apply
CO5. Competent with designing and developing mobile applications using one application development framework.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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

Introduction –Basics of embedded systems design –Embedded OS -Design constraints for mobile applications, both hardware and software related –Architecting mobile applications –User interfaces for mobile applications –touch events and gestures –Achieving quality constraints –performance, usability, security, availability and modifiability.

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

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI –Persisting data using SQLite–Packaging and deployment –Interaction with server side applications –Using Google Maps, GPS and Wifi –Integration with social media applications.

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

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.

REFERENCES

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012.

2. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012.

3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013

Course Designers:

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2.	Mrs. S. Leelavathy	Assistant Professor (G-II)	CSE	leelavathy@avit.edu.in

OPEN ELECTIVE

INNOVATION ENTREPRENEURSHIP, SKILL DEVELOPMENT ETC.

CREDITS (6-9)

	INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE

commercialization of innovation and new products in fast-paced, high-tech markets and matching technological innovation to market opportunities.

PREREQUISITE - Not Required

COURSE OBJECTIVES

1	To make students understand multiple-perspective approach in organization to capture knowledge and creativity to develop successful products and services for Volatile, Uncertain, Complex and Ambiguous (VUCA) world.
2	Inculcate a disruptive thought process to generate ideas for concurrent and futuristic problems of society in general and markets in particular which focus on commercialization
3	Improved understanding of organizational best practices to transform exciting technology into successful products and services
4	Critically assess and evaluate innovation policies and practices in organizations especially from a cultural and leadership point of view
5	Explain why innovation isessential to organizational strategy – especially in a global environment

COURSE OUTCOMES

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

CO1: Understand the role of innovation in gaining and maintaining competitive advantage	Understand
CO2: Integrate the innovation basis and its role in decision making especially under uncertainty	Apply
CO3: Analyze business challenges involving innovation management	Apply
CO4: Having problem solving ability – solving social issues and business problems	Apply
CO5: Comprehend the different sources of innovation	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	M	-	-	-	-	M	S	S	-	M	-	-
CO2	S	S	S	M	M	M	-	-	-	-	-	-
CO3	S	S	S	M	M	M	-	-	-	-	-	-
CO4	S	S	S	M	M	M	-	-	-	-	-	-
CO5	S	S	S	M	M	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Pre-launch, during launch and Post launch preparations;

SYLLABUS:

Introduction to Innovation Management - Innovation – What it is? Why it Matters? - Innovation as a Core Business Process – system thinking for innovation – Framework for System Thinking - system thinking tools

Creating New Products and Services - Product and Service Innovation – Exploiting Open Innovation and

Collaboration –The Concept of Design Thinking and Its Role within NPD and Innovation – framework for design thinking

Capturing Innovation Outcome - New Venture – Benefits of Innovation, and Learning from Innovation – Building Innovative Organization and Developing Innovation Strategy - Globalization for Innovations, Innovating for Emerging Economies and Role of National Governments in Innovation

New Product Brand Development and Pricing Strategies - Importance of Brand decisions and Brand identity development; Pricing of a new product, Pre-test Marketing

The Product offer Selecting Market opportunity and Designing new market offers-Concept Generation and Evaluation, Developing and Testing Physical offers - Pre-launch, during launch and Post launch preparations;

Text Book:

1. Joe Tidd, John Bessant (2013), Managing Innovation: Integrating Technological, Market and Organizational Change, 5th edition, Wiley.

Reference Books:

1. Schilling, M (2013), Strategic management of technological innovation, 4th edition, McGraw Hill Irwin.
2. Allan Afuah (2003), Innovation Management: Strategies, Implementation and Profits, 2nd edition, Oxford University Press.
3. Michael G. Luchs, Scott Swan, Abbie Griffin (2015), Design Thinking: New Product Development Essentials from the PDMA, Wiley-Blackwell.
4. John Boardman, Brian Sauser (2013), Systemic Thinking: Building Maps for Worlds of Systems, 1st edition, Wiley.
5. Rich Jolly (2015), Systems Thinking for Business: Capitalize on Structures Hidden in Plain Sight, Systems Solutions Press

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

	NEW VENTURE PLANNING AND MANAGEMENT	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE

Contemporary methods and best practices for the entrepreneur to plan, launch, and operate a new venture and creation of a business plan

PREREQUISITE - Not Required

COURSE OBJECTIVES

1	An opportunity for self-analysis, and how this relates to success in an entrepreneurial environment.
2	Information and understanding necessary to launch and grow an entrepreneurial venture.
3	A realistic preview of owning and operating an entrepreneurial venture.
4	An entrepreneur must understand the diversity, emotional involvement, and workload necessary to succeed.
5	The opportunity to develop a business plan.

COURSE OUTCOMES

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

CO1: Explain the concept of new venture planning, objectives and functions and its components.	Understand
CO2: Analyze the business plan issues and remuneration practices in startups business.	Apply
CO3: Explore an entrepreneurial idea to the point where you can intelligently and decide whether to "go for it" or not.	Apply
CO4: Compare and contrast the different forms entrepreneurial environment in terms of their key differences and similarities.	Apply
CO5: Explore the business plan and business model canvas for your idea.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	M	-	-	-	-	M	S	S	-	M	-	-
CO2	S	S	S	M	M	M	-	-	-	-	-	-
CO3	S	S	S	M	M	M	-	-	-	-	-	-
CO4	S	S	S	M	M	M	-	-	-	-	-	-
CO5	S	S	S	M	M	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS:

STARTING NEW VENTURE: Opportunity identification - Search for new ideas - Sources of innovative ideas - Techniques for generating ideas - Entrepreneurial imagination &creativity - The role of creative thinking - Developing your creativity - Impediments to creativity.

METHODS TO INITIATE VENTURES: Pathways to new venture - Creating new ventures - Acquiring an existing venture - Advantages of acquiring an established venture - Examination of key issues – Franchising - How a franchise works and franchise law - Evaluating franchising opportunity.

THE SEARCH FOR ENTREPRENEURIAL CAPITAL: The venture capital market - Criteria for

evaluating new venture proposals - Evaluating venture capitalists - stage of venture capital financing - Alternate sources of financing for Indian entrepreneurs - Bank funding - State financial corporations - Business incubators and facilitators - Informal risk capital - Angel investors.

THE MARKETING ASPECTS OF NEW VENTURE: Developing a marketing plan - Customer analysis - Sales analysis - Competition analysis - Market research - Sales forecasting - Sales Evaluation - Pricing decisions.

BUSINESS PLAN PREPARATION FOR NEW VENTURE: Business plan concept - Pitfalls to avoid in business plan - Developing a well conceived business plan - Elements of a business plan - Harvest strategy - Form of business organization - Legal acts governing businesses in India .

Text Book:

1. The Successful Business Plan, Secrets & Strategies, Rhonda Abrams, Published by The Planning Shop Titan, Ron Chernow, Random House
2. Osterwalder, A. and Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Hoboken, NJ: John Wiley & Sons

Reference Books:

1. Blackwell, E. (2011). How to Prepare a Business Plan: Create Your Strategy; Forecast Your Finances; Produce That Persuasive Plan. Kogan Page Publishers.
2. Levi, D. (2014). Group Dynamics for Teams. Sage Publications, Inc. Thousand Oaks.
3. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.
4. Business Model Generation by Osterwalder and Pigneur.

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

	SOCIAL ENTREPRENEURSHIP	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE

Social entrepreneurship involves the creativity, imagination and innovation often associated with entrepreneurship.

PREREQUISITE - Not Required

COURSE OBJECTIVES

1	To provide students with a working knowledge of the concepts, opportunities and challenges of social entrepreneurship..
2	To demonstrate the role of social entrepreneurship in creating innovative responses to critical social needs (e.g., hunger, poverty, inner city education, global warming, etc)..
3	To engage in a collaborative learning process to develop a better understanding of the context and domain of social entrepreneurship..
4	To help prepare you personally and professionally for meaningful employment by reflecting on the issues of social entrepreneurship.
5	Engage with a diverse group of social entrepreneurs

COURSE OUTCOMES

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

CO1: Explain the concept social entrepreneurship and distinguish its elements from across a continuum of organizational structures from traditional nonprofits to social enterprises to traditional for profits	Understand
CO2: Analyze the operations of a human service organization using social entrepreneurial orientation and industry assessment and diagnostic tools.	Apply
CO3: Apply the Social Business Model Canvas and lean startup methods for planning, developing, testing, launching and evaluating social change ventures.	Apply
CO4: Compare funding options for social change ventures.	Apply
CO5: The outcomes of social entrepreneurship are focused on addressing persistent social problems particularly to those who are marginalized or poor.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	M	-	-	-	-	M	S	S	-	M	-	-
CO2	S	S	S	M	M	M	-	-	-	-	-	-
CO3	S	S	S	M	M	M	-	-	-	-	-	-
CO4	S	S	S	M	M	M	-	-	-	-	-	-
CO5	S	S	S	M	M	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS:

Social entrepreneurship – dimensions of social entrepreneurship – social change theories – equilibrium and

complexity – theory of social emergence

Social entrepreneurs – mindset, characteristics and competencies – developing a social venture sustainability model – feasibility study – planning – marketing challenges for social ventures

Microfinance– MFI (Micro Finance Institutions) in India – regulatory framework of MFI – Banks and MFIs – sustainability of MFI – Self Help Groups– successful MFI models

Angel Investors & Venture Capitalists – difference – valuation of firm – negotiating the funding agreement – pitching idea to the investor

Corporate entrepreneurship – behavioral aspects – identifying, evaluating and selecting the opportunity – venture– location – organization – control – developing business plan – funding the venture – implementing corporate venturing in organization.

Text Book:

1. Constant Beugré, Social Entrepreneurship: Managing the Creation of Social Value, Routledge, 2016.

2. Björn Bjerke, Mathias Karlsson, Social Entrepreneurship: To Act as If and Make a Difference, Edward Elgar Publishing, 2013.

Reference Books:

1. Wei-Skillern, J., Austin, J., Leonard, H., & Stevenson, H. (2007). Entrepreneurship in the Social Sector (ESS). Sage Publications.
2. Janus, K. K. (2017). Social startup success. New York, NY: Lifelong Books.
3. Dancin, T. M., Dancin, P. A., & Tracey, P. (2011). Social entrepreneurship: A critique and future directions.
4. Alex Nicholls, Social Entrepreneurship: New Models of Sustainable Social Change, OUP Oxford, 2008.
5. David Bornstein, Susan Davis, Social Entrepreneurship: What Everyone Needs to Know, Oxford University Press, 2010.

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

	ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE:

A startup means company initiated by individual innovator or entrepreneurs to search for a repeatable and scalable business model. More specifically, a startup is a newly emerged business venture that aims to develop a viable business model to meet a marketplace needs or wants in an optimum manner.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the basics of Startups Management and components.
2. To analyze the startups fund management practices
3. To practice the various kinds of stocks and employment considerations in startups.
4. To apply the importance of intellectual property rights and its procedures.
5. To explore the entrepreneurial mindset and culture.

COURSE OUTCOMES:

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

CO1: Explain the concept of engineering startups, objectives and functions and its components.	Understand
CO2: Analyze the startups funding issues and remuneration practices in startups business.	Analyse
CO3: Analyze the various kinds of stocks and employment opportunities and consideration in startups business.	Analyse
CO4: Compare and contrast the various forms of intellectual property protection and practice.	Analyse
CO5: Explore the entrepreneurial mindset and culture that has been developing in companies of all sizes and industries.	Evaluates

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

Elements of a successful Start up: Startup Process – Create Management Team and Board of Directors – Evaluate market and Target Customers – Define your product or service – preparation of business plan -

specific problems and challenge in startup.

