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

Faculty of Engineering and Technology

REGULATIONS 2021

Programme:

REGULATIONS 2021

DEPARTMENT OF BIOTECHNOLOGY

Full Time (4 Years)

Programme:

B.Tech.BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM

(Semester I to VIII)

PROGRAMME OUTCOMES

Post Graduates will be able to:

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of problems in the area of Biotechnology.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex biotechnology- oriented problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex bio-based 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 modelling to complex engineering activities with an understanding of the limitations in the area of biotechnology.
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 practice.
PO7	**Environment and sustainability**: Understand the impact of the professional biotechnological 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 technology 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 technology audience 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.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

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

(C) PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

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

PEO3: Identify, design and develop biotechnological process and technologies to meet the industrial challenges and produce tools which a sound and economically viable and sustainable.

Mapping of PEOs with POs

PEO\PO	1	2	3	4	5	6	7	8	9	10	11	12
1	S	M	M	M	S	S	S	L	M	M	S	M
2	S	M	S	S	S	S	S	S	M	M	S	S
3	M	M	M	M	M	M	L	S	M	S	S	M
4	M	S	S	M	M	M	L	M	S	L	L	L

S- Strong Correlation, M – Medium Correlation, L – Low Correlation

CREDIT STRUCTURE OF COURSE CATEGORY

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM – REGULAR STUDENTS

Sl. No.	Category of Courses	Types of Courses		Suggested Breakup of 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
6.	**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
7.	****E. Mandatory Courses**	Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Employability Enhancement Value Added Courses, NSS, RRC, YRC, Sports and Games, Student Clubs, Unnat Bharat Abhiyan, Swachh Bharat etc.		0 Credit Course
			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.**

CURRICULUM

B.TECH.–BIOTECHNOLOGY - SEMESTER I TO VIII

B.TECH. – BIOTECHNOLOGY - SEMESTER I TO VIII									
A.FOUNDATION COURSES									
HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES - CREDITS (9-12)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		TECHNICAL ENGLISH	ENG	FC-HS	3	0	0	3	NIL
2.		BUSINESS ENGLISH	ENG	FC-HS	3	0	0	3	NIL
3.		PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT LAB	ENG	FC-HS	0	0	2	1	NIL
4.		ENGLISH LANGUAGE LAB	ENG	FC-HS	0	0	4	2	NIL
5.		TOTAL QUALITY MANAGEMENT	MANAG	FC-HS	3	0	0	3	NIL
6.		PROFESSIONAL ETHICS AND HUMAN VALUES	MANAG	FC-HS	3	0	0	3	NIL
7.		MANAGEMENT PRINCIPLES FOR ENGINEERS	MANAG	FC-HS	3	0	0	3	NIL
8.		UNIVERSAL HUMAN VALUES-UNDERSTANDING HARMONY	ENG	FC-HS	3	0	0	3	NIL
BASIC SCIENCE COURSES - CREDITS (18 -25)									
1.		MATHEMATICS FOR BIO-ENGINEERING	MATH	FC-BS	2	1	0	3	NIL
2.		PHYSICAL SCIENCES	PHY & CHEM	FC-BS	4	0	0	4	NIL
3.		PHYSICAL SCIENCES LAB	PHY & CHEM	FC-BS	0	0	4	2	NIL
4.		BIOSTATISTICS	MATH	FC-BS	2	1	0	3	MATHEMATICS FOR BIO-ENGINEERING
5.		SMART MATERIALS	PHY	FC-BS	3	0	0	3	NIL
6.		SMART MATERIALS AND NANOTECHNOLOGY	PHY	FC-BS	3	0	0	3	NIL
7.		FUNDAMENTALS OF BIOCHEMISTRY (THEORY AND PRACTICALS)	BTE	FC-BS	3	0	2	4	NIL
8.		MICROBIOLOGY	BTE	FC-BS	3	0	0	3	NIL
9.		MICROBIOLOGY LAB	BTE	FC-BS	0	0	4	2	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.		FUNDAMENTALS OF BIOTECHNOLOGY	BTE	FC-ES	3	0	0	3	NIL
2.		FOUNDATIONS OF COMPUTING AND 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.		PYTHON PROGRAMMING (THEORY AND PRACTICALS)	CSE	FC-ES	2	0	2	3	NIL
5.		BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	EEE & ECE	FC-ES	4	0	0	4	NIL
6.		BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	EEE & ECE	FC-ES	0	0	4	2	NIL
7.		ENGINEERING GRAPHICS AND DESIGN	MECH	FC-ES	0	0	6	3	NIL
8.		WORKSHOP PRACTICES	MECH	FC-ES	0	0	4	2	NIL

B. PROFESSIONAL									
CORE COURSES - CREDITS (48-54)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PRE REQUISITE**
1.		CELL AND MOLECULAR BIOLOGY (THEORY AND PRACTICALS)	BTE	CC	3	0	2	4	NIL
2.		CLASSICAL AND MOLECULAR GENETICS	BTE	CC	3	0	0	3	NIL
3.		UNIT OPERATIONS IN PROCESS INDUSTRIES	BTE	CC	3	0	0	3	NIL
4.		ADVANCED BIOCHEMISTRY	BTE	CC	3	0	0	3	ESSENTIALS OF BIOCHEMISTRY
5.		ADVANCED BIOCHEMISTRY LAB	BTE	CC	0	0	4	2	NIL
6.		BIOORGANIC CHEMISTRY	BTE	CC	3	0	0	3	
7.		BIOORGANIC CHEMISTRY LAB	BTE	CC	0	0	4	2	
8.		BIOINSTRUMENTATION (THEORY AND PRACTICALS)	BTE	CC	3	0	2	4	NIL
9		PRINCIPLES OF CHEMICAL ENGINEERING	BTE	CC	3	0	0	3	NIL
10		CHEMICAL ENGINEERING LAB	BTE	CC	0	0	4	2	NIL
11.		PLANT AND ANIMAL BIOTECHNOLOGY	BTE	CC	3	0	0	3	NIL
12.		FOOD PROCESSING TECHNOLOGY (THEORY AND PRACTICALS)	BTE	CC	3	0	2	4	NIL
13.		GREEN BIOTECHNOLOGY AND POLLUTION ABETMENT	BTE	CC	3	0	0	3	NIL
14.		ENZYME ENGINEERING & TECHNOLOGY	BTE	CC	3	0	0	3	NIL
15.		PROTEIN ENGINEERING	BTE	CC	3	0	0	3	NIL
16.		GENETIC ENGINEERING	BTE	CC	3	0	0	3	NIL
17.		GENETIC ENGINEERING LAB	BTE	CC	0	0	4	2	NIL
18.		IMMUNOLOGY (THEORY AND PRACTICALS)	BTE	CC	3	0	2	4	NIL
19.		BIOPROCESS ENGINEERING (THEORY AND PRACTICALS)	BTE	CC	3	0	2	4	NIL
20.		DOWNSTREAM PROCESSING IN BIOTECHNOLOGY	BTE	CC	3	0	0	3	BIOPROCESS ENGINEERING
21.		DOWNSTREAM PROCESSING IN BIOTECHNOLOGY LAB	BTE	CC	0	0	4	2	NIL
22.		MASS TRANSFER OPERATIONS	BTE	CC	3	0	0	3	NIL

C.ELECTIVE COURSES									
PROFESSIONAL ELECTIVES - CREDITS (12)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		THERMODYNAMICS FOR BIOTECHNOLOGY	BTE	EC-PS	3	0	0	3	NIL
2.		PLANT AND ANIMAL DISEASES AND THEIR CONTROL	BTE	EC-PS	3	0	0	3	MICROBIOLOGY
3.		PRINCIPLES OF BIOINFORMATICS	BTE	EC-PS	3	0	0	3	NIL
4.		DIAGNOSTICS AND THERAPEUTICS	BTE	EC-PS	3	0	0	3	MICROBIOLOGY
5.		STEM CELL BIOLOGY AND TISSUE ENGINEERING	BTE	EC-PS	3	0	0	3	NIL
6.		MICROBIAL BIOTECHNOLOGY	BTE	EC-PS	3	0	0	3	MICROBIOLOGY
7.		CRYOPRESERVATION THEORY AND APPLICATIONS	BTE	EC-PS	3	0	0	3	NIL
8.		FOOD MICROBIOLOGY	BTE	EC-PS	3	0	0	3	NIL
9.		CANCER BIOLOGY	BTE	EC-PS	3	0	0	3	CELL AND MOLECULAR BIOLOGY
10.		APPLIED BIOTECHNOLOGY	BTE	EC-PS	3	0	0	3	NIL
11.		CLINICAL TRIALS	BTE	EC-PS	3	0	0	3	NIL
12.		AGRICULTURAL BIOTECHNOLOGY	BTE	EC-PS	3	0	0	3	NIL
13.		GENOMICS AND PROTEOMICS	BTE	EC-PS	3	0	0	3	GENETIC ENGINEERING
14.		MOLECULAR MODELLING AND DRUG DESIGNING	BTE	EC-PS	3	0	0	3	PRINCIPLES OF BIOINFORMATICS
15.		NANOBIOTECHNOLOGY	BTE	EC-PS	3	0	0	3	NIL
16.		GOOD MANUFACTURING AND LABORATORY PRACTICE	BTE	EC-PS	2	1	0	3	NIL
17.		BIOPHYSICS	BTE	EC-PS	3	0	0	3	NIL
18.		BASICS OF HUMAN PHYSIOLOGY	BTE	EC-PS	3	0	0	3	NIL
19.		SKILL BASED ETHANOMEDICINE	BTE	EC-PS	3	0	0	3	NIL

INDUSTRY DESIGNED/ INDUSTRY SUPPORTED/ INDUSTRY OFFERED/ INDUSTRY SPONSORED COURSES - CREDITS (6)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		LEARNING IT ESSENTIALS BY DOING	INFOSYS	EC-IE	3	0	0	3	NIL
2.		MOBILE APPLICATION DEVELOPMENT	INFOSYS	EC-IE	3	0	0	3	NIL
3.		BIOPHARMACEUTICS	KNOVONOT	EC-IE	3	0	0	3	NIL
4.		CLINICAL RESEARCH	KNOVONOT	EC-IE	3	0	0	3	NIL
5.		TOOLS AND TECHNIQUES OF MODERN BIO-INFORMATICS	SIMBIOEN LABS AND SCIENTIFIC SERVICE,	EC-IE	3	0	0	3	NIL

OPEN ELECTIVES									
INNOVATION, ENTREPRENEURSHIP, SKILL DEVELOPMENT ETC.CREDITS -(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		INTELLECTUAL PROPERTY RIGHTS	MANAG	OE-IE	3	0	0	3	NIL
5.		ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL
EMERGING AREAS LIKE 3D PRINTING, ARTIFICIAL INTELLIGENCE, INTERNET OF THINGS ETC. - CREDITS (9)									
SL. 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.		3D PRINTING AND ITS APPLICATIONS	MECH	OE-EA	3	0	0	3	NIL
4.		INDUSTRIAL ROBOTICS	MECH	OE-EA	3	0	0	3	NIL
5.		FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	CSE	OE-EA	3	0	0	3	NIL
6.		INTRODUCTION TO INTERNET OF THINGS	CSE	OE-EA	3	0	0	3	NIL
7.		DESIGN OF ELECTRONIC EQUIPMENT	ECE	OE-EA	3	0	0	3	NIL
8.		INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	ECE	OE-EA	3	0	0	3	NIL
9.		GREEN POWER	EEE	OE-EA	3	0	0	3	NIL

		GENERATION SYSTEMS							
10.		INDUSTRIAL DRIVES AND AUTOMATION	EEE	OE-EA	3	0	0	3	NIL
11.		DISASTER RISK MANAGAMENT	CIVIL	OE-EA	3	0	0	3	NIL
12.		MUNICIPAL SOLID WASTE MANAGEMENT	CIVIL	OE-EA	3	0	0	3	NIL
13.		BIOMOLECULES – STRUCTURE AND FUNCTION	PE	OE-EA	3	0	0	3	NIL
14.		PHARMACOGENOMICS	PE	OE-EA	3	0	0	3	NIL

D. COURSES FOR PRESENTATION OF TECHNICAL SKILLS RELATED TO THE SPECIALIZATION									
PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE CREDITS-(15)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		PROJECT WORK	BTE	PI-P	0	0	16	8	NIL
2.		MINI PROJECT	BTE	PI-M	0	0	6	3	NIL
3.		SEMINAR	BTE	PI-S	0	0	2	1	NIL
4.		INTERNSHIP	BTE	PI-IT	3 weeks			3	NIL

E. MANDATORY COURSES									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		YOGA AND MEDITATION	PHED	AC	0	0	2	0	NIL
		ANY OF THE FOLLOWING TWO COURSES							
1.		NCC / NSS / RRC / YRC / STUDENT CLUBS / UNNAT BHARAT ABHIYAN/SWACTH BHARAT	GEN	AC	30 HOURS			0	NIL
2.		SPORTS AND GAMES	PHED	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		GENDER EQUITY AND LAW	LAW	AC	0	0	2	0	NIL

SPECIALIZATION COURSES –NUTRITIONAL BIOLOGY									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		DIET THERAPY	BTE	EC-SE	3	0	0	3	NIL
2.		FOOD COMMODITIES	BTE	EC-SE	3	0	0	3	NIL
3.		NUTRITIONAL BIOCHEMISTRY	BTE	EC-SE	3	0	0	3	NIL
4.		INTRODUCTION TO FOOD SAFETY	BTE	EC-SE	3	0	0	3	NIL
5.		COMMUNITY HEALTH AND NUTRITION	BTE	EC-SE	3	0	0	3	NIL
6.		BASIC DIETETICS	BTE	EC-SE	3	0	0	3	NIL
7.		NUTRITIONAL BIOCHEMISTRY LAB	BTE	EC-SE	0	0	4	2	NIL
8.		DIETETICS LAB	BTE	EC-SE	0	0	4	2	NIL

SPECIALISATION – BIOLOGICAL COMPUTING									
S. No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1		ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	CSE	EC (SE)	3	0	0	3	NIL
2		DATA STRUCTURES	CSE	EC (SE)	3	0	0	3	NIL
3		DATABASE MANAGEMENT SYSTEM	CSE	EC (SE)	3	0	0	3	NIL
4		INTERNET OF THINGS APPLICATIONS	CSE	EC (SE)	3	0	0	3	NIL
5		OBJECT ORIENTED PROGRAMMING	CSE	EC (SE)	3	0	0	3	NIL
6		BIOINFORMATICS TOOLS AND SOFTWARES	CSE	EC (SE)	3	0	0	3	NIL
7		BIOINFORMATICS TOOLS AND SOFTWARES LAB	CSE	EC (SE)	0	0	4	2	NIL
8		DATA STRUCTURES LAB	CSE	EC (SE)	0	0	4	2	NIL
9		OBJECT ORIENTED PROGRAMMING LAB	CSE	EC (SE)	0	0	4	2	NIL

CATEGORY A – FOUNDATION COURSES - HSS, BS AND ES COURSES - CREDITS

(i) HUMANITIES AND SCIENCES (ENGLISH AND MANAGEMENT SUBJECTS) - CREDITS (9-12)

	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 assist students understand the role of thinking in all forms of communication
6	To equip students with employability and job searching skills

COURSE OUTCOMES

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

CO1. Communicate with a range of formal and informal context	Understand
CO2. Students will undergo in activities, demonstrating interaction skills and consider how own communication is adjusted in different scenario	Apply
CO3. Strengthening of oral and written skills in the business context	Apply
CO4. Create interest among the students about a topic by exploring thoughts and ideas	Apply
CO5. Make the students to start with pleasing note and make them to give different ideas	Apply
CO6. Make them in better performance in the art of communication	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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				**M**				**M**	**L**	**S**		**L**			
CO6		**L**		**M**		**L**	**L**			**S**		**S**	**M**	**M**	**S**

S- Strong; M-Medium; L-Low

SYLLABUS

SUBJECT AND VERB AGREEMENT:

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

STRESS:

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

READING SKILLS:

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

CORPORATE COMMUNICATION:

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

CRITICAL READING:

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

TEXTBOOK

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

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.P.Saradha	Associate Professor	English	saradhap@vmkvec.edu.in
2	Mr.S.K.Prem Kishor	Assistant Professor	English	Prem.english@avit.ac.in

	PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT LAB	Category	L	T	P	Credit
		FC (HS)	0	0	2	1

PREAMBLE

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	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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

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,

GRAMMAR & SYNTAX:

Subject verb concord, tenses, Homophones, Homonyms, Spotting errors.

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.

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.

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

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

	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

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

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

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

Telephone Etiquette, Dining Etiquette, Meeting Etiquette, Corporate Etiquette, Business Etiquette.

Case study of Etiquette in different scenario.

Course Designers:

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

	TOTAL QUALITY MANAGEMENT	Category	L	T	P	Credit
		FC (M)	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- (5^{th} 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:

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1	A. Mani	Associate Professor	Management Studies	mani@vmkvec.edu.in
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	PROFESSIONAL ETHICS AND HUMAN VALUES	Category	L	T	P	Credit
		FC (M)	3	0	0	3

PREAMBLE: Ethics is a system of moral principles governing the appropriate coduct of a person or a group. Good Ethics is a fundamental requirement of any profession. Regardless of profession, ethics is an important part of work. The success depend on how the workers and their dealing with the situations ethically or unethically. Professional ethics are as important as personal ethics. Professional ethics encompass the personal and corporate standards of behavior expected by professional. Human values are the features that guide people to take into account the human element when one interacts with other human. They have many positive characters and positive feelings that create bonds of humanity between people and thus have value for all human beings and have the effect of bonding, comforting, reassuring and procuring serenity. They build space for a drive, a movement towards one another, which leads to peace.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the basic concept of Human Values and Ethics.
2. To analyse the common ethical practice in the engineering professionals.
3. To Practice various code of ethics in Engineering.
4. To apply the rights,legal,ethical issues.
5. To practice ethical responsibilities of a professional engineer.

COURSE OUTCOMES:

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

CO1: Understand the moral values that ought to be practiced in engineering profession	Understand
CO2: Analysethe role of ethics in the field of engineering.	Analyse
CO3: Practice the code of ethics and Industrial standards	Apply
CO4: Assess the Safety, Quality Management and Risk analysis	Evaluate
CO5: Apply the skills and knowledgeto handle the contemporary issues.	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	M	L	M	-	-	L
CO2	M	-	-	-	-	S	L	M	L	M	L	M	-	-	L
CO3	M	-	M	L	L	M	-	M	-	-	M	M	L	L	M
CO4	M	M	M	-	M	L	-	M	L	L	L	M	L	M	M
CO5	M	M	M	L	L	-	-	M	L	M	M	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS:

Introduction to Human Values

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy –Self-Confidence–Discrimination -Character – Challenges in the work place -Spirituality –and stress management.

Overview of Engineering Ethics

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics- Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Types of Inquiry – Engineering and Ethics-Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma.Case study: Choice of the theory.

Engineering as Social Experimentation

Engineering as Experimentation – Engineering Projects VS. Standard Experiments - Engineers as responsible Experimenters – Learning from the Past- Codes of Ethics – anticorruption-A Balanced Outlook on Law.

Safety, responsibilities and rights

Safety and Risk – Assessment of Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk - Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Responsibilities- Professional Rights – Employee Rights – Intellectual Property Rights

(IPR) – Discrimination

GLOBAL ISSUES

Transnational and MNC corporations-Environmental Ethics-Computer Ethics-computers as the instrument of Unethical behaviour-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics - Weapons development and – Corporate Social ResponsibilityCase Studies

TEXT BOOK:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. R.S. Nagarajan, A Text Book on Professional Ethics and Human Values, New Age International (P) Limited, Publishers,2006

REFERENCES:

1. CharlesD.Fleddermann,"EngineeringEthics",PearsonEducation/PrenticeHall,NewJersey, 2004
2. CharlesEHarris,MichaelS.ProtchardandMichaelJRabins,"EngineeringEthics–Concepts and Cases",WadsworthThompsonLeatning, United States,2000
3. John R Boatright, "EthicsandtheConductofBusiness", PearsonEducation,NewDelhi,2003.
4. EdmundGSeebauerandRobertLBarry,"FundamentalsofEthicsforScientistsandEngineers", Oxford Press, 2000
5. R.Subramanian,"ProfessionalEthics",Oxford University Press ,Reprint ,2015.

COURSE DESIGNERS:

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	MANAGEMENT PRINCIPLES FOR ENGINEERS	Category	L	T	P	Credit
		FC (M)	3	0	0	3

PREAMBLE:

From the knowledge of management principles managers get direction on how to manage an organization. The management principles enable managers to decide what should be done to accomplish given tasks and to handle situations which may arise in management.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1) To enable the students to study the evolution of Management.
2) To study the functions and principles of management.
3) To learn the application of the principles in an organization.
4) To enable the effective and barriers communication in the organization.
5) To study the system and process of effective controlling in the organization.

COURSE OUTCOMES:

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

CO1:Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, and have same basic knowledge on international aspect of management	Analyze
CO2: To understand the planning process in the organization	Create
CO3:To understand the concept of organization	Understand
CO4:Demonstrate the ability to directing ,leadership and communicate effectively	Apply
CO5: To analysis isolate issues and formulate best control methods.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

PLANNING

Nature and purpose of planning – planning process – types of planning – objectives – setting -Objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

ORGANISING

Nature and purpose – Formal and informal organization – organization chart – organization structure– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

DIRECTING

Foundations of individual and group behavior – motivation – motivation theories – motivational - Techniques – job satisfaction – job enrichment – leadership – types and theories of leadership –Communication – process of communication – barrier in communication – effective communication – communication and IT.

CONTROLLING

System and process of controlling – budgetary and non-budgetary control techniques – use of Computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

Text Books:

1. Stephen P. Robbins & Mary Coulter, "Management", 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.

Reference Books:

1 .Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

COURSE DESIGNERS:

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	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY	Category	L	T	P	C
		FC (M)	3	0	0	3

PREREQUISITE – Nil

COURSE OBJECTIVES

1	1. Development of a holistic perspective based on self- exploration
2	2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3	3. Strengthening of self-reflection.
4	4. Development of commitment and courage to act.
5	1. Development of a holistic perspective based on self- exploration

Syllabus

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.

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

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

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.

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

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(ii) BASIC SCIENCES (MATHS, PHYSICS AND CHEMISTRY SUBJECTS) - CREDITS (18 -2)

	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: -

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

	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

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.

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

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

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	PHYSICAL SCIENCES PART-B - ENGINEERING CHEMISTRY (Common to all Branches)	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	PSO 1	PSO 2	PSO 3
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

WATER TECHNOLOGY

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.

ELECTROCHEMISTRY, CORROSION AND BATTERIES

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)

FUELS AND COMBUSTION

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:

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2	Dr. R. Nagalakshmi	nagalakshmi.chemistry@avit.ac.in

	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

CO6. Recognize the importance of units while performing the experiments, calculating the physical parameters and obtaining results	Understand
CO7. Operate the equipments with precision	Apply
CO8. Practice to handle the equipments in a systematic manner	Apply
CO9. Demonstrate the experiments through virtual laboratory	Apply
CO10. 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				
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	PHYSICAL SCIENCES PART B - ENGINEERING CHEMISTRY LAB (Common to All Branches)	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	PO 2	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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1.	Dr.R.Nagalakshmi	nagalakshmi.chemistry@avit.ac.in
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	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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	SMART MATERIALS Total Contact Hours: 45 Prerequisite: Physical Sciences	CATEGORY	L	T	P	C
		FC (BS)	3	0	0	3

PREAMBLE

Smart Materials gives an outlook about various types of materials having potential application in Engineering and Technology. In particular, Students learn about Properties of Crystalline Materials, Smart Materials and Nanomaterials, and their industrial applications, characteristics and industrial applications of Magnetic and Superconducting materials.

COURSE OBJECTIVES:

1	To impart the basic properties of different materials.
2	To understand the structure of crystalline materials.
3	To understand the properties of smart materials and realize its industrial applications.
4	To learn the synthesis of Nano materials and carbon nanotubes.
5	To learn the properties, classification and relevant applications of magnetic materials.
6	To understand the concept of superconductivity, properties of super conductor and their industrial applications.

COURSE OUTCOMES:

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

CO1	understand the basic properties of various materials.	Understand
CO2	learn the structure of Crystalline Materials	Apply
CO3	gain the basic knowledge and recognize the applications of Smart Materials	Apply
CO4	get an exposure about the properties of Nano materials	Apply
CO5	gain the knowledge about the properties of magnetic materials and familiarize their applications.	Apply
CO6	gain the knowledge about Superconducting materials	Apply

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

CRYSTALLINE MATERIALS

Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures – determination of interplanar distance (d).

SMART MATERIALS

Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application – SMA in Actuators and Blood clot filters, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and industrial applications (Core of the Transformer).

NANO MATERIALS

Nanophase materials – Top-down approach - Mechanical Grinding - Lithography - Bottom-up approach – Sol-gel method – Carbon nanotubes – Fabrication – applications; Chemical Sensors.

MAGNETIC MATERIALS

Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials – Applications of Magnetic materials (Magnets in Generators and MRI scan).

SUPER CONDUCTING MATERIALS

Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High Tc Superconductors – Industrial Applications of superconductors (SQUID, Cryotrons and Maglev Trains).

TEXT BOOKS

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2015.
2. A.K. Katiyar and C.K. Pandey, Engineering Physics Theory and Practical, Wiley Publisher, 2015.

REFERENCES

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, 2

COURSE DESIGNERS

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2.	Dr. R. N. Viswanath	Professor	Physics	rnvishwanath@avit.ac.in
3.	Dr. B. Dhanalakshmi	Associate Professor	Physics	dhanalakshmi.phys@avit.ac.in

	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:

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

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.

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

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.
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**
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2	Dr G. SURESH	Asso. Professor	Physics	suresh.physics@avit.ac.in
3	Dr. R. N. VISWANATH	Professor	Physics	rnviswanath@avit.ac.in

	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

COURSEOBJECTIVES

1	To understand the basic structure and properties of carbohydrate, lipids, aminoacids 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.

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentswillbeableto

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 aminoacids, proteins and Nucleic acids.	Understand
CO4. Prepare solutions and biological buffers	Apply
CO5. Determine the quality and quantity of biomolecules	Analyze

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

Biological importance, Nomenclature and Definition, Classification and Properties of Monosaccharides, Formulation of monosaccharides, Disaccharides, Oligosccharides and Polysaccharides (Homopolysaccharide sand Heteropolysaccharides).

LIPIDS

Biological importance, Definition and Classification. Fattyacids: classification, nomenclature, structure and properties of saturated and unsaturated fattyacids. Essential fattyacids, Triacylglycerols: nomenclature, physical properties, chemical properties.

AMINOACIDS 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-Crickmodel), Nucleoproteins–histone and non-histone.

VITAMINS & MINERALS

Nutritional importance of vitamin, classification, source, daily requirements and functions, Deficiency symptoms – hypervitaminosis of fat soluble vitamins. Nutritional importance of Minerals – classification, source, daily requirement and deficiency symptoms.

PRACTICAL'S

1. pH measurements and Buffer preparations.

TITRIMETRICEXPERIMENTS

2. Determination of Saponification value of Edible oil
3. Determination of Iodine value of Oil
4. Determination of Acid number of Edible oils.

BIOCHEMICALPREPARATIONS

5. Casein from Milk.
6. Starch from Potato.

TEXTBOOKS

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

REFERENCES:

1. "TextBook 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.

COURSEDESIGNERS

S.No.	NameoftheFaculty	Designation	Department	MailID
1	Dr.S.Anandakumar	Assistant Professor	Biotechnology	anandakumars@vmkvec.edu.in
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	MICROBIOLOGY	Category	L	T	P	Credit
		FC (BS)	3	0	0	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 and their control.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To describe about the evolution of microorganisms and microscopy.
2	To Explain the Structure and replication in microorganisms – concepts.
3	To interpret the effects of Microbes in food and the clinical importance of microorganisms.
4	To learn about viruses that are life threatening to mankind such as covid-19, Influenza virus, Nipah virus,
5	To outline the requirements of Microbial nutrition for growth of microorganisms and the impact of environment on its growth.