Funding Issues and Remuneration Practices: Funding Issues: Investment Criteria – Looking for seed cash – Seed, Startup, and subsequent Funding Rounds – Milestone Funding - Remuneration Practices for your Start –up : Salaries – Equity Ownership – Other compensation – Employment Contracts

Stock Ownership & startup Employment Considerations: Stock ownership: Risk- Reward Scale – Ownership Interest over time – Common and preferred stock – Authorized and outstanding shares – Acquiring stock – Restricted Stock Grants – Future Tax Liability on Restricted Shares - Compensation and startup Employment Considerations : Entrepreneurs Need Insurance – Do Fringe benefits – outsourcing your benefits work – Life Insurance – Health Insurance – Disability Insurance

Protecting Intellectual Property: Protecting your intellectual property: Copyrights - patents–Trade secrets – Trademarks - The Legal Form of your Startup: Corporation – Partnership – Limited Liability Company – Sole Proprietorship - – Making the startup decision: commitment – Leaving a current employer - stay fit.

Startup Capital Requirements and Legal Environment:

Identifying Startup capital Resource requirements - estimating Startup cash requirements - Develop financial assumptions- Constructing a Process Map - Positioning the venture in the value chain - Launch strategy to reduce risks- Startup financing metrics - The Legal Environment- Approval for New Ventures- Taxes or duties payable for new ventures..

Text Book:

1. James A. Swanson & Michael L. Baird, "Engineering your start-up: A Guide for the High-Tech Entrepreneur" 2nd ed, Professional Publications.inc
2. Donald F Kuratko, " Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.

Reference Books:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005.
3. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

COURSE DESIGNERS:

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	INTELLECTUAL PROPERTY RIGHTS	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE

To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

PRE-REQUISITE–Nil

COURSEOBJECTIVES

1	To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
2	To disseminate knowledge on copyrights and its related rights and registration aspects
3	To disseminate knowledge on trademarks and registration aspects
4	To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
5	To aware about current trends in IPR and Govt. steps in fostering IPR

COURSEOUTCOMES

Onthesuccessful completionofthecourse, studentswill beable to

CO1.The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works.	Understand
CO2.Comprehend the applicable source, scope and limitations of Intellectual Property within the purview of engineering domain.	Apply
CO3. Knowledge and competence related exposure to the various Legal issues pertaining to Intellectual Property Rights with the utility in engineering perspectives.	Analyze
CO4. Enable the students to have a direct experience of venture creation through a facilitated learning environment	Analyze
CO5. It allows students to learn and apply the latest methodology, frameworks and tools that entrepreneurs use to succeed in real life.	Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

Introduction:

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property)

Trade Marks:

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

Industrial Design, Copy Right&Intellectual property and cyberspace:

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

Trademarks:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks – Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

IPR Legislations and Case Studies:

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

Case Studies on – Patents (Basumatirice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXTBOOK

1. Subbaram N.R. “Handbook of Indian Patent Law and Practice “, S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

REFERENCES

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].

COURSEDESIGNERS

S.No.	Name of theFaculty	Designation	Department	Mail Id
1.	Mr. J. Vijay	Asst. Professor Gr. II	ECE	vijay.ece@avit.ac.in
2.	Dr.T.Sheela	Asso.Professor	ECE	sheela@vmkvec.edu.in

OPEN ELECTIVE
EMERGING AREAS
CREDITS (6-9)

	PRINCIPLES OF BIOMEDICAL INSTRUMENTATION	Category	L	T	P	Credit
		OE-EA	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. Discuss the working principles of diagnostic and therapeutic equipments.	Understand
CO3. Examine the various instruments like as ECG, EMG, EEG, X-ray machine.	Apply
CO4. Illustrate medical instruments based on principles and application used in hospital.	Analyze
CO5. Analyze and calibrate fundamental biomedical instrumentation used in hospital.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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, Pc02, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, auto-analyser. Biotelemetry-wireless telemetry, single channel telemetry, multichannel telemetry, multi patient telemetry.

TEXT BOOKS:

1. Khandpur R.S, **"Hand-book of Biomedical Instrumentation"**, Tata McGraw Hill, 2nd Edition, 2003.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, **"Biomedical Instrumentation and Measurements"**, Prentice-Hall India, 2nd Edition, 1997.

REFERENCES:

1. John G. Webster, **"Medical Instrumentation application and design"**, John Wiley, 3rd Edition, 1997.

Carr, Joseph J, Brown, John.M, **"Introduction to Biomedical equipment technology"**, John Wiley and sons, New York, 4th Edition, 1997.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. N.Babu	Professor	BME	babu@vmkvec.edu.in
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3	Mrs. S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
4	Ms. Lakshmi Shree	Assistant Professor	BME	lakshmishree.bme@avit.ac.in

	BIOSENSORS AND TRANSDUCERS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

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 discuss the various types of electrodes.
3	To determine the recording of biological components.
4	To employ the knowledge in electrochemical and optical biosensors.
5	To outline the various biological components using biosensors.

COURSE OUTCOMES

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

CO1. Describe the working principles of transducers.	Understand
CO2. Explain the various types of electrodes.	Understand
CO3. Utilize various FET sensors for recording of biological components.	Apply
CO4. Distinguish various biosensors like electrochemical and optical biosensors.	Analyze
CO5. Analyze the biological components using biosensors in various applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

TRANSDUCERS:

Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

BIO POTENTIAL ELECTRODES:

Half cell potential, Types of Electrodes –Micro electrodes, Depth and needle electrodes, Surface electrodes, Chemical

electrodes, Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.

BIOSENSORS:
Biological elements, Immobilization of biological components, Chemical Biosensor-ISFET, IMFET, electrochemical sensor, chemical fibro sensors.

APPLICATIONS OF BIOSENSORS:
Bananatrode, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

TEXT BOOKS:

1. H.S. Kalsi, **"Electronic Instrumentation & Measurement"**, Tata McGraw HILL, 1995.
2. Brain R Eggins, **"Biosensors: An Introduction",** John Wiley Publication, 1997.
3. Shakthi chatterjee, **"Biomedical Instrumentation"**, Cengage Learning, 2013.
4. John G Webster, **"Medical Instrumentation: Application and design"**, John Wiley Publications, 2001.

REFERENCES:

1. K.Sawhney, **"A course in Electronic Measurements and Instruments"**, Dhapat Rai & sons, 1991.
2. John P Bentley, **"Principles of Measurement Systems"**, 3rd Edition, Pearson Education Asia, (2000 Indian reprint).

Geddes and Baker, **"Principles of Applied Biomedical Instrumentation"**, 3rd Edition, John Wiley Publications, 2008.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.L.K.Hema	Professor & Head	BME	hemalk@avit.ac.in
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3	Mr.V.Prabhakaran	Assistant Professor (Gr-II)	BME	Prabhakaran.bme@avit.
4	Mrs.S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.e

	INTRODUCTION TO BIOFUELS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

This course will provide an overview of existing energy utilization, production and infrastructure. We will also cover the consequences of our energy choices on the environment. The topics covered will include the chemistry of biofuels, the biology of important feed stocks, the biochemical, genetic and molecular approaches being developed to advance the next generation of biofuels and the economical and global impacts of biofuel production.

PREREQUISITE–NIL

COURSEOBJECTIVES

1	To understand the different types and differences between existing energy resources.
2	To understand the improcurement, utilization and their impacts on society and environment
3	To gain knowledge about the existing different biofuels and the methods of production from different sources
4	To introduce the techonologies involved in the production, characterization of biofuels
5	To impact the knowledge and applications of biofuel in various sectors and their beneficial aspects to the society.

COURSEOUTCOMES

Afterthesuccessfulcompletionofthecourse,learnerwillbeableto

CO1.Understandtheexistingandemergingbiomasstoenergytechnologies	Remember
CO2.Understandtheconceptof1st generation,2nd generationandadvancebiofuels	Understand
CO3.Appraisethetechno-economicanalysesofbiofuelconversiontechnologies	Understand
CO4.Toarticulatetheconceptofabiorefinerysystemandbeabletodevelopmajorunit Operations of an integrated biorefinery	Apply
CO5.Illustratetheenvironmentalimplications	Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

OVERVIEWOFBIOFUELS

Generation of biofuels − Development of biological conversion technologies – Integration of biofuels into biorefineries − Energy security and supply − Environmental sustainability of biofuels − Economicsustainabilityofbiofuels.

BIODIESEL

Biodiesel − Microorganisms and raw materials used for microbial Oil production − Treatment of the feed stocks priorto production of the Biodiesel − Current technologies of biodiesel production – Purification of biodiesel; Industrial production of biodiesel – Biodiesel production from single cell.

BIOETHANOL

Bioethanol – Properties – Feedstocks – Process technology – Pilot plant for ethanol production from lignocellulosic feedstock –Environmental aspects of ethanol as a biofuel.

BIOMETHANEANDBIOHYDROGEN

Biomethanol − Principles, materials and feedstocks – Process technologies and techniques – Advantages and limitations − Biological hydrogen production methods − Fermentative hydrogen production – Hydrogen economy−Advantages and limitations.

OTHERBIOFUELS

Biobutanol production − Principles, materials and feedstocks − Process technologies – Biopropanol – Bioglycerol−Productionofbio-oilsviacatalyticpyrolysis−Life-Cycleenvironmentalimpactsofbiofuelsand Co-products.

TEXTBOOKS:

1. Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing Limited20112.Gupta,V,K.andTuohy, M,G.BiofuelTechnologies, Springer,20133.Moheimani, N.R.,Boer,M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015

REFERENCES:

1. Eckert,C,A.andTrinh,C,T.BiotechnologyforBiofuelProductionandOptimization,Elsevier, 20162.Bernardes,M,A, D,S.Biofuelproduction–recentdevelopmentsandprospects,InTech,2011

COURSEDESIGNERS

S.No	Name ofthe Faculty	Designation	Department	MailID
1	Dr.A.Balachandar	AssistantProfessor–Gr-II	Biotechnology	Balachandar.biotech@avit.ac.in
2	Dr.M.Sridevi	Professor&Head	Biotechnology	sridevi@vmkvec.edu.in

	FOOD AND NUTRITION TECHNOLOGY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The course aims to enable the students to understand the physicochemical, nutritional, microbiological and sensory aspects, To familiarize the students about the processing and preservation techniques. To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

PREREQUISITE–NIL

COURSEOBJECTIVES

1	Understand the tradition food processing techniques and the basics concept of food biochemistry
2	Demonstrate the product development technique, quality and contaminant check
3	To articulate their technical knowledge for industrial purpose
4	Describe national food laws and standards
5	Laws and qualities of standard for food products

COURSEOUTCOMES

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

CO1:Recall the processing techniques practiced in olden days and the biological process	Remember
CO2.Illustrate the methods for animal product development, quality control and also screen the contaminant	Understand
CO3.Transfer the techniques in scaling up for industrial needs	Apply
CO4.Interpret and Troubleshoot instruments to maintain accuracy	Apply
CO5.Develop standards for food additives	Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTRODUCTIONTOFOODBIOTECHNOLOGY

Introduction, History and scope of food Biotechnology, development and prospects of biotechnology in animal products, ancient and traditional food processing techniques; Biochemical and metabolic pathways of biological systems used in food production.

METHODS IN FOOD BIOTECHNOLOGY: Role of biotechnology in productivity of livestock, Modern biotechnological methods and processes in animal product development, chemical and physical factors required for growing microbial cultures in nutritive substrate; Meatspecies identification, Quality control, Screening products for contaminants

BIOTECHNOLOGYMETHODSIN FOODPROCESSING:

Use of biotechnology in the production of food additives, use of biotechnological tools for the processing and preservation and foods of animal origin, use of biotechnology improved enzymes in food processing industry, Basic principles of the industrial use of bio-reactions for production of biomass-upstream and downstream processing application of microorganisms as starter cultures in meat industry, microbial production of food ingredients; Biosensors and novel tools and their application in food science.

HURDLETECHNOLOGY:

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology

FOODSAFETY&SECURITY:

Consumer concerns about risks and values, biotechnology & food safety, Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; Future and applications of foodbiotechnology in India.