COURSE OUTCOMES

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

CO1. 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. Demonstrate the microorganism have an indispensable role in the environment	Apply
CO5. Categorize the role of microorganisms in environmental 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	M	L	M	-	-	-	-	-	-	-	-	-	-	-
CO2	S	L	M	M	-	-	-	-	-	-	-	-	M	-	-
CO3	S	S	M	S	-	-	-	-	-	-	-	-	-	-	-
CO4	S	S	S	S	-	-	M	-	-	-	-	-	-	M	S
CO5	M	M	M	M	-	-	M	-	-	-	-	M	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

WORLD OF MICRORGANISMS AND MICROSCOPY

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

STRUCTURAL ORGANISATION OF MICROORGANISMS

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

MICROBIAL GROWTH AND NUTRITION

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

FOOD AND CLINICAL MICROBIOLOGY

Food spoilage and poisoning, Pandemic microorganisms- Corona virus, Influenza virus, Nipah virus and their effects on infections, Formation of toxic materials by microorganisms and their role in clinical microbiology.

CONTROL OF MICROORGANISMS

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, antifungal and anti-viral agents; mode of action and resistance to antibiotics; Vaccine production and its types.

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. 5thEdn.
3. Frazier, W.S. and Weshoff, D.C., 1988. Food Microbiology, 4thEdn., McGraw Hill Book Co., New York.
4. George, J.B., 1987. Basic Food Microbiology. CBS Publishers and Distributors.
5. James, M.J., 1987. Modern Food Microbiology. CBS Publishers and Distributors.

COURSE DESIGNERS

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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

	MICROBIOLOGY LAB	Category	L	T	P	Credit
		FC (BS)	0	0	4	2

PREAMBLE

This course includes preparing stained smears, culturing microorganisms, conducting immunology experiments, performing tests to identify bacteria and fungi, and studying microbial growth control.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	Describe the safe practices in a microbiology laboratory and handling method of glass wares and instruments.
2	Perform various cells staining techniques.
3	Demonstrate proper usage, identify the parts/functions of the following microscopes
4	Perform transfer of living microbes using aseptic technique.
5	Differentiate the microbes enumerated from various environments.

COURSE OUTCOMES

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

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

S- Strong; M-Medium; L-Low

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. Isolation, Enumeration and Purification of Microbes from a given sample.
5. Preservation of Bacterial Culture.
6. Examination of quality of milk – Methylene blue test
7. Identification of Microorganisms
   a. Staining techniques-Simple-Gram-Spore-Hanging drop
   b. Biochemical identification
7. Quantification of microorganisms Microscopy
   a. Serial dilution and plating
8. Environmental Sample Analysis-.MPN Test
9. Food Microbiology
   -Milk
   -Fermented food

10. Antibiotic Sensitivity Assay

REFERENCES:

1. Cappuccino, J. G. and Sherman, N., 1999. Microbiology: A laboratory Manual. 4th Edition, Addison - Wesley.
2. Collee, J. G., et al., 1996. Mackie and McCartney Practical Medical Microbiology. 4th Edition, Churchill Livingstone.
3. Sundararaj, T., 2007. Microbiology laboratory manual. A swathy Sunndararaj.
4. Laboratory Manual

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

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.

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.

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.

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.

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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2.	A. Gilbert Sunderraj	gilbertsunderraj@vmkvec.edu.in

(iii) ENGINEERING SCIENCES (BASIC ENGINEERING COURSES) - CREDITS (18-24)

	FUNDAMENTALS OF BIOTECHNOLOGY	Category	L	T	P	Credit
		FC (ES)	3	0	0	3

PREAMBLE

Biotechnology is the Combination of biological sciences and engineering in order to understand and improve the lifestyle of living organisms. Bioprocesses and pathways, living microorganisms, plant and animal cells and/or cellular materials are exploited to develop new expertise. Advanced tools and technologies developed by biotechnologists are used in research and development, healthcare, agriculture, and the industry to further enhance organisms and bioprocesses. Fundamental principles of genetic engineering, rDNA technology helps to produce commercial manufacture of new recombinant DNA derived products.

PREREQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Knowledge about fundamental principles about biotechnology.	Understand
CO2. Acquired good knowledge on genetically modified products in food andagricultural field.	Understand
CO3. Understand in detail about the applications of genetically modifiedanimals in research and development	Understand
CO4. Apply the knowledge of biotechnology to improve Marine environment.	Apply
CO5. Analyzing in detail about the performance of drugs produced by novelmethods	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	M	L	-	-	-	-	-	-	-	-	L	-	-
CO2	S	M	M	L	-	-	S	-	-	-	-	L	L	-	L
CO3	S	S	M	S	-	-	M	-	-	-	-	L	S	S	S
CO4	S	S	S	M	S	-	M	-	-	-	-	M	S	S	S
CO5	S	M	M	S	M	-	M	-	-	-	-	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

SCOPE AND INTRODUCTION TO BIOTECHNOLOGY :

Scope of Biotechnology. Branches of Biotechnology: Conventional and Modern Biotechnology – Biotech industries. Biotechnology Tree. Biotech Policy Initiatives Biotechnology in context of Developing World Strategies of gene cloning

TOOLS IN BIOTECHNOLOGY:

Molecular Scissors, Vectors, PCR, ELISA, FACS, FISH, Chromatography, Electrophoresis, Cell culture techniques

MARINE ENVIRONMENTAL BIOTECHNOLOGY

Marine pollution-major pollutants (heavy metal, pesticide, oil, thermal, radioactive, plastics, litter and microbial); Biological indicators (Marine microbes, algae and crustaceans). Biodegradation of natural and synthetic waste materials; Bioremediation; Separation and bio removal of pollutants.

INDUSTRIAL BIOTECHNOLOGY

Industrial Enzyme production: α-amylase, cellulase, protease and lipase, Recombinant protein production: Insulin and interferon, Antibiotic production: Penicillin- Synthetic and Semi synthetic and Bacitracin (Novartis and Genetech), Clinical Diagnosis using electronic devices (Glucometer, Biosensor).

APPLICATION IN BIOTECHNOLOGY

Biofertilizers. Biopesticides. Biorepellants. Pest control and management. Biomass (SCP). Bioplastics. Bioweapons. Bio dyes, Bio fuels – Biodiesel & Biogas. Bioindicators. Biodegradation- Role of GMO's, Genetically Modified Food – Bovine somatotropin, alpha lactalbumin & lactoferrin in milk, Edible vaccine (Cholera vaccine –potatoes & Hepatitis B vaccine - maize). Rice, Flavr – Savr Tomato, Bt- potatoes, BT Cotton and BT Brinjal

TEXT BOOKS

1. Gupta, P.K., "Elements of Biotechnology", Rastogi Publications, 2nd Edition, 2010.
2. Satyanarayana.U., "Biotechnology", Books and Allied Pvt Ltd., 2005.
3. Environmental Biotechnology and cleaner Bioprocess – Olguni, E.J. et al., 2000
4. Environmental Biotechnology Theory and applications – Evans et al., 2000.
5. Principles of Gene Manipulation Old & Primrose, (1989), 3rd edition

REFERENCES

1. John E. Smith., "Biotechnology", Cambridge Press. 3rd Edition, 2005.
2. Glazer A and Nikaido H., "Microbial Biotechnology - Fundamentals of Applied Microbiology",Cambridge University Press, 2nd Edition, 2007.
3. Jogdand S.N., "Environmental Biotechnology", Himalaya Publishing House, 2003.
4. Kumar H.D., "Modern Concepts and Biotechnology", Vikas Publishing House Pvt. Ltd, 1998.
5. R.C. Dubey., "Textbook of Biotechnology", S. Chand Publishing., 2001.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor&Head	Biotechnology	sridevi@vmkvec.edu.in
2	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in

	FOUNDATIONS OF COMPUTING AND PROGRAMMING(THEORY AND PRACTICALS)	Category	L	T	P	Credit
		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

	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.

COURSE OUTCOMES

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

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

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.

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

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

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
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	PYTHON PROGRAMMING (THEORY AND PRACTICALS)	CATEGORY	L	T	P	CREDIT
		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	PO 12	PSO 1	PSO 2	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

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	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 theelectrical 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	PSO 3
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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3	Ms. D. Saranya	Assistant Professor (Gr-II)	EEE/AVIT	dsaranya@avit.ac.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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1	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
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4	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	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

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1	Dr. R. Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in
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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	1

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

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4	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	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
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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
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%20Micromachining%20laboratory
2	Casting	http://fabcoep.vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Engineering&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

CATEGORY B – CORE COURSES RELEVANT TO THE PROGRAMME - CREDITS (48-54)

	CELL AND MOLECULAR BIOLOGY (THEORY & PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

Cell and Molecular biology deals with the structures, organization and functions of the cells and organelles, their physiological properties, life cycle, metabolic processes, signalling pathways and their interactions with their environment at microscopic and molecular level. It gives in-depth knowledge of basic principles and Structure of DNA, RNA, DNA Replication, Transcription and Translation. The paper starts with the basic organization of the genome in prokaryotes and eukaryotes along with their discerning features. This is followed by chapters on prokaryotic and eukaryotic replication, transcription, translation processes.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, and the concepts behind cell division.
2	Students will understand how these cellular components are used to generate and utilize energy in cells and To give an overview of cell signaling molecules and their receptors.
3	To describe on Nucleic acids, structure, their characteristics and organization, biological importance, replication process etc.
4	Estimate the nucleic acids- RNA / DNA.
5	Acquire laboratory skills in techniques such as micro pipetting, spectrophotometry and electrophoresis.

COURSE OUTCOMES

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

CO1. Differentiate fundamental features of prokaryotic and eukaryotic cells, their structure, composition and role of cell membranes and the major stages of the cell cycle	Understand
CO2. To illustrate about secondary messengers and signal transduction.	Understand
CO3. Discuss and distinguish the replication of prokaryotic and eukaryotic DNA	Understand
CO4. Quantify the nucleic acids	Understand
CO5. Illustrate the enzymatic action on nucleic acids & proteins	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	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	-	-	M	-	-	-	-	-	-	-	-	-	-	-
CO3	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-
CO4	M	M	-	M	-	-	-	-	-	-	-	-	M	-	-
CO5	S	M	-	-	-	-	-	-	-	-	-	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

CELL STRUCTURE AND FUNCTION OF THE ORGANELLES & CELL DIVISION

Prokaryotic, Eukaryotic cells, Sub-cellular organelles and functions. Principles of membrane organization, Extra cellular matrix, cell-cell junctions. Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle

TRANSPORT ACROSS CELL MEMBRANE & SIGNAL TRANSDUCTION

Passive and Active Transport, Permeases, Ion channels, ATPase pumps. Na^+ / K^+ / Ca^{+2} T pumps, uniport, symport antiporter system. Agonists and Antagonists. autocrine / paracrine / endocrine models, Secondary messengers molecules

SIGNAL TRANSDUCTION PATHWAYS

Signal amplification – Different models of signal amplifications, secondary messengers & its role in signal transduction, Phosphorylation of protein kinases

REPLICATION, TRANSCRIPTION AND TRANSLATION

Replication in prokaryotes and eukaryotes – Different modes of replication, Inhibitors of replication. Structure and function of mRNA, rRNA and tRNA, Exon, Intron, Transcription in prokaryotes and eukaryotes, Inhibitors, Post transcriptional modifications, Reverse transcription. Genetic code and its features, Wobble hypothesis and its importance. Translation mechanism and regulation.

REGULATION OF GENE EXPRESSION

Organization of genes in prokaryotic and eukaryotic chromosomes, Regulation of gene expression with reference to λ phage life cycle. Gene regulation – Operon concept

PRACTICALS

1. Isolation of Cell organelles.
2. Cell staining and counting - Leishman staining, Tryphan blue assay
3. Isolation of Bacterial Genomic DNA
4. Isolation of plant Genomic DNA
5. Agarose gel electrophoresis
6. Quantification of RNA / DNA

TEXT BOOKS:

1. De Robertis E.D.P and De Robertis E.M.F, "Cell and Molecular Biology", 8th Edition, Lippincott Williams & Wilkins, New York, USA, 2001.
2. Harvey Lodish, Arnold Berk, Chirs A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, HiddePloegh and Paul Matsudaira, "Molecular Cell Biology", 6th Edition, W. H. Freeman and Company, New York, 2008.
3. Freifelder, D., "Molecular Biology", 2nd Edition, Narosa Publishing House, 1999.
4. Benjamin L., "Genes IX" Jones and Bartlett, 2008.
5. Jeremy M. Berg, John L. Tymoczko and LubertStryer, 2002 "Biochemistry". 5th Edition. W.H. Freeman and Company.

REFERENCES:

1. Alberts B, A Johnson, J Lewis, M Raff, K Roberts and P Walter, "Molecular Biology of the Cell", (4th Edition) New York: Garland Science, 2002.
2. Kimball, T.W., "Cell Biology', Addision Wesley Publishers, 1989.
3. Geoffrey M. Cooper and Robert E. Hansman, "The Cell: A Molecular Approach", ASM Press and Sinauer Associates Inc., USA, 4th Edition, 2007.
4. James Watson et al., 1987. Molecular Biology of Gene. The Benjamin / CummingsPublication Co. Inc., California.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@ vmkvec.edu.in
2	Dr.A.Nirmala	Assistant Professor(Gr-II)	Biotechnology	Nirmalabt@avit.ac.in

	CLASSICAL AND MOLECULAR GENETICS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

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

PREREQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Recallthe development of genetic concepts, the differences between transmission genetics, molecular genetics and classical genetics	Remember
CO2. Explain the genetic data to determine the modes of inheritance, linkage and predict outcomes in future generations	Understand
CO3. Illustrate the various theories of how new species form and the molecular role of inheritance.	Apply
CO4. Determine the factors that play a role in the process of disease development and understand the genetic basis of evolutionary change.	Apply
CO5. Explain about various genetic transfer methods	Apply

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	S	M	S	M	M	-	-	-	-	-	-	-	-	-
CO3	S	M	S	M	M	-	-	-	-	-	-	-	-	M	-
CO4	M	S	M	S	-	-	-	-	-	-	-	-	M	-	-
CO5	M	-	M	M	-	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF GENETICS & GENES

Classical genetics, Mendelian laws, Patterns of Inheritance for Monogenic Traits: Autosomal inheritance-dominant, recessive, sex-linked inheritance, sex-limited and sex- influenced traits and mitochondrial inheritance.

Fine structure of genes, Gene as the unit of expression, Control sequences - promoter, operator, terminator and attenuator.

KARYOLOGY

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

ALLELES

Classical concept of allelomorphs, Multiple alleles, Sex linkage in Drosophila, Sex determination in Human beings, X and Y linked inheritance, Colour blindness, Haemophilia, Blood group antigens.

LINKAGE AND CROSSING OVER

Coupling and repulsion – Hypothesis, Test cross in maize and Crossing over, Sex chromosomes, Inherited immunodeficiency, Linkage, Crossing over and Genetic mapping of chromosomes.

MICROBIAL GENETIC TRANSFER

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

TEXT BOOKS:

1. Gardner, Simmons and Snustad, Principles of genetics, John wiley and Sons, inc. New York. 8th Edition, 2005
2. Verma, P.S. and Agarwal, V.K., Genetics. S. Chand Publication, 2005.
3. Robert H. Tamarin, Principles of Genetics, 7th Edition, Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. David Freifelder., Microbial Genetics, Narosa Publishing House, New York, New Delhi, 2nd Edition, 2001.
2. Stanly R. Maloy, John E. Cronan and David Freifelder, Jr., 2006. Microbial Genetics. Narosa Publishing House.
3. Brown, T. A. Genetics – A Molecular Approach.2011.
4. Snustad, D. P., 2008. Principles of Genetics. 6th Edition., John Wiley & Sons
5. Simmons S 2006, Principles of genetics, 4th Edition, John Wiley & Sons (Asia) Pte Ltd. New Jersey.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@ vmkvec.edu.in
2	Dr.R.Balachandar	Assistant Professor GII	Biotechnology	balachandar.biotech@avit.ac.in

	UNIT OPERATIONS IN PROCESS INDUSTRIES	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

In the Engineering related fields, a unit operation is a basic step in a process. Unit operations involve a physical change (or) a chemical transformation such as separation, crystallization, evaporation, filtration, polymerization, isomerization, and other reactions. For example, in milk processing, homogenization, pasteurization, and packaging are each unit operations which are connected to create the overall process. A process may require many unit operations to obtain the desired product from the starting materials, or feedstocks. Knowledge of various unit operation principles will enable students to understand to work in any biotechnology industries.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To describe the knowledge about the various modes of heat transfer.
2	To Carry out the stress analysis calculations for various forces on a body
3	To outline about the heat exchanger and its operation
4	To discuss about the fluids, types and its measurement.
5	To evaluate the drying and other mechanical separation processes and its role in industries

COURSE OUTCOMES

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

CO1. Describe about basic concepts of various models of heat transfer, radiation, convection and black bodies and its application.	Understand
CO2. Practice the usage of heat exchanger, evaporators and its application	Apply
CO3. Demonstrate the nature, properties of the fluids and its measurement.	Apply
CO4. Categorize about drying, mechanical separation techniques and its applications	Analyze
CO5. Evaluate various unit operations and heat transfer equipment in chemical and biochemical industries.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

CONDUCTION, CONVECTION AND RADIATION

Modes of Heat Transfer – Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders; Insulation, Critical Thickness of Insulation, individual and Overall Heat transfer Coefficient, Convection – Dimensional Analysis – Forced Convection and Natural convection – Boiling and condensation, Concept of Radiation, Laws of Radiation, Grey & Black Bodies

PARTICLE CHARACTERISTICS, SIZE ANALYSIS AND SIZE REDUCTION

Introduction: General characteristics of solids, their behaviour under different external forces, agglomeration techniques for size analysis, Mohr's stress circle, flow of solids in conduits, Laws of size reduction, classification of equipment, methods of size reduction

HEAT EXCHANGER

Heat Exchanger – Types of Heat Exchangers – Types of Flows, LMTD, Fouling Factor, NTU concept, Types of Evaporators – Calculation for Single and Multiple Effects.

FLUID MECHANICS

Introduction – Nature of Fluids, Properties of Fluids, Types of Fluids, Fluid Statics, Pressure measurement, Measurement of Fluid flow – Venturimeter, orifice meter, rotameter, Fluidization – Mechanism, types and its applications

DRYING AND MECHANICAL SEPARATION

Drying – Air properties – Drying Equipment – Drying Rates and Drying time. Classification of Mechanical Separation processes, Solid Liquid Separation – Filtration – Constant Pressure, Constant Volume, Batch and Continuous Filtration – Industrial Filter, Centrifugal Separation, Settling and Sedimentation.

TEXT BOOKS:

1. Warren McCabe, Julian Smith, Peter Harriott, 2005.Unit Operations of Chemical Engineering 7th Ed., McGraw Hill Inc., New York.
2. C.J. Geankoplis, 2003.Transport Processes and separation Principles: Includes Unit Operations, 4th Ed., Prentice-Hall Inc., New Jersey
3. Fluid Mechanics by K L Kumar, S Chand & Company Ltd

REFERENCES:

1. R.E. Traybal, Mass Transfer Operations, 3rd Ed, McGraw-Hill, New York, 1981.
2. Frank P. Incropera, David T. Dewitt, Theoder l. Bergman. 2013. Fundamentals of Heat and Mass Transfer and Interactive Heat Transfer. *John Wiley & Sons.*
3. Gavahane.K. A. 2011 Heat and Mass Transfer. Vol. II. Nirali Prakashan

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Associate professor	Biotechnology	nirmala@vmkvec.edu.in
2	Ms.Subathra	Assistant Professor	Biotechnology	subathra.biotech@avit.ac.in

	ADVANCED BIOCHEMISTRY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Advanced Biochemistry uses the knowledge and understanding gained in the prerequisite course and provides understanding of metabolism of macromolecules like carbohydrate, amino acid, lipids and nucleic acid. This course also highlights the process of Biological oxidation involved in the energy production by burning the food materials and give awareness to the various diseases associated with the errors of metabolism of the biomolecules.

PREREQUISITE - FUNDAMENTALS OF BIOCHEMISTRY

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Explain the metabolic pathways of carbohydrates, amino acids, nucleic acids and	Understand
CO2. Describe the causes of metabolic disorder	Understand
CO3. Examine the importance of molecules derived from amino acids	Apply
CO4. Illustrate the Integration of energy metabolism of macromolecules	Apply
CO5. Infer the bioenergetics and oxidative phosphorylation concepts	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	-	-	-	-	-	-	-	-	-	-	-
CO2	M	-	M	M	-	-	-	-	-	-	-	-	M	M	-
CO3	S	S	M	-	M	-	-	-	-	-	-	M	-	M	-
CO4	S	-	-	M	-	-	-	-	-	-	-	-	-	-	-
CO5	M	M	-	M	-	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

CARBOHYDRATE METABOLISM

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

AMINO ACID METABOLISM

Introduction-Metabolism of amino acids- Transamination- Deamination-Metabolism of ammonia-Urea Cycle-Biosynthesis and degradation of amino acids- Gly, Ser and Cys;, aromatic amino acids. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4). Amino acid disorder - Alkaptonuria, Albinism, Phenylketonuria, Gout, Cystinuria.

FATTY ACID METABOLISM

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

NUCLEIC ACID METABOLISM

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

deficiency.

INTEGRATION OF METABOLISM & OXIDATIVE PHOSPHORYLATION

Integration of major Metabolic pathways of energy metabolism, Organ specialization and metabolic integration, metabolism in starvation. Introduction-Bioenergetics, High energy compounds, Biological Oxidation-Electron transport chain, Oxidative phospholyration, Shuttle pathway – Glycerol phosphate Shuttle, Malate aspartate Shuttle.

TEXT BOOKS:

1. Principles of Biochemistry by Lehninger, D.L., Cox, M.M., McMillan Publishers (2008) 4th edition
2. Biochemistry by Stryer, Lubert. W.H Freeman & Co., (2000) 4th edition.
3. Fundamentals of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W., John Wiley & Sons (2008), 3rd edition Pratt.

REFERENCES:

1. Fundamentals of Biochemistry by Jain, J L, Jain, Nitin, Sunjay Jain, S. Chand Group, ISBN: 8121924537
2. Text book of Biochemistry by Sathyanarayana, U. and Chakrapani, U., 2006, 3rd Edition, Uppala Author Publishers Interlinks.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.Anandakumar	Assistant Professor	Biotechnology	anandakumar@vmkvec.edu.in
2	Dr.A.Nirmala	Assistant Professor (Gr-II)	Biotechnology	Nirmalabt@avit.ac.in

	ADVANCED BIOCHEMISTRY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

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

PREREQUISITE- NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Amino acids.
3. Qualitative Analysis of Lipids.
4. Estimation of Glucose by O-toludine method.
5. Estimation of Protein by Lowry's Method
6. Estimation of Cholesterol by Zak's method.
7. Estimation of urea DAM method.
8. Estimation of Hemoglobin.
9. Separation of plant pigments by column chromatography (Demo).
10. Demonstration of Thin layer chromatography

REFERENCES:

1. Laboratory Manual.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor and Head	Biotechnology	sridevim@vmkvec.edu.in
2	Dr.A.Nirmala	Assistant Professor(Gr-II)	Biotechnology	Nirmalabt@avit.ac.in

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

PREAMBLE

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

PREREQUISITE : NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1Discuss about the chemistry of living cells	Understand
CO2Describe the Proximity effects in organic chemistry, molecular recognition and the supramolecular systems - concepts	Understand
CO3Generalize the importance of enzyme catalysis in the living cells.	Apply
CO4Employ the various reactions of metal ions in proteins and biological molecules	Apply
CO5Use the knowledge of designing in molecular cleft and enzymes	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	-	-	-	-	-	-	-	-	L	L	L	L
CO2	M	M	M	M	-	-	-	-	-	-	-	-	L	M	L
CO3	S	M	M	S	-	-	-	-	-	-	-	M	L	L	M
CO4	M	L	M	-	-	-	-	-	-	-	-	-	M	M	L
CO5	M	M	S	M	L	-	-	-	-	-	-	M	M	S	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIO-ORGANIC CHEMISTRY

Basic Considerations - Proximity effects in Organic chemistry -Molecular recognition and the supramolecular systems

BIO - ORGANIC CHEMISTRY OF AMINO ACIDS ANDPEPTIDES

Chemistry of living cells, Analogy between organic reactions and Biochemical Transformations, Chemistry of the peptide bond, Asymmetric synthesis of amino acids - Retrosynthetic analysis, Transition state analogues.

ENZYME CHEMISTRY

Introduction to catalysis - Mutifunctional, Acid - base and Covalent catalysis, Introduction to enzymes - Chymotrypsin, Pyruvate dehydrogenase, Ribonuclease, Lysozyme, Enzymes in synthetic organic chemistry, Design of molecularclefts.

ENZYME MODELS

Host guest Complexation chemistry - Cyclodextrin, Development in Crown ether chemistry - Azo Crown ethers and Lariat Crown ethers, Enzyme design using steroid templates -, Co - enzyme chemistry- NAD, NADP, FAD and pyridoxal phosphate.

METAL IONS IN BIOLOGICAL SYSTEMS

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

TEXT BOOK

1. Zubay, G., 1987. Biochemistry. 2nd Edn., Maxwell Macmillan International Editions.

2. Dugas, H., 1989. Bio-organic Chemistry - A Chemical Ap-proach to Enzyme Action. Springer Verlag.3. David Van

3. Vranken, Gregory A. Weiss., 2012. Introduction to Bioorganic Chemistry and Chemical Biology. (1st Edition) New York: Garland Science.

REFERENCE BOOKS

1. Mathew, Van Holde and Athern, 2000. Biochemistry. Pearson Publishers Ltd.

2. Page, M. I. and Williams, A., 1997. Organic and bio-organic mechanisms. Pearson India Edition.

3. Ariya, K. and Kumtake T., 2006. Supramolecular chemistry: Fundamentals and applications. Springer India Edition.

4. Palmer, Trevor, 2004. Enzymes: Biochemistry, biotechnology, clinical chemistry. East - West Press Pvt. Ltd.

5. Fersht, Alan, 1998. Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding. W. H. Freeman.

COURSE DESIGNER

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
1	Dr.S.Anandakumar	Assistant Professor	Biotechnology	anadakumars@vmkvec.edu.in
2	Ms.Subathra	Assistant Professor	Biotechnology	subathra.biotech@avit.ac.in

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

PREAMBLE

The purpose of teaching Bioorganic Chemistry is a fundamental science and has contributed immensely to the improvement of the life of human beings by providing many of human requirements and essentialities. The developments in Bioorganic Chemistry during last few decades are phenomenal. It is also seen that these developments are crossing the traditional vertical boundaries of scientific disciplines; the more inclination is seen towards biological sciences. The practice of Bioorganic Chemistry at industrial scale also is undergoing radical changes and is more or more based on deep understanding the phenomena.

PREREQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Describe about the basic bioorganic chemistry	Understand
CO2. Illustrate the importance of measurements and units in bioorganic reaction procedures	Apply
CO3. Estimate the basics steps involved in the synthesis of various bioorganic substances	Analyze
CO4. Evaluate their understanding skills in the inter-conversions	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

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

REFERENCES:

1. Laboratory Manual.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.Anandakumar	Assistant Professor	Biotechnology	anadakumars@vmkvec.edu.in
2	Ms.Subathra	Assistant Professor	Biotechnology	subathra.biotech@avit.ac.in

	BIOINSTRUMENTATION (THEORY & PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

The Bioinstrumentation course acts as to link between academics and industry. Knowledge gained in this course applied on varies fields in biotechnology industry. The techniques studied in this course include principle, instrumentation and its applications.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To discuss about various instruments used in biotechnology.
2	Describe in detail about the molecular spectroscopy techniques.
3	To summarize about different separation and purification techniques used in biotechnology field
4	To interpret the thermal analysis concepts and their use.
5	To understand the basic concepts of Radioisotopes techniques and their uses.

COURSE OUTCOMES

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

CO1. Discuss about basic principles and instruments in biotechnology.	Understand
CO2. Explain about spectroscopy techniques in biotechnology.	Understand
CO3. Demonstrate purification techniques in biotechnology.	Apply
CO4. Identify the bimolecular structure by thermal analysis	Analyze
CO5. Able to analyse the biological molecules using radio isotopes.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO1	PO2	PO3	PO4	P	P	PO	PO	PO9	PO10	PO11	PO12	PSO1	PSO	PSO
CO	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO	S	M	L	L	-	-	-	-	-	-	-	-	L	-	-
CO	S	L	M	S	-	-	-	-	-	-	-	-	M	M	-
CO	M	M	M	-	-		-	-	-	S	S	M	M	-	-
CO	-	M	M	-		-	-	-	-	-	S	-	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF BIOINSTRUMENTION

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

MOLECULAR SPECTROSCOPY

General design and components of spectroscopy, Principles, Instrumentation and applications of colorimetry, UV – Visible – IR- Raman spectroscopy –NMR spectroscopy

SEPERATION AND PURIFICATION TECHNIQUES:

Basic concepts of chromatography, Paper and column chromatography, Ion exchange, Size exclusion, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC). Centrifugation techniques, Types of centrifuge.

THERMAL ANALYSIS:

Thermo-gravimetric methods, Differential thermal analysis, Differential scanning calorimetry.

RADIOISOTOPES TECHNIQUES:

Radioisotopes - Basics concepts, GM counting and scintillation counting, Safety aspects and application.

PRACTICALS

1. Validating Lambert – Beer's law using KMnO4.
2. Determination of complementary color and complementary wavelength
3. Estimation of Al 3+ concentration using Alizarin in the spectrometer.
4. Turbidity meter.
5. Estimation of Dissolved oxygen.
6. Determination of Fe2+ content in fruit juices

TEXT BOOKS:

1. Chatwal and Anand, 2016. Instrumental Methods of Chemical Analysis, Himalaya Publishing House,5th Edition

2. Upadhyay, Upadhyay and Nath.,2017. Himalaya Publishing House. Biophysical Chemistry (Principles & Technology,4th Edition.

3. Skoog, D., 2014. Instrumental Methods of Analysis, David Hariss, 6th Edition.

4. Willard, H.H., Merrit, J.A., Dean, L.L. and Setlle, F.A., 1986. Instrumental Methods of Analysis. CBS Publishers and Distributors.

REFERENCES:

1. Dinesh Kumar Chatanta and Prahlad Singh Mehra, 2012. Instrumental Methods of Analysis in Biotechnology. I K International Publishing House.
2. P.Asokan. 2003. Analytical Biochemistry. 2nd Edition. China publications.
3. Hobart H. Willard, Lynne L. Merrit, John, A. and Frank A. Settle, 1981. Instrumental Methods of Analysis. Van Nostrand.
4. Campbell, I.D. and Dwek, R.A., 1986. Biological Spectroscopy, Benjamin Cummins and Company.
5. Sewell, P.A. and Clarke, B., 1991. Chromatographic Separations. John Wiley and Sons.
6. Ewing, G.W., 1989. Instrumental Methods of Chemical Analysis. McGraw Hill Book Company.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mrs.C.Nirmala	Associate professor	Biotechnology	nirmala@vmkvec.edu.in
2.	Dr.A.Nirmala	Assistant Professor (Gr-II)	Biotechnology	nirmalabt@avit.ac.in

	PRINCIPLES OF CHEMICAL ENGINEERING	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, fluid mechanics and chemical kinetics. It also provides a basis for non-chemical engineers to realize the chemical engineering aspects of subsequent modules.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the stoichiometric principles, process flow sheet development for industrial process.
2	To perform the material balance calculations for unit operations and processes
3	To carry out the energy balance calculations for industrial unit processes
4	To interpret the vapour pressure of mixtures and humidity values of air-water vapour system
5	To derive the expressions for pressure drop calculation for different geometries and to understand the basic concepts of chemical kinetics

COURSE OUTCOMES

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

CO1. Demonstrate the stoichiometric principles for problem solving in chemical and bioprocess industries	Understand
CO2. Perform material balance calculation for unit processes, operations and process designing of equipment	Apply
CO3. Interpreting the problems in energy balances related to chemical and bioreactors processes and calculate the heat loads for industrial equipment and safety purpose.	Apply
CO4. Determine the vapour pressure of mixtures using suitable methods by analytical methods and predict humidity of air water system for industrial applications.	Apply
CO5. Predict the pressure drops in various industrial equipment and estimate the order of the reactions	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF STOICHIOMETRY

Role of chemical engineering and Chemical engineers in biotechnology, Basic concepts of Unit process and operations, Process flow sheets, Units and dimensions, conversion factors, Stoichiometric principles- Equivalent weight, Normality , Morality, Molality, Atomic weight ,Molecular mass, Composition of mixtures and solutions,

Density and specific gravity, molecular weight of mixtures, Ideal Gas law, actual gas equation; compressibility factor , Gaseous mixtures- Dalton's law of additive volumes, Amagts law, Dimensional analysis.

MATERIAL BALANCES

Steady state and unsteady operations and processes, Overall and component balances, Material balances without chemical reactions – Mixing, Distillation, absorption, Evaporation, Extraction, Drying, leaching, crystallization; Material balances with chemical reactions - Limiting reactant, Excess reactant concept, conversion and yield in single and multiple reactions, Recycling , purge and bypass operations; Excess air concept, Material balance of unsteady state operations; Problems in industrial applications.

ENERGY BALANCE

Law of conservation of energy, Open and closed system, , heat capacity - heat capacities of gas and liquid mixture; Heat of formation, combustion, reaction, Hess's law of summation, Latent heat; Enthalpy calculations for chemical reactions, Theoretical and adiabatic flame temperatures

VAPOUR PRESSURE AND HUMIDITY CALCULAITON

Vapour pressure calculation – Antoine equation, Clapeyron clausius equation; Humidity calculation –air- water vapour system; Psychometric chart.

FLUID MECHANICS AND CHEMICAL KINECTICS

Fluid flow , types of fluid flow –Reynolds experiment, Pressure drop calculation – flow through pipe, packed bed, Compressible fluid flow concept, Compressors and pumps, Classification of reactions, Rate law, rate constant, order and molecularity of the reaction, activation energy, first order and second order kinetics, types of reactors, Basic performance equations of ideal reactors.

TEXT BOOKS:

1. Bhatt B.I & SB Thakore, Stoichiometry - Fifth edition Tata McGraw Hill 2012
2. Geankoplis C.J. “Transport process & Separation process Principles 4th edition-PHI 2006.
3. Octave levenspiel , Chemical reaction engineering, Third edition, Wiley India , January 2006
4. Warren McCabe, Julian Smith, Peter Harriott, 2005.Unit Operations of Chemical Engineering 7th Ed., McGraw Hill Inc., New York.

REFERENCES:

1. George T. Austine, Shreeves chemical process industries, 1984, McGraw Hill International Edition, 5th Edition.
2. Finlayson, B. A., Introduction to Chemical Engineering Computing, 2006, John Wiley & Sons, New Jersey.
3. Himmelblau. D.M “Basic principles & Calculations in Chemical Engineering” 6th edn PHI, 2006.
4. Nicholas Chopey, Handbook of Chemical Engineering Calculations Process Principles”, Mc Graw Hill, 2004

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mrs.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in
2.	Ms.Subathra	Assistant Professor	Biotechnology	subathra.biotech@avit.ac.in

	CHEMICAL ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

Chemical engineering laboratory focus on the demonstrate of lab scale experimental procedures for various unit operations and unit processes which are based on Mass Transfer and Heat Transfer, fluid mechanics and chemical kinetic concepts. It helps students for the development of their skills in understanding and operating basic and more complex industrial systems.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To interpret chemical engineering principles and their practical applications in the areas of mass, heat transfer, reaction engineering and particle mechanics.
2	To demonstrate the use of flow meters to find the discharge rate and coefficient.
3	To perform the distillation, adsorption, extraction and sedimentation processes to separate the industrial solid and fluid mixtures in laboratory scale.
4	To demonstrate the method of finding the boiling and vapour pressure of compounds.
5	To impart the knowledge of chemical kinetic studies and to find the order of any chemical reactions

COURSE OUTCOMES

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

CO1 Apply industrial flow meters to find discharge coefficients and volumetric flow rate of fluid flowing pipes.	Apply
CO2 Perform the steam and simple distillation, adsorption , extraction and sedimentation processes to separate and purify fluid mixtures effectively both in lab and large scale units.	Apply
CO3 Estimate the Pressure drop for industrial fluidized and packed bed units	Apply
CO4 Conduct experiment to find Boiling and vapour pressure of a industrial organic and inorganic compounds	Apply
CO5 Calculate the order of a industrial biochemical reactions by experimental and graphical methods	Analyz

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	P	PO2	PO	PO	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO12	PSO1	PSO22	PSO3
CO1	S	S	S	S	S	-	-	-	-	-	-	M	S	S	M
CO2	S	S	S	S	S	-	-	-	-	-	-	M	S	S	L
CO3	S	S	S	S	S	-	-	-	-	-	-	M	S	S	L
CO4	S	S	S	S	S	-	-	-	-	-	-	M	S	S	-
CO5	S	S	S	S	S	-	-	-	-	-	-	M	S	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

PRACTICALS:

1. Flow measurement and discharge calculation using a) Orifice meter b) Venturimeter
2. Performance studies of double pipe heat exchanger
3. Simple and Steam distillation.
4. Liquid – liquid equilibria - Extraction
5. Solid liquid extraction – leaching
6. Determination of Boiling point and Vapour pressure of a compound

7. Determination of order of a reaction mixture.
8. Pressure drop calculation for the fluid flow through pipe
9. Pressure drop calculation for the fluid flow through porous beds
10. Adsorption equilibrium
11. Batch sedimentation

REFERENCE BOOKS:

Laboratory Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in
2	Ms.Subathra	Assistant Professor	Biotechnology	subathra.biotech@avit.ac.in

	PLANT AND ANIMAL BIOTECHNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course is customized to provide a perceptive of the basic concepts, techniques and methods underlying plant and animal biotechnology. The learners will gain understanding of theoretical principles enabling them to employ the knowledge to solve problems related to plant protection and disease diagnosis through biotechnological approaches.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	Summarize about different types of cell culture methods
2	Describe about the genetic transformation techniques and principles in plants and animal.
3	To develop an understanding on transgenic plants and animals, patenting and ethical issues
4	Outline cell culture technique, significance of its cultivation and its application in the disease diagnosis and protection

COURSE OUTCOMES

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

CO1. Explain the basics of tissue culture	Understand
CO2. Demonstrate the techniques for development of transgenic plants, screening and selection procedure.	Apply
CO3. Appraise the plant tissue culture and genetic manipulation of plants	Analyze
CO4. Categorize about the different animal tissue culture and Molecular biological technique for rapid diagnosis of genetic disease.	Analyze
CO5. Inspect the animal gene transfer techniques and their ethical issues	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF TISSUE CULTURE

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

GENETIC TRANSFORMATION METHODS

Protoplast isolation, Culture and regeneration, hybrids and Cybrids, Plant vectors, basic features of vectors,

Direct gene transfer methods, Agrobacterium mediated gene transfer, applications, Transplastomics and its utility.

TRANSGENIC PLANTS AND MOLECULAR MARKERS

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

ANIMAL CELL CULTURE

History of Animal Cell Culture, Characteristics of animal cell, metabolism, regulation and nutritional requirements, Culture Media and Growth Conditions, Development of Primary Culture and Cell Lines, Suspension Culture, Scale up of animal cell culture Characterization and maintenance of cell lines, Gene cloning techniques for mammalian cells.

TRANSGENIC ANIMALS AND ETHICAL ISSUES

Transgenic animals, Gene transfer methods in animals, Microinjection of recombinant DNA into fertilized eggs/stem cells, Organ Culture, Xenotransplantation, Human Embryonic Stem Cell research, Manipulation of Therapeutic proteins, patenting genetically engineered animals, Ethical Concerns and Biosafety.

TEXT BOOKS:

1. Gupta, P.K., 1996. Elements of Biotechnology. *Rastogi*and Co., Meerut.
2. Ranga, M.M., 2002. Animal Biotechnology. *Agrobios India Limited.*
3. Ignacimuthu, S., 1996. Applied Plant Biotechnology. *Tata McGraw Hill.*
4. Gamburg, O.L. and Philips, G.C., 1995. Plant Tissue and Organ Culture Fundamental Methods. *Narosa Publications.*
5. Singh, B.D., 1998. Text Book of Biotechnology. *Kalyani Publishers.*
6. Ramadas, P. and Meera Rani, S., 1997. Text Book of Animal Biotechnology. *Akshara Printers.*

REFERENCES:

1. Hamond, J., McGarvey, P. and Yusibov, V., 2000. Plant Biotechnology. *Springer Verlag.*
2. Mantal, S.H., Mathews, J.A. and Mickee, R.A., 1985. Principles of Plant Biotechnology. An Introduction of Genetic Engineering in Plants. *Blackwell Scientific Publication*

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Associate professor	Biotechnology	nirmala@vmkvec.edu.in
2	Dr.R.Balachandar	Assistant Professor GII	Biotechnology	balachandar.biotech@avit.ac.in

	FOOD PROCESSING TECHNOLOGY (THEORY AND PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

Food Processing Technology deals with the study of food production, processing, packaging, preservation and the use of technology and Engineering techniques in aiding the above-mentioned stages. It also deals with artificial food, artificial edible items, nutrition science and its Chemistry. It allows students to learn about food and nutrients, role of functional foods and the strategies to produce specific food ingredients.

PRERQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Identify different microbes associated with foods, and food borne diseases.	Understand
CO2. Infer the role of microbes in food spoilage and food preservation	Apply
CO3. Illustrate all food processing methods and demonstrate its application in food product preparation	Apply
CO4. Utilize the modern methods for foods preservation using biotechnology.	Apply
CO5. Inspect the packing methods, materials and factors affecting food packing.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF FOOD MICROBIOLOGY

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

FOOD SPOILAGE

Food Spoilage types & causes. Spoilage of foods and Shelf –life – Vegetables and fruits, Milk and milk products, meat and meat products, cereals and cereals products, Alcoholic beverages. Factors influencing food spoilage. Control of microbes in foods.

PROCESSING OF FOODS

Heating, boiling, oxidation, toxic inhibition, dehydration, drying-Yeast based products, Milk products, Jams and jellies, Pickles, Meat and meat products. Labeling Instructions.

INDUSTRIALZATION

Pasteurization, Vacuum packing, irradiation, bio preservation, Modified atmosphere packing, cryopreservation, Pickling, salting, drying, freezing, refrigeration.

FOOD ADDITIVES AND PACKAGING

Food additives- Intentional and Nonintentional additives, Food colorants- natural and artificial, food flavours, Packaging of solid and liquid foods.

1. Preparation of fruit squash, Jam and Jelly
2. Preparation of tomato ketchup
3. Fermented Food preparation
4. Experiment on preparation of fruit bar.
5. Preparation of bread
6. Preparation of food flavors

TEXT BOOKS

1. Frazier. Food Microbiology. McGraw Hill Publication.4th Edition.2001
2. Sivashankar.B.Food processing Preservation, Prenlice Hall of India.Pvt.Ltd.2002

REFERENCE BOOKS

1. James M Jay, Martin J, Loessner and David A Golden. Food Microbiology, Springer Publication, 7th Edition. 2005
2. Shetty K, Paliyath, Food Microbiology, 2nd Edition, Taylor and Francis, 2006

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in
2	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in

	GREEN BIOTECHNOLOGY AND POLLUTION ABETMENT	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This is a multidisciplinary course deals with various aspects like Environmental Biotechnology, Bioremediation of various problems, Ecofriendly Bioproducts from renewable biosources to educate students within the field of Biotechnology. Students will gain theoretical and practical competence within the broad field of Biotechnology as well as with its applications.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand how Biotechnology can help in monitoring or Removing the pollutants
2	To Describe the novel techniques used in production of Biofuels, renewable energy sources
3	To understand the knowledge to Develop the stress- tolerant plants which can minimize the harmful impact of pollutants
4	To Describe the techniques of Bioremediation and Bioresoration
5	To execute the use of genetically engineered organisms in environment

COURSE OUTCOMES

On the successful completion of the course, students will gain knowledge about

CO1. Outline the basic information about maintaining the Environment	Understand
CO2. Demonstrate the various novel techniques for production of Biofuels	Understand
CO3. Apply the different methods for the waste management	Apply
CO4.Apply the technologies in Bioremediation and Green Energy	Apply
CO5. Employ the uses of genetically engineered organism in Environmental issues	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	L	L	-	-	-	-	-	-	-	-	-	-	-	-	L
CO2	L	L	L	-	L	-	L	-	-	-	-	L	L	-	L
CO3	S	S	M	M	M	-	M	-	-	-	-	-	M	M	M
CO4	S	S	S	L	M	L	M	M	-	-	-	-	M	M	S
CO5	S	S	M	M	S	L	S	S	L	-	-	-	M	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

BIOLOGICAL WASTE TREATMENT

Principles and design aspects of various waste treatment methods with advanced bioreactor configuration: Solid waste management: landfills, recycling and processing of organic residues, minimal national standards for waste disposal. Fundamentals of composting process: scientific aspects and prospects of biofuel production: bioethanol, biohydrogen and biodiesel; biofertilizers and biopesticides.

BIODEGRADATION OF XENOBIOTIC COMPOUNDS

Xenobiotic compounds–Definition, examples and sources. Biodegradation- Introduction, effect of chemical structure on biodegradation, recalcitrance, co metabolism and biotransformation. Factors affecting biodegradation, microbial degradation of hydrocarbons.

BIOTRANSFORMATIONS AND BIOCATALYSTS

Basic organic reaction mechanism- Common prejudices against enzymes, advantages & disadvantages of biocatalysts, isolated enzymes versus whole cell systems, biocatalytic application, catalytic antibodies; stoichiometry.

BIOREMEDIATION AND BIORESTORATION

Introduction and types of bioremediation, bioremediation of surface soil and sludge, bioremediation of subsurface material, In situ and Ex-situ technologies, phytoremediation- restoration of coal mines a case study. biorestoration: reforestation through micropropagation, use of mycorrhizae in reforestation, use of microbes for improving soil fertility, reforestation of soils contaminated with heavy metals.

ECO-FRIENDLY BIOPRODUCTS FROM RENEWABLE SOURCES

Fundamentals of composting process: scientific aspects and prospects of biofuel production: bioethanol, biohydrogen and biodiesel; biofertilizers and biopesticides. Biotechnology in Environment Protection: Current status of biotechnology in environment protection and its future, release of genetically engineered organisms in the environment.

TEXT BOOKS

1. Introduction to Wastewater Treatment- R. S. Ramalho, Academic Press.
2. Elements of Water Pollution Control Engineering – O.P. Gupta, Khannabooks.
3. Energy Technology – O.P. Gupta, Khannabooks, 2018.
4. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.
5. Environmental Microbiology & Biotechnology, D.P. Singh, S.K. Dwivedi, New Age International Publishers, 2004.
6. Biodegradation and Bioremediation 1999 (2nd edition). Martin Alexander, Elsevier Science & Technology.

REFERENCE BOOKS

1. Environmental Biotechnology by Bruce Rittmann and Perry McCarty.
2. Environmental Processes I-III, J. Winter, 2nd ed., Wiley Publications
3. Environmental Biotechnology, B.C. Bhattacharya & Ritu Banerjee, Oxford Press, 2007.
4. Environmental Biotech, Pradipta Krimar, I.K. International Pvt. Ltd., 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.	Dr.R. Devika	Profeesor & Head	Biotechnology	devika@avit.ac.in

	ENZYME ENGINEERING & TECHNOLOGY	Category	L	T	P	Credit
		CC	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 about the different classes of enzymes and their characteristics.
2	To Illustrate in detail about mechanism and kinetics of enzyme activity.
3	To Generalize about enzyme inhibition and enzyme immobilization and its applications.
4	To correlate in details about performance of immobilized enzymes in different types of bioreactors and their own design restrictions.
5	To examine the knowledge of enzymes to enhance bioreactions and to design sensors for diagnostic applications.

COURSE OUTCOMES

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

CO1. Classify about classification of enzymes and their characteristics.	Understand
CO2. Exemplify fundamental knowledge about enzyme kinetics and mechanism of enzyme activity.	Understand
CO3. Demonstrate the effect of enzyme inhibition and enzyme immobilization.	Apply
CO4. Utilize the enzyme kinetics to design biosensors.	Apply
CO5. Categorize in detail about consequences of immobilized enzymes and its effect in bioreactors.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION, PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES

Classification of enzymes, Production and purification of crude enzyme extracts from plants, Animals and microbial sources – Case studies (Isolation and purification of lipase and protease from microbial sources), Methods of characterization of enzymes, Overview of enzymatic assays.

MECHANISMS AND KINETICS OF ENZYME ACTION

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

INHIBITION OF ENZYME ACTIVITY AND ENZYME IMMOBILIZATION

Types of enzyme inhibition – Competitive inhibition, Uncompetitive inhibition, Non- competitive inhibition, Mixed inhibition, Substrate inhibition, Allosteric inhibition, Irreversible inhibition, Physical and chemical techniques for enzyme immobilization – Adsorption, Matrix entrapment, Encapsulation, Cross - linking, Covalent binding etc., Advantages and disadvantages of different immobilization techniques, Application of immobilized enzyme systems.

IMMOBILIZED ENZYME REACTORS AND DIFFUSIONAL LIMITATIONS

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

APPLICATIONS OF ENZYMES

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

TEXT BOOKS:

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. 2ndEdn.

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	Dr.R.Devika	Professor and Head	Biotechnology	devika@avit.ac.in
2	Mrs.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in

	PROTEIN ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

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

PREREQUISITE –NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Describe the importance of bonds in protein structure	Understand
CO2.Identify the amino acid sequence and structure of proteins, and relate this information to the function of proteins strategies.	Understand
CO3. Illustrate the folding pathway and their importance on the structure and function of proteins	Apply
CO4. Correlate the Structure-function correlations of protein with other molecules	Apply
CO5. Employ new methodologies for protein engineering and protein design.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	PO	PO1	PO1	PO12	PSO	P	P
CO1	L	M	L	L	L	-	-	-	-	-	-	-	-	-	-
CO2	L	M	M	L	M	-	-	-	-	-	-	-	S	-	-
CO3	S	M	M	M	S	S	-	-	-	-	-	L	S	M	-
CO4	S	M	S	S	S	S	L	-	L	-	-	-	S	S	-
CO5	M	S	S	S	M	M	-	L	-	-	-	L	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

BONDS AND ENERGIES IN PROTEIN MAKEUP

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

PROTEIN ARCHITECTURE

Primary structure, Secondary structures, Super secondary structures (Alpha-turn-alpha, beta-turn beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down and TIM barrel structures), prediction of substrate binding sites. Topology diagrams, Nucleotide binding folds, Tertiary structures, Quaternary structures.

PROTEIN FOLDING AND STRUCTURE DETERMINATION

Protein Denaturation and Renaturation, Protein folding pathways, Stability of folded conformation of proteins, Protein folding errors: Alzheimer's, prions and Mad Cow (BSE, CJD), Cystic Fibrosis and cancer. Methods to determine primary, tertiary and quaternary structure - Peptide mapping, Peptide sequencing, Circular Dichroism, Mass spectroscopy and X-ray diffraction.

PROTEIN STRUCTURE - FUNCTION RELATIONSHIP

Helix-turn-Helix motifs, Cro, Lamda and Trp repressor, Zn fingers, Tata Box binding proteins, Homeodomain, Leucine zippers, Structure-function correlations in the context of protein ligand interactions & protein protein/carbohydrate interactions.

PROTEIN ENGINEERING AND PROTEIN DESIGN

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

TEXT BOOKS:

1. Branden, C. and Tooze,J., 1999.Introduction to Protein structure. 2nd Garland Publishing, NY, USA. Edn.,

2. Daniel C. Liebler, "Introduction to Proteomics – Tools for the New Biology," Humana Press, 2001

REFERENCES:

1. Moody P.C.E. and Wilkinson A.J., 1990. Protein Engineer-ing. IRL Press,Oxford, UK.

2. DoanaldVoet and Judith Voet, G., 2001. Biochemistry. 3rd Edn., John Wiley and Sons, 2001.

3. Stefan Lutz and Uwe T. Bornscheuer, 2009. Protein Engineering Handbook. Vol 1 & 2, 1st Edn., Wiley Publishers.

4. Berg, J. M., Tymoczko, J. L. and Stryer, L., 2002. Biochemis-try. 5th Edn., W.H. Freeman and Company.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor& Head	Biotechnology	sridevi@vmkvec.edu.in
2	Dr.A.Nirmala	Assistant Professor - GII	Biotechnology	nirmalbt@avit.ac.in

	GENETIC ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Genetic engineering has developed genetic recombination techniques to manipulate gene sequences in plants, animals and other organisms to express specific traits. Applications of genetic engineering are increasing as engineers and scientists work together to identify the locations and functions of specific genes in the DNA sequence of various organisms. Once each gene is classified, engineers develop ways to alter them to create organisms that provide benefits such as cows that produce larger volumes of meat, fuel- and plastics-generating bacteria, and pest-resistant crops.

PRERQUISITE –NIL

COURSE OBJECTIVES

1	To understand the principle of nucleic acid isolation, nucleic acid labelling and hybridization and also aware of cloning vectors
2	To discuss the gene cloning methods and the tools and techniques involved in gene cloning
3	The students would be aware gene modification and types of PCR
4	To explain the preparation of rDNA molecule
5	To demonstrate gene cloning and screening of recombinants

COURSE OUTCOMES

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

CO1. Identify the problems they could encounter and how to troubleshoot and learn various types of host-vector systems and steps in creating a recombinant DNA molecule	Apply
CO2: Develop the construction of libraries and strategies of cloning	Analyze
CO3. Illustrate the gene modifications and DNA amplifications using PCR	Analyze
CO4. Employ the methods of plasmid DNA isolation and Restriction digestion	Apply
CO5. Employ gene cloning and screening of recombinants.	Apply

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

S- Strong; M-Medium; L-Low

SYLLABUS

TOOLS IN GENETIC ENGINEERING

Restriction enzymes -Cutting and joining of DNA, Design of linkers and adaptors, DNA sequencing - Maxam and Gilbert method and Sanger and Coulson enzymatic chain termination method; DNA labelling Methods; Nucleic acid hybridization techniques – Southern, Northern and Western.

CLONING AND EXPRESSION VECTORS

Characteristics of cloning and expression vectors, Plasmids as vectors – pBR 322, pUC vectors, Lambda vectors,, M13 vectors, Cosmids, Phasmids, Vectors for insect, yeast and mammalian system, Introduction of recombinant DNA

in to host cells and selection methods.

GENE LIBRARIES AND GENE MAPPING

Construction and screening of Genomic DNA and cDNA Library; Screening of DNA libraries using nucleic acid probes and antisera.; Chromosome walking, Chromosome jumping; DNA probes; Molecular markers - Variable Nucleotide Tandem Repeats (VNTR's), Short Tandem Repeats (STR); Mini and Microsatellite sequences; Restriction mapping **,** Hybridization mapping, Radiation Hybrid Maps, Optical mapping.

CLONING STRATEGIES

Construction of recombinant DNA; Preparation of competent cells- Transformation and Transfection; Selection and screening of recombinants; Gene transfer - Shotgun method, Electroporation, Particle bambartment, Nuclear injection method; Cloning in plants-Ti Plasmids of *Agrobacterium*

GENE MODIFICATIONS AND AMPLIFICATION

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

TEXT BOOKS:

1. Primrose SB and R. Twyman "Principles of Gene Manipulation &Geneomics Blackwell Science Publications, 2006.
2. Principles of Genome Analysis and Genomics by S.B.Primrose and R.M.Twyman, Third Edition (Blackwell Publishing), 2003.