TEXTBOOKS:

1. Potter,Norman.M.FoodScience,5thEd.SpringerUS

2. Manay,S.; Shadakshara Swamy, M., (2004). Foods: Facts and Principles,4thEd. New Age Publishers.

3. B.Srilakshmi., (2002)Food Science, New Age Publishers..

REFERENCES:

1. Meyer,(2004).FoodChemistry.NewAge

2. Deman J M.(1990) Principles of FoodChemistry.2nd Ed. Van Nostrand Reinhold, NY

3. RamaswamyHandMarcottM.FoodProcessingPrinciplesandApplications.CRCPress

COURSE DESIGNERS

S.No.	Nameofthe Faculty	Designation	Department	MailID
1	Dr.A.Nirmala	AssistantProfessorGII	Biotechnology	nirmalabt@avit.ac,in
2	Mrs.C.Nirmala	Associateprofessor	Biotechnology	nirmala@vmkvec.edu.in

OVERVIEWOFBIOFUELS

Generationofbiofuels−Development ofbiologicalconversiontechnologies−Integrationofbiofuelsintobiorefineries − Energy security and supply − Environmental sustainability of biofuels − Economicsustainabilityofbiofuels.

BIODIESEL

Biodiesel − Microorganisms and raw materials used for microbial Oil production − Treatment of thefeedstockspriorto productionoftheBiodiesel−Currenttechnologiesofbiodieselproduction−Purificationofbiodiesel;Industrialproductionofbiodiesel−Biodieselproductionfromsinglecell.

BIOETHANOL

Bioethanol–Properties– Feedstocks−Processtechnology−Pilotplantforethanolproductionfromlignocellulosicfeedstock−Environmentalaspectsofethanolasabiofuel.

BIOMETHANEANDBIOHYDROGEN

Biomethanol−Principles, materialsandfeedstocks−Processtechnologiesandtechniques−Advantagesandlimitations − Biological hydrogen production methods − Fermentative hydrogen production − Hydrogeneconomy−Advantagesandlimitations.

OTHERBIOFUELS

Biobutanol production − Principles, materials and feedstocks − Process technologies – Biopropanol – Bioglycerol−Productionofbio-oilsviacatalyticpyrolysis−Life-CycleenvironmentalimpactsofbiofuelsandCo-products.

TEXTBOOKS:

1. Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing Limited20112.Gupta,V,K.andTuohy, M,G.BiofuelTechnologies, Springer,20133.Moheimani, N.R.,Boer,M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015**REFERENCES:**

1. Eckert,C,A.andTrinh,C,T.BiotechnologyforBiofuelProductionandOptimization,Elsevier, 20162.Bernardes,M,A, D,S.Biofuelproduction–recentdevelopmentsandprospects,InTech,2011

COURSEDESIGNERS

S.No	Name ofthe Faculty	Designation	Department	MailID
1	Dr.A.Balachandar	AssistantProfessor–Gr-II	Biotechnology	Balachandar.biotech@avit.ac.in
2	Dr.M.Sridevi	Professor&Head	Biotechnology	sridevi@vmkvec.edu.in

	Disaster Mitigation and Management	Category	L	T	P	Credit
		OE-EA	3	0	0	3

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 Outcomes

1	To Understand basic concepts in Disaster Management
2	To Understand Definitions and Term in ologies used in Disaster Management
3	To Understand the Challenges posed by Disasters
4	To Understand Impacts of Disasters

COURSEOUTCOMES

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.	Understand
CO2.Identify the potential deficiencies of existing buildings for Earthquake disaster and Suggest suitable remedial measures.	Understand
CO3.Derive the guidelines for the precautionary measures and rehabilitation measures for Earthquake disaster.	Apply
CO4. Derive the protection measures against floods, cyclone, landslides	Apply
CO5.Understand the effects of disasters on built structures in India	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

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); Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etcDos and Don'ts during various types of Disasters.

RISK ASSESSMENT AND VULNERABILITY ANALYSIS: Response time, frequency and for warning 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, Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster

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, , Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake- holders

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 2.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10:1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. AbarquezI. & Murshed Z. Community Based Disaster Risk Management: Field Practitioner's Handbook, ADPC, Bangkok,2004.
2. Goudie,A. Geomorphological Techniques, Unwin Hyman, London 1990.
3. Goswami,S.C. Remote Sensing Application in North East India, PurbanchalPrakesh,Guwahati,1997.
4. Manualon Natural Disaster Management in India, NCDM, New Delhi, 2001.
5. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. National Policy on Disaster Management, NDMA, New Delhi, 2009.
7. Disaster Management Act.(2005), Ministry of Home Affairs, Government of India,NewDelhi,2005.

Course Designers

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1	Ms.S.Ispara Xavier	Assistant Professor	Civil/AVIT	isparaxavier.civil@avit.ac.in

	MUNICIPAL SOLID WASTE MANAGEMENT	Category	L	T	P	Credit
		OE-EA	3	0	0	3

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	Understand
Co2 . To Study the on site Storage & Processing	Apply
Co3. To study about the collection & transfer the waste	Apply
Co4. To Study the process of off site processing	Apply
CO5. To know about the solid waste disposal	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	COs	PO1
CO1	S	M	L	-	-	L	S	-	-	-	-	-	-	-	L
CO2	S	M	L	S	-	-	M	-	-	-	-	-	-	M	S
CO3	S	M	M	S	-	-	M	-	-	-	-	-	-	M	S
CO4	S	M	M	M	-	-	M	-	-	-	-	-	-	M	S
CO5	S	M	M	-	-	M	M	-	-	-	-	L	-	-	S

S- Strong; M-Medium; L-Low

SYLLABUS

SOURCES AND TYPES OF MUNICIPAL SOLID WASTES

Sources and types of solid wastes-major legislation-monitoring responsibilities-Effects of disposal of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization– Requirement of Solid Waste Management - public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs - Legislation.

ON-SITE STORAGE & PROCESSING

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options – Case Studies Under Indian Condition

COLLECTION AND TRANSFER

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, Anaerobic digestion, RDF and Incineration and co-generation of energy using waste, Pyrolysis of solid Waste 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- cradle to grave management concept, Prevailing laws of hazardous waste management- Thermal processing options - Risk assessment.

DISPOSAL

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

TEXT BOOKS

George Tchobanoglous et.al., “Integrated Solid Waste Management”, McGraw-HillPublishers, 2002. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, “Waste Management”,Springer, 1994. Charles A. Wentz; "Hazardous Waste Management", McGraw-Hill Publication, Latest publication, (1992).

REFERENCE BOOKS

1. R.E.Landreth and P.A.Rebers, “Municipal Solid Wastes – problems and Solutions”, Lewis Publishers, 1997. Bhide A.D. and Sundaresan, B.B., “Solid Waste Management in Developing Countries”, INSDOC, 1993.
2. Handbook of Solid Waste Management by Frank Kreith, George Tchobanoglous, McGraw Hill Publication, (2002). Bagchi, A., Design, Construction, and Monitoring of Landfills, (2nd Ed). Wiley Interscience, ISBN: 0-471-30681-9. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development,
3. Government of India, New Delhi, (2000).
4. NPTEL – Municipal Soild Waste Management by Prof. Ajay Kalamdhad – IIT Guwahati.

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mrs.P.Subathra	Assistant Professor	Civil / AVIT	subathra@avit.ac.in
2	Mr.Harish	Assistant Professor	CIVIL/ VMKVEC	harshk317@gmail.com

	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

This syllabus is intended for the Engineering students and enable them to lean about Artificial Intelligence. This syllabus contains intelligent agent, Knowledge Representation and Game playing. Thus, this syllabus focuses on to know about AI and its concepts.

PREREQUISITE :NIL

COURSE OBJECTIVES

1.	To introduce the basic principles, techniques, and applications of Artificial Intelligence.
2.	To have knowledge of generic problem-solving methods in Artificial Intelligence.
3.	To design software agents to solve a problem.
4.	Apply the knowledge of algorithms to solve arithmetic problems.
5.	Assemble an efficient code for engineering problems.

COURSE OUTCOMES

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

CO1:. Identify the different agent and its types to solve the problems	Understand
CO2: know about the problem solving technique in Artificial Intelligence.	Apply
CO3: Construct the normal form and represent the knowledge.	Apply
CO4: to know about extension of condition probability and how to apply in the real time environment.	Apply
CO5: To lean about Information Retrieval and Speech Recognition	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	M	M	M	M	M	-	-	-	-	-	-	M	S	M	-
CO 2	M	M	L	M	L	-	-	-	-	-	M	M	S	M	M
CO 3	M		S	M	M	-	-	-	-	-	-	M	S	-	M
CO 4	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO 5	S	M	M	M	M	-	-	-	-	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

INTRODUCTION
What is AI? – AI Problems – What is an AI technique – Defining the problem as a state space search – Production system - Production system – Characteristics – Problem Characteristics?
HEURISTIC SEARCH TECHNIQUES
Generate and test – Hill Climbing – Best first Search – Problem Reduction – Constraints satisfaction – Means end analysis.
KNOWLEDGE REPRESENTATION
Propositional Logic-First Order Predicate Logic-Prolog Programming-Unification-Forward Chaining- Backward Chaining-Ontological Engineering-Categories and Objects-Events-Mental Events and Mental Objects.
REPRESENTING KNOWLEDGE USING RULES
Procedural versus – Declarative Knowledge – logic Programming – Forward versus Backward Reasoning – Matching
GAME PLAYING
The Minimax search procedure – Adding Alpha Beta cut offs – Addition Refinements – Waiting for Quiescence – Secondary Searches – Using Book moves.
TEXT BOOKS
1. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2015 Bratko, I., Prolog Programming For Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th Edition, 2011..
REFERENCES
1.David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: A Logical Approach", Oxford University Press, 2004. 2. G. Luger, "Artificial Intelligence: Structures and Strategies For Complex Problem Solving", Fourth Edition, Pearson Education, 2002. 3. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publishers, 1998.

COURSE DESIGNERS				
S. No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Dr.M.Nitya	Professor	CSE	nithya@vmkvec.edu.in
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	INTRODUCTION TO INTERNET OF THINGS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

Introduction to IoT for statistical data manipulation and analysis. It was inspired by and is most compatible with the statistical language.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To learn Introduction to IoT
2	To Study methodology of IoT
3	To Develop IoT applications using Arduino and Intel Edition

COURSE OUTCOMES

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

CO1: To Understand the basics in Introduction to IoT in terms of constructs, control statements, string functions	Understand
CO2: To Understand the use of Introduction to IoT fundamentals.	Understand & Apply
CO3: Learn to apply Introduction to IoT for Communicating Sequential Process	Understand & Apply
CO4: Able to appreciate and apply the Introduction to IoT from a statistical perspective	Understand & Apply
CO5 To learn Introduction to IoT Challenges	Understand & Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I –INTRODUCTION to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

.

UNIT II- IoT & M2M

Machine to Machine, Difference between IoT and M2M, Software define Network

UNIT III – Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT IV – Domain specific applications of IoT

Design challenges, Development challenges, Security challenges, Other challenges

UNIT V – Reflection, Low-Level Programming

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

TEXT BOOKS

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

REFERENCES

1. Macro Schewartz, “Internet of Things with the Arduino Yun” Packet Publishing, 2014.

COURSE DESIGNERS

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	DESIGN OF ELECTRONIC EQUIPMENT	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The objective of this course is to sensitise a registrant to various aspects of an electronics product. Specifically on non-Electrical aspects like mechanical design and detailing. Starting from a need translated into specifications, leading to design and prototyping and ending up in a manufacturable physical prototype.

PREREQUISITE – BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES

1	*To understand the various Concept of Industrial Design process.*
2	*To apply the basic Concept of electronic Product designs methodology.*
3	*To classify the Concept of Ergonomics & aesthetics in product design.*
4	*To understand the Knowledge regarding the design of product packaging and working environment.*
5	*To understand the Knowledge of different industrial standard and value analysis.*

COURSE OUTCOMES

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

CO1. Visualize the concept for product design with respect to ergonomics and aesthetics.	*Remember*
CO2. Analyze, design and implement control panels of electronic equipment	*Apply*
CO3. Apply creativity in the design of system by formulating architecture with proper placement of components.	*Apply*
CO4. Apply the concept of visual communication techniques in product design.	*Apply*
CO5. Apply the process of value analysis in existing product.	*Apply*

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

MODULE 1: INTRODUCTION

Introduction to industrial design, Role of industrial design in the domain of industry, Generic product development process, ID process, Product innovations, tools and methods.

MODULE 2: PRODUCT PROTOTYPES

Management of ID process, Product architecture, Structure: standard and non-standard structures. Product prototypes.

MODULE 3: PRODUCT DESIGN AND PLANNING

Electronic product design and development Methodology, Creativity techniques, brainstorming documentation.

Product planning: Defining the task, scheduling the task and its execution. Costing and Pricing of Industrial design,

MODULE 4: ERGONOMICS

Ergonomics: Ergonomics of electronic equipment, Ergonomics of control panel design. Use of ergonomics at work places and plant layout. Aesthetics: Elements of aesthetics, aesthetics of control panel design.

MODULE 5: CASE STUDIES

Value engineering, Product quality and design management. Industrial standards, Graphics and packaging

TEXTBOOKS:

1. Carl T. Ulrich, Steven. D. Eppinger," "Product Design and Development", McGraw Hill Companies.

REFERENCE BOOKS:

1. Ernest J Mccormick ,"Human factors in Engineering and Design" -, McGraw-Hill Co.

2. Yammiyavar P," Control Panel Design and Ergonomics", CEDT/IISc Publication.

3. Murrell K, Chapman," Ergonomics: Man in his Working Environment", &Hall. London. Flurschiem C H, "Industrial Design and Engineering Design ", Council, London and Springer Verlag, 1983

COURSE DESIGNERS

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1	*Mr.Rajat Kumar Dwibedi*	*Assistant Professor*	*ECE*	*rajatkumar.ece@avit.ac.in*
2	*Dr. L.K.Hema*	*Prof. & Head/ ECE*	*ECE*	*hodece@avit.ac.in*
3	*Mr.G.Murali*	*Assistant Professor*	*ECE*	*muralig@vmkvec.edu.in*

	INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

Industry 4.0 and Industrial Internet of Things is the pioneer of today's modern technology. To match the engineering skills with the industry skills this subject will induce and impart the knowledge among the young professionals.

PREREQUISITE

Basic knowledge of computer and internet

COURSE OBJECTIVES

1	*Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing.*
2	*Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation.*
3	*Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems.*
4	*IIoT links the automation system with enterprise, planning and product lifecycle.*
5	*Real case studies*

COURSE OUTCOMES

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

CO1. Apply & Analyzing the transformation of industrial process by various techniques.	*Analyze*
CO2. Evaluate the transformation technologies are considered to be the different drivers.	*Apply*
CO3. Existing industrial systems will adopt the applications of IIoT.	*Apply*
CO4. Intensive contributions over automation system with enterprise, planning and product life cycle	*Analyze*
CO5. Analyze of various Real time case studies.	*Analyze*

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO1	S	S	M	-	M	-	-	-	-	-	-	M	S	M	-
CO2	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO3	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	S	S	S	M	-	-	-	-	-	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO INDUSTRY 4.0 ANDINDUSTRIAL INTERNET OF THINGS*Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems, Cyber Physical Systems and Next Generation Sensors, Collaborative Platformand Product Lifecycle Management*

INDUSTRIAL INTERNET OF THINGS& IT'S LAYERS

Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation. IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II, Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II.

IIoT COMMUNICATION

Communication-Part I, Industrial IoT- Layers: IIoT Communication, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT

IIoT BIG DATA & SDN APPLICATIONS

Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, and Industrial IoT-Application Domains. Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

APPLICATIONS & REAL TIME CASE STUDIES

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies - Virtual reality lab, Manufacturing industries – part one, Manufacturing industries – part two, Milk processing and packaging industries, Steel technology lab, Student projects – part one, Student projects – part two

TEXT BOOKS:

1. *Anandarup Misra, Sudip | Roy, Chandana | Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0, CRC press, 2003.*

REFERENCE BOOKS:

1. *Gilchrist, Alasdair, "Introduction to IoT", Apress, 2016*
2. *Gilchrist, Alasdair "IIoT Reference Architecture", Apress, 2016*

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	*Dr. L.K.Hema*	*Professor &Head*	*ECE*	*hodece@avit.ac.in*
2	*Dr.T.Muthumanickam*	*Professor& Head*	*ECE*	*hodece@vmkvec.edu.in*

	GREEN POWER GENERATION SYSTEMS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The course presents the various sources of renewable energy including wind, solar, and biomass as potential sources of energy and investigates the contribution they can make to the energy profile of the nation. The technology used to harness these resources will be presented. Discussions of economic, environment, politics and social policy are integral components of the course.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	Understand the nexus between energy, environment, and sustainable development
2	Appreciate energy ecosystems and its impact on environment
3	Learn basics of various types of renewable and clean energy technologies
4	Serve as bridge to advanced courses in renewable energy

COURSE OUTCOMES

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

CO1: Explain renewable energy sources & systems.	Understand
CO2: Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen, and sterling engine.	Apply
CO3: Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry and wind energy systems.	Analyze
CO4: Demonstrate self -learning capability to design & establish renewable energy systems.	Analyze
CO5: Conduct experiments to assess the performance of solar PV, solar thermal and biodiesel systems	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

ENERGY

Introduction to the nexus between energy, environment and sustainable development, Energy sources overview and classification, sun as the source of energy, fossil fuel reserves and resources - overview of global/ India's energy scenario. Energy consumption models – Specific Energy Consumption

ECOLOGY AND ENVIRONMENT

Concept and theories of ecosystems, - energy flow in major man-made ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and environment - environmental laws on pollution control, The environmental protection act: Effluent standards and ambient air quality, innovation and sustainability, eco-restoration: Phyto-remediation.

RENEWABLE SOURCES OF ENERGY

Solar Energy: Solar radiation: measurements and prediction. Indian's solar energy potential and challenges, solar energy conversion principles and technologies: Photosynthesis, Photovoltaic conversion, and Photo thermal energy conversion. Wind Energy: Atmospheric circulations, atmospheric boundary layers, classification, factors influencing wind, wind shear, turbulence, wind energy basics and power Content, wind speed monitoring, Betz limit, wind energy conversion system: classification, characteristics, and applications. Ocean Energy: Ocean energy resources-ocean energy conversion principles and technologies: ocean thermal, ocean wave & ocean tide

BIOENERGY

Biomass as energy resources; bio-energy potential and challenges, Classification, and estimation of biomass; Source and characteristics of biofuels: Biodiesel, Bioethanol, Biogas. Types of biomass energy conversion systems - waste to energy conversion technologies

OTHER ENERGY SOURCES AND SYSTEMS

Hydropower, Nuclear fission, and fusion-Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; hydrogen energy, Magneto-hydro-dynamic (MHD) energy conversion – Radioisotope Thermoelectric Generator (RTG), Bio-solar cells, battery & super capacitor, energy transmission and conversions.

TEXTBOOKS:

1. Energy and the Environment, Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., 2nd Edition, John Wiley, 2006,
2. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, 2000.
3. Figueiredo, 'Green Power: Perspectives On Sustainable Electricity Generation', Taylor & Francis Exclusive(Cbs), 2014

REFERENCE BOOKS:

1. Ocean Energy: Tide and Tidal Power by R. H. Charlier and Charles W. Finkl, Springer 2010
2. Introduction to Electrodynamics (3rd Edition), David J. Griffiths, Prentice Hall, 2009
3.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Devarajan	Professor	EEE	devarajan@vmkvec.edu.in
2	Mr. R. Sathish	Assistant Professor	EEE	sathish@vmkvec.edu.in
3	Mr. V.Rattankumar	Assistant Professor	EEE	rattankumar@avit.ac.in

	INDUSTRIAL DRIVES AND AUTOMATION	Category	L	T	P	C
		OE-EA	3	0	0	3

Preamble
To introduce foundation on the principles of drives & automation and their elements with the implementation.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To explore the various AC,DC & Special Machine Drives for industrial Application
2	To study about the various Open loop and closed loop control schemes for drives
3	To know about hardware implementation of the controllers using PLC
4	To study the concepts of Distributed Control System
5	To understand the implementation of SCADA and DCS

COURSE OUTCOMES

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

CO 1	To understand working principles of various types of motors, differences, characteristics and selection criteria.	Understand
CO 2	To apply the knowledge in selection of motors, heating effects and braking concepts in various industrial applications	Apply
CO 3	To explain control methods of special drives	Understand
CO 4	To carry out programming using PLC and use of various PLCs to Automation problems in industries.	Understand
CO 5	To discuss supervisory control and data acquisition method and use the same in complex automation areas	Understand

Mapping with Programme outcomes and Programme Specific Outcomes

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

SYLLABUS

INTRODUCTION

Working principle of synchronous, Asynchronous & stepper motors, Difference between Induction and servo motors, Torque v/s speed characteristics, Power v/s. Speed characteristics, Vector duty induction motors, Concepts of linear and frameless motors, Selection of feedback system, Duty cycle, , V/F control, Flux Vector control.

INDUSTRIAL DRIVES

Electric drive – Definition – Parts – Types -Individual – Group – Multi motor. Stepper motor – Definition – Step angle – Slewing rate -Types -Variable reluctance -Hybrid – Closed loop control of stepper motor – Drive system(any one) – logic sequencer – Optical encoder. Servo motor – Definition – Types -DC servo motor – Permanent magnet DC motors – Brushless motor – AC servo motor -Working of an AC servo motor in control system – Induction motors – Eddy current drive for speed control of induction motors.

PROGRAMMABLE LOGIC CONTROLLER

Definition Conventional Hard wired logicRelays- Features of PLC- Advantages of PLC over relay logic – Block diagram of PLC -Programming basics of PLC – Ladder logic -Symbols used in ladder logic – Logic functions – Timers – Counters – PLC networking – Steps involved in the development of Ladder logic program – Program execution and run operation by PLC – Ladder logic diagram for liquid level operation. List of various PLCs and their manufactures.

DISTRIBUTED CONTROL SYSTEM

Evolution of distributed control system -Definition of DCS – Functional elements of DCS – Elements of local control unit -Interfaces-Types of information displays – Architecture of anyone commercial DCS – Advantages of DCS -Selection of DCS – List of various DCS and their manufactures.

SUPERVISORY CONTROL & DATA ACQUISITIONS

Introduction to Supervisory control & data Acquisitions, distributed Control System (DCS): computer networks and communication in DCS. different BUS configurations used for industrial automation – GPIB, HART and OLE protocol, Industrial field bus – FIP (Factory Instrumentation Protocol), PROFIBUS (Process field bus), Bit bus. Interfacing of SCADA with controllers, Basic programming of SCADA, SCADA in PC based Controller / HMI.

TEXTBOOK

1. G.K.Dubey, Fundamentals of Electrical Drives', Narosa Publication, 2002.
2. FrankD. petruzella programmable logic controls third edition TATA mc graw-hill edition 2010.
3. M.S.Berde, Electric Motor Drives Khanna publishers.2008.
4. Fundamentals Of Industrial Drives by B. N. Sarkar , PHI Learning, 2011

REFERENCES

1. Pradheep kumar srivastava, Programmable logic controllers with applications', BPB publications.2004.
2. John W.Webb, Ronald A.Reis, Programmable logic controllers-Principles and Applications', Fifth Edition, Prentice Hall of India.
3. Michel P.Lukas, Distributed Control system', van Nostrand Reinhold Co, 1986
4. R.Srinivasan Special electrical Machines lakshmi publication.2012
5. Process Control Instrumentation Technology, Johnson Curties, Prentice hall of India, 8th edition
6. Andrew Parr, Industrial drives, Butterworth – Heineaman

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.L.Chitra	Professor	EEE/AVIT	chitra@avit.ac.in
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	3D PRINTING AND ITS APPLICATIONS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

Preamble

The course is designed to impart knowledge and skills related to 3D printing technologies its type applications.