REFERENCES:

1. Winnacker, Ernst – L. "From Genes to Clones: Introduction to Gene Technology", Panima, 2003.
2. Glover, D. M., 1984. Gene cloning: The mechanism of DNA manipulation. IRC Press, Oxford University.
3. Jose Cibelli, Robert P. Lanza, Keith H.S. Campbell, Michael D. West, 2002. Principles of cloning. Academic Press.
4. Glick, B.R. and J.J. Pasternak "Molecular Biotechnology: Principles and Applications of Recombinant DNA", 3rd Edition, ASM, 2003.
5. Ansubel FM, Brent R, Kingston RE, Moore DD, "Current Protocols in Molecular Biology "Greene Publishing Associates, NY, 1988.
6. Berger Sl, Kimmer AR, "Methods in Enzymology", Vol 152, Academic Press, 1987.
7. Genomes 3 by T.A.Brown, Third Edition (Garland Science Publishing), 2007
8. Sambrook and Elliot. Molecular Cloning. Vol. III.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in
2	Dr.Balachandar	Assistant professor –GII	Biotechnology	balchandar@avit.ac.in

	GENETIC ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE
To understand and develop the skills involved in rDNA Technology.

PRERQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Describe core Nucleic acid techniques such as extraction, nucleic acid separations and elution.	Understand
CO2. Illustrate DNA amplification using Polymerase Chain Reaction	Apply
CO3. Classify the methods of Nucleic acids characterization, through the application of gene probes	Apply
CO4. Employ Gene cloning and screening of recombinants.	Apply
CO5. Compare the proteins through SDS-PAGE.	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	S	M	-	-	-	-	-	-	-	-	S	-	-
CO2	S	M	L	L	-	-	-	-	S	-	-	-	-	M	-
CO3	M	L	M	M	-	-	-	-	-	-	-	-	-	S	-
CO4	S	L	M	S	-	-	-	-	-	-	-	-	L	-	-
CO5	M	L	S	M	-	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Isolation of Plasmid DNA.
2. Polymerase Chain Reaction.
3. Electro elution of DNA from Agarose gel.
4. Restriction digestion of λ DNA.
5. Ligation of DNA.
6. Preparation of Competent Cells – Calcium chloride Method.
7. Transformation in *E. coli* by Heat Shock Induction Method.
8. SDS Poly Acrylamide Gel Electrophoresis.
9. Blotting techniques – Southern, Western.
10. Blue and white screening of recombinant

REFERENCES:

1. Laboratory Manual.
2. Sambrook, Joseph and David W. Russell "The Condensed Protocols: From Molecular Cloning; A Laboratory Manual" Cold Spring Harbor Laboratory Press, 2006.

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevim@vmkvec.edu.in
2	Dr RBalachandar	Asst Professor	Biotechnology	Balaclone1@avit.ac.in

	IMMUNOLOGY (THEORY & PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

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

PRERQUISITE – NIL

COURSE OBJECTIVES

1	To gain knowledge about the general concepts of immune system, immune organ and cell mediated immunity
2	To learn the mechanisms related to complement system, hypersensitivity and transplantation immunology.
3	To acquire knowledge on the principles of microbial pathogenesis the concepts and principle of Immune assay techniques in routine diagnosis, research.
4	To summarize the techniques like blood grouping, PBMC cells.
5	To compare the various Immunological techniques and its applications.

COURSE OUTCOMES

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

CO1. Explain the general concepts of immune system, describe the cells and organs of the immune system, and describe the properties of antigens and antibodies, cell mediated immunity	Understand
CO2. Identify the mechanisms behind transplantation immunology, autoimmunity and hypersensitivity	Understand
CO3. Inspect the various antigen-antibody interactions and techniques, Vaccine production and explore the diagnostic methods	Apply
CO4. Employ the knowledge for isolation of PBMC, blood grouping.	Apply
CO5. Assess the Immuno assay to understand complement fixation system and other diseased conditions.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO IMMUNE SYSTEM

Cells Of Immune System, Innate And Acquired Immunity, Clonal Nature Of Immune Response, Organization And Structure Of Lymphoid Organs, Antigens: Chemical And Molecular Nature, Haptens, Adjuvants, Cells of Immune System– Haematopoiesis And Differentiation– B-Lymphocytes, T - Lymphocytes, Macrophages, Dendrite Cells, T Cell Maturation, Activation, Differentiation And B Cell Maturation, Activation, Differentiation.

HUMORAL AND CELL MEDIATED IMMUNITY

Immunoglobulins, Classes and subclasses, Organisation and expression of Immunoglobulin genes, Immunoglobulin gene rearrangement, antibody diversity, B-cell development and activation. TCR, TCR diversity, T cell receptor gene arrangement, T-cell development & activation, Classes, molecular structure and assembly of MHC, HLA genetic loci, Antigen Presenting cells.

TRANSPLANTATION, AUTOIMMUNITY AND HYPERSENSITIVITY

HLASystem,Transplantation–Organtransplantation, Grafting–graft rejection and prevention, Immunosuppressive drugs, Autoimmunity– Autoantibodies in human, Pathogenic mechanism, Experimental models of Autoimmune disease, Treatment of Autoimmune disorders, Complement system, Hypersensitivity.

MOLECULAR IMMUNOLOGY

Immunity to virus, Bacteria, Parasites, Genetic control of immune response, MHC associated predisposition to disease, Vaccine – Principle & production, Principles and strategy for developing vaccines, Newer methods of vaccine production, Antigen-antibody interaction, Agglutination and precipitation Immuno deficiency diseases.

IMMUNOTECHNOLOGY

Hybridoma Technology, Production and Purification of Monoclonal Antibodies, Polyclonal Antibodies, Antibody engineering, Immuno techniques: complement fixation test, Immuno diffusion, Immuno electrophoretic, RIA, Enzyme Linked Immuno sorbent Assay (ELISA), Fluorescenceimmunoassay– Immuno Fluorescence(IF), Fluorescence Activated Cell Sorter, Immunodiagnostics, Immunotherapeutics, Current trends and its Application

PRACTICE SYLLABUS

DEMO

1. Handling of animals, immunization and raising antisera.
2. Identification of cells in a blood smear.

PRACTICALS

1. Identification of blood groups.
2. Immuno diffusion – Single Radial and Ouchterlony Double Diiffusion
3. Immunoelectrophoresis – Rocket Immuno electrophoresis.
4. Testing for Typhoid antigens by Widal test.
5. Enzyme Linked Immuno Sorbent Assay (ELISA).
6. Western Blotting.

TEXT BOOKS:

1. Lydyard, P.M., Whelan, A. and Fanger, M.W., 2003. Instant Notes in Immunology. 2nd Edn., Viva Books Private Limited.

2 Richard A., Goldsby, Thomas J.Kindt and Barbara A, Osborne, Kuby, Immunology. IV Edition, W.H. Freeman and Company, New York.

REFERENCES:

1. Talwar, G.P. and Gupta, S.K., 1992.A Handbook of Practical and Clinical Immunology. Volume 12. CBS Publications.Dulsy Fatima and Arumugam N., 2014.

3. Goding, J.W., 1983. Monoclonal Antibodies: Principles and Practice, Academic Press.

4. Benjamin, E. and Leskowitz, S., 1991. Immunology – A Short Course. Wiley Liss., New York.

5. Kuby J, Immunology, WH Freeman & Co., 7th Edition 2012.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevim@vmkvec.edu.in
2	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in

	BIOPROCESS ENGINEERING (THEORY & PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

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

PRERQUISITE- NIL

COURSE OBJECTIVES

1.	To Explain about the historical development of Bioprocess technology, Design and construction of fermenter.
2.	To Interpret the kinetics of Microbial growth and product formation
3.	To Summarize the knowledge on Design and operation of Bioreactors
4.	To Perform the optimization on growth medium.
5.	To Execute the Methods of enzyme immobilization and enzyme kinetic study.

COURSE OUTCOMES

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

CO1. Explain the appropriate bioreactor configurations, operation modes based upon the nature of Bio products, cell lines and other process criteria.	Understand
CO2. Illustrate about modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.	Understand
CO3. Plan a research career to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.	Apply
CO4. Apply the knowledge about optimization on medium and organisms growth.	Apply
CO5. Utilize the knowledge of Enzyme Immobilized to use in bioreactors and Review Information on activity of enzyme and parameters affects enzyme activity.	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	L	-	-	L	L	-	-	-	-	-	-	-	-	-	-
CO2	L	L	-	-	L	-	-	-	-	-	-	-	-	-	-
CO3	S	S	M	M	M	M	-	-	-	-	-	L	M	M	-
CO4					S	-	-	-	-	-	-	-	M	-	L
CO5	-	-	-	-	S	-	-	-	-	-	-	-	L	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOPROCESS AND KINETICS

Historical development of the fermentation industry, Basic configuration of fermenter and ancillaries, Kinetics of Batch, Fed batch and Continuous culture processes, Comparison of batch and continuous culture in industrial process.

KINETIC MODELS AND MONOD EQUATIONS

Introduction to structured and unstructured models –Substrate limited growth (Monod equation and alternatives to Monod equation), Models with growth inhibitors (Substrate, Product inhibition and Inhibition by toxic compounds).

DESIGN OF BIOREACTORS

Classification of bioreactors- Design of bioreactors – Aseptic operation and containment, Body construction, Aeration and agitation Types of agitators and spargers, Sterilization of Media, Fermentor, Air supply and Exhaust, Thermal death kinetics of microorganisms, Design of Sterilization Equipment – Batch and Continuous.

BIOREACTOR SCALE-UP

Scale up of fermentation process – Factors involved in scale-up, Scale-up of aeration / agitation, Oxygenmass transfer in bioreactors,

MASS TRANSFER AND MONITORING

Determination of KLa values Main parameters to be monitored and controlled in fermentation processes**.** Methods of measuring process variables – Online and offline analysis, Control systems – Manual and automatic control.

PRACTICALS

1. Growth of microorganism – Estimation of Monod parameters.
2. Medium optimization – Plackett Burman design.
3. Enzyme activity – Effect of pH.
4. Enzyme activity – Effect of temperature.
5. Enzyme Immobilization – Gel Entrapment.
6. Production of Wine by Yeast.

TEXT BOOKS

1. Shuler and Kargi, 1992. Bioprocess Engineering. *Prentice Hall*.
2. James E. Bailey and David F. Ollis, 1986. Biochemical Engineering Fundamental. 2nd Edn. *Mc Graw Hill*.

REFERENCES:

1. Trevan, Boffey, Goulding and Stanbury. Biotechnology. *Tata Mc Graw Hill Publishing Co*. Anton Moser. Bioprocess Technology, Kinetics and Reactors. *Springer Verlag*.
2. James M. Lee. Biochemical Engineering. *PHI, USA*.
3. Atkinson. Handbook of Bioreactors.
4. Harvey W. Blanch, Douglas S. Clark. Biochemical Engineering. *Marcel Decker Inc*
5. Pauline M. Doran, 2002. Bioprocess Engineering Principles. *Academic Press*

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.M.Sobana	Assistant Professor	Biotechnology	sobanam@vmkvec.edu.in
2	Ms.M.Subathra	Assistant Professor	Biotechnology	Subathra.biotech@avit.ac.in

	DOWNSTREAM PROCESSING IN BIOTECHNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Downstream processing is defined as various stages of cascade or non-cascade process that occurs after the completion of the fermentation or biotransformation to recover and purify synthetic bio products includes drugs, antibiotics, enzymes, hormones, etc., from fermentation broth. Downstream processing includes separation, purification, and packaging of the fermented products

PRERQUISITE - BIOPROCESS ENGINEERING

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Explain the knowledge about Role and importance of Downstream processing in biotechnology	Understand
CO2.Summarize the fundamental knowledge about the physical methods of separation.	Understand
CO3.Apply the various downstream processing techniques for theisolation of products.	Apply
CO4.Select the methods for product fractionation and purification	Apply
CO5. Compare the various techniques to formulate the final product.	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	-	M
CO2	M	M	-	M	-	-	-	-	-	-	-	L	S	S	-
CO3	S	S	M	S	-	-	-	-	-	-	-	-	M	-	S
CO4	S	M	M	S	-	-	-	L	-	-	-	-	-	M	-
CO5	M	M	M	M	L	-	-	-	-	-	-		S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

DOWNSTREAM PROCESSING IN BIOTECHNOLOGY

Role and importance of Downstream processing in biotechnological processes, Characteristic of Biomolecules and Bioprocesses, Cell disruption for product release - Mechanical, Enzymatic and Chemical methods. Pre-treatment and stabilization of bioproducts.

PHYSICAL METHODS OF SEPARATION

Unit operation for solid liquid separation - Removal of Insoluble, Biomass, Flocculation, sedimentation, Centrifugation and Filtration methods.

ISOLATION OF PRODUCTS

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

PRODUCT FRACTIONATION / PURIFICATION

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

PRODUCT FORMULATION AND FINISHING OPERATION

Crystallization - Basic concepts, Crystal size distribution, Batch crystallisation, Continuous crystallization of pharmaceuticals and Solution crystallization, Drying - Drying equipment - Conduction dryers, Adiabatic dryers, Drying rate and Drying time, Zone refining, Lyophilization in final product formulation. Stabilization of bioproducts: Formulation. Integration of reaction and separation

TEXT BOOKS:

1. H. Sivasankaran. Bioseparation
2. Asenjo, J.M., 1993. Separation Processes in Biotechnology. Marcel Dekker Inc.
3. Belter, P.A., Cussler, E.L. and Wei - Houhu, 1988. Bioseparations - Downstream
4. Processing for Biotechnology. Wiley Interscience Publications.

REFERENCE BOOKS:

1. Wankat, P.C., 1990. Rate Controlled Separation. Elsevier.
2. Satinder Ahuja., 2000 Volume 2 Handbook of Bioseparations, Academic Press.
3. Janson, J.C. and Ryden, L., 1989. Protein Purification - Principles, High Resolution Methods and Applications. VCH Publication.
4. Scopes, R.K., 1994.Protein Purification - Principles and Practice. Narosa Publication.
5. Jenkins, R.O., 1992. Product Recovery in Bioprocess Technology - Biotechnology by Open Learning Series. Butterworth -Heinemann.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Associate Professor	Biotechnology	Nirmala@vmkvec.edu.in
2	Dr.R.Devika	Professor & Head	Biotechnology	devika@avit.ac.in

	DOWNSTREAM PROCESSING IN BIOTECHNOLOGY LAB	Category	L	T	P	C
		CC	0	0	4	2

PREAMBLE

Downstream processing laboratory is used to provide the understanding and knowledge on techniques like Solid-liquid separation, Cell disruption, High resolution purification, Product polishing of bio-products from fermenter. This course provides deeper understanding about the techniques in downstream processing.

PRERQUISITE -Nil

COURSE OBJECTIVES

1	To explain the importance of downstream processing in biotechnology.
2	To describe in detail about the Solid-Liquid Separation methods such as Centrifugation, Microfiltration.
3	To describe the knowledge on cell disruption techniques to extractvaluablebiomolecules.
4	To demonstrate in detail about Chromatography techniques for product purification.
5	To demonstrate the knowledge of extraction techniques to separate biomolecules.

COURSE OUTCOMES

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

CO1. Illustrate the role and importance of downstream processing in biotechnology.	Apply
CO2. Apply the knowledge about the solid-liquid separation to acquire the product.	Apply
CO3. Compute the information on cell disruption techniques for separation of biomolecules.	Apply
CO4. Focus the knowledge about product fractionation and purification by chromatography Technique.	Analyze
CO5. Test the knowledge of flocculation and aqueous two phase extraction to extract living or non-living cells / intracellular materials such as enzymes, proteins, etc.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO	S	M	-	-	-	-	-	-	-	-	-	-	S	-	-
CO	S	M	-	-	-	-	-	-	-	-	-	-	S	-	-
CO	S	M	-	-	-	-	-	-	-	-	-	-	S	-	-
CO	S	S	M	-	-	M	-	-	M	-	-	L	-	M	-
CO	S	S	M	-	-	M	-	-	M	-	-	-	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. Solid-Liquid Separation – Centrifugation, Microfiltration.
2. Mechanical cell disruption – homogeneizer
3. Cell Disruption Techniques – Ultra sonication.
4. Downstream processing of the yeast fermented product (Sedimentation, Filtration, Pasteurization)
5. Separation of Pigments by Thin Layer Chromatography.
6. Precipitation – Ammonium Sulphite Precipitation.
7. Ultra Filtration Separation.
8. Aqueous Two Phase Extraction of Biologicals.
9. Flocculation

TEXT BOOKS

1. Wankat, P.C., 1990. Rate Controlled Separation. Elsevier.
2. Satinder Ahuja., 2000 Volume 2 Handbook of Bioseparations, Academic Press.
3. Asenjo, J.M., 1993. Separation Processes in Biotechnology. Marcel Dekker Inc.
4. Belter, P.A., Cussler, E.L. and Wei - Houhu, 1988. Bioseparations - Downstream
5. Processing for Biotechnology. Wiley Interscience Publications.

REFERENCE BOOKS

1. Janson, J.C. and Ryden, L., 1989. Protein Purification - Principles, High Resolution Methods and Applications. VCH Publication.
2. Scopes, R.K., 1994.Protein Purification - Principles and Practice. Narosa Publication.
3. Jenkins, R.O., 1992. Product Recovery in Bioprocess Technology - Biotechnology by Open Learning Series. Butterworth -Heinemann.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Associate Professor	Biotechnology	Nirmala@vmkvec.edu.in
2	Dr.R.Devika	Professor & Head	Biotechnology	devika@avit.ac.in

	MASS TRANSFER OPERATIONS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Mass transfer is the net movement of mass from one location, usually meaning stream, phase, fraction or component, to another. Mass transfer occurs in many processes, such as absorption, evaporation, drying, precipitation, membrane filtration, and distillation. Mass transfer is used by different scientific disciplines for different processes and mechanisms. The phrase is commonly used in engineering for physical processes that involve diffusive and convective transport of chemical species within physical systems. Mass transfer operations include separation of chemical components in distillation columns, absorbers such as scrubbers or stripping, absorbers such as activated carbon beds, and liquid-liquid extraction.

PRERQUISITE-NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

S- Strong; M-Medium; L-Low

SYLLABUS

DIFFUSION

Molecular diffusion in fluids, Mass transfer coefficients, Diffusion in solids, Interphase mass transfer, Multicomponent diffusion and diffusivity in solids

SOLID–FLUID OPERATION

Adsorption equilibria–Liquids, Single gases and vapours, Leaching–Unsteady state operation, Steady state continuous operation.

GAS–LIQUID OPERATION

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

DISTILLATION

Vapour–Liquid Equilibria, Single stage-Flash vaporization, Differential or simple distillation, Continuous rectification–Binary system, Multistage tray towers–McCabe- Thiele and Ponchon Savarit principles. Multi component distillation

LIQUID–LIQUIDEXTRACTION

Liquid– Liquid Equilibria, Stage wise contact, Stage type extractor, Differential extractor

TEXTBOOKS

1. Treybal, R .E., 1981. Mass Transfer Operations. 3rd Edn., *McGraw Hill*.
2. Geankoplis, C. J., 2002. TransportProcessesandUnitOperations.3rd Edn., *Prentice HallofIndia*.

REFERENCES:

1. Coulsonand Richardson's, 1998. Chemical Engineering. Vol. I & II, *Asian Books Pvt. Ltd*.
2. Badgerand Banchero. Introduction to Chemical Engineering. *Tata McGraw Hill*, New Delhi.
3. Mc Cabe, W.L., Smith, J.C., Harriot, P., 1993. Unit Operations in Chemical Engineering. 5th Edn., *McGraw Hill Book Co.*, New York.
4. Pauline M. Doran, 2002. Bioprocess Engineering Principles. *Academic Press*.
5. Butterworth-Heinemann, 1992. Bioprocess Technology: Modelling and Transport Phenomena.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
2	Ms.M.Subathra	Assistant Professor	Biotechnology	Subathra.biotech@avit.ac.in

CATEGORY C – ELECTIVE COURSES - CREDITS (12)

(i) PROGRAMME ELECTIVES (CLASS ROOM OR ONLINE) - CREDITS (12)

	THERMODYNAMICS FOR BIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PRERQUISITE

PRINCIPLES OF CHEMICAL ENGINEERING.

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

LAWS OF THERMODYNAMICS AND ITS APPLICATIONS

Introduction - Work, Energy, Heat, Internal energy, Extensive and intensive properties, State and path functions, First law of thermodynamics, Energy balance for closed systems, Equilibrium, The reversible process, Constant - v and Constant - p processes, Enthalpy, Heat capacity, Application of First law to Steady state flow processes, Entropy and Second law of thermodynamics – Limitations of First law, Third law of Thermodynamics. Heat engines, Thermodynamic temperature scale, Power cycles, Calculation of Ideal work.

VOLUMETRIC AND THERMODYNAMIC PROPERTIES OF FLUIDS

Ideal gas law, Isobaric, Isochoric, Isothermal, Adiabatic and Polytropic process. P-V-T relations of fluid, Equation of state for gases, Compressibility factors, Compressibility charts, The principles of corresponding states, Acentric factor. Thermodynamic properties of fluids – Reference properties, Energy properties, Derived properties, Maxwell's relations. Heat capacity relations, Effect of pressure and volume on heat capacities.

SOLUTION THERMODYNAMICS

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

PHASE EQUILIBRIA

Phase equilibrium – Criteria for phase equlilbria, Phase equilibria in single and multi-component systems, Vapour Liquid Equilibria (VLE), Liquid – Liquid Equilibria (LLE), Solid – Liquid Equilibrium.

CHEMICAL REACTION EQUILIBRIA

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

TEXT BOOK:

1. Narayanan, K.V., 2001. A Text Book of Chemical Engineering Thermodynamics. Prentice Hall India.
2. Smith, J.M., Van Ness, H.C. and Abbot, M.M., 2001. Chemical Engineering Thermodynamics. 6thEdn., McGraw- Hill.

REFERENCES:

1. Rao, Y.V.C. Chemical Engineering Thermodynamics.
2. Sandler, S.I., 1989. Chemical and Engineering Thermodynamics. John Wiley and Sons.
3. Roels, J.A., 1983. Kinetics and Energetics in Biotechnology. Elsevier.
4. Donald T. Haynie. Biological Thermodynamics. Cambridge.
5. Volker Hessel, 2005. Chemical Microprocess Engineering. John Wiley and Sons.
6. Irving J. Dunn and Eth Zurich, 2003. Biological Reaction Engineering. John Wiley.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs Subathra M	Assistant Professor	Biotechnology	Subathra.biotech@avit.ac.in
2	Mrs.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in

	PLANT AND ANIMAL DISEASES AND THEIR CONTROL	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE: MICROBIOLOGY

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Demonstrate the common plant pathogens in agriculture	Understand
CO2. Discuss about epidemiology of diseases caused by pests in plant and animals.	Understand
CO3. Classify about the plant and animal disease & integrated control measures.	Apply
CO4. Examine the diseases in plants and animal & its control	Analyze
CO5. Infer the different samplings methods	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	M	L	L	-	L	L	-	L	-	-	L	M	M	-
CO2	M	M	M	L	L	M	L	-	M	L	-	-	S	S	M
CO3	S	S	S	-	L	-	M	L	M	-	-	L	-	M	-
CO4	S	M	M	M	L	M	S	M	S	-	L	M	S	M	S
CO5	M	L	-	S	M	M	S	S	S	-	-	M	S	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION OF PESTS AND PESTICIDES

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

AGRICULTURAL PESTS AND THEIR CONTROL

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

PEST CONTROL PRACTICES

Issues, Challenges and Opportunities in the Control of Insects in Vegetable Crops, Control measures- Cultural, Physical, Mechanical, Chemical, Herbal and Biological control. Pheromonal and autocidal control.

EMERGING CONCEPTS AND PRACTICES IN INTEGRATED CONTROL MEASURES

The integrated control/IPM concept, Damage thresholds, Forecasting, Increasing agro-ecosystem resistance, Pesticide selectivity, Eradication versus control, Pests and humans – direct pests and vectors of plant and animal diseases, potential human practices and the occurrence of pests, Prevention of communicable diseases after the disaster.

SAMPLING AND MONITORING ARTHROPODS

Methods of sampling and monitoring, Components of a sampling plan, Types of sampling plans, Allocation of Sampling units. Monitoring of arthropods, Monitoring techniques, monitoring methods, Importance of monitoring.

TEXT BOOKS:

1. Principles and procedures of plant protection, 1993. S.B.Chattopadhyay, Oxford-IBH.
2. Agricultural pests of India and south East Asia - A. S. Atwal, 1986. Kalyani Publishers.
3. Francisco Prieto Garcia, Sandra Y. Cortés Ascencio, John C. GaytanOyarzun, Alejandra Ceruelo Hernandez and 3Patricia Vazquez Alavarado (2012) Pesticides: classification, uses and toxicity. Measures of exposure and genotoxic risks. Journal of Research in Environmental Science and Toxicology (Vol. 1(11) pp. 279-293.

REFERENCES:

1. Agricultural insect pests of the crops and their control-D.S.Hill, Cambridge Univ. Press Insect pest of crops - S.Pradhan, National Book trust.
2. Healthy Roses: Environmentally friendly ways to manage pests and disorders in your garden and landscape, 2nd Edition , John Karlik, Mary Louise Flint, and Deborah Golino.
3. Hayes' Handbook of Pesticide Toxicology, Editor-in-Chief: Robert Krieger, University of California, Riverside, U.S.A. Published by January 2010, imprint: Academic Press, ISBN: 978-0-12-374367-1.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.A.Nirmala	Assistant Professor	Biotechnology	Nirmalabt2@avit.ac.in
2	Mrs.M.Sobana	Assistant Professor	Biotechnology	sobanam@vmkvec.edu.in

	PRINCIPLES OF BIOINFORMATICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE –NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Relate the basics of computer science and interdisciplinary subjects related to Bioinformatics	Understand
CO2.Demonstrate the importance of biological databases and their significance in Biotechnology	Understand
CO3. Construct various tools and software which can be adopted in different fields of Biotechnology	Apply
CO4. Build the evolutionary traits using Bioinformatics tools and software	Apply
CO5. Apply the various bioinformatics tools in different fields	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	L	-	-	L	L	-	-	-	-	-	-	L	-	M	M
CO2	L	L	-	-	L	-	L	-	L	M	-	-	M	-	-
CO3	S	S	M	M	M	M	-	-	M	-	-	L	M	M	-
CO4	S	M	S	S	L	M	L	-	M	-	L	L	S	S	M
CO5	S	M	M	S	L	S	L	L	L	S	L	M	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOINFORMATICS

Introduction, Scope of bioinformatics – Introduction to UNIX- Files and processes, Basic UNIX commands for listing files and directories, Making directories, Changing to a different directory, Copying and moving files, Removing files in directories, Clear, CAT and Less commands, Word count, Help, Redirection, Access rights, Running background process and killing processes, ftp, telnet, Internet, http, Search engines.

DATABASES

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

SEQUENCE ALIGNMENT

Introduction to sequence alignment and its significance, Types – Global, Local, Pairwise and Multiple alignment. DOT PLOTS, Scoring matrices – PAM, BLOSSUM. Dynamic programming algorithms, BLAST, FASTA. Multiple sequence alignment by PSI- BLAST. GOLD, CLUSTERS

PHYLOGENETIC ANALYSIS

Terminology and basics of Phylogenetics – Clades, Taxons, Baranches, Nodes; Orthologs and Paralogs. Steps to construct a Phylogenetic tree – Constructing a Multiple Sequence Alignment, Determining the substitution model, Tree building and tree evaluation.

APPLICATION OF BIOINFORMATICS

Application of bioinformatics in various fields – IT, Pharrmaovigilence, Drug discovery, Medicine, Agriculture and Industries.

TEXT BOOKS:

1. Rastogi, S.C., NamitaMendiratta, ParagRastogi. 2006. Bioinformatics – Concepts, Skills, Application. CBS Publications.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., 2000. Instant Notes in Bioinformatics.

   BIOS Scientific Publishers.
3. Teresa, K., Attwood and David J. Parry-Smith, 2007. Introduction to Bioinformatics. *Pearson Education Ltd*.