Prerequisite – NIL

Course Objective

1	To Know the importance of 3D printing in Manufacturing
2	To know about Vat Photo Polymerization & Material Jetting.
3	To know about binder jetting material extrusion & sheet lamination
4	To know about the methods for powder bed fusion & direct energy deposition.
5	To know about the applications of 3D Printing.

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

CO1.	Importance of 3D printing in Manufacturing	Remember
CO2.	Vat Photo Polymerization & Material Jetting.	Understand
CO3.	Binder jetting material extrusion & sheet lamination	Understand
CO4.	Powder bed fusion & direct energy deposition.	Understand
CO5.	Applications of 3D Printing.	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PSO3
CO1	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	M	-	S	M	M	-	-	-	-	-	M	M-	M
CO3	M	L	M	-	S	M	M	-	-	-	-	-	M	M-	M
CO4	M	L	M	-	S	M	M	-	-	-	-	-	M	M-	M
CO5	M	L	L	-	-	-	-	-	-	-	-	-			

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Need - Development of AM systems – AM process chain -Classification of AM processes- Applications- Advantages of AM and Types of materials for AM.Introduction to STL format, Pre & Post-processing of STL files, Various slicing methods, Part orientation and support generation, Support structure design, Tool path generation

VAT PHOTO POLYMERIZATION & MATERIAL JETTING

Vat Photo polymerization - Stereo lithography process, working principle, advantages and disadvantages, Material Jetting - process, working principle, advantages and disadvantages.

BINDER JETTING-MATERIAL EXTRUSION & SHEET LAMINATION

Binder Jetting- process, working principle, advantages and disadvantages. Material Extrusion –Fused Deposition Modeling process, working principle, advantages and disadvantages. Sheet Lamination – Laminated Object Manufacturing process, working principle, advantages and disadvantages.

POWDER BED FUSION & DIRECT ENERGY DEPOSITION

Powder Bed Fusion – Selective Laser Sintering process, working principle, advantages and disadvantages, Direct Energy Deposition- process, working principle, advantages and disadvantages.

APPLICATIONS OF 3D PRINTING

Applications for 3D Printing - Use of 3D Printing-Limitations of 3D Printing and Further Development of Medical 3D Printing Applications. Use of Multiple Materials in 3D Printing-Embedded Component 3D Printing, Commercial Applications Using Multiple Materials, Future Directions, Business Opportunities and Future Directions.

Text Books

1	Ian Gibson, David Rosen, and Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, New York, NY, 2015.
2	Venuvinod, Patri K., and Weiyin Ma. Rapid prototyping: laser-based and other technologies. Springer Science & Business Media, 2013.

Reference Books

1	Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2	Ali K. Kamrani, Emand Abouel Nasr,"Rapid Prototyping: Theory & Practice", Springer, 2006.
3	Kumar, L. Jyothish, Pulak M. Pandey, and David Ian Wimpenny, eds. 3D printing and additive manufacturing technologies. Singapore: Springer, 2019.

Course Designers

Sl.No	**Faculty Name**	**Designation**	**Department/ Na me of the college**	**Email id**
1	S.Kalyanakumar	Assistant Professor Gr II	Mech / AVIT	kalyanakumar@avit.ac.in

	INDUSTRIAL ROBOTICS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

Preamble

The objective of this course is to impart knowledge about industrial robots for their control and design.

Prerequisite :
NIL

Course Objective

1	To introduce basic concepts, parts of robots and types of robots
2	To learn about Robot kinematics and dynamics
3	To learn different types of sensors used in robots and its control
4	To understand the different types of actuation systems used in robots
5	To understand the robot control Systems, programming of robots and its Applications.

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

CO1.	Understand the basic configurations and kinematic systems of robots	Understand
CO2.	Solve problems of robot kinematics and dynamics	Apply
CO3.	Understand the different types of sensors used in robot systems and their applications, different types of control systems used in robots	Understand
CO4.	Understand and applications of the different types of actuators used in robot systems	Understand
CO5.	Understand the Robot Applications in various fields	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO ROBOTICS

Introduction to Automation and Robotics– Basic concepts, Need, Law, History, Anatomy, specifications classification, present and future applications. Components of the Industrial Robotics: common types of arms. Components, Architecture, degrees of freedom, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

ROBOT ARM KINEMATICS

Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control

GRIPPERS AND SENSORS FOR ROBOTICS

Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics, Selections of sensors. Necessity for sensors and vision system in the working and control of a robot.

ROBOT ACTUATION SYSTEMS

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors – End Effectors and Tools

ROBOT APPLICATIONS

Robot Application in Manufacturing: Material Transfer – Material handling, loading and unloading- Processing – spot and continuous arc welding & spray painting – Assembly and Inspection. Applications in Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Micro and Nano robots, Future Applications.

Text Books

1	Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2	Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.
3	Mittal R.K. and Nagrath I.J., “Robotics and Control”, Tata McGraw Hill.

Reference Books

1	Ghosal, A., “Robotics”, Oxford, New Delhi, 2006.
2	Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi.
3	Steve Heath, “Embedded System Design”, 2nd Edition, Newnes, Burlington, 2003
4	Merzouki R., Samantaray A.K., Phathak P.M. and Bouamama B. Ould, “Intelligent Mechatronic System: Modeling, Control and Diagnosis”, Springer.

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	P.KUMARAN	AP-II	MECH/AVIT	kumaranp@avit.ac.in

	CYBER SECURITY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

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 and issues
2.	To study various cyber crimes and legal remedies
3.	To apply various privacy and security
4.	To study E-Commerce and digital payments
5.	To study the basic security aspects related to Computer and Mobiles

COURSE OUTCOMES

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

CO1: able to understand the concept of Cyber security and issues and challenges associated with it.	Understand
CO2: able to understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures	Apply
CO3: able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.	Apply
CO4: able to understand the basic concepts related to E-Commerce and digital payments.	Apply
CO5: able to understand the basic security aspects related to Computer and Mobiles.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION TO CYBER SECURITY	**9 hours**
Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	
CYBER CRIME AND CYBER LAW	**9 hours**
Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.	
SOCIAL MEDIA OVERVIEW AND SECURITY	**9 hours**
Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.	
E - C O M M E R C E AND DIGITAL PAYMENTS	**9 hours**
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007.	
DIGITAL DEVICES S E C U R I T Y , TOOLS AND TECHNOLOGIES FOR CYBER SECURITY	**9 hours**
End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	
REFERENCES	
1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010. 2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011) 3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001) 4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd. 5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.	

6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd. 7. Fundamentals of Network Security by E. Maiwald, McGraw Hill

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.R.Jaichandran	Assistant professor G-II	CSE	rjaichandran@avit.ac.in
2.	Mr. B. Sundharamurthy	Associate Professor	CSE	sundharamurthy@vmkvec.edu.in

D. COURSES FOR PRESENTATION OF TECHNICAL SKILLS

	MINI PROJECT	Category	L	T	P	Credit
		PI-M	0	0	6	3

PREAMBLE To obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To conceptualize a novel idea / technique into a product
2	Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component
3	To understand the management techniques of implementing a project
4	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work

COURSE OUTCOMES

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

CO1. Apply the knowledge and skills acquired in their courses to a specific problem or issue.	Apply
CO2. Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component	Apply
CO3. Take the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work	Analyze
CO4. Explain design thinking practices and their applications	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	L	-	-	-	M	M	-	M	M	M	M
CO2	S	L	L	M	M	-	-	-	M	M	-	M	M	M	-
CO3	M	M	M	M	L	-	-	-	M	L	-	M	M	M	M
CO4	S	S	M	M	-	-	-	L	-	L	S	M	S	M	-

S- Strong; M-Medium; L-Low

Norms

- Each student must register to the project course related to his or her program
- Mini Project course consists of one semester and would be allowed to register only during the final year of study.
- Minor design project identification, the objective and methodology and expected outcome of the proposed work.
- Presentation of the proposed work design, implementation and partial result
- Presentation of complete project work with results and discussion Demonstration of project work
- Minor Project Report

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Dept	Mail ID
1	Dr.S.Anusuya	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in
2	Dr.P.David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	PROJECT WORK	Category	L	T	P	Credit
		PI-P	0	0	16	8

PREAMBLE

The project provides learners with the opportunity to explore a problem or issue of particular personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member. The project demonstrates the learner's ability to synthesize and apply the knowledge and skills acquired in his/her academic program to real-world issues and problems. This final project affirms learners' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To provide learners with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem or issue.
2	To allow learners to extend their academic experience into areas of personal interest, working with new ideas, issues, organizations, and individuals.
3	To encourage learners to think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve these issues.
4	To provide learners with the opportunity to refine research skills and demonstrate their proficiency in written & oral communication skills.
5	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.

COURSE OUTCOMES

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

CO1. Apply the knowledge and skills acquired in their courses to a specific problem or issue.	Apply
CO2. Extend their academic experience into areas of personal interest, working with new ideas, issues, organizations, and individuals.	Analyze
CO3. Think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve these issues.	Create
CO4. Refine research skills and demonstrate their proficiency in written & oral	Evaluate

communication skills.	

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CO1	S	L	L	M	M	-	-	-	M	M	-	M	M	M	-
CO2	M	M	M	M	L	-	-	-	M	L	-	M	M	M	M
CO3	S	S	M	M	-	-	-	L	-	L	S	M	S	S	-
CO4	S	M	M	M	-	-	-	L	-	L	M	M	S	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. The project is a major component of our engineering curriculum: it is the culmination of the program of study enabling the learners to showcase the knowledge and the skills they have acquired during the previous four years, design a product/service of significance, and solve an open-ended problem in engineering.
2. Each student must register to the project course related to his or her program
3. Project course consists of one semester and would be allowed to register only during the final year of study.
4. Project may be initiated during the pre-final semester but will be assessed and credits transferred only during the last semester of study, upon completion of all other degree requirements. Generally the undergraduate project is a team based one.
5. Each team in the major course will consist of maximum of 5 learners.
6. Each project will be assigned a faculty, who will act as the supervisor.
7. The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability.
8. Each group must document and implement a management structure. Group leadership roles must be clearly identified including who has responsibility for monitoring project deliverables and group coordination.
9. A group project may be interdisciplinary, with learners enrolled in different engineering degrees, or in Engineering plus other faculties such as Management, Medical and Health Sciences, Science and Humanities.
10. Each student team is expected to maintain a log book that would normally be used to serve as a record of the way in which the project progressed during the course of the session.
11. Salient points discussed at meetings with the supervisor (i.e., suggestions for further meetings, changes to experimental procedures) should be recorded by the student in order to provide a basis for subsequent work.
12. The logbook may be formally assessed;

13. The contribution of each individual team member will be clearly identified and the weightage of this component will be explicitly considered while assessing the work done.
14. A project report is to be submitted on the topic which will be evaluated during the final review.
15. Assessment components will be as spelt out in the regulations.
16. The department will announce a marking scheme for awarding marks for the different sections of the report.
17. The project report must possess substantial technical depth and require the learners to exercise analytical, evaluation and design skills at the appropriate level.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.Anusuya	Associate Professor	Pharmaceutical Engineering	dr.s.anusuya@vmkvec.edu.in
2	Dr.P.David Annaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

E. MANDATORY COURSES

INDUCTION TRAINING, INDIAN CONSTITUTION, ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE, EMPLOYABILITY ENHANCEMENT, NSS, RRC, YRC, SPORTS AND GAMES, STUDENT CLUBS, UNNAT BHARAT ABHIYAN, SWACHH BHARAT ETC.

Course Code	Course Title	Category	L	T	P	C
	YOGA AND MEDITATION	**AC**	**0**	**0**	**2**	**0**

OBJECTIVES:

Yoga is derived from a Sanskrit word 'yuj' which loosely means 'union.' It is a path through which an individual unites with the entire existence. Sounds heavy, right? It basically means how you are not a separate entity but part of a greater energy. It increases your consciousness and makes you realize your true self-clearing the clutter of all that you imbibed as part of your culture, family, and education. It makes you realize that there is something more than what you see around. It is a deeply spiritual practice that is part philosophy, religion, science, and exercise.

COURSE CONTENT

- Surya namaskar,Padmasana, Uttakatasana
- Surya pranayama, BrahmariPranayama
- Anjalimudra, Mahamudra, Chin Mudra
- Kapalabathikriya,Bhastrika, Tratakkriya
- Simple Meditation,YogaBreath awareness meditation,.

OUTCOMES :

- It incorporates breathing exercises, meditation and poses designed to encourage relaxation and reduce stress.
- Practicing yoga is said to come with many benefits for both mental and physical health.
- Yoga is known for its ability to ease stress and promote relaxation.
- Many people begin practicing yoga as a way to cope with feelings of anxiety.
- Could Improve Heart Health
- Improves Quality of Life.
- Could Promote Sleep Quality.
- Improves Flexibility and Balance.
- Could Help Improve Breathing.
- Promotes Healthy Eating Habits.
- Can Increase Strength.

TEXT BOOK:

YogacharyaSundaram, *Sundra Yoga Therapy*, Asana Publications, 2009

REFERENCES:

1. Dr.V.Krishnamoorthy, *Simple Yoga for Health*, Sri MathiNilayam, 2012.
2. Dr.AnandaBalayogiBhavanani, *A Primer of Yoga Theory*, Dhivyananda Creations,2008.

3. Dr.S.Hema, Easy *Yoga for Beginners*, Tara yoga Publications,2008.
4. Dr.AsanaAndiappan, *Ashtanga Yoga*, Asana Publications, 2009.
5. Dr.JohnB.Nayagam, *MudumaikkuMutrupulliVaikkumMuthiraigal*, SaaruPrabha Publications, 2010.

	Gender Equity and Law	Category	L	T	P	Credit
		AC	0	0	2 x	0

Gender Equity is the provision of fairness and justice in the distribution of benefits and responsibilities between ,Men, Women, Transgender, and Gender non-binary individuals. Gender equity is important because, historically, societies around the world have deemed females, transgender people, and nonbinary people as “weaker” or less important than males.Gender equity emphasizes respecting individuals without discrimination, regardless of their gender. There are legal provisions thataddress issues like inequalities that limit a person’s ability to access opportunities to achieve better health, education, and economic opportunity based on their gender.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To sensitize the students regarding the issues of gender and thegender inequalities prevalent in society.
2	To raise and develop social consciousness about gender equity among thestudents.
3	To build a dialogueand bring a fresh perspective on transgender and gender non-conforming individuals.
4	To create awareness among the students and to help them face gender stereotype issues.
5	To help the studentsunderstand the various legal provisions that are available in our society.

COURSE OUTCOMES

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

CO1.Understand the importance of gender equity	Understand
CO2.Initiate the awareness and recognize the social responsibility with regards to gender equity.	Apply
CO3.To develop a sense of inclusiveness and tolerance towards various genders without any discrimination.	Apply
CO4. To evaluate the social issues and apply suitable gender-related regulations for inclusive living.	Evaluate
CO5.To identify and analyze the existing gender inequality problems faced in various institutions.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT –I INTRODUCTION TO GENDER AND SEX

6hrs

Definition of Sex – Definition of Gender - Sex Vs. Gender - Social Construction of Gender and Gender Roles – GenderStereotypes - Gender Division of Labour - Patriarchy, Masculinity and Gender Equality -Feminism and Patriarchy.

UNIT –II - GENDER BIAS

6 hrs

Introduction to Gender Inequality in India - Gender Bias in Media - Misleading Advertisement And

Poor Portrayal of Women and gender non-conforming individuals- Objectification of Women, Transgender, and gender non-conforming individuals - Differential Treatment of Women, Transgender, Exploitation Caused by Gender Ideology - Female Infanticide - Honor Killing.

UNIT –III GENDER SENSITIZATION AND INTERNATIONAL CONVENTIONS 6 hrs

Gender Sensitization -Need and Objective - Gender Sensitivity Training at Workplace – GenderSensitization in Judiciary - Gender Sensitization in School Curriculum.

UNIT-IV - SEXUAL OFFENCES AGAINST WOMEN 6 hrs

Indian Penal Code, 1860 - S., 304B, 354, 354C, 354d, 376, 498A & 509 - The ImmoralTrafficPrevention Act 1986 - The Sexual Harassment of Women at Workplace (Prevention,Prohibition and Redressal) Act, 2013 - Protection of Women from Domestic Violence Act, 2005- Indecent Representation of Women Act, 1986**.**

UNIT-V ROLE OF GOVERNMENT FOR INCLUSIVE DEVELOPMENT

6hrs

Initiatives of NCERT -Role of Ministry of Women and Child Development - Governmental Initiatives: Beti

BachaoBeti Padhao (BBBP) - Ujjawala Scheme - Working Women Hostels (WWH), National Council for Transgender Persons.

TEXT BOOKS

1. IGNOU: Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi IGNOU
2. Jane Pilcher and Imelda Whelehan (2005): Fifty Key Concepts in Gender Studies

REFERENCES:

1. Women's Empowerment & Gender Parity: @Gender Sensitization, Dr. Shikha Bhatnagar, Repro Books (2020).

2. Gender Sensitization: Issues and Challenges, Anupama Sihag Raj Pal Singh, Raj Publications (2019).

3. Violence Against Women: Current Theory and Practice in Domestic Abuse, Sexual Violence, andExploitation (Research Highlights in Social Work), Jessica Kingsley Publishers (2012).

4. Gill, Rajesh, Contemporary Indian Urban Society- Ethnicity, Gender and Governance, BookwellPublishers, New Delhi (2009).

5. Sexual Violence Against Women: Penal Law and Human Rights Perspectives, Lexis Nexis (2009) 6. Chatterjee, Mohini, Feminism and Gender Equality, Aavishkar, Jaipur,2005.

7. Mies, Maria, Indian Women and Patriarchy, Concept Publishing Company, New Delhi, 2004.

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1.	Gnana Sanga Mithra.S	sangamithra@avil.edu.in
2.	Aarthy.G	aarthy@avil.edu.in

Course Code	Course Title	category	L	T	P	C
	INDIAN CONSTITUTION	**AC**	**0**	**0**	**2**	**0**

Course Objectives:

On completion of this course, the students will be able:

1 To understand the nature and the Philosophy of the Constitution.

2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.

3 To Analyse Panchayat Raj institutions as a tool of decentralization.

4 To Understand and analyse the three wings of the state in the contemporary scenario.

5 To Analyse Role of Adjudicatory Process.

5 To Understand and Evaluate the recent trends in the Indian Judiciary.

Course Content

UNIT I

The Constitution - Introduction

The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and the Basic Structure - Fundamental Rights and Fundamental Duties – Directive Principles State Policy

UNIT II –Government of the Union

The Union Executive- Powers and duties of President –Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha

UNIT III –Government of the States

The Governor –Role and Powers - Cheif Minister and Council of Ministers- State Legislature

UNIT IV – Local Government

The New system of Panchayats ,Municipalities and Co-Operative Societies

UNIT V – Elections

Powers of Legislature -Role of Chief Election Commissioner-State Election Commission

TEXTBOOKS AND REFERENCE BOOKS:

1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition Suggested.

Total Hours: 30 hours

Software/Learning Websites:

1. https://www.constitution.org/cons/india/const.html

2. http://www.legislative.gov.in/constitution-of-india

3. https://www.sci.gov.in/constitution

4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of india/ **Alternative NPTEL/SWAYAM Course:**

S.NO	NPTEL ID	NPTEL Course Title	Course Instructor
1	12910600	CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS	PROF. M. K. RAMESH NATIONAL LAW SCHOOL OF INDIA UNIVERSITY

COURSE DESIGNER				
S.NO	**NAME OF THE FACULTY**	**DESIGNATION**	**NAME OF THE INSTITUTION**	**MAIL ID**
1	Dr.Sudheer	Principal	AV School of Law	Sudheersurya18@gmail.com

Course Code	Course Title	Category	L	T	P	C
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	MC	0	0	2	0

Course Objectives:

1. To facilitate the students with the concepts of Indian traditional knowledge and tomake them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and applyit to their day to day life

Course Outcomes:

At the end of the Course, Student will be able to:

1. Identify the concept of Traditional knowledge and its importance.
2. Explain the need and importance of protecting traditional knowledge.
3. Illustrate the various enactments related to the protection of traditional knowledge.
4. Interpret the concepts of Intellectual property to protect the traditional knowledge.
5. Explain the importance of Traditional knowledge in Agriculture and Medicine.

UNIT-I:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT-2:

Protection of traditional knowledge: The need for protecting traditional knowledgeSignificance of TK Protection, value of TK in global economy, Role of Government to harnessTK.

UNIT-3:

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT-4:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-5:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Text Books:

Traditional Knowledge System in India, by Amit Jha, 2009.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

Web Links:

1.https://www.youtube.com/watch?v=LZP1StpYEPM

SPECIALIZATION
INDUSTRIAL PHARMACY
CREDITS - 12

	COSMETIC TECHNOLOGY	Category	L	T	P	Credit
			3	0	0	3

PREAMBLE

The course gives an extensive knowledge and training in the formulation of cosmetic products

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To define the significance of cosmetic products.
2	To discuss about the building blocks of cosmetic formulations.
3	To demonstrate the preparation of skin and hair care formulations
4	To outline the role of herbs in cosmetic formulations.
5	To emphasize the importance of packaging techniques of cosmetic products.

COURSE OUTCOMES

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

CO1. Recall the significance of cosmetics.	Remember
CO2. Summarize the importance of suspensions & emulsions	Understand
CO3. Using the principles of suspension and emulsion in cosmetic formulations	Apply
CO4. Examine the suitability of herbal constituents in cosmetic formulations.	Analyze
CO5. Evaluate the packaging methods which will enhance the sales	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	-	L	-	-	-	-	L	L	-	-
CO2	S	L	M	S	L	L	-	-	-	-	-	L	L	-	L
CO3	M	L	M	L	L	-	-	L	-	-	-	M	M	L	-
CO4	L	L	L	L	M	-	-	-	-	-	-	L	L	-	-

CO5	M	M	L	L	M	-	-	-	-	-	-	M	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

COSMETICS – INTRODUCTION, EXCIPIENTS AND BUILDING BLOCKS

Introduction, Classification of cosmetic products.

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives, hydrocolloids, diluents, vehicles.