REFERENCES:

1. Bergeran, B., 2002. Bioinformatics Computing. *PHI*.
2. Richard Durbin, Sean Eddy, Anders Krogh and Graeme Mitchison, 1998. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. *Cambridge University Press*.
3. Bishop, M.J., Rawlings, C.J., 1997. DNA and Protein Sequence Analysis. A Practical Approach. *IRL Press*, Oxford.
4. Gibas, C. and Jambeck, P., 1999. Developing Bioinformatics Skills. *O'Reilly*.
5. Dan Gusfield, 2007. Algorithms on Strings Tree and Sequence. *Cambridge University Press*.
6. Baldi, P. and Brunak, S., 1998. Bioinformatics: A Machine Learning Approach. *MIT Press*
7. Essential Bioinformatics. Jin Xiong. Cambridge University Press. 2006.
8. An Introduction ti Bioinformatics Algorithms. Neil C Jones, Pavel A Pevzner. MIT Press.2004.

9. The New Avenue in Bioinformatics. Joseph SeckbeckEitan Rubin. Springer.2010.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.R.Devika	Professor	Biotechnology	devika@avit.com
2	Mrs.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in

	DIAGNOSTICS AND THERAPEUTICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE: MICROBIOLOGY

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Recall about infection, sample collection, transport and the data.	Remember
CO2. Explain about the most appropriate infectious agent.	Understand
CO3. Demonstrate the microorganism have an indispensable role in disease Diagnosis	Apply
CO4. Appraise the genomic knowledge.	Analyze
CO5. Choose the tool for disease diagnosis.	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	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	L	-	M	-	-	M	-	-	-	-	L	-	-	-
CO4	L	L	L	-	-	-	-	-	S	-	-	M	-	-	-
CO5	S	M	L	L	M	-	-	-	-	-	-	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO DIAGNOSTICS AND THERAPEUTICS

Mode of transmissions of infection, Pre-disposing factors of microbial pathogenicity, Normal microbial flora of the human bod of infectious diseases, Host - Parasite relationships, Clinical specimens Collection, Transport and Processing of samples, Inter of results., Cystic Fibrosis, Neonatal and Pre-natal disease diagnostics, Gender identification, Analysis of mitochondrial I maternal inheritance, Genetic counselling. Normal microbial flora of the human body, Host - Parasite relationships

METHODS IN MOLECULAR DIAGNOSTICS

Isolation and purification of nucleic acids, Nucleic acid labelling, Hybridization, PCR and types, PCR based molecular typing, M Diagnosis of Bacteria (Mycobacterium), DNA virus (HBV/H1N1), RNA virus (HIV/HCV), Parasite (Malaria).Diagnosis of Prot diseases: Amoebiosis, Malaria, Trypnosomiosis, Leishmaniasis. Study of helminthic diseases- Fasciola hepatica and Ascarislumbricoides. Filariasis and Schistosomiasis

MICROBIAL INFECTIONS AND DIAGNOSIS

Pathogenicity and diagnosis of major bacterial infections: Streptococcus, Coliforms, Salmonella, and Mycobacterium, Pathogen diagnosis of major fungal infections: Dermetophytosis, Candidiosis and Aspergillosis, Pathogenicity and diagnosis of major P infections: Amoebiosis, Malaria, Leishmaniasis, DNA and RNA Viruses: Pox viruses, Hepatitis viruses, Adeno viruses a viruses. Infection – mode of transmission in infections, factors predisposing to microbial pathogenicity, types of infectious bacterial, viral, fungal, protozoans and other parasites

MEDICAL GENETICS

Organization of Human genome, Identifying human disease genes, Genetic disorders - Sickle cell anemia, Duchenne muscular Dystrophy, Retinoblastomadiagnosis of pathogens based on 18S and 16S rRNA sequences, Automated DNA sequencing, Microa types and applications. · Neonatal and Prenatal disease diagnostics. Gender identification using amelogenin gene locus. Amplific Y chromosome specific Short Tandem Repeats (Y-STR). Analysis of mitochondrial DNA for maternal inheritance. Molecular di for early detection of cerebral palsy, Down syndrome etc.

BIOSAFETY FOR MOLECULAR DIAGNOSTICS

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

TEXT BOOKS:

1. Lele Buckingham and Maribeth L. Flaws, 2007. Molecular Diagnostics: Fundamentals,Methods & ClinicalApplications.
2. David E. Bruns, Edward R. Ashwood and Carl A. Burtis, 2007. Fundamentalsof MolecularDiagnostics.
3. Griffiths, A. J. F., Miller, J. H. and Suzuki, D. T., 2000. An Introduction to GeneticAnalysis.
4. Jeremy M. Berg, John L. Tymoczko and LubertStryer, 2002. Biochemistry. W.H. Freeman andCompany.5thEdn.
5. Parasitology, Chatterjee K.D, Chatterjee MedicalPublishers

REFERENCES:

1. Lodish, Berk, Zipursky, Matsudaira, Baltimore Darnell, 2000. Molecular Cell Biology. W.H. Freeman and Company.4thEdn.
2. Benjamin L., 2008. Genes IX. Jones andBartlett.
3. Turner, P. C., McLennan, A. G., Bates, A. D. and White, M. R. H., 2003. Instant Notes in Molecular Biology. *Viva Book PrivateLimited*

COURSE DESIGNERS

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1	Dr A Nirmala	Assistant Professor Gr II	Biotechnology	nirmalabt2@avit.ac.in
2	Ms.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

	STEM CELL BIOLOGY AND TISSUE ENGINEERING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO STEM CELL BIOLOGY

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

EMBRYONIC STEM CELLS AND INDUCED PLURIPOTENT STEM CELLS

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

ADULT STEM CELLS

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

TISSUE REGENERATION AND BIOENGINEERING OF TISSUE AND ORGANS

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

ETHICAL, POLITICAL AND SOCIETAL IMPLICATIONS

Future innovations, trends and misconceptions of using human stem cells. Practicalities and feasibilities of using stem cells to treat human disease and injuries. Commercialization of stem cell-based therapies.

TEXT BOOKS:

1. Robert Lanza, John Gearhart, BrigidHogan,Douglas Melton, Roger Pedersen, James ThomsonE and Donnall Thomas. Essentials of Stem cell Biology. Elsevier Academic press.
2. Robert Lanza, Robert Langer and Joseph Vacanti, "Principles of Tissue Engineering", Academic Press, 2007

REFERENCES:

1. Scudellari, Megan "A decade of iPS cells" *Nature*, 534: 310-312.
2. Bredenoord, AL, Clevers, H, Knoblich J (2017) "Human tissues in a dish: The research and ethical implications of organoid technology" Science 355.
3. ThomsonE and DonnallThomas.Essentials of Stem Cell Biology. Elsevier Academic press.
4. Stewart Sell. Stem Cell Handbook, 2004. *Humana Press*.
5. Freshney, R. and Ian. Alan, R. Culture of Animal Cells : A Manual of Basic Techniques. Liss Inc.
6. Modlinske, J.A., Reed, M., A., Wagner, T.E. and Karasiewicz, J., 1996. Embryonic Stem Cells: Developmental Capabilities and their Possible Use in Mammalian Embryo Cloning. *Animal Reproduction Science* 42: 437 – 446.

COURSE DESIGNERS

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2	Ms.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

	MICROBIAL BIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE: MICROBIOLOGY

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1: To describe the historical background and cultural characteristics of microbes	Remember
CO2: To describe the differences between culturing techniques, product purification and recovery process	Understand
CO3: To analyze the production of microbial metabolites	Analyse
CO4: To compare and contrast the production of primary and secondary metabolites	Analyse
CO5: Identify the factors that play a role in the production of antibiotics.	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	S	S	L	-	S	-	-	-	L	-	-	-	-
CO3	-	-	L	L	S	-	-	M	-	-	L	M	-	M	-
CO4	-	-	-	-	-	-	S	-	-	-	L	M	-	M	-
CO5	-	-	L	-	M	-	-	-	-	-	-	S	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

MICROBES AND APPLICATION

Introduction, aims and scope: Organization and function of prokaryotes, primary and seconday screening of industrially important microorganisms from different sources. Extremophiles and their applications: Characteristics of selected groups of microbes. Classify industrially important microorganisms, Culture concept and cultural characteristics

ISOLATION OF INDUSTRIALLY IMPORTANT MICROBES

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

INDUSTRIALLY IMPORTANT MICROBIAL METABOLITES

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

APPLICATIONS OF GREEN CONCEPTS

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

RECOVERY AND PURIFICATION OF MICROBIAL PRODUCTS

Removal of microbial cells- Precipitation, filtration, centrifugation. Cell disruption- extraction and chromatography, Separation of insoluable products, separation of soluable products, Chromatographic techniques, Ultra and micro filtration, Drying and crystallization

TEXT BOOKS:

1. Michael T. Madigan, John M. Martinko, Paul V. Dunlap, and David P. Clark "Brock Biology of microorganisms", Prentice Hall, 12th Edition,2008
2. Michael J. Pelczar, S. Chan, and Noel R. Krieg "Microbiology", McGraw Hill, 7th Edition, 2011 3.
3. Richard Harvery, Cynthia NauCornelissen, Bruce D Fisher, 2011, Microbiology, Lippincott illustrated Reviews:Microbiology.
4. Stanier Y. Roger, Adelberg A. Edward, and Ingraham John "General Microbiology", Prentice Hall, 5th Edition, 1986.

REFERENCES:

1. Geo Brooks, Karen C. Carroll, Janet Butel, and Stephen Morse "Medical Microbiology", McGraw-Hill Medical, 26th Edition, 2012 6.
2. Lansing M. Prescott, Donald A. Klein, and John P. Harley, "Microbiology", McGraw Hill, 5th Edition, 2002 7.
3. G. Reed, Prescott and Dunn's, "Industrial Microbiology", 4th Edition, CBS Publishers, 2009.
4. P. E. Stanbury, A. Whitaker, and S. J. Hall, "Principles of Fermentation Technology", Indian Edition, Hall

Books, 2007

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R Balachandar	Asst. Professor	Biotechnology	balaclone1@gmail.com
2	Ms.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in

	CRYOPRESERVATION THEORY AND APPLICATIONS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE –NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	P S
CO1	L	L	-	-	-	-	L	-	-	-	-	-	M	-	
CO2	L	L	-	-	L	L	L	-	-	M	-	-	-	M	-
CO3	S	M	L	L	S	M	-	-	M	M	L	-	M	M	S
CO4	S	M	M	M	S	S	-	-	-	L	M	-	-	-	S
CO5	S	M	M	-	-	S	-	-	L	-	-	L	S	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

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

VARIATION IN CRYOPRESERVATION

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

TECHNOLOGY OF CRYOPRESERVATION

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

CRYOPRESERVATION AND FERTILITY

Fertility failures, Embryo cryofreezing, techniques in embryo freezing, Storage thawing, retrieval, Cryoprotectant solution.

CRYOPRESERVATION MAN'S HOPE

Cryopreservation of egg, Sperm of *Homosapiens*, Techniques employed in aquaculture (Fish Plankton), Cawthron collection, Design and use of thermal transport containers for cryopreservation, Role of cryopreservation in therapeutics.

TEXT BOOKS:

1. AnnamariaPardo, John M. Baust and Todd Upton, 2005. Improving Quality in Cryopreserved Cells.
2. Gardner, Weissman, Howles and Shoham, 2009. Textbook of Assisted Reproductive Technology. Informa Health Care. 3rd Edn.

REFERENCES:

1. Walvekar, V. R., Jassawalla, M. J., Anjaria, P. H. And Wani, R. J., 2001. Reproductive Endocrinology. Federation of OGS of India. Jaypee Publications. 2nd Edn.
2. Benson, E., Paul T. Lynch and Glyn N. Stacey, 1998. Advance in Plant Cryopreservation Technology Current Application. Erica.
3. Peter R. Brinsden, 2005. Textbook of in vitro Fertilization and Assisted Reproduction – Guide to Clinical Lab Practice. Taylor & Francis. 3rd Edn.
4. Steven R. Bayer, Michael M. Alperand Alan S. Perzias, 2007. Handbook of Infertility. Informa Health Care. 2nd Edn.
5. Igor I. Katkov, 2012. Current Frontiers in Cryopreservation. Intech Publishe

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R Balachandar	Asst. Professor	Biotechnology	balaclone1@gmail.com
2	Mrs.C.Nirmala	Associate professor	Biotechnology	nirmala@vmkvec.edu.in

	FOOD MICROBIOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1: Recall the various food safety levels.	Remember
CO2: Explain the various factors affecting growth of microorganisms	Understand
CO3: Identify the role of food preservation techniques	Understand
CO4: Analyze the risk involved in fermented dairy products	Analyse
CO5: Differentiate the various food spoilage substances	Analyse
CO6: Practice the safety procedure in lab and others research institutions.	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	L	L	L	L	-	-	-	-	-	M	-	L	S	M	-
CO2	M	L	-	M	-	-	-	-	-	-	M	L	-	-	M
CO3	S	-	M	L	L	-	-	M	-	-	-	-	-	-	-
CO4	M	S	L	M	L	-	-	S	-	-	-	-	-	M	-
CO5	S	M	L	-	L	-	-	-	-	-	-	-	-	-	-
CO6	M	S	L	L	-	-	-	S	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

History and development of Food microbiology

Common Food borne Bacteria, Molds and yeasts. Role, and Significance of Microorganisms in Foods. Methods for detection of microorganisms in food: Meat diary, sea foods, vegetables.Physical, Chemical Immunological and biochemical assays.

FACTORS AFFECTING THE GROWTH OF MICROORGANISMS

Factors Affecting the Growth and Survival of Micro-organisms in Foods. -Microbial Growth, Intrinsic Factors- Nutrient Content, pH and Buffering Capacity, Redox Potential, Antimicrobial Barriers and Constituents, Water Activity and Extrinsic Factors - Relative Humidity, Temperature and GaseousAtmosphere

FOOD PRESERVATION

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

FERMENTED DIARY PRODUCTS

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

QUALITY AND SAFETY ASSURANCE

Quality and safety assurance in food and dairy industry Good manufacturing practice, hazard analysis and critical control point (HACCP) concept. BIS Laboratory services

TEXT BOOKS:

a. Adams, M.R. and Moss, M.O. 2008. Food Microbiology, RSC Publishing, Cambridge,UK.
b. Benwart, G.J. 1987. Basic Food Microbiology, CBS Publishers & Distributors, NewDelhi.
c. Blackburn C. de W. 2006, Food spoilage microorganisms, WoodheadPublishing, Cambridge,UK
d. Frazier, W.C., and Westhoff, D.C. 1988. Food Microbiology (Reprint 1995), Tata McGrawHill Publishing Ltd.,NewDelhi

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REFERENCES:

1. Garbutt, J. 1997. Essentials of Food Microbiology, Arnold – International Studentsedition,London.
2. Jay J.M. 2000. Modern Food Microbiology. 6th Edition. 2000. Chapman & Hall, NewYork.
3. Prescott, L.M., Harley, J.P. and Helin, D.A. 2008. Microbiology, Fifth Edition, McGraw Hill,

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
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2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in

	CANCER BIOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PRERQUISITE: MOLECULAR BIOLOGY

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

SYLLABUS

FUNDAMENTALS OF CANCER BIOLOGY

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

PRINCIPLES OF CARCINOGENESIS

Theory of carcinogenesis, Chemical carcinogenesis, Metabolism of carcinogenesis, Principles of physical carcinogenesis – X – ray radiation, Mechanism of radiation carcinogenesis.

PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER

Signal targets and cancer, Activation of kinases, Oncogenes, Identification of Oncogenes, Retroviruses and oncogenes, Detection of oncogenes.Oncogenes / Proto oncogene activity. Growth factors related to transformation. Telomerases.

PRINCIPLES OF CANCER METASTASIS

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

NEW MOLECULES FOR CANCER THERAPY

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

TEXTBOOKS

1.Maly, B.W.J., 1987. Virology A Practical Approach. IRLI Press, Oxford.
2.Dunmock, N.J. and Primrose, S.B., 1988. Introduction to Modern Virology. Blackwell Scientific Publications, Oxford.

REFERENCES:

1. An Introduction Top Cellular and Molecular Biology of Cancer, Oxford Medical Publications, 1991.
2. Primrose, S.B. and Twyman, R.M., 2006. Principles of Gene Manipulation and Genomics. Blackwell Publishing.
3. Lewis J. Klein Smith, 2005. Principles of Cancer Biology. Benjamin Cummings.
4. MomnaHejmadi, 2000. Introduction to Cancer Biology. Asian Publishing Exchange Pvt. Ltd.
5. Leonard Maurice Franks L., Natalie N., 2007. Cellular and Molecular Biology of Cancer. Oxford University Press.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.B.Prabasheela	Professor & Head	Biotechnology	prabasheela@avit.ac.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.ac.in

	APPLIED BIOTECHNOLOGY	Category	L	T		Credit
		EC (PS)	3	0		3

PREAMBLE

This is a multidisciplinary course deals with various aspects like plant and animal biotechnology, medical biotechnology, Biopharmaceutical technology, Bioprocess and Environmental biotechnology to educate students within the field of Biotechnology. Students will gain theoretical and practical competence within the broad field of Biotechnology, both in the molecular level as well as with itsapplications.

PREREQUISITE

PLANT AND ANIMAL BIOTECHNOLOGY

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

On the successful completion of the course, students will be able to	
CO1. Recall the basic information about plant tissue culture techniques	
CO2. Demonstrate the various novel techniques used in medical field	Remember
CO3. Validate the different methods for the production of therapeutics agents in pharmaceutical industry	Understand
CO4.Examine the uses of genetically engineered microbes in Industrial application	Evaluate
CO5. Employ the uses of genetically engineered organism in Environmental issues	Analyze
On the successful completion of the course, students will be able to	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	-	S	-	M	S	-	-	-	M	-	-	-
CO2	S	M	M	-	S	-	M	-	-	-	-	L	-	-	-
CO3	S	M	-	S	M	S	-	S	-	-	-	M	-	-	-
CO4	M	L	M	-	S	M	M	S	-	-	-	L	-	-	-
CO5	M	-	-	-	M	L	S	S	-	-	-	L	-	-	-

SYLLABUS

PLANT AND ANIMAL BIOTECHNOLOGY

Plant tissue culture and application of transgenic for crop improvement in agriculture, Embryo culture and embryo rescue method, in vitro pollination and fertilization , Plantibodies, plastic from plant, genetically modified soybean, transgenic animals and its uses.

MEDICAL BIOTECHNOLOGY

Gene therapy – gene delivery methods, New approaches, Applications of stem cell in the treatment for major diseases in reparative medicine, Hematopoietic Stem Cell transplantation, Applications of tissue engineering – reconstruction of connective tissues, epithelial and endothelial surfaces, DNA fingerprinting, DNA based diagnosis of Genetic disease.

BIOPHARMACEUTICAL TECHNOLOGY

Production of recombinant pharmaceutical products – Biotechnology derived products (Therapeutic proteins): Study of hematopoietic growth factor, Interferon's and Interleukins, Insulin, Growth hormones, Vaccines and Monoclonal antibody-based pharmaceuticals, Anti sense therapyRNAi. Drug designing process, receptor–ligand interaction, ligand docking-Bioinformatics tools.

BIOPROCESS TECHNOLOGY

Basic outline of upstream and downstream process. Isolation and preservation of industrially important organisms, Application of microbes in industry – Industrial Processing, recovery, extraction and purification, Production of antibiotics, solvents, organic acids, amino acids, enzymes, vitamins, single cell protein, food substances from brewing and dairyindustry.

ENVIRONMENTAL BIOTECHNOLOGY

Use of genetically engineered organisms, bioleaching and its applications in environmental science, Fuel technology – Ethanol and Biogas. Biotechnological applications in waste management, Novel methods for pollution control, Biosensors, Biodegradable plastics, Biotechnology in Pesticide, Tannery and Paper industry. Bioremediation- Insitu and Exsitu- bioventing, Biosparging and Phytoremediation. Role of microbes in improving soil fertilityMycorrhiza

TEXT BOOKS

1. Gupta, P.K. , 2015. Elements of Biotechnology. *RastogiPublications*.
2. VaidyanathPratapReddy and SathyaPrasad, 2004. Introduction toApplied Biology and Biotechnology. 1st Edn.,*B. S. Publications.*Hyderabad.
3. Gary Walsh. Biopharmaceutical: Biochemistry and Biotechnology. 2nd Edn.,*John Wiley & sonsLtd.*
4. Samuel E. Lynch and Be Roberts J. Geng. TissueEngineering.

REFERENCE BOOKS

1. Maulikand Patel, 1996. Molecular Biotechnology TherapeuticApplicationsand Strategies. *Wiley &Sons*.
2. Cruger,W.andCruger,A.,2004.Biotechnology:ATextBookofIndustrial Microbiology. 2ndEdn

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.B.Prabasheela	Professor & Head	Biotechnology	prabasheela@avit.ac.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.ac.in

	CLINICALTRIALS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Clinical Trial is to expose the students to literature survey and to understand research objectives, learn the advanced instrumental techniques to be used in research, and computational application in Pharmaceutical and Medicinal Chemistry research. The students should also be made aware of the research ethics, principles and conduct of clinical trials for medical research and Intellectual Property Right.

PRERQUISITE –NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

PURPOSE OF RESEARCH

Research –Meaning, Purpose,Types, (Educational, Clinical, Experimental, Historical Descriptive, Basic applied and Patent oriented research), Objectives of research, Literature survey –Use of Library, Books and Journals–Medline's–Internet, Patent Search and Reprints of articles as a source for Literature survey, Selecting a problem and preparing research proposals.

BASIC TERMINOLOGY USED IN CLINICAL RESEARCH

Research –Meaning, Purpose, Research –Meaning, Purpose. Basic terminology –Adverse event, arm assessment , background therapy , blinding , cross over trial, double blind, early patient withdrawal, Informed consent, confidentiality, Interventional study, observational study.

CLINICAL TRIALS

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

PRECLINICAL TOXICOLOGY

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

APPLICATIONS

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

TEXTBOOKS

1. Katzung, B. G. Basic and Clinical Pharmacology. *Prentice Hall International.*
2. Laurence, D. R. And Bennet, P. N. Clinical Pharmacology. *Scientific Book Agency*.
3. Krishna, D. R. And Klotz, V. Clinical Pharmacokinetics. *Springer Verlab*.
4. Lippincott, Williams and Wilkins. Remington Pharmaceutical Sciences.
5. KvenStockley and Hamsten. Drug interaction.

REFERENCES:

1. Ethical Guidelines for Biomedical Research on Human Subjects. *Indian Council of Medical Research*, New Delhi, 2000.
2. Rick, N.G., 2004. Drug from Discovery to Approval. *John Wiley & Sons Inc.*.
3. Mehra, J. K. Drug interaction. *Basic Bussiness Publication.*
4. Grahame smith and Aronson. Clinical Pharmacology and Drug Therapy.
5. Richard A. Helms. Text Book of Therapeutics Drug and Disease Management. Hardbound.
6. Herfindal, E. T., Hirschman, J. L., Williams and Wilkins. Clinical Pharmacy and Therapeut

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.ac.in

	AGRICULTURAL BIOTECHNOLOGY	CATEGORY	L	T	P	C
		EC (PS)	3	0	0	3

Preamble

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

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Prerequisite

Nil

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

Course Outcomes

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

CO1:	Summarize the basic information about cell structure ,functions and their nutrients	Understand
CO2:	Demonstrate the plant and microbes interactions	Understand
CO3:	Apply the novel techniques used in genetic engineering and genetic manipulation in crop improvement	Apply
CO4:	Identify the uses of different vectors and their application in biotechnology field	Apply
CO5:	Examine the different organic compounds like vitamins, amino acids and proteins etc, using plant as a major source.	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	-	-	-	-	-	-	-	L	-	-	
CO2	L	M	L	L	-	L	-	-	-	-	-	L	-	-	M
CO3	S	S	M	S	M	M	M	-	-	-	-	-	M	S	S
CO4	S	S	M	S	M	M	M	L	-	-	-	-	M	S	S
CO5	M	S	M	M	M	L	S	L	L	M	-	-	M	S	M
S- Strong; M-Medium; L-Low															

Syllabus

	BIOLOGY OF PLANTS
Plant cell structure and functions. Plant nutritition, Water and mineral availability and uptake. Growth regulators- Phytohormones, auxins, cytokinens, Gibberillins, Abscisic acid, ethylene.	
	PLANT –MICROBES INTERACTIONS
Biotic and Abiotic stress. Plant response to pathogens. Toxins of fungi, algae and bacteria. Systemic and induced resistance, pathogen derived resistance. Genetic engineering for biotic stress resistance	
	GENETIC MANIPULATION IN CROPS
Genetic engineering- scope and methods. Gene guns, electroporation, transformation, microinjections, CRISPR, TALEN. Types of modifications- Transgenic, cisgenic, subgenic. Stress resistance, pest resistance, herbicide tolerance and other modified traits.	
	PLASMIDS AND PROMOTERS
Ti and Ri plasmids, Antisense and RNAi in crop improvement. Disarming Ti plasmid, opines and their significance. Co integrate and binary vectors. Screenable and selectable markers. Promoters and poly A signals.	
	PLANTS AS BIO –FACTORIES
Seed storage proteins, essential amino acids, vitamins and minerals, heterologous protein production in transgenic plants for agriculture, industry and pharmaceuticals uses, biodegradable plastics.	

TEXTBOOK

1. Ahindra Nag. Textbook of Agricultural Biotechnology.PHI Publisher. 2008

REFERENCES

1. Adrian Slater, Nigel Scott and Mark Fowler. 2003. Plant Biotechnology: The genetic manipulation of plants. I edition, Oxford University Press.
2. Vidhyasekaran P. 2005.Bacterial disease resistance in plants. Molecular Biology and Biotechnological applications. Haworth food and agricultural products press. New York.
3. Pessarakti M. 1999. Handbook of planrt and crop stress, 2nd edition. Marcel Dekkar Inc. New York.
4. Melvin J oliver. Agricultural Biotechnology.Wiley Blackwell. 2009

	GENOMICS AND PROTEOMICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE

GENETIC ENGINEERING

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. To describe the organisations genes in prokaryotes and eukaryotes	Understand
CO2. To illustrate various genome mapping techniques and its strategies.	Apply
CO3. To relate the flow of genetic information from DNA to RNA to protein	Apply
CO4. To compare the advantages and the drawbacks of various proteomics technologies with the emerging technologies	Analyse
CO5. To evaluate the role of proteomics in drug discovery	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	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	L	L	L	-	L	-	-	-	-	L	L	L	L
CO3	M	L	-	L	L	L	-	-	-	-	-	-	-	L	-
CO4	L	L	L	-	L	-	L	-	L	-	-	-	L	-	-
CO5	S	M	L	L	-	-	-	-	L	-	-	-	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF GENOMES OF PROKARYOTES, EUKARYOTES AND HUMAN

Organisation of genes, Coding and non-coding chromosomes and high order structures, Genome relatedness, Introduction of genomics.

MAPPING TECHNIQUES

Mapping strategies, Maps – Physical and Genetic maps, Comparative map, Integrated map, Top down and bottom up approach, linking and jumping of clones, STS maps, Human Genome Project,Identification and classification using molecular markers-16S rRNA typing/sequencing, EST's and SNP's

FUNCTIONAL GENOMICS

Gene identification and prediction, Annotation, Functional prediction, Gene expression and micro arrays, Substractive DNA library screening, differential display and representational difference analysis, SAGE. **PROTEOMIC TOOLS**

Edman protein microsequencing, Proteome analysis, 2D gel electrophoresis, Metabolic labeling, Detection of protein on SDS gels. Mass spectrometry – MALDI - TOF, Tandem MS - MS, Peptide mass finger printing.Protein analysis (includes measurement of concentration, aminoacid composition, Nterminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting

PROTEIN PROFILING AND APPLICATION OF PROTEOMICS

Protein – protein interaction, Post translational modification, Proteomics in drug discovery.High throughput screening in genome for drug discovery identification of gene targets, Pharmacogenetics and drug development

TEXT BOOKS:

1. Rastogi, S.C., Mendiratta, N. and Rastogi, P, 2008. Bioinformatics Methods and Applications. Prentice-Hall of India (Private),Limited.
2. Andreas D. Baxevanis and Francis Oueliette, B.F, 2004. Bioinformatics A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition. *John Wiley and Sons Inc*.