Building Blocks of Cosmetic formulations: Bulk powders, Emulsions, Suspensions, Ointments, Paste, Creams, Jellies, Sticks,

SKIN CARE PRODUCTS

Skin Care Products: Moisturizing cream, cold cream, vanishing cream, skin tonning creams, soaps, face wash, face packs and masks, perfumes, antiperspants, deodorants, humectants, astringents and skin tonics, skin cleansers, skin lighteners or bleaches, sebum absorbers, sunscreen lotions, anti-sunburn preparations. Lipstick, Lip Balm, Lip Gloss, Lip liner

Nail Care Products: Nail polish, Enamel removers, Nail creams, Nail bleaches, Cuticle softeners and removers

HAIR CARE & ORAL CARE PRODUCTS

Hair Care Products: Shampoos, anti-dandruff shampoo, Hair Tonics & conditioner, Hair oils, hair dyes, Hair colorants, Hair setting lotions & sprays, Hair strengtheners

Oral Care Products: Toothpaste - for bleeding gums, sensitive teeth, teeth whitening. Mouthwashes and gargles

HERBS IN COSMETIC FORMULATION

Study the following herbs with reference to their sources, chemical constituents and cosmetic uses and formulations: Aloe, Babool, Brahmi, Bawachhi, Chandan, Cucumber, Haldi, Ambahaldi, Jashtamadh, Jatamansi, Lodra, Mehndi, Neem, Nagarmotha, Ritha, Raktachandan, Shikakai, Tulsi, Arnica, Manjishtha

PACKAGING AND DISPENSING

Importance of different materials for containers and closures. Packaging of cosmetic product and labeling. Environmental aspects of packaging materials, appropriate recycling and disposal

TEXT BOOKS

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2. Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th edition, Vandana Publications Pvt. Ltd., Delhi.

3. Text book of cosmeticology by Sanju Nanda & Roop K. Khar, Tata Publishers.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	VACCINE TECHNOLOGY	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

This course will enrich the students about the basic principles in immunology, vaccines, its types, production, quality control measures and commercialization.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To demonstrate the immunological concepts behind vaccines
2	To illustrate the preparation and types of vaccines.
3	To develop a design and demonstrate the action of vaccine.
4	To inference of animal testing and commercialization of vaccine.
5	To discover a vaccine by new technologies and scale up with the help of molecular and biopharming.

COURSE OUTCOMES

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

CO1. Demonstrate the immunological concepts in vaccinology	Understand
CO2.Illustrate the preparation and types of vaccines.	Understand
CO3. Developing a design and demonstrate the action of vaccine.	Apply
CO4. Inference of animal testing and commercialization of vaccine.	Analyze
CO5. Discover a vaccine by new technologies and scale up with the help of molecular and biopharming.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

IMMUNOLOGICAL CONCEPTS IN VACCINOLOGY

Antigen, Antibody, APC, MHC, Epitopes- Paratopes, Active and passive immunization, Monoclonal antibodies, engineering of antibodies, antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions Short history of vaccination.

CLASSIFICATION OF VACCINES

Classification- Live, killed, attenuated, sub unit vaccines; Viral/bacterial/parasite vaccine differences, recombinant DNA and protein-based vaccines, plant-based vaccines, edible vaccines, reverse vaccinology, combination vaccines, therapeutic vaccines; Peptide vaccines, conjugate vaccines; Cell based vaccines.

VACCINE PRODUCTION

Vaccine technology-methods of vaccine preparation –Live, killed, attenuated, sub unit vaccines**,** a rational approach for Vaccine development , Cellular basis of T- Cell memory, Rational design of new vectors, Transcutaneous immunisation, Vaccination studies and recent advances in Malaria, Rabies, Tuberculosis , HIV.

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.

RECENT TRENDS IN VACCINE TECHNOLOGY

Fundamental research to rational vaccine design, Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens, Vaccine from molecular pharming technology and biopharming technology. requirements,Scope of future vaccine strategies.

TEXTBOOKS

1. Male, David et al., “Immunology”, VIIEdition, Mosby Publication,2007.

2. Kindt, T.J. etal., “Immunology”, VIEdition, W.H. Freeman,2007.
3. Janeway, C.A. etal., “Immunology: The Immune Systems in Health andDiseases”,VIEdition,Garland Science, 2005
4. Lydyard, P.M. “Instant Notes in Immunology”, Viva Books Pvt. Ltd., 2000.

REFERENCES

1. S. Hockfield, S. Carlson, C. Evans, P. Levitt, J. Pintar, L. Silberstein, Selected methods for Antibody and Nucleic Acid probes, Volume1, Cold Spring Harbor Ed Harlow, David Lane, Antibodies Laboratory Manual, Cold Spring Harbor, Laboratory Press, 1993.
2. Coico, R. etal., “Immunology: A Short Course”, Vth Edition, Wiley – Liss,2003.
3. Parham, Peter “The Immune System”, II Edition, Garland Science,2005.
4. Abbas, A.K. etal., “The Cellular and Molecular Immunology”, VI Edition, Sanders / Elsevier,2007.
5. Weir, D.M. and Stewart, John “Immunology”, VIII Edition, Churchill Pvt. Ltd.,2000.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya@vmkvec.edu.in

	VALIDATION IN PHARMACEUTICAL INDUSTRIES	Category	L	T	P	C
			3	0	0	3

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. Describe the regulatory basics for process validation and outline the prospective validation.	Understand
CO2. Explain the GMP regulation regarding the utilities Pharmaceutical manufacturing.	Understand
CO3. Illustrate the importance of impurity and the procedure for determination of expiry date.	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

COS	PO1	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO11	PO1	PSO	PSO	PSO3
CO1	M	M	M	M	L	L	M	L	M	L	L	L	-	-	-
CO2	M	M	M	M	L	L	M	-	M	L	L	L	-	-	-
CO3	M	M	S	M	L	L	M	-	M	L	L	L	-	-	-
CO4	M	M	M	M	M	M	S	-	S	-	-	M	-	M	-
CO5	L	L	L	L	M	S	M	-	M	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

DRUGS AND COSMETICS ACT AND GMP FOR API

Drugs and cosmetics act-1948–Organization and personnel –Buildings and facilities –Equipment – URS, FAT, DQ, SAT, IQ, OQ, PQ of machines and equipment - Documentation and records–Material management– Production and in process control– Packaging 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 INAPI 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-Organization, Part 11, Electronic Records; Electronic Signatures - Scope and Application - product development, development of manufacturing capability, full scale production development, defining experimental programs, experimental design and analysis.

TEXT BOOKS:

1. R.A. Nash, A.H. Wachter, “Pharmaceutical Process Validation”, 3rd ed., CRC Press, Taylor & Francis Group, 2003.
2. Y. Anjaneyulu, R.Maraya, “Quality Assurance and Quality Management in Pharmaceutical Industry”, Pharma Book Syndicate, 2005.
3. J. P. Agalloco, F.J. Carleton, “Validation of Pharmaceutical Processes”, 3rd ed., Informa Healthcare, NY, USA, 2007.

REFERENCES:

1. Willig, S.H., “Good Manufacturing Practice for Pharmaceuticals”, 5th Edition, Marcel Dekker, 2005.
2. A.A. Signore, T. Jacobs, “Good Design Practices for GMP Pharmaceutical Facilities” 1st ed., CBS Publishers & Distributors Pvt. Ltd., 2009.
3. S.C. Chow, “Statistical Design and Analysis of Stability Studies” Chapman and Hall/CRC, 2007.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Ms. R. Jaishri	Assistant professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	PHARMACEUTICAL PACKAGING TECHNOLOGY	Category	L	T	P	C
		EC-SE	3	0	0	3

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

1	To list on different packaging materials and their selection, uses control and impact on product stability.
2	To explain the concept, Formulation, evaluation and packaging of various semisolid dosage forms
3	To perform the collection, processing and storage of biological products like blood and plasma substitutes.
4	To categories the regulatory aspects of tablet, vial and bottle packaging.
5	To check Packaging operations and their risks and control.

COURSE OUTCOMES

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

CO1. Relate the concepts of quality control and quality assurance during entire manufacturing practices.	Remember
CO2. Explain the pharmacopoeia testing, defects and stability of blister and strip packaging materials.	Understand
CO3. Demonstrate sterilization of packaging materials used in parenteral, ophthalmic and aerosols as per their legal requirement.	Apply
CO4. Develop new concepts in pharmaceutical packaging and their control.	Analyse
CO5.Estimate the different samplings methods.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

CO4	L	L	L	L	S	L	-	-	S	-	-	M	L	M	M
CO5	S	-	L	L	-	M	-	-	-	-	-	S	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

PHARMACEUTICAL PACKAGING

Introduction of packaging - classification of packaging - packaging essential requirements functionsof packaging - importance / significance of pharma packaging - main packaging materials - ideal package material properties. Environmental considerations for packing materials

PRIMARY PACKAGING MATERIAL

Glass containers- introduction - selection of glass as packaging materials for the pharmaceutical products - properties of glass - production of glass - types of glass - test for glass containers advantages and disadvantages of glass containers. Metals containers- aluminium - aluminium foil - collapsible tubes and stainless steel. Polymers -and plastics- introduction to plastics - raw materials of plastics - types of plastics - resin identification code - plastics and packaging and testing of plastic containers.

SOLID DOSAGE FORM PACKAGING

Blister package- introduction to blister package - types of blisters - advantages and disadvantages of blister packaging - types of problems/ defects. Strip package- strip Packaging Process – packaging materials - child-resistant and multi-dose strip packaging ; and package machinery

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

Specifications–quality control tests–methods and evaluation of packaging of materials– stability of packaging materials–law and regulations governing packaging. Labels and symbols

TEXT BOOKS

1. D.A. Deak, E.R. Evans, I.H. Hall, “Pharmaceutical Packaging Technology”, Taylor and Francis, 2000.
2. Edward J. Bauer, Pharmaceutical Packaging Handbook. CRC Press, 2009.
3. S. Natarajan, M. Govindarajan, B. Kumar, “Fundamental of Packing Technology”, PHI Learning

Pvt ltd., New Delhi, 2009

REFERENCES

1. Anonymous, "Quality Assurance of Pharmaceuticals:A Compendium of Guidelines and Related Materials",2nd Edition, World Health Organization,2004.
2. U.K. Jain, D.C. Goupale, S. Nayak, "Pharmaceutical Packaging Technology", 2nd Ed.,Pharma Med Press, Hyderabad, 2008.
3. Remington: The Science and Practice of Pharmacy. 21st Ed., 2005.
4. James Swarbrick, "Encyclopedia of Pharmaceutical Science and Technology",4th ed., CRC Press, 2013.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in
2	Ms.R.Jaisri	Assistant professor	Pharmaceutical Engineering	jaishri.vmkvec@vmrf.edu.in

	DOWNSTREAM PROCESSING	Category	L	T	P	Credit
		EC-SE	3	0	0	3

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.

PREREQUISITE - NIL

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 down streaming.	Apply
CO2. Distinguish the various methods of separation.	Analyse
CO3. Appraise the isolation of products.	Analyse
CO4. Categorizes the various purification methods	Analyse
CO5. Assess the knowledge of formulation and finishing operations	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF DOWNSTREAM PROCESSING

Introduction to downstream processing – principles, properties of biomolecules – Size, Molecular weight, Diffusivity, Sedimentation coefficient, Osmotic pressure, Electrostatic charge, Solubility. Cell disruption process- bead mill, rotor-stator mill, ultrasonic vibrations, detergents, enzymes, organic solvents, osmotic

shock

SEPARATION AND ISOLATION OF PRODUCTS

Introduction to centrifugation, Laboratory centrifuge, Preparative centrifuge, Ultracentrifugation. Theory of filtration, Filter medium, Driving force, Improvement of filtration efficiency, Membrane separation - Microfiltration, Ultrafiltration, Dialysis, Extraction, Precipitation of proteins.

CHROMATOGRAPHY

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction, Membrane, HPLC, affinity and pseudo affinity chromatographic techniques.

FINAL POLISHING AND CASE STUDIES

Lyophilization, Freeze drying, spray drying and crystallization. Case studies on purification of: cephalosporin, aspartic acid, Recombinant Streptokinase.

ADVANCED BIOSEPARATIONS AND CASE STUDIES

Recent trends in bioseparations, perevaporation, reverse miceller extraction, super critical fluid extraction spin base, magnetic separation and their application, case studies of product purification and recovery.