REFERENCES:

1. David W. Mount, 2001. Bioinformatics, Sequence and Genome Analysis. *Cold Spring Harbor Laboratory Press*.
2. Pennington and Dunn, 2001. Proteomics. *BIOS ScientificPublishers*.
3. Liebler, 2002. Introduction to Proteomics. *HumanaPrem*.
4. Primrose and Twyman, 2003. Principles of Genome Analysis and Genomics. *Blackwell PublishingCo*.
5. Westhead, D.R., Parish, J.H. and Twyman, R.M., 2003. Instant Notes Bioinformatics. 1stEdn.,*Viva Books PrivateLimited*.
6. Ignacimuthu, S., 2005. Basic Bioinformatics. *Narosa PublishingHouse*.

COURSE DESIGNERS

Name of thenFaculty	Designation	Department	Mail ID
Dr.R Balachandar	Assistant Professor	Biotechnology	Balaclobne1@gmail.com
Ms.C.Nirmala	Associate Professor	Biotechnology	nirmala@vmkvec.edu.in

	MOLECULAR MODELLING AND DRUG DESIGNING	Category	L	T	P
		EC (PS)	3	0	0

PREAMBLE

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

PREREQUISITE

PRINCIPLES OF BIOINFORMATICS

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Recognize about molecular modelling concepts

CO2. Classify molecular mechanisms behind energy minimization problems

CO3. Illustrate the models to study the molecular dynamics

CO4. Compare molecular dynamics with drug designing concepts

CO5. Design new techniques for the discovery of drugs

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

QUANTUM MECHANICS & CONCEPTS IN MOLECULAR MODELING

Introduction – coordinate systems – potential energy surfaces – introduction to quantum mechanics – postulates – Schrodinger wave equation – hydrogen molecule – Born-Oppenheimer approximation, introduction to computer hardware and software.

MOLECULAR MECHANICS AND ENERGY MINIMIZATION

Empirical force field models – Bond stretching – angle bending – torsional term – nonbonding interactions – thermodynamics properties using a forcefield – derived and non-derived energy minimization method – simplex – sequential univariate method – steepest descent method – conjugate gradient method- Newton-Rapson method.

MOLECULAR DYNAMICS AND MONTE CARLO SIMULATION

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

HOMOLOGY MODELING

Comparative modeling of proteins – comparison of 3D structure – Homology – steps in homology modeling – tools – databases – side chain modeling – loop modeling.Advantage and disadvantage. Ramachandran plot. Applications.

DRUG DESIGN

General approach to discovery of new drugs –drug targets, lead discovery – lead modification – physiochemical principles of drug action – drug stereo chemistry –drug action - 3D database search – computer aided drug design – Mechanism based drug design – ligand based drug design– structure based drug design – pharmacophores - QSAR

TEXTBOOKS:

1. Leach R. (1996), "Molecular Modeling Principles and Application", 2nd edition, Longman Publications.
2. Baxivanis D. and Foulette - Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition edition, Wiely-Blackwell Publishers
3. Kothekar V. (2001), "Essentials of Drug Designing", Indian Edition, Dhruv Publications
4. Gerhard Edwin Seibold, Alexander Hillisch, Rolf, (2002) "Modern Methods of Drug Discovery", Hilgenfeld Publisher.

REFERENCES:

1. Attwood, T K , parry-Smith, D J (2005), " Introduction to Bioinformatics", Pearson Education, 1st Edition, 11th Reprint
2. Alan Hinchliffe, (2003), " Molecular Modelling for Beginners", John-Wiley
3. "Drug Design: Cutting Edge Approaches". AngewandteChemie, International Edition,Vol.42
   "Advanced Drug Design and Development" Kourounakis Taylor and Francis

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr R Devika	Professor & Head	Biotechnology	devika@avit.ac.in
2	Mrs.M.Sobana	Assistant Professor	Biotechnology	sobanam@vmkvec.edu.in

	NANOBIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

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

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To define about the basic concepts of Nanotechnology.
2	To explain about the Fabrication and Characterization of nanomaterials
3	To classify the nanoscale elements delivery inBiosystems
4	To outline the interaction of Microorganism in Nanobiotechnology.
5	To design the novel drug delivery system for *in vivo* studies

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO NANOBIOTECHNOLOGY

Introduction to types and properties of nanoparticles, Overview of nanodevicesand techniques, Inorganic nanoscale systems for biosystems–Nanostructured materials–Fullerenes: Properties and characterization – Carbon nanotubes: Characterisationand application–Quantum dots and wires–Gold Nanoparticles –Nanopores

FABRICATION AND CHARACTERISATION

Synthesis –Top-down and Bottom-up Methods, Epitaxial growth, Characterization: X-Ray Diffraction(XRD), Transmission Electron Microscopy(TEM), Scanning Electron Microscopy (SEM), Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM), Energy Dispersive of X ray spectrum (EDS)

NANOMOLECULES IN BIOSYSTEMS

DNA, RNA, Proteins and Lipids–Nanoscaleelements for delivery of materials into cells, Nanotechnology in cell –Cell motility: Nanomotorsand cellular navigation– Chemotaxis –Transmembranesignallingand related proteins.

MICROORGANISMS AND NANOBIOTECHNOLOGY

Nanobiotechnology and microorganisms – Polyhydroxyalkanotes (PHA) Cyanophycininclusions– Magnetosomes– Alginates s-layer proteins –Bacteriorhodopsin.

APPLICATIONS OF NANOBIOTECHNOLOGY

Nanomedicine, Nanobiosensor–Electrochemical DNA sensors, Nanobiochips, Nanocrystalsin Biological Detection, Small scale systems for *in vivo* drug delivery, Nanotechnology for diagnosis and treatment (Cancer and Leprosy), Commercializing Nanobiotechnology. Nanotechnology for disaster relief – Decontamination Emergency equipment, Lab on a chip and sustainability.

TEXT BOOKS:

1. BhushanBharat (Ed.). Hand book of Nanotechnology. *Springer* 3rd Edition (2010)
2. AjayanP.A. and SchadlerL, Braun P. V., NanocompositeScience and Technology. *Wiley– VCH* (2003).
3. Nlemeyer, C.M. (Ed.)andMirkin, C.A. (Ed.) Nanobiotechnology–Concepts, Applications and Perspectives. *Wiley–VCH* (2004)
4. GeoffOzinand Arsenault, A., Nanochemistry: A Chemical Approach to Nanomaterials. 1st Edn., *Royal Society of Chemistry* (2005)
5. Charles P. Poole and Junior Frank J. Owens, Introduction to Nanotechnology. *John Wiley and Sons* (2003).

REFERENCES:

1. Rosenthal, S.J. and Wright, D.W. NanobiotechnologyProtocols in methods in Molecular Biology Series. *Humana Press* (2005).
2. Michael Crichton. Understanding Nanotechnology. *Scientific American Publisher* (2002).
3. RalphS.Greco,FritzB.Prinzand LaneSmithm,R., NanoscaleTechnology in Biological systems. *CRC Press* (2005).

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Balachandar	Assistant professor	Biotechnology	Balaclone1@avit.ac.in
2	Ms.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

	GOOD MANUFACTURING AND LABORATORY PRACTICE	Category	L	T	P	Credit
		EC (PS)	2	1	0	3

PREAMBLE

The course will emphasis on good manufacturing and laboratory practices. Through knowledge on testing facilities, equipment, testing and controls, records, reports, and protocol for and conduct of non-clinical labs. Exposure on ethical issues and clnical regulations.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	Basic understanding of the regulatory requirement of GMP and GLP
2	To understand the significance of GMP and GLP
3	Thorough knowledge on testing equipment, procedures and maintain records and reports.
4	Exposure to clinical regulations and ethical issues

COURSE OUTCOMES

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

CO1 Understand that the areas that come under the Good Laboratory Practices are: personnel and organizational, testing facilities, equipment, testing and controls, records, reports, and protocol for and conduct of non-clinical labs.	Remember
CO2. Understand the areas of GMP and GLP	Understand
CO3. Knowledge and practices of equipment production process control and packaging	Understand
CO4. Regulations of clinical practices	Understand
CO5. Knowledge about ethical issues and amendments	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		M			L						M		-
CO2	M	L	L			L									-
CO3	S	M												L	-
CO4			M			M							L		-
CO5	M		M												-

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Good Manufacturing and Laboratory Practice

Introduction to Good Manufacturing and Laboratory Practice, Requirement of GLP and GMP compliance for regulatory approval,

concept of Design of Experiment

Introduction to the concept of Design of Experiment (DOE) Application of QBD principles in Biotech product development. Case studies: Example of QBD and DOE in Process Development, Example of DOE in analytical development

Guidelines of regulatory affairs

Introduction to ICH guidelines and their usage, National and international regulatory authorities and their function, Pharmaceutical Jurisprudence and Laws related to Product design, Drug Development & Approval Process.

Clinical and Preclinical Studies

Regulation of Clinical and Preclinical Studies, Good Manufacturing Practices, Formulation Production Management, Authorization and marketing of drugs.

Principles and Ethics

Ethics in manufacturing and control, Principles of quality by design (QBD)

TEXT BOOKS:

1. GMP starter guide: Principles in Good Manufacturing Practices for Beginners, Emmet P. Tobin, Createspace Independent Publishing Platform, April 2016.

2. Good Manufacturing Practices for Pharmaceuticals: GMP in Practice, B Cooper, Createspace Independent Publishing Platform, July 2017.

3. Sarwar Beg and Md Saquib Hasnain, Pharmaceutical Quality by design: Principles and application, Academic press, March 2019.

4. Ron S. Kenett, Shelemyahu Zacks, Daniele Amberti, Modern Industrial Statistics: with applications in R, MINITAB and JMP, 2nd Edition, Wiley, January 2014.

5. N Politis S, Colombo P, Colombo G, M Rekkas D.Design of experiments (DoE) in pharmaceutical development, Drug Dev Ind Pharm. 2017 Jun;43(6):889-901. doi: 10.1080/03639045.2017.1291672.

REFERENCES:

1. Andrew Teasdale, David Elder, Raymond W. Nims, ICH quality guidelines- An implementation guide, Dec 2017.

2. Gajendra Singh, Gaurav Agarwal an Vipul Gupta, Drug regulatory affairs, CBS publication, 2005.

3. Marc P. Mathieu, New Drug Development: A regulatory overview, Nov 2000.

4. ICH guidelines available in the official website "https://www.ich.org

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.R.Balaichandar	Asst.Prof G-II	Biotechnology	Balachandar.biotech@avit.ac.in
2	Mrs.S.Subriya	Assistant Professor	Biotechnology	subriya@vmkvec.edu.in

	BIOPHYSICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

The course lightens the structural knowledge of biological system and the properties.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To gain structural knowledge of biological systems
2	To understand transport and dynamic properties of biological systems.

COURSE OUTCOMES

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

CO1. To analyze the various forces responsible for biological molecular structure	Remember
CO2. To be familiar with different levels of conformation in biomolecules	Remember
CO3. To gain the knowledge of cellular permeability and ion transport	Understand
CO4. To understand the ionic conduction and transportation among the cellular strucutres	Understand
CO5. To gain knowledge in the dynamics of biological 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	M		M			L			L						-
CO2	L	L			L			L							-
CO3	L			M			L								-
CO4	M		L		L										-
CO5		L				L		L							-

S- Strong; M-Medium; L-Low

SYLLABUS

MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS

Intramolecular bonds – covalent – ionic and hydrogen bonds – biological structures –general features – water structure – hydration – interfacial phenomena and membranes – self assembly and molecular structure of membranes.

CONFORMATION OF NUCLEIC ACIDS

Primary structure – the bases – sugars and the phosphodiester bonds- double helical structure – the a b and z forms – properties of circular DNA – topology – polymorphism and flexibility of DNA – structure of ribonucleic acids – hydration of nucleic acids.

CONFORMATION OF PROTEINS

Conformation of the peptide bond – secondary structures – Ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.

CELLULAR PERMEABILITY AND ION – TRANSPORT

Ionic conductivity – transport across ion channels – mechanism - ion pumps- proton transfer – nerve conduction – techniques of studying ion transport and models.

ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS

Concepts in thermodynamics – force and motion – entropy and stability – analyses of fluxes – diffusion potential – basic properties of fluids and biomaterials – laminar and turbulent flows

TEXT BOOKS:

1. Biophysics ; R. Glaser, Springer Verlag , 2000. 2. Biophysics: Molecules In Motion ; R. Duane. Academic Press , 1999

REFERENCE:

1. Cantror, Charles R. and Paul R. Schimmel "Biophysical Chemistry". 1-3 Vols. W.H.Freeman & Co.,1980

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.A Nirmala	Asst.Professor Gr II	Biotechnology	nirmalabte@avit.ac.in
2	Mrs.S.Subriya	Assistant Professor	Biotechnology	subriya@vmkvec.edu.in

	BASICS OF HUMAN PHYSIOLOGY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The principle focus of human physiology is, at the level of organs and systems within human body. The science of physiology is concerned with the function of the body. The prime concern of this syllabus is to integrate the individual functions of all the cells and tissues and organs into functional whole, the human body. In a typical undergraduate setting, this course would fulfill requirements for students applying to professional health science programs like medical coding.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To recall the basic terminologies, cells, tissues and organs in human body.
2	To understand the basics of respiratory system and cardiovascular system
3	To illustrate the functions of nervous and muscular system.
4	To describe the basic anatomy and functions of digestive and excretory system
5	To outline the role of hormones and various functions in the body

COURSE OUTCOMES

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

CO1. Define the basic terminologies and identify the different cells, tissues and organs and their function	Remember
CO2. Describe about the respiratory and cardiovascular system and their functions	Understand
CO3. Students would be understand working physiology of nervous system and musculoskeletal system	Apply
CO4. Students would able to comprehend physiology of digestive, excretory systems.	Analyze
CO5. Analyze the functions of hormones with physiological process and their clinical importance	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	--	--	L	--	M	--
CO2	M	L	--	--	--	--	--	--	M	--	--	L	--	M	M
CO3	S	S	M	--	--	S	--	--	S	--	--	S	S	S	S
CO4	S	S	M	--	--	S	--	--	S	--	--	S	S	S	S
CO5	S	S	M	--	--	S	--	--	S	--	--	S	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CELL AND ORGANELLS

Structure and functions of Cell and organelles. Overview of organ systems. Membrane - Transport across membrane, Origin of cell membrane potential, Action potential. Blood - Properties and functions, Cellular Components: RBC, WBC, platelets, Blood Groups.

RESPIRATORY SYSTEMS AND CARDIOVASCULAR SYSTEM

Respiratory Organs, Mechanism of respiration, Carbon dioxide and oxygen transport, Regulation of respiration, Volumes and capacities of lung. Structure of heart, Blood vessels, Conduction system of heart, Physiology of Cardiac Muscle, Cardiac cycle, Heart Sound, Cardiac output, Blood pressure and its regulation.

NERVOUS SYSTEM AND MUSCULOSKELETAL SYSTEM

Neurons, Synapse and neurotransmitters, Central nervous system: Structure and functions of brain. Peripheral nervous system: Classification of peripheral nervous system, Autonomic nervous system, Reflex action.
Muscular System: Classification of muscles. Bone: Types, Functions, Anatomy of long bone – Formation, growth and repair, Structural and functional classification of joints.

DIGESTIVE AND EXCRETORY SYSTEM

Digestive: Organs of Digestive system – Digestion and Absorption. Urinary: Structure of Kidney and Nephron – Mechanisms of Urine formation – Regulation of Blood pressure by Urinary System, Composition of Urine. Skin and Sweat Gland.

ENDOCRINE GLANDS:

Endocrine system: Structure and functions of Pituitary gland, Thyroid gland, Parathyroid gland, Adrenal gland, Pancreas, Pineal gland, Thymus, Ovaries and Testes.

TEXT BOOKS:

3. Arthur C. Guyton, John E. Hall, **"Textbook of Medical Physiology"**, W.B. Saunders Company, Twelfth Edition, 2006.
4. Ranganathan, T.S. **"Text Book of Human Anatomy"**, S.Chand & Co. Ltd., Delhi, 1996.

REFERENCES:

1. Ross & Wilson, **"Anatomy & Physiology for Health and Illness"**, Elsevier, 11th Edition, 2010.
2. Stuart I. Fox, **"Human Physiology"**, Tata McGraw Hill, 9th Edition, 2006.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.A.Nirmala	Assistant Professor(Gr-II)	Biotechnology	nirmalabt@avit.ac.in
2	Dr.M.Sridevi	Professor	Biotechnology	sridevi@vmkvec.edu.in

	SKILL BASED ETHNO MEDICINE	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

Ethno medicine course deals with the interaction of people and plants with a broad survey on diversity of plants described both scientifically and culturally. Students learn about the social impact of plants on culture and also gain knowledge on identification, characterization and the uses of different medicinal plants in treating various diseases.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To state the scope and history of people and plant interaction from the past
2	To explain the functions and uses of plants
3	To demonstrate the different tribal medicine used for disease diagnosis and treatment.
4	To develop an understanding of the importance of plants in our daily lives
5	To produce cosmetics using medicinal plants

COURSE OUTCOMES

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

CO1. Recall the basic information and ethnic knowledge about plants	Remember
CO2. Demonstrate the knowledge about the uses of medicinal plants	Understand
CO3. Illustrate the uses of different tribal medicine for disease diagnosis and treatment	Apply
CO4. Appraise the traditional knowledge and utility of some commonly used medicinal plants	Analyze
CO5. Develop the cosmetics using medicinal plants	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INRODUCTION TO ETHNOMEDICINE

Ethno medicine – definition, history and its scope – Inter disciplinary approaches in ethno botany – Collection of ethnic information.

MEDICINAL PLANTS AND HEALTH CARE

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

TRIBAL MEDICINE

Tribal medicine – Plants in folk religion – *Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum*- methods of disease diagnosis and treatment.

MEDICINAL PLANTS IN DAY TO DAY LIFE

Traditional knowledge and utility of some medicinal plants in Tamilnadu – *Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica, Phyllanthus fraternus and Boerhaavia diffusa. Ocimum sanctum, Centella asiatica, Solanum trilobatum, Cassia auriculata, Aloe vera.*

HERBAL PLANTS USED IN COSMETICS

Plants used as a cosmetics-Almond (*Prunus dulcis*), Aloe (*Aloe vera*), Argan Tree (*Argania spinosa*), Buriti Palm (*Mauritia flexuosa*), Cinnamon (*Cinnamomum verum*), Grape (*Vitis vinifera*), Lemonbalm (*Melissa officinalis*), Malabar Tamarind (*Garcinia cambogia)*

TEXT BOOKS:

1. Ethnobiology – R.K.Sinha & Shweta Sinha – 2001. Surabhe Publications – Jaipur.
2. Swapan Kumar Kolay, Ethno-medicine for Traditional Health Care, 2016,

   Publisher B.R. Publishing Corporation

REFERENCES:

1. Tribal medicine – D.C. Pal & S.K. Jain 1998, Naya Prakash, 206, Bidhan Sarani, Calcutta – 700 006.
2. Contribution to Indian ethnobotany – S.K. Jain 1995, 3rd edition, Scientific publishers, P.B.No. 91, Jodhpur, India.
3. A Manual of Ethnobotany – S.K.Jain, 1995, 2nd edition.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. A.Nirmala	Assistant Professor	Biotechnology	nimmi_aruna@yahoo.com
2	Mrs. C.Nirmala	Assistant Professor	Biotechnology	Nirmala@vmkvec.edu.in

(i) INDUSTRY DESIGNED/ INDUSTRY SUPPORTED/INDUSTRY OFFERED/INDUSTRY SPONSORED COURSES - CREDITS (6)

	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

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

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.

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.

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.

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:

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr. K. Sasikala	Associate Professor	CSE	sasikalak@vmkvec.edu.in
2.	Mrs. S. Leelavathy	Assistant Professor (G-II)	CSE	leelavathy@avit.edu.in

SOFT SKILLS

	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 monitoring, reporting, close-out activities etc..	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

	TOOLS AND TECHNIQUES OF MODERN BIO-INFORMATICS	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

This course is an introduction to bioinformatics for biology and biomedical students. It introduces bioinformatics methodology and technologies without relying on any prerequisites. The aim of this course is for students to be in a position to understand important notions of bioinformatics and tackle simple bioinformatics-related problems. Analysis scripts and reproducible analysis reports to interrogate,visualize and understand data in a tidy tabular format.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To understand the basics of Bioinformatics database management
2	To emphasize the gene sequence mapping and screening
3	To illustrate the structure prediction of protein
4	To correlate the Bioactivity Predictions, Physiochemical properties prediction.

COURSE OUTCOMES

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

CO1. Recall the basic database management, types of database	Remember
CO2. Discuss about the omics, alignment and tool handling	Understand
CO3. Identify the gene, mapping, expression	Understand
CO4. Correlate the structure prediction, folding and analysis	Analyse
CO5. Illustrate the aminoacid residue prediction, physiochemical property prediction	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO02	PSO3
CO1	L	L	L	S	-	L	M	-	L	-	M	-	M	-	M
CO2	L	S	-	L	-	-	-	S	-	-	-	-	-	-	-
CO3	-	-	-	L	L	-	M	-	-	-	-	S	-	-	-
CO4	-	-	-	S	-	-	-	-	-	-	-	S	-	-	-
CO5	L	M	L	L	-	S	L	-	-	-	-	L	-	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF BIOINFORMATICS

Introduction to Bioinformatics, Database development and management, Various Biological data and its formats, Different types of Database – Primary, Secondary and Tertiary Database

INTRODUCTION TO GENOMICS & GENOME INFORMATICS

Gene: Retrieval, Handling & processing, Gene sequence Matching: Alignment and Handling, Genome Scan, Alignment Tools – Blast, ClusterW, Omega

PROTEOMICS: PROTEIN EXPRESSION

ORF Mapping, Gene Mapping: Gene Scan, Gene screening for protein Expression, Proteomics: Six frame translation

FOLD RECOGNITION AND SECONDARY STRUCTURE PREDICTION

Secondary Structure Predictions – Fold recognition – Homology modelling, Stability Analysis, Ramachandran plot, Q mean Value

PROTEIN PHYSIOCHEMICAL PROPERTY PREDICTIONS & BIOACTIVITY PREDICTIONS

Active site Predictions, Physiochemical properties prediction – Denaturation temperature, Molecular weight, λmax absorbance, Amino acid residue predictions, Bioactivity Predictions – Antibacterial, antiviral and Anticancer properties.

REFERENCES:

1. Bult, Carol J. "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins." Science 282, no. 5389 (1998): 635-636.
2. Srinivasa, K. G., G. M. Siddesh, and S. R. Manisekhar, eds. Statistical Modelling and Machine Learning Principles for Bioinformatics Techniques, Tools, and Applications. Springer Nature, 2020.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. K. K. Prashanth	Director	Bioinformatics	

II) OPEN ELECTIVE **Electives from Innovation, Entrepreneurship, Skill Development etc. Credits – 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	Dr. P. Marishkumar	Associate Professor	Management Studies	marishkumarp@vmkvec.edu.in
2	T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

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

	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 DESIGNER

S.No	Name of the faculty	Designation	Department	E-Mail Id
1	Dr. G. Murugesan	Professor	Management Studies	murugesan@vmkvec.edu.in
2	Mr. T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

	INTELLECTUAL PROPERTY RIGHTS	Category	L	T	P	Credit
		FC (M)	3	0	0	3

PREAMBLE: The course is designed 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.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To introduce fundamental aspects of Intellectual property Rights
2. To disseminate knowledge on patents and copyrights
3. To disseminate knowledge on trademarks, Design and Geographical Indication (GI),
4. To disseminate knowledge on Plant Variet, Layout Design Protection and create awareness about current trends in IPR
5. To disseminate knowledge on Legislation of IPRs and Alternate Dispute Resolution

COURSE OUTCOMES:

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

CO1: Understand the important of intellectual property rights	Understand
CO2: Apply for the patents	Apply
CO3: Understand and apply for the copyrights	Understand
CO4: Understand the important of trademarks	Apply
CO5: Appreciate the importance of IPR and its related issues	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	L	-	-	-	-	L	S	L	-	L	-	L	L	M	-
CO2	L	S	S	M	M	L	-	-	-	-	-	L	M	L	-
CO3	L	S	L	M	M	L	-	-	-	-	-	L	M	L	-
CO4	L	S	S	S	M	L	-	-	-	-	-	L	L	L	-
CO5	L	S	S	M	-	L	-	-	-	-	-	L	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS:

Overview of Intellectual Property

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design –

Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994.

Patents & Copyright

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

Copyright - Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

Trademarks, Design and Geographical Indication (GI)

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

Design: Meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI): Meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

Plant Varieties, Layout Design and Indian National Intelectual Property Policy

Plant Variety Protection: Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection.

Layout Design Protection: Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection.

Indian National Intelectual Property Policy: India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies

Legislation of IPRs and Alternate Dispute Resolution

Legislation of IPRs: The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh- Dole Act - Patent Ownership and Transfer, Patent Infringement, International Patent Law

Alternate Dispute Resolution: Alternate Dispute Resolution and Arbitration – ADR Initiatives –Reason for Choosing ADR – Advantages and Disadvantages of ADR – Assessment of ADR's – Litigation – Arbitration - Effective Mechanism for Business Issues.

Text Books:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference Book:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	Mail ID
1	P. S. Balaganapathy	Associate Professor	Management	dydirectormanagementstudies@avit.ac.in
2	A. Mani	Associate Professor	Management	mani@vmkvec.edu.in

	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:

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. G. Murugesan	Professor	Management Studies	murugesan@vmkvec.edu.in
2	Mr. T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

(iii) OPEN ELECTIVE – EMERGING AREAS (CLASS ROOM OR ONLINE) - CREDITS (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
2	Mr.V.Prabhakaran	Assistant Professor (Gr-II)	BME	prabhakaran.bme@avit.ac.in
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
2	Dr.N.Babu	Professor	BME	babu@vmkvec.edu.in
3	Mr.V.Prabhakaran	Assistant Professor (Gr-II)	BME	Prabhakaran.bme@avit.ac.in
4	Mrs.S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in

	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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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/ Name 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 anddesign.

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

	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

SYLLABUS

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.

	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

–INTRODUCTION to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

.

- IoT & M2M

Machine to Machine, Difference between IoT and M2M, Software define Network

– Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

– Domain specific applications of IoT

Design challenges, Development challenges, Security challenges, Other challenges

– 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

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Jayachandran	Professor	CSE	jayachandran@avit.ac.in
2	Dr.M.Nitya	Professor	CSE	nithya@vmkvec.edu.in

	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

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.

PRODUCT PROTOTYPES

Management of ID process, Product architecture, Structure: standard and non-standard structures. Product prototypes.

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,

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.

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

S.No	Name of the Faculty	Designation	Department	Mail ID
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	PSO2	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

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Devarajan	Professor	EEE	devarajan@vmkvec.edu.in
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	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.petruzellaprogrammable logic controlsthird 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. Pradheepkumarsrivastava, 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.SrinivasanSpecial 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
2	Dr.R.Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in

	DISASTER RISK MANAGEMNT	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 adisaster 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. &MurshedZ. Community Based Disaster Risk Management: Field Practitioner's Handbook, ADPC, Bangkok,2004.
2. Goudie,A. Geomorphological Techniques, UnwinHyman, London 1990.
3. Goswami,S.C.RemoteSensingApplicationinNorthEastIndia,PurbanchalPrakesh,Guwahati,1997.
4. Manualon Natural Disaster Management in India, NCDM, NewDelhi,2001.
5. Disaster Management in India, Ministry of Home Affairs, Government of India, NewDelhi,2011.
6. National Policy on Disaster Management, NDMA, NewDelhi,2009.
7. Disaster Management Act.(2005), Ministry of Home Affairs, Government of India,NewDelhi,2005.