TEXT BOOKS:

1. Belter, P.A., Clussler, E.L. “Bioseparation – Downstream Processing & Biotechnology”. John – Wiley Interscience, 1998.
2. Asenjo, Juan A. “Separation Processes in Biotechnology”. Taylor & Francis / CRC, 1990.
3. Scopes, R.K. “Protein Purification: Principles and Practice”. Narosa Publication,
4. Downstream Process Technology: A New Horizon in Biotechnology Paperback– 2010 by Prasad, Krishna

REFERENCES:

1. Ghosh, Raja “Principles of Bioseparations Engineering”. World Scientific, 2006.
2. “Product Recovery in Bioprocess Technology”. (BIOTOL – Biotechnology by Open Learning Series). Butterworth – Heinmann / Elsevier.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. A. Arunagiri	Assistant professor	Pharmaceutical engineering	arunagiri@vmkvec.edu.in

	QUALITY CONTROL AND QUALITY ASSURANCE	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The course the working of the quality control and quality assurance section in a pharma industry. It gives brief understanding about the various parameters followed for ensuring the quality of a medicinal product. The course emphasizes on methods used by pharmacists for a safe and quality medicinal product.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To state the importance of quality and different quality management systems.
2	To discuss the tools for quality improvement and analyse the issues in quality production
3	To describe the stability and testing of various drug substances.
4	To understand the statistical approaches for quality
5	To compare the different pharmacopoeia with Indian pharmacopoeia and using that knowledge for future career

COURSE OUTCOMES

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

CO1. Define the importance of quality with respect to different quality management systems	Remember
CO2. Discuss the tools for quality improvement and analyse issues.	Understand
CO3. Illustrate the stability and testing of drugs effectively.	Apply
CO4. Practice the statistics behind quality control	Apply
CO5. Develop the ability to suggest improvements to drug quality	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO1	PO2	PO	PO	PO	PO	PO	PO	PO9	PO1	PO1	PO1	PSO	PSO	PSO3
CO	L	L	L	L	-	-	-	-	-	L	-	-	L	-	-
CO	M	M	M	M	-	-	-	L	-	-	-	-	L	-	-
CO	S	S	S	S	-	-	-	-	-	-	-	-	L	-	-
CO	M	M	M	M	M	-	-	-	-	-	-	-	M	-	-
CO	L	L	L	L	S	-	-	-	-	M	-	-	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION AND GOOD LABORATORY PRACTICES

Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP,

Overview of ICH Guidelines – QSEM. Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.

cGMP GUIDELINES FOLLOWED IN DIFFERENT COUNTRIES

cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control.

RULES & REGULATIONS OF DIFFERENT PHARMACOPOEIAS

Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).

DOCUMENTATION IN PHARMACEUTICAL INDUSTRY

Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles-How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing. Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents.

MANUFACTURING OPERATIONS AND CONTROLS

Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging.

TEXT BOOKS

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.

3. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2nd edition, WHO Publications, 1999.
4. How to Practice GMP's – P P Sharma, Vandana Publications, Agra, 1991.

REFERENCES

1. The International Pharmacopoeia – vol I, II, III, IV & V - General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excepients and Dosage forms, 3rd edition, WHO, Geneva, 2005.
2. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
3. ICH guidelines ISO 9000 and total quality management
4. The drugs and cosmetics act 1940 – Deshpande, Nilesh Gandhi, 4th edition, Susmit Publishers, 2006.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.R.Jaishri	Assistant professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in
2	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in

	ADVANCED INDUSTRIAL PHARMACY	Category	L	T	P	Credit
		EC-SE	3	0	0	3

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.,

PRERQUISITE - 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. Choose the components needed to produce various drugs.	Understand
CO2. Summarize the materials require to produce specific drug.	Understand
CO3. Employee knowledge to perform Scale-up operations.	Apply
CO4.Develop to know how on product formulations in pharmaceuticals.	Analyse
CO5. Appraise the design of Production planning and control system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

PREFORMULATION STUDIES

Introduction, organoleptic properties, purity, particle size, shape and surface area. Solubility, Methods to improve

solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism. Preformulation stability 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

1. C.V.S. Subrahmanyam," Pharmaceutical Production and management", Published by Vallabh Prakashan, 1 st edition, 2005.

2. D.A.Savant "The Pharmaceutical Sciences Pharma Pathway Pure Applied Pharmacy", Published by Nirali Publication; 1st edition, 2016.

3. Yoshoika.S. Stella V.J., "Stability of Drugs and Dosage Forms", Published by Kluwer Academic/Plenum Publishers, 1 st edition 2005.

REFERENCES

1. Shayne Cox Gad, "Pharmaceutical Manufacturing Handbook: Production and Processes", Published by John Wiley & Sons, 1st Edition, 2008.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Ms. R. Jaishri	Assistant professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	FUNCTIONAL FOODS AND NUTRACEUTICALS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

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 foods, their chemical nature.
2	To describe the probiotics, prebiotics and symbiotics.
3	To outline the mechanisms of phytochemicals as nutraceuticals
4	To outline the role of nutraceuticals in health and diseases.
5	To emphasize 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 probiotics, prebiotics and symbiotics.	Understand
CO3. Demonstrate about of some important phytochemicals as nutraceuticals	Apply
CO4. Examine the roles of nutraceuticals in health and diseases	Analyse
CO5. Developing neutraceutical formulation	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	M	-	-	-	-	-	-	-	-	-	-	-
CO2	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-	M	-	-	S	-	-	-	-	-	-	-	-
CO4	S	M	L	-	-	-	-	-	M	-	-	-	-	-	-
CO5	S	M	M	L	-	-	-	-	-	-	-	L	-	-	-
CO6	M	M	L	L	-	L	L	S	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION AND SIGNIFICANCE

Introduction to Functional Foods and Nutraceuticals : Definition, History and Classification, Perceived Effects of Functional Foods, Phytochemicals, Zoochemicals and Microbes In Food, Plants, Animals.

PROBIOTICS, PREBIOTICS AND SYNBIOTICS

Introduction to Probiotics, Prebiotics and Synbiotics Probiotics: Taxonomy and Important Features of Probiotic Microorganisms Health Effects of Probiotic Microorganisms, Probiotics in Various Foods, Quality Assurance of Probiotics and Safety, Prebiotics: Non Digestible Carbohydrates/ Oligosaccharides, Dietary Fiber, Resistant Starch, Gums.

PHYTOCHEMICALS AS NUTRACEUTICALS

Polyphenols: Flavonoids, Catechins, Isoflavones, Tannins, Phytoestrogens, Phytosterols, Glucosinolates, Pigments: Carotenoids, Lycopene, Curcumin, Organosulphur Compounds, Introduction to Anti-nutritional Factors, Phytates, Enzymes, Protease inhibitors, Amylase inhibitors, Saponins, Haemagglutinin.

ROLE IN HEALTH AND DISEASE

Active Biodynamic Principles in Spices, Condiments and Plant extracts, Resveratrol, Kaempferol, Quercetin, Cinnamaldehyde, Crocin, Lutoline**,** Capsaicin, Piperine, Gingerol, Eugenol, Rosemarinic acid, Apigenine, Thymoquinone Fenugreek and Diosgenin.

NON NUTRIENT EFFECT OF SPECIFIC NUTRIENTS & NUTRACEUTICAL FORMULATIONS

Conjugated Linoleic Acid, Omega 3 Fatty acids, Proteins and Peptides and Nucleotides, Vitamins, Minerals. Formulation of functional foods containing nutraceuticals – stability, analytical and labelling issues.

TEXT BOOKS

1. Bisset, Normal Grainger and Max WichH "Herbal Drugs and Phytopharmaceuticals", 2nd Edition, CRC, 2001.
2. Handbook of Nutraceuticals and Functional Foods: Robert Wildman, CRC, Publications.2006
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006
4. Ikan, Raphael "Natural Products: A Laboratory Guide", 2nd Edition, Academic Press /Elsevier, 2005.

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
2. Functional Foods and Nutraceuticals in Cancer Prevention by Ronald Ross Watson(Author), Blackwell Publishing, 2007

3. Marketing Nutrition: Soy, Functional Foods, Biotechnology, and Obesity by Brian Wansink.
4. Functional foods: Concept to Product: Edited by G R Gibson and C M Williams, Woodhead Publ., 2000
5. Hanson, James R. “Natural Products: The Secondary Metabolites”, Royal Society of Chemistry, 2003.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr. A. Arunagiri	Assistant professor	Pharmaceutical engineering	arunagiri@vmkvec.edu.in

	NOVEL DRUG DELIVERY SYSTEMS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

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.

PRERQUISITE- 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. Recognize 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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

SUSTAINED RELEASE FORMULATIONS

Introduction, concept, advantages and disadvantages. Physicochemical and biologicalproperties of drugs relevant to sustained release formulations

GASTRORETENTIVEDRUG DELIVERY SYSTEMS

Floating, high density systems, inflatable and gastroadhesive systems and their applications.

TRANSDERMAL DRUG DELIVERY SYSTEMS

Permeation through skin, factors affecting permeation, basic components of TDDS, formulationapproaches used in development of TDDS and their evaluation, permeation enhancers.

PARENTERAL CONTROLLED RELEASE DRUG DELIVERY SYSTEMS

Approaches for injectable controlled release formulations and development of Implantable drug

delivery systems,osmotic pumps

TARGETED DRUG DELIVERY SYSTEMS

Concept. Advantages and disadvantages, biological processes and events involved in drugtargeting, nanoparticles, liposomes, resealed erythrocytes, microspheres, and monoclonal antibodies.

FUTURE DIRECTIONS OF DRUG DELIVERY AND TARGETING

Plasmid based Gene therapy, Protein delivery system, Nucleic acids delivery, IntegratingDrug Discovery and delivery and New Generation Technology.

TEXT BOOKS

1. Binghewang, Teruna Siahaan and Richard A Soltero “Drug delivery principles and applications” John wiley and Sons Inc, 2005.
2. Junginger H.E, “Drug Targeting and Delivery- concepts in dosage form design”, EllisHarwood series in Pharmaceutical Technology.1992
3. Vasant Ranade, Mannfred A Hollinger “Drug delivery systems” II ed , CRC Press.2003
4. Grietje Molema and Dirk K F Meijer “Drug Targeting organ - specific strategies”WILEY-VCH , 2001.
5. Anya M Hillery et al “Drug Delivery and Targeting”, CRC Press, 2010.

REFERENCES

1. S.P.Vyas and R.K.Khar, Controlled Drug Delivery -concepts and advances, VallabhPrakashan, New Delhi, First edition 2002. Remington: The science and practice ofpharmacy, 20th edition Pharmaceutical Science (RPS)
2. Theory And Practice Of Industrial Pharmacy by Liberman & Lachman,2014
3. Pharmaceutics-the science of dosage form design by M.E.Aulton, Churchill living stone, 2001
4. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea & febiger, Philadelphia, 5thedition, 2005
5. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, NewDelhi, First edition 1997 (reprint in 2001).

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.DavidAnnaraj	Assistant professor	Pharmaceutical Engineering	davidannaraj@vmkvec.edu.in
2	Mrs. Pillai Divya U	Assistant Professor	Pharmaceutical Engineering	pillaidivyau@vmkvec.edu.in

REFERENCES

1. S.P.Vyas and R.K.Khar, Controlled Drug Delivery -concepts and advances, VallabhPrakashan, New Delhi, First edition 2002. Remington: The science and practice ofpharmacy, 20th edition Pharmaceutical Science (RPS)
2. Theory And Practice Of Industrial Pharmacy by Liberman & Lachman,2014
3. Pharmaceutics-the science of dosage form design by M.E.Aulton, Churchill living stone, 2001
4. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea & febiger, Philadelphia, 5thedition, 2005
5. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, NewDelhi, First edition 1997 (reprint in 2001).

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
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2	Mrs. Pillai Divya U	Assistant Professor	Pharmaceutical Engineering	pillaidivyau@vmkvec.edu.in