Course Designers

S.No.	NameoftheFaculty	Designation	Department	MailID
1	Ms.S.IsparaXavier	AssistantProfessor	Civil/AVIT	isparaxavier.civil@avit.ac.in

	MUNICIPAL SOLID WASTE MANAGEMENT	Category				Credit
		OE-EA	3	0	0	3

PREAMBLE

The primary goal of solid waste management is reducing and eliminating adverse impacts of waste materials on human health and the environment to support economic development and superior quality of life

PRE-REQUISITE - Nil

COURSE OBJECTIVES

1	To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste..
2	The student is expected to know about the various effects and disposal options for the municipal solid waste.
3	to identify any potential environmental impacts from the generation of waste at the site;
4	To introduce and aware students to real concerns of environment and its sustainability
5	The student is expected to know the treatment and disposal of waste and harmful impacts

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO:1	understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.	Understand
CO:2	Reduction, reuse and recycling of waste..	Understand
CO:3	ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.	Apply
CO:4	knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.	Apply
CO:5	Design and operation of sanitary landfill.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO:1	L							L							
CO:2		S	L						M						
CO:3	L				M		M				L				
CO:4	M	L	M							L					
CO:5	S	L							L		S				

S – STRONG, M – MEDIUM and L – LOW

SYLLABUS

SOURCES AND CHARACTERISTICS

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) –- Role of public and NGO‟s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

SOURCE REDUCTION , WASTE STORAGE AND RECYCLING

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

COLLECTION AND TRANSFER OF WASTES

Methods of Residential and commercial waste collection – Collection vehicles – Manpower –Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

PROCESSING OF WASTES

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

WASTE DISPOSAL

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment

TEXT BOOK (S)

1. illiam A. Worrell, P. Aarne Vesilind (2012) Solid Waste Engineering, Cengage Learning, 2012.

2. John Pitchel (2014), Waste Management Practices-Municipal, Hazardous and industrial – CRC Press, Taylor and Francis, New York.

3.George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 2002.

REFERENCE BOOKS

1.CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi.

2 George Tchobanoglous and Frank Kreith (2002).Handbook of Solid waste management, McGraw Hill, New York.

3.R.E.Landreth and P.A.Rebers, "Municipal Solid Wastes – problems and Solutions", Lewis Publishers, 1997.

COURSE DESIGNERS

	Name of the Faculty	Designation	Department	E-Mail ID
	Mr.C.Kathirvel	Asso. Professor & Head	Civil / VMKVEC	kathirvel@vmkvec.edu.in

	BIOMOLECULES - STRUCTURE, FUNCTION	Category	L	T	P	C
		OE-EA	3	0	0	3

PREAMBLE

Biomolecules like carbohydrates, proteins, fat are vital components of any living system. Basic knowledge about them helps in maintaining a healthy lifestyle, free of sickness and a general awareness about hygiene.

PREREQUISITE NIL

COURSE OBJECTIVES

1	To give an overview of importance of biomolecules
2	To elaborate the structure of proteins and nucleic acids and its role in disease.
3	To enumerate the role of carbohydrates and their cellular function in physiology and pathology
4	To enumerate the role of lipids and their cellular function in physiology and pathology.
5	To briefly cholesterol and its role in diseases

COURSE OUTCOMES

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

CO1. Relate the basics of biomolecules in and around him	Understand
CO2. Understand the structure of biomolecules such as proteins and nucleic acids	Understand
CO3. Discover the role of carbohydrates in healthy and diseased conditions	Apply
CO4. Relate disfunctioning of lipids with disease	Analyse
CO5. Criticize the role of cholesterol in diseases.	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

PROTEINS

Protein – Structure – primary, secondary, tertiary. Types of proteins and their function. Role of each type of Protein in Health and Disease.

NUCLEIC ACIDS

Nucleic Acids – Components of nucleic acids, Conformational parameters. Nucleic acids – Types of DNA and RNA. DNA Polymorphism, Circular DNA, Supercoil DNA, DNA-Protein interactions. Role of nucelic acids in Health and disease

CARBOHYDRATES

Carbohydrates – Introduction. Types – monosaccharide, disaccharide, oligosaccharide and polysaccharides. Structure of each type. Artificial sugars. Role of carbohydrates in Health and Disease

FATTYACIDS AND LIPIDS

Fatty acids- Introduction, nomenclature, types - Saturated and unsaturated fatty acids, Essential and non-essential fatty acids.

Lipids – Introduction, Classification - simple and compound lipids, phospholipids, Cholesterol and its role in health and disease, Micelles and Liposomes : Applications in biology and medicine

CELL MEMBRANE AND CELL SIGNALING

Cell membrane - components and architecture, Various membrane models including Fluid-mosaicmodel. Ion channels, Receptors, Signaling molecules, Signaling mechanism, Role of cell signaling in Health and Disease. Inter-relationship of biomolecules.

TEXTBOOKS

1. Biophysical Chemistry, Part II, Techniques for the study of biological structure and function, by Cantor C.R. and Schimmel P R., W.H. Freeman and Company, 1980.

2. Nucleic Acids in chemistry and Biology, by Blackburn G.M. and gait M.J., IRL Press, 1990.

3. Biochemistry, by Voet D. and Voet J.G., John Wiley and sons, 1995.

4. Physical Biochemistry, by Freifelder D., W.H. Freeman and company, 1976-1982.

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	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya.vmkvec@vmrf.edu.in

	PHARMACOGENOMICS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

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

PREREQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1.Recognize the effect of genetic differences between individuals in the outcome of drug therapy and in drug efficacy and toxicity.	Remember
CO2. Describe the role of single nucleotide polymorphism as a biomarker for the prediction of risk, therapeutic response and prognosis of malignancies.	Understand
CO3. Utilize and manage the new genomics based tools as they become available as well as make best treatment choices.	Understand
CO4. Examine the applications of genomics principles in drug action and toxicology	Analyze
CO5. Validation of case studies related to pharmacogenomics	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

PHARMACOGENOMICS AND PERSONALIZED MEDICINE

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

HUMAN GENOME

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

ASSOCIATION STUDIES IN PHARMACOGENOMICS

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

GENOMICS APPLICATIONS FOR DRUG ACTION, TOXICITY AND DESIGN

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

PHARMACOGENOMICS – CASE STUDIES

Study of pharmacogenomics of human P-Glycoprotein, drug transporters, lipid lowering drugs,

chemotherapeutic agents for cancer treatment.

TEXT BOOKS

1. Martin M. Zdanowicz, M.M. “Concepts in Pharmacogenomics” Second Edition, American Societyof Health-System Pharmacists, 2017.
2. Licinio, J and Wong, Ma-Li. “Pharmacogenomics: The Search for the Individualized Therapies”,Wiley-Blackwell, 2009.
3. Yan Q, “Pharmacogenomics in Drug Discovery and Development” Humana Press, 2nd Edition,2014.

REFERENCES

1. Brazeau, D.A. and Brazeau, G.A. “Principles of the Human Genome and Pharmacogenomics” American Pharmacist Association, 2011
2. Werner, K., Meyer, U.A., Tyndale, R.F. “Pharmacogenomics”, Second Edition, Taylor and Francis,2005.
3. Langman, L.J. and Dasgupta, A. "Pharmacogenomics in Clinical Therapeutics", Wiley – Blackwell,2012

COURSE DESIGNERS

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

CATEGORY E MANDATORY COURSES (0CREDIT)

	YOGA AND MEDITATION	Category	L	T	P	Credit
		MC	**0**	**0**	**2**	

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 yourealize 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

1	Surya namaskar, Padmasana,Navasana,PavanaMukatasanaSavasana.
2	Sheetalipranayama, Chandra Pranayama ,AnulomVilom, Sheetkari
3	Yoga mudra, Mahamudra,Shanmukhimudra.
4	Kapalabathikriya,Bhastrika.
5	Simple Meditation,MantraMeditation, Mindfulness meditation

OUTCOMES :

1	It incorporates breathing exercises, meditation and poses designed to encourage relaxation and reduce stress.
2	Practicing yoga is said to come with many benefits for both mental and physical health.
3	Yoga is known for its ability to ease stress and promote relaxation.
4	Many people begin practicing yoga as a way to cope with feelings of anxiety.
5	Could Improve Heart Health
6	Improves Quality of Life.
7	Could Promote Sleep Quality.
8	Improves Flexibility and Balance.
9	Could Help Improve Breathing.
10	Promotes Healthy Eating Habits.
11	Can Increase Strength.

TEXT BOOK:

1. Dr.AsanaAndiappan, *Ashtanga Yoga*, 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. YogacharyaSundaram, *Sundra Yoga Therapy*, Asana Publications, 2009
5. GeetaIyer, Illuminating Lives with Yoga,www.geetayoga.com

Daniel Lacerda, 2100 Asanas,

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 totheir 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.

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

Protection of traditional knowledge: The need for protecting traditional knowledgeSignificance of TK Protection, value of TK in global economy, Role of Government to harnessTK.

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.

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

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:

Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
"Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

Web Links:

1.https://www.youtube.com/watch?v=LZP1StpYEPM

Course Code	Course Title	category	L	T		
	INDIAN CONSTITUTION	MC	0	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

The Constitution - Introduction

The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and theBasic Structure - Fundamental Rights and Fundamental Duties –Directive Principles State Policy

–Government of the Union

The Union Executive- Powers and duties of President –Prime Minister and Council of Ministers - Lok Sabha and RajyaSabha

–Government of the States

The Governor –Role and Powers - Cheif Minister and Council of Ministers- State Legislature

– Local Government

The New system of Panchayats ,Municipalities and Co-Operative Societies

– 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, 20082 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:**

	NPTEL ID	NPTEL Course Title	Course Instructor
	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 OFTHE FACULTY**	**DESIGNATION**	**NAME OF THE INSTITUTION**	**MAIL ID**
1	Dr.Sudheer	Principal	AV School of Law	Sudheersurya18@gmail.com

	Gender Equity and Law (Common to all Branches)	Category	L	T	P	Credit
		MC	0	0	2	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 anydiscrimination.	Apply
CO4. To evaluate the social issues and apply suitable gender-related regulations for inclusiveliving.	Evaluate
CO5.To identify and analyze the existing gender inequality problems faced in various institutions.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
											S			
											S			
											S			
											S			
											S			

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO GENDER AND SEX

Definition of Sex – Definition of Gender - Sex Vs. Gender - Social Construction of Gender and Gender Roles – GenderStereotypes - GenderDivision of Labour - Patriarchy, Masculinity and Gender Equality - Feminism and Patriarchy.

GENDER BIAS

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.

GENDER SENSITIZATION AND INTERNATIONAL CONVENTIONS 6 hrs

Gender Sensitization -Need and Objective - Gender Sensitivity Training at Workplace – GenderSensitization in Judiciary - GenderSensitization in School Curriculum.

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**.**

ROLE OF GOVERNMENT FOR INCLUSIVE DEVELOPMENT

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

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 inSocial 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 andGender Equality, Aavishkar, Jaipur,2005.
6. 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

SPECIALISATION – NUTRITIONAL BIOLOGY

	DIET THERAPY	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE:

Obtain the knowledge of clinical nutrition and dietetics, and work independently as selfdriven, lifelong learners and innovators so as to prevent or treat diseases being faced by the humans.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

To enable the students to know the effect of the various life style diseases on nutritional status of individuals. .

To enhance the knowledge on dietary requirements for different disease conditions

To overview the types of disease , their symptoms and management measures

To know the different disease occur in liver and biliary system

To analyse the general perceptions of anaemia and diet management

COURSE OUTCOMES:

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

CO1: .Apply the principles of diet and determine the dietary essentials for recovery from critical illness	Understand
CO2: Plan and prepare menu for the given disease condition	Understand
CO3: Identify and describe the etiology, symptoms and complications of any life style diseases	Understand
CO4: Differentiate the disease condition and finding suitable feeding techniques.	Analyze
CO5: Interpret the factors causes anaemia and diet recommendation for anaemic patient	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Os	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
O1															
O2															
O3															
O4															
O5															

S- Strong; M-Medium; L-Low

SYLLABUS:

BASIC CONCEPTS OF DIET THERAPY:

Therapeutic adaptations - normal diet, principles and classification of therapeutic diets. Approach to health care, Assessment of Patient's needs.

ROUTINE DIETS, FEEDINGS:

Diets for different febrile conditions - influenza, malaria and typhoid. Regular, light, soft, fluid, parenteral and enteral feeding.

ETIOLOGICAL FACTORS, SYMPTOMS, AND MANAGEMENT:

Etiology, symptoms and management of intestinal diseases: Diarrhoea, steatorrhoea, inflammatory bowel disease, Ulcerative Colitis, Constipation, Irritable Bowel Syndrome. Common diseases of stomach-Gastritis and Peptic ulcer.

DISEASES OF THE LIVER AND BILIARY SYSTEM:

Liver function tests. Etiology, symptoms, dietary care and general management of Viral Hepatitis and Cirrhosis of liver. Dietary care and management of Gall Bladder diseases –Cholecystitis and Cholelithiasis.

ANAEMIAS:

General concept, aetiology, classification and dietary management of Nutritional anaemia.

TEXT BOOKS:

1. Fundamentals of Foods, Nutrition and Diet Therapy, S.R.Mudambi, M.V.Rajagopal, 5th Edition, New age International Publishers.

2.William's Essentials of Nutrition and Diet Therapy, Eleanor Schlenker, Joyce Ann Gilbert, 12th Edition, Elsevier

REFERENCE BOOKS:

1. Fundamentals of Clinical Nutrition, Morgan, Sarah L, Weinsier, Roland L, 2nd Edition, Elsevier – Health Sciences Division.
2. Galen on Food and Diet, Galen, Grant, Mark, Routledge Publisher.
3. Applications in medical nutrition therapy, Zeman, Frances J, Denise M, Bock, Margaret Ann, 3rd Edition, Prentice Hall Higher Education Publisher.

COURSE DESIGNERS:

.No	Name of the Faculty	Designation	Department	Mail ID
	Dr. J.Madhusudhanan	Associate Professor	Biotechnology	madhusudhanan.biotech@avit.ac.in
.	Dr.R.Balachandar	Assistant Professor	Biotechnology	Balachandar.biotech@avit.ac.in

	FOOD COMMODITIES	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE:

Applying principles of diet when planning food and nutrition programmes and supervising meal preparations in hospitals and other food service establishments.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1.To understand the history and evolution of food processing.

2.To study the structure, composition, nutritional quality and post harvest changes of various plant foods

3. To study the properties of diary and bakery products

4. To study the structure and composition of various animal food

5. To study the different methods of processing Vegetables, fruits and sweeteners

COURSE OUTCOMES:

CO1: Cite and explain the chemistry, structure and composition underlying the properties of various food components	Understand
CO2:Ascertain the major chemical reactions that occur during food preparation and storage	Understand
CO3: Apply food science knowledge to describe functions of ingredients in food	Understand
CO4: Plan appropriate sensory evaluation tests to answer specific questions regarding food attributes or consumer preferences	Analyze
CO5: Describe techniques that can be used to monitor quality of raw ingredients and final packaged products	Evaluates

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Os	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
O1															
O2															
O3															
O4															
O5															

S- Strong; M-Medium; L-Low

SYLLABUS:

CEREALS, MILLETS AND BEVERAGES:

Structure, processing, storage, use in various preparation, variety, selection and cost. Cereal products in breakfast, fast food Beverages: Tea; Coffee. Chocolate and Cocoa Powder-Processing, cost and nutritional aspects, other beverages and juice

PULSES AND LEGUMES:

Pulses and legumes storage, Processing, use in different preparations, Nutritional aspects and cost. Food Adjuncts: Spices, condiments, herbs, extracts; concentrates essences, food colours.

MILK AND MILK PRODUCTS, RAISING AGENTS:

Composition, Classification, Selection Quality and Cost, Processing, Storage and uses in different preparations, Nutritional aspects, shelf life and spoilage. Raising and Leavening agents: Types, constituents, uses in cookery, bakery and storage.

EGGS, MEAT, FISH, POULTRY:

Egg - Production, grade, quality selection, storage and spoilage, cost nutritional aspects and use in different preparations. Meat, Fish and Poultry: Types, Selection, Purchase, Storage, Uses, preparations Cost, Spoilage of fish Poultry and meat.

VEGETABLES, FRUITS, SUGAR PRODUCTS:

Variety, Selection, purchase, storage, availability causes and nutritional aspects of raw and processed products. Sugar and sugar Products: Types of natural sweeteners, manufacture, selection, storage and use as preservatives, stages in sugar cookery.

TEXT BOOK

1. Food commodities, Bernard Davis, 1991, Butterworth-Heinemann Publisher.

REFERENCE BOOKS

1. Food and beverage management, Bernard Davis, Andrew Lockwood, LoannisPantelidis, Peter Alcott, 5th edition, Wilmington Media.
2. Irradiation of Food commodities, Loannis Arvanitoyannis, 1st Edition, Elsevier.

COURSE DESIGNERS:

.No	Name of the Faculty	Designation	Department	Mail ID
	Dr. J.Madhusudhanan	Associate Professor	Biotechnology	madhusudhanan.biotech@avit.ac.in
	Dr.R.Balachandar	Assistant Professor	Biotechnology	balachandar.biotech@avit.ac.in

	NUTRITIONAL BIOCHEMISTRY	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE:

Exhibiting constant enhancement in their profession through life-long learning thereby escalating human wellness either as sovereign patient counsellors or as a team with multidisciplinary healthcare approach

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. Augment the knowledge of biochemistry acquired at the undergraduate level.
2. Understand the mechanisms adopted by the human body for regulation of metabolic pathways
3. Develop an insight into interrelationships between various metabolic pathways
4. Understand integration of cellular level metabolic events to nutritional disorders and imbalances
5. Become proficient for specialization in nutrition

COURSE OUTCOMES:

CO1.Understand integration of cellular level metabolic events to nutritional disorders and imbalances.	Understand
CO2.Become proficient for specialization in nutrition	Understand
CO3.Gain in-depth knowledge of the physiological and metabolic role of macronutrients, fat soluble vitamins and electrolytes and their importance in human nutrition.	Understand
CO4.Enable the understanding of basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs	Understand
CO4.Familiarize with the recent advances in nutrition and apply this knowledge in planning for public health programmes	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Os	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	SO1	SO2	SO3
O1															
O2															
O3															
O4															
O5															

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION:

Definition, objectives, scope and inter relationship between biochemistry and other biological science.

ENZYMES:

Definition, types and classification of enzymes, definition and types of coenzymes, Functions of coenzymes and cofactors, Specificity of enzymes, Isozymes,

ENZYME KINETICS:

Factors affecting enzyme action, velocity of enzyme catalysed reactions, regulations of enzyme activity, zymogen, allosteric enzymes, enzyme inhibition.

INTERMEDIARY METABOLISM:

Carbohydrate Metabolism, Glycolysis, TCA cycle & energy generation, HMP Shunt pathway, gluconeogenesis, glycogenesis, glycogenolysis, blood sugar regulation.

LIPIDS:

Oxidation and biosynthesis of fatty acids (saturated & mono-unsaturated), Synthesis and utilization of ketone bodies, Ketosis, fatty livers, Essential Fatty acids, Cholesterol and its clinical significance.

TEXT BOOK:

1. Nutritional Biochemistry and Metabolism, Maria C. Linder, 2nd Edition, 1985, Prentice Hall Publisher.

REFERENCE BOOKS:

1. 2. Introduction of Nutrition and Metabolism, David A. Bender, Shauna M.C.Cunninghan, 6th Edition, CRC Press.

3. Introduction to Nutrition and Metabolism, David A. Bender, 5th Edition, CRC Press

COURSE DESIGNERS:

.No	Name of the Faculty	Designation	Department	Mail ID
	Dr. J.Madhusudhanan	Associate Professor	Biotechnology	madhusudhanan.biotech@avit.ac.in
	Dr.R.Balachandar	Assistant Professor	Biotechnology	Balachandar.biotech@avit.ac.in

	INTRODUCTION TO FOOD SAFETY	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

. Food is an indispensable part of our life and safety of food is of more concern. Hence this course aims to provide fundamentals about food safety measures, storage and food. This programme is also designed to develop a practical "hands on training" in food safety and quality.

PRERQUISITE – Nil

COURSE OBJECTIVES

	To understand about the important parameters of food safety systems.
	To Demonstrate proper personal hygiene procedures with regard to food handling
	To build fundamental knowledge of food additives; provide role of factors influencing the activity of food additives in food

COURSE OUTCOMES

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

CO1. To explain the concept/idea of food safety	Understand
CO2. To describe the major causes and impact of food safety	Understand
CO3.To identify the challenges to food safety in their particular kind of food business operation	Apply
CO4. To illustrate by example the types of food storage and their distinguishing characteristics	Apply
CO5.To Characteristics of food contamination.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

OS	O1	PO2	O3	P O4	O5	O6	O7	O8	O9	PO10	O11	PO12	PSO1	SO2	P SO3
O1		-	-									-	S		-
O2		M	L									M	S		M
O3		M	S									-	M		M
CO4		S	M									-	S		L
O5		M	M									S	S		M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION : PHN Definition of PHN,Levels of health care services

FOOD SAFETY AND STORAGE: Concept of food safety, Key terms, factors affecting food, safety, recent concerns Food safety measures: basic concept of HACCP. Safe food handling practices and storing food safety, Food additives.

FOOD ADULTERATION:

PFA definition of food adulteration, Adulterants in commonly consumed food items. Accidental contamination: botulism, staphylococcal and aflatoxin intoxication

FOOD PACKAGING AND LABELLING

Food packaging and its need, selection of packaging material, Package environment, Importance of food labels in processed foods and nutritional labelling

FOOD LAWS:

Food laws, regulations and standards- Codex Alimentarius - Prevention of Food Adulteration (PFA) Act - Agmark - Fruit Products Order (FPO) - Meat Products Order (MPO) - Bureau of Indian Standards (BIS) - MMPO - FSSAI

TEXT BOOKS:

1.Sethi P and lakra P Aahaar vigyaan ,Poshan evam Suruksha, Elite Publishing house, 2015.

2.Khanna K et al. Textbook of Nutrition and Dietetics;2013; Phoenix Publisher.

REFERENCE BOOKS:

1.Sharma S, Wadhwa A. Nutrition in the Community- A textbook; 2003; ElitePublishing House Pvt. Ltd.
2.Srilakshmi B. Dietetics; Fourth Ed; 2002; New Age International (P) Ltd.
3. Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009;Oxford & IBH Publishing Co. Pvt Ltd.
4. The Food Safety and Standards Act along with Rules and Regulations. Delhi: Commercial Law Publishers (India) Pvt Ltd, 20116.Reddy V, Prahlad RaoN, Sastry G and Nath KK, Nutrition trends in India, Hyderabad, NIN,1993

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.ac.in

	COMMUNITY HEALTH AND	Categor					C

	NUTRITION	y				redit
		EC (SE)				3

PREAMBLE

. This course focuses on community wellness and also emphazises the role of nutrition as a major modifiable factor in community health and the preventive, promotive and curative role of diet in health

PRERQUISITE – Nil

COURSE OBJECTIVES

	Understand the concept of health from the individual and community perspective.
	Understand the common nutritional problems of the community their causes, symptoms, treatment and prevention
	To know the schemes, programmes and policies of Government of India to Combat Malnutrition

COURSE OUTCOMES

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

CO1. To understand the concept of health care delivery at different levels in a community.	Understand
CO2. To describe the major causes and impact of communicable and non-communicable diseases and their pathology	Understand
CO3.To assess and understand the health status of population, determinants of health and illness and factors contributing to health promotion and disease prevention	Apply
CO4. To identify and monitor malnutrition and hunger in individuals and communities, using clinical, dietary, anthropometric and biochemical measures	Apply
CO5.To assess, monitor and evaluate the impact of public health programs .	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	O5	O6	O7	O8	O9	P O10	I O11	I O12	SO1	S O 2	P SO3
CO1	S									-	-	-			-
CO2	S									-	-	M			M
CO3	S									-	-	-			M
CO4	S									-	-	-			M
CO5	S									-	-	S			M

S- Strong; M-Medium; L-Low

SYLLABUS

CONCEPT OF COMMUNITY HEALTH & NUTRITION CONCEPT OF COMMUNITY- Types of community, factors affecting health of the community. Health Care- Levels of health care- Primary Health Care- Primary health care, health care delivery, National immunization schedule, Role of public nutritionist in health care delivery.

NUTRITIONAL PROBLEM OF COMMUNITY NUTRITIONAL AND NON- NUTRITIONAL- Incidence of nutritional problems, signs, symptoms and treatment- Protein Energy Malnutrition-Micro Nutrient deficiencies (Vit-A, Iron, Iodine and Zinc),Fluorosis. Communicable Diseases -cholera, polio, measles, HIV. Impact of NCD's on public health :Obesity, DM 2, CVD, Cancers and Osteoporosis and hip fractures.

DEMOGRAPHY, NUTRITION AND QUALITY OF LIFE Demographic cycle- Population trends in India- Population structure- sex composition Age composition- Fertility behavior- Vital statistics in vulnerable groups ,population growth (Maternal Mortality rate, Infant Mortality Rate, Net Reproduction Rate). Causes of malnutrition, consequences of malnutrition, Intervention in malnutrition- Food security- PDS ,Food production- Food Pricing

METHODS OF ASSESSING NUTRITIONAL STATUS: Sampling techniques , Identifications of risk groups, Direct assessment - Diet surveys, anthropometric, clinical and biochemical estimation. Indirect assessment- Food balance sheet, ecological parameters and vital statistics. Improvement of nutrition of a community: Modern methods of improvement or nutritional quality of food, food fortification, enrichment and nutrient supplementations. Nutrition education themes and messages in nutrition and health, Antenatal and postnatal care.

NATIONAL AND INTERNATIONAL AGENCIES IN UPLIFTING THE NUTRITIONAL STATUS -WHO, UNICEF, CARE, ICMR, ICAR, CSIR, CFTRI. Various nutrition related welfare programmes, ICDS, SLP, MOM, NIPPCD Fortification and Enrichment of foods.

TEXT BOOKS:

1. Bamji SM, Rao NP and Reddy V, Text book of human nutrition, oxford and IBH publishing co.,New Delhi.
2. Gopalan C,Combating undernutrition-basic issues and practical approaches, Nutrition Foundation of India,1987.

REFERENCE BOOKS:

1. Michael.J.G,Barrie.M.M:Public health nutrition,Blackwell publishing,2005.
2. Nweze Eunice Nnakwe.,Community Nutrition – planning health promotion and disease prevention., Jones And Bartlett publishers, 2009.
3. Park.K,Park's textbook of preventive and social medicine.,12th edition.M/S Banarsidas bhanot publishers,2009.
4. 6.Reddy V, Prahlad RaoN, Sastry G and Nath KK, Nutrition trends in India, Hyderabad, NIN,1993

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.ac.in

	BASIC DIETETICS	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

This course enables the students to understand the basic principles of diet and diet therapy. This programme is also designed to develop a practical "hands on training" in dietary therapies.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To understand the foundation sciences which underpin therapeutic dietetic practice, the principles of disease prevention and health promotion, the principles of therapeutic intervention practice
2	To understand the organization, management and provision of healthcare both in the hospital and in primary care
3	Gain knowledge about aetiology, risk factors, clinical features and hospital dietary management

COURSE OUTCOMES

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

CO1. To understand the dietary treatment related to pathophysiology.	Understand
CO2. To describe the choice of dietary need to various disease patients in the hospital	Understand
CO3.To assess and understand the health status of population, determinants of health and illness and factors contributing to health promotion and disease prevention	Apply
CO4. To apply technical skills, knowledge of health behavior, clinical judgment, and decision-making skills when assessing and evaluating the nutritional status of diseases and their response to nutrition intervention.	Apply
CO5. To provide nutrition counseling and education to individuals,.	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	M	-
CO2	S	M	L	-	M	-	-	-	-	-	-	M	S	M	M
CO3	S	M	S	-	S	-	-	-	-	-	-	-	M	-	M
CO4	S	S	M	-	S	-	-	-	-	-	-	-	S	M	L
CO5	S	M	M	-	M	-	-	-	-	-	-	S	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

ROLE OF DIETARIAN: The hospital & community,Basic concepts of diet therapy. Principles of diet therapy & therapeutic nutrition for changing needs. Adaptation of normal diet for changing needs.

ROUTINE HOSPITAL DIETS - Regular diet, light diet, full liquid and tube feeding. Modification of diet - Febrile conditions, infections and surgical conditions. Diets for gastro - intestinal disorders, constipation, diarrhoea, peptic ulcer. Diet for renal diseases - Nephritis, Nephrotic syndrome and renal failure.Diet for obesity and cardiovascular disorders. Diet for Diabetes mellitus.Diet & nutrition in kidney diseases. Nutrition in cancer.

Nutrition in Immune system dysfunction, AIDS & Allergy.Nutrition support in metabolic disorders. Nutrition in burns and surgery. Nutrition - Addictive behaviour in annorexia, nervosa, bulimia & alcoholism. Nutrient drug interaction.

FEEDING THE PATIENTS - Psychology of feeding the patient, assessment of patient needs. Feeding infants & children - problems in feeding children in hospitals. Nutrition & diet clinics - Patients checkup and dietary counseling, educating the patient and follow up .

TEXT BOOKS:

1. Textbook of Human Nutrition by Agrawal , Udipi
2. Textbook of Nutrition & Dietetics by Kumud Khanna
3. Basics of Clinical Nutrition by Y.K.Joshi.

REFERENCE BOOKS:

1. Nutrition and Diet Therapy by Corroll lutz & Karen Przytulski
2. Antia, F.P. (2005): Clinical Nutrition and Dietetics, Oxford University Press, Delhi
3. Dietetics by B .Srilakshmi
4. Principles of Nutritional Assessment by Rosalind S. Gibso

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.ac.in

	NUTRITIONAL BIOCHEMISTRY LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

1. Quantitative estimation of Sugars
2. Quantitative estimation of lactose
3. Quantitative estimation of starch
4. Estimation of acid value,
5. Estimation of iodine value,
6. Estimation of saponification value of fats
7. Estimation of blood Glucose
8. Estimation of serum cholesterol

COURSE DESIGNERS

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2	Dr.R.Balachandar	Assistant Professor	Biotechnology	Balachandar.biotech@avit.ac.in

	DIETETICS LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PRACTICAL

1. Standardization of common food preparations.
2. Planning, preparation and calculation of following diets :

a) Normal diet.

b) Liquid diet

c) Soft diet

d) High and low caloric diet

e) Bland diet for peptic ulcer

f) Diet for Viral hepatitis and cirrhosis

g) Diet for Diabetes mellitus

h) Diet for Hypertension

i) Anaemia

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
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SPECIALISATION – BIOLOGICAL COMPUTING

	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	Category	T	P	Credit
		EC (SE)	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 Machine learning, and application. Which is useful to how represent knowledge and in machine learning contain some important prediction method. Thus, this syllabus focuses on to know about AI and its concepts, application.

PREREQUISITE

COURSE OBJECTIVES

1.	To identify the kind of problems that can be solved using AI technique: to know the relation between AI and other areas of computer science.
2.	To have knowledge of generic problem-solving methods in AI..
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M		L					L	L	L	**L**		
CO2	M	M	L	L	L					M		L		L	S
CO3	M	M	L	L		M				L				M	
CO4	M	S	L			L				L		M	**M**		M
CO5	M	L				M				M	M	L	**S**		

S- Strong; M-Medium; L-Low

	INTRODUCTION	**9 Hours**
Introduction-Definition-History of Artificial Intelligence-Intelligent Agents-Types Of Agents- simplex reflex agent, model based agent, utilized based agent, learning agent, agent environments.		
	PROBLEM SOLVING	**9 Hours**
Problem Solving Methods-Search Strategies-Uninformed Search Strategies-Comparison of Uninformed Search Algorithms-Informed Search Strategies-Local Search Algorithms-Searching With Partial Information-Constraint Satisfaction Problem		
	KNOWLEDGE REPRESENTATION	**9 Hours**
Propositional Logic-First Order Predicate Logic-Prolog Programming-Unification-Forward Chaining- Backward Chaining-Ontological Engineering-Categories and Objects-Events-Mental Events and Mental Objects.		
	MACHINE LEARNING	**9 Hours**
Conditional Probability-Joint probability, Prior Probability- Bayes Rule and Its Applications-Bayesian Networks-Inferences in Bayesian Networks- Morkov chain, Hidden Markov Models- Learning from Observation-SupervisedLearning.		
	APPLICATIONS OF AI IN BIOTECHNOLOGY	**9 Hours**
Drug discovery-diagnosis of disease -radiation therapy planning process-Evidence based medicine and clinical decision support systems designed on the machine learning platform-Medication Management		

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.

2. Artificial Intelligence in Biotechnology Hardcover – Import, 30 December 2020by Preethi Kartan

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

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	DATA STRUCTURES	CATEGORY	L	T	P	CREDIT
		EC (SE)	3	0	0	3

PREAMBLE

This course aims at understanding the basic concepts in programming structures, linear structures and non linear structures

PRERQUISITE

NIL

COURSE OBJECTIVES

1.	To remember and understand the basic concepts in linear structures
2.	To learn about tree structures.
3.	To understand about balanced trees
4.	To learn about hashing and sets.
5.	To learn and understand about graphs

COURSE OUTCOMES

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

CO1. Able to remember the basic concepts in linear structures	Remember and Understand
CO2. Able to learn about tree structures and tree traversals	Understand
CO3. Able to understand about balanced trees	Understand
CO4. Able to learn about hashing and sets.	Remember and Understand
CO5. Able to learn and understand about graphs	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	L
CO2	S	M	L	-	-	-	-	-	-	-	-	-	S	L	L
CO3	S	M	M	-	M	-	-	-	-	-	-	-	S	M	-
CO4	S	M	M	-	M	-	-	-	-	-	-	-	S	L	-
CO5	S	M	M	-	M	-	-	M	M	-	-	M	S	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Linear Structures : Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists –Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues.

Tree Structures : Tree ADT – tree traversals – left child right sibling data structures for general trees and graphs.

Balanced Trees : AVL Trees – Splay Trees – B-Tree - heaps – binary heaps – applications of binary Heaps **.**

Hashing and Set : Hashing – Separate chaining – open addressing – rehashing – extendible hashing - Disjoint Set ADT – dynamic equivalence problem – smart union algorithms – path compression – applications of Set.

Graphs: Definitions – Topological sort – breadth-first traversal - shortest-path algorithms –minimum spanning tree – Prim's and Kruskal's algorithms – Depth-first traversal – bi-connectivity – Euler circuits – applications of graphs.

TEXT BOOKS:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education.

REFERENCES:

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint.

2. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India,Edition,

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	DATABASE MANAGEMENT SYSTEM	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE:

This course aims at facilitating the student to understand the various concepts and functionalities of Database Management Systems, the method and model to store data and how to manipulate them through query languages, the effective designing of relational database and how the system manages the concurrent usage of data in multi user environment.

PREREQUISITE:

NIL

COURSE OBJECTIVES

1	Describe a relational database and object-oriented database.
2	Create, maintain and manipulate a relational database using SQL.
3	Describe ER model and normalization for database design.
4	Examine issues in data storage and query processing and can formulate appropriate solutions.
5	Design and build database system for a given real world problem.

COURSE OUTCOMES

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

CO1. Illustrate the database design for applications and use of ER Diagram.	Apply
CO2. Build and manipulate relational database using Structured Query Language and relational languages.	Apply
CO3. Develop a normalized database for a given application by incorporating various constraints like integrity and value constraints.	Apply
CO4. Apply concurrency control & recovery mechanism for database problems.	Apply
CO5. Construct data structures like indexes and hash tables for the fast retrieval of data.	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	-	-	-	-	-	-	-	-	-	-	S	S	-
CO2	S	S	-	-	-	L	-	-	-	-	-	-	S	L	L
CO3	M	S	-	-	-	-	-	-	-	-	-	-	S	L	-
CO4	S	S	-	L	-	L	L	-	-	-	-	-	S	S	-
CO5	S	S	-	-	-	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Database System Applications - Views of data - Data Models - Database Languages -Modification of the Database - Database System Architecture - Database users and Administrator- Introduction to relational databases - Structure of Relational Databases - Entity-Relationship model (E-R model) - E-R Diagrams.

RELATIONAL APPROACH

The relational Model - Additional & Extended Relational - Types of Keys - Relational Algebra - Null Values - Domain Relational Calculus - Tuple Relational Calculus - Fundamental operations - Additional Operations- SQL fundamentals - Structure of SQL Queries SQL Data Types and Schemas - Nested Sub queries - Complex Queries - Integrity Constraints - Triggers - Security - Advanced SQL Features - Embedded SQL- Dynamic SQL- Views - Introduction to Distributed Databases and Client/Server Databases..

DATABASE DESIGN

Overview of the Design Process - Functional Dependencies - Non-loss Decomposition - Functional Dependencies -

Normalization and its Types - Dependency Preservation - Boyce/Codd Normal Form- Decomposition Using Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form - Entity Sets and its Types.

TRANSACTION &CONCURRENCY CONTROL

Transaction Concepts - Transaction State - Transaction Recovery - ACID Properties - System Recovery - Media Recovery - Two Phase Commit - SQL Facilities for recovery -Advanced Recovery Techniques - Buffer Management - Remote Backup Systems - Concurrency Control - Need for Concurrency - Locking Protocols -Two Phase Locking - Internet Locking - Deadlock Handling - Serializability - Recovery Isolation Levels - SQL Facilities for Concurrency.

STORAGE STRUCTURE

Introduction to Storage and File Structure - Overview of Physical Storage Media - Magnetic Disks - RAID - Tertiary storage - File Organization - Organization of Records in Files - Indexing and Hashing - Ordered Indices - B+ tree Index Files - B- tree Index Files - Bitmap Indices - Static Hashing - Dynamic Hashing -Query Processing - Catalog Information for Cost Estimation – Selection Operation - Sorting - Join Operation - Query optimization - Database Data Analysis.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Fourth Edition, Tata McGraw Hill, 2002.

REFERENCES:

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Addision weskey, 2002.

2. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2002.

3. Peter Rob and Corlos Coronel, “Database Systems – Design, Implementation and Management, Fifth Edition, Thompson Learning, Course Technology, 2003.

COURSE DESIGNERS

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	INTERNET OF THINGS APPLICATIONS	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

To study and understand the technologies involved in Internet of Things (IoT) and apply them practically.

PREREQUISITE: NIL

COURSE OBJECTIVES

1.	To understand the basic concepts of IOT
2.	To study the methodology of IOT
3.	To Develop IOT applications using Raspberry PI
4.	To Develop IOT applications using Arduino and Intel Edison
5.	To apply IoT concept in various areas.

COURSE OUTCOMES

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

CO1: Able to understand basics in IOT	Understand
CO2: Able to understand Methodology in IOT	Understand
CO3: Able to design IOT applications using Raspberry	Design
CO4: Able to design IOT applications using Aurdino and Intel Edison	Design
CO5: Able to apply IOT in health, agriculture etc.,	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	L	L	M	L	
CO2	M	M		L						M		L	L	M	
CO3	M	M	L	L		M				M				M	M
CO4	M	S	L			L				L		M	M		
CO5	M	L				M					S	L			M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M.

IOT METHODOLOGY

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

IOT WITH RASPBERRY

Bascis of Raspberry PI, Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services

IOT WITH AURDINO AND INTEL EDISON
Basics of Aurdino, Intel Edison with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks
APPLICATIONS
Home automation, Smart cities, Environment, Energy, Retail Management, Logistics, Agriculture, Industry applications, Oil and gas, Big data, Health and Lifestyle Surveillance applications, Green house.
TEXT BOOKS
1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015. **2.** Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
REFERENCES
1. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014

COURSE DESIGNERS

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1.	Dr.R.Jaichandran	Professor	CSE	rjaichandran@avit.ac.in
2.				

	OBJECT ORIENTED PROGRAMMING	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

This syllabus is intended for the Computer science students and enables them to learn Object Oriented Programming and the design of computer solutions in a precise manner. The syllabus emphasizes on OOP concepts, Functions, Polymorphism, Inheritance and I/O. The intention is to provide sufficient depth in these topics to enable candidates to apply Object Oriented Programming approach to programming. The modules in the syllabus reflect solving general problems via programming solution. Thus, modules collectively focus on programming concepts, strategies and techniques; and the application of these toward the development of programming solutions.

PRERQUISITE

Nil

COURSE OBJECTIVES

1	To implement the concepts of object oriented programming.
2	To learn the syntax and semantics of C++ programming language
3	To design C++ classes for code reuse, Constructors and member functions
4	To learn how inheritance and virtual function implement dynamic binding with polymorphism
5	To learn and implement the concepts of Templates and Exception handling

COURSE OUTCOMES

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

CO1. Construct object-oriented programs for a given scenario using the concepts of abstraction, encapsulation, message-passing and modularity.	Apply
CO2. Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism.	Apply
CO3. Construct object-oriented programs for a given application by using constructors	Apply
CO4. Develop object-oriented applications that can handle exceptions.	Apply
CO5. Construct object-oriented applications for a given scenario to persist data using files and object-serialization.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FUNDAMENTAL CONCEPTS OF OOP

Object Oriented Paradigm: Elements of Object Oriented Programming – Working with classes, Classes and Objects-Class specification- accessing class members- defining member functions - Passing and returning objects – Array of objects - inline functions - accessing member functions within class - Static members.

OBJECT INITIALIZATION AND FRIEND FUNCTION

Constructors - Parameterized constructors - Constructor overloading. Copy constructor, Destructors, Default arguments - new, delete operators - "this" pointer, friend classes and friend functions.

OVERLOADING AND GENERIC PROGRAMMING

Function overloading – Operator overloading- Non-over loadable operators- unary operator overloading- operator keyword- limitations of increment/decrement operators- binary operator overloading- Generic programming with templates-Function templates- class templates.

INHERITANCE AND VIRTUAL FUNCTION

Inheritance-Base class and derived class relationship-derived class declaration-Forms of inheritance- inheritance and member accessibility, abstract class, virtual functions, pure virtual function **.**

EXCEPTION HANDLING AND STREAMS

Exception handling - Try Catch Throw Paradigm - Uncaught Exception- Files and Streams-Opening and Closing a file-file modes- file pointers and their manipulation, sequential access to a file-random access to a file-Reading and Writing – Exception handling. String Objects.

TEXT BOOKS:

1. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
2. K. R. Venugopal, Rajkumar, T. Ra vishankar, Mastering C++, 4th Edition, Tata McGraw 2. Hill, 2008.
3. Budd T., An Introduction to Object-oriented Programming, Addison-Wesley 3rd 4. edition, 2008.
4. Bjarne stroustrup, The C++ programming Language, Addison Wesley, 3rd edition2008.
5. Harvey M. Deitel and Paul J. Deitel, C++ How to Program, 7th edition, Prentice Hall, 2010.
6. Tony Gaddis, Starting Out with Java: From Control Structures through Objects, 4/E, Addison-Wesley, 2009.

REFERENCES:

1. H.M. Deitel and P.J. Deitel, C How to program Introducing C++ and Java, Fourth Edition, Pearson Prentice Hall, 2005.
2. B. Stroustrup, "The C++ Programming language", Third edition, Pearson Education, 2004.

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	BIOINFORMATICS TOOLS AND SOFTWARES	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

Bioinformatics is information technology applied to the management and analysis of biological data with the aid of computers. It is the science of using information to understand biology. It is a field in which biological information collected, compared, studied and analyses to find the interrelation between them for solving structural, functional and evolutionary problems using computational technologies. The biological information stored in various databases is available online through internet.Bioinformatics refers to the creation and development of databases, software, computational and statistical techniques and theory to solve problems generated from the management and analysis of biological data. Specific biological problem using computers, carried out with experimental or simulated data, with the primary goal of discovery and the advancement of biological knowledge.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To understandthe most important computer organization and basic concepts, methods and tools used in bioinformatics
2	To elucidate the function of genes and proteins based on its structure and utilization of these concepts, algorithms
3	To illustrate the sequence information sources and to understand the structure of each source
4	To predict the use of bioinformatics tools to solve the problems on their own research

COURSE OUTCOMES

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

CO1. To recall the protein sequencing their interaction, activity, modification and their analysis	Remember
CO2. Find the molecular interactions, gene expression, analysis and prediction	Understand
CO3. Analyze, separate, annotate DNA, Protein using tools for further modeling	Understand
CO4. Correlate the sequences, analyze with various tools and to find the distances by various methods	Analyze
CO5. Illustrate the applications in different field, design libraries and to generate molecular libraries useful for drug discovery	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO02	PSO3
CO1	S	L	M	-	M	-	-	-	M	-	M	-	L	-	-
CO2	L	-	L	-	-	-	M	-	-	-	-	M	-	L	L
CO3	M	-	M	-	-	-	-	M	-	-	L	-	-	-	-
CO4	L	L	L	S	M	L	-	-	-	-	-	M	-	-	-
CO5	M	L	M	S	-	M	-	-	-	-	S	-	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Genes, Proteins and search engines: 9 hours

Genome Sequences, ORFs, Genes, Introns, Exons, Splice Variants, DNA/RNA Secondary Structure Triplet CodingProtein Sequences, Protein Structure: Secondary, Tertiary, Quaternary, The notion of Homology. WWW, HTML, URLs, Browsers: Netscape / Opera / Explorer, Search Engines Google, PUBMED, EMBL, GENBANK, Entrez, Unigene, PDB, SwissProt, TrEMBL.

Strings, Graphs, Algorithms, alignments:9 hours

Strings, Graphs, Algorithms, Alignments: Pairwise, Global, Local, Star, tree, Scoring functions, General gap and affine gap penalty, Statistical significance, Multiple Sequence alignment, SP (Sum of Pairs) measure, Motifs and Profile, Alignment Representation and Applications.

Applications of Perl in Bioinformatics:9 hours

Concatenating DNA Fragments, Transcription: DNA to RNA, Reading Protein Files, Finding Motifs, Simulating DNA, Generating Random DNA, Analysing DNA, Translating DNA to Proteins, Reading DNA from Files in FASTA format, Separating Sequence and Annotation, Parsing Annotation, Parsing PDB files, Parsing BLAST output, Bio-perl .

Database homology, Modeling of sequence, Structure analysis; 9 hours

Scoring matrices, BLAST algorithm, Blast versions : Blastp, Blastx, tBlastn, tbalstx, PSI and PHI Blast, Independent and indentically distributed sequences, Markov Chain models, Restriction site, Finding repeats, General Pattern search, DNA and Protein motifs search – Transfac, Prosite, Stem and Loop structure, RNA fold algorithm, Distances and Parsimony methods, Clustering methods, Rooted and Unrooted tree, Bootstrap analysis, PHYLIP.

Applications and Chemoinformatics:9 hours

Graph theoretical applications in chemistry, Diversity searches and diversity analysis,Algorithms for diversity analysis, Estimation of Physical andChemical properties, Chemometrics,Design of chemical (combinatorial) libraries – Examples ofchemoinformatics software.Web based chemoinformatics: Molecular data generated in modern drug discovery efforts, Data, structured numerical annotation /text – overview.

TEXT BOOKS:

1. Arthur M. Lesk (2002) "Introduction to Bioinformatics" Oxford University Press
2. T. K. Attwood & D. J. Parry-Smith (2001), "Introduction to Bioinformatics", Pearson Education Ltd,Low Price Edition.
3. R. Durbin, S. Eddy, A. Krogh and G. Mitchison, "Biological sequence analysis: Probablisticmodels of proteins and nucleic acids", Cambridge University Press, 1998 Indian low pricededition.
4. Stuart Brown (2000) "Bioinformatics – A biologists guide to Biocomputing and Internet". Eaton Publishing
5. Bioinformatics: Sequence and Genome Analysis. D. W. Mount (2001) Cold Spring Harbor Laboratory Press.
6. Cynthia Gibas and Per Jambeck (2001), "Developing Bioinformatics Computer Skills". O'Reilly press, Shorff Publishers and Distributors Pvt. Ltd., Mumbai.
7. J. Gasteiger "Chemoinformatics: A text book" John Wiley and Sons 2003

REFERENCES:

1. Neil C. Jones and Pavel A Pevzner. An introduction to Bioinformatics algorithms MIT Press reprinted by Ane Books, New Delhi 2005.
2. Ian korf, Mark yandell& Joseph Bedell. "BLAST". O'Reilly press 2003.
3. Bryan Bergeron MD (2003), "Bioinformatics Computing". Prentice Hall India (Economy Edition)
4. Setubal Joao and Meidanis Joao, "Introduction to Computational Molecular Biology", PWS Publishing Company (An International Thomson Publishing Company), 1997, Indian lowpriced edition.
5. Warren Ewens and Gregory R. Grant, "Statistical Methods in Bioinformatics: An Introduction" Springer-Gerlag 2001.
6. Chemoinformatics (Methods in Molecular Biology) Vol. 275 Ed. By Jurgenbajorath. Humana Press 2004

COURSE DESIGNERS

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2.				

	BIOINFORMATICS TOOLS AND SOFTWARES LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

Bioinformatics tools and software without relying on any prerequisites since it is an interdisciplinary field that develops methods and software tools for understanding biological data. This ought to be on data skills is that a notable difficulty in modern, multidisciplinary research is communication.

PRERQUISITE - NIL

COURSE OUTCOMES

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

CO1. To recall the computer basics - hardware, browser, search engines network	Remember
CO2. To understand the database, their uses and installation	Understand
CO3. To analyze the biomolecules using databases	Analyze
CO4. To correlate the sequences, structures with software and tools	Apply
CO5. Illustrate the applications of alignment by using different web tool and analyze	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO02	PSO3
CO1	M	M	L	M	L	M	-	-	-	-	-	-	-	-	-
CO2	L	-	M	L	L	-	-	-	-	-	-	-	M	-	L
CO3	S	M	L	M	L	M	-	-	-	-	-	-	-	L	M
CO4	M	L	-	M	M	-	-	-	-	-	-	-	L	-	-
CO5	M	-	M	L	-	L	-	-	-	-	-	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

List of Experiments

1. Computer basic knowledge; hardware, connection cables, typing, Windows98/XP, Internet browsers, search engines, LAN connections, setting up the IP address, network security.
2. Internet surfing and searching information, downloading and installing software, Understanding PubMed database.
3. Analysis of protein and gene sequences from protein and nucleotide databases.
4. Getting and analysis of primary and secondary protein structure.
5. Pair-wise and multiple sequence alignment by using ClustalW.
6. Introduction of BioEdit - Pairwise and Multiple sequence alignment.
7. Phylogenetic analysis using web tool

REFERENCES:

1. D. Baxevanis and F. Oulette, (2002) “Bioinformatics : A practical guide to the analysis of genes andproteins”, Wiley Indian Edition
2. Stephen A. Krawtz and David D. Womble “Introduction to Bioinformatics: a theoretical and practical approach. Humana Press.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr. J. Madhusudhanan		Biotechnology	madhusudhanan.biotech@avit.ac.in
2.				

	DATA STRUCTURES LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

This laboratory enables the students clearly understand the concepts of data structures. Also students can implement the searching and sorting algorithms.

PRERQUISITE

NIL

COURSE OUTCOMES

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

CO1. Develop algorithms for the concepts of data structures.	Apply
CO2. Able to Apply searching and sorting techniques	Apply
CO3. Construct implementations for Abstract Data Types (ADT) using appropriate Data Structures	Apply
CO4. Assess the suitability of a data structure to solve a problem, based on the time and space complexities of different operations on the data structure	Apply , Analysis
CO5. Implement algorithms which use sorting, searching and/or selection as sub-procedures.(CO5)	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	L	M	L	-	-	-	-	L	L	M	-	L	S	L	
CO2	-	-	-	-	-	-	-	-	-	L	L-	-	S	M	
CO3	S	S		S	-	M	S	-	-	M	-L	M	S	L	L
CO4										M		L	S	M	
CO5	S	S		S		M	S			L			S	M	S

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS:

1. Exercises using Objects, Classes, Inheritance
2. Operator Overloading and Polymorphism
3. Array implementation of List Abstract Data Type (ADT)
4. Linked list implementation of List ADT
5. Cursor implementation of List ADT
6. Array implementations of Stack ADT
7. Linked list implementations of Stack ADT
8. Queue ADT
9. Search Tree ADT - Binary Search Tree
10. Heap Sort
11. Quick Sort

REFERENCES:

1. Laboratory Reference Manual.
2. Balaguruswami. E, “Programming in C”, TMH Publications, 1997
3. Gottfried, “Programming with C”, schaums outline series, TMH publications, 1997.
4. Mahapatra , “Thinking in C”, PHI publications, 2nd Edition, 1998.
5. Subbura.R , “Programming in C”, Vikas publishing, 1st Edition, 2000.

COURSE DESIGNERS

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	OBJECT ORIENTED PROGRAMMING LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

With a dynamic learn-by-doing focus, this laboratory course encourages students to understand the use of object oriented way of problem solving. This course challenges students to exercise their creativity in both programming and analysis.

PRERQUISITE

NIL

COURSE OBJECTIVES

1.	To be capable of explaining procedure as well as object oriented programming concepts & their differences.
2.	To be able to implement inline and friend function very well.
3.	To be familiar with how to make programs using function overloading & operator overloading
4.	To get the capability to implement the different types of inheritance & done problems related to them

COURSE OUTCOMES

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

CO1. Construct object-oriented programs for a given scenario using the concepts of abstraction, encapsulation, message-passing and modularity.	Apply, Analysis
CO2. Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism.	Apply
CO3. Construct object-oriented programs for a given application by demonstrating the inter-relationship between classes using inheritance and aggregation.	Apply
CO4. Develop object-oriented applications that can handle exceptions..	Apply
CO5. Construct object-oriented applications for a given scenario to persist data using files and object-serialization.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Write a program to illustrate function overloading feature
2. Write a program to illustrate the overloading of various operators Ex. Binary operators, Unary operators, New and Delete operators.
3. Write a program to illustrate the use of following functions: a) Friend functions b) Inline functions c) Static Member functions d) Function with default arguments
4. Write a program to illustrate the use of destructor and the various types of constructors (no arguments, constructor,

constructor with arguments, copy constructor etc).
5. Write a program to illustrate the various forms of inheritance: Ex. Single, Multiple, multilevel, hierarchical inheritance etc.
6. Write a program having student as on abstract class and create many derived classes such as Engg. Science, Medical, etc. from student's class. Create their objects and process them.
7. Write a program to illustrate the use of virtual functions.
8. Write a program to illustrate the use of virtual base class.
9. Write a program to illustrate file handling operations: Ex. a) Copying a text files b) Displaying the contents of the file etc.
10. Write a program to illustrate how exceptions are handled (ex: division-by-zero, overflow and underflow in stack etc).

REFERENCES:

1. H.M. Deitel and P.J. Deitel, C How to program Introducing C++ and Java, Fourth Edition, Pearson Prentice Hall, 2010.
2. B. Stroustrup, "The C++ Programming language", Third edition, Pearson Education, 2004.
3. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
4. K. R. Venugopal, Rajkumar, T. Ra vishankar, Mastering C++, 4th Edition, Tata McGraw 2. Hill, 2008.
5. Budd T., An Introduction to Object-oriented Programming, Addison-Wesley 3rd 4. edition, 2008.
6. Bjarne stroustrup, The C++ programming Language, Addison Wesley, 3rd edition2008.
7. Harvey M. Deitel and Paul J. Deitel, C++ How to Program, 7th edition, Prentice Hall, 2010.
8. Tony Gaddis, Starting Out with Java: From Control Structures through Objects, 4/E, Addison-Wesley, 2009.

COURSE DESIGNERS

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2.	Mr.B.Sundaramurthy	Associate Professor	CSE	sundaramurthy@vmkvec.edu.in

CATEGORY D

Courses for presentation of technical skills related to the specialization

PROJECT + MINI PROJECT + SEMINAR + INDUSTRY INTERNSHIP OR ELSEWHERE (P + I + I) CREDITS (15)

Project Work, Seminar and Internship in Industry or elsewhere Credits-(15)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		PROJECT WORK	BTE	PII	0	0	20	8	NIL
2.		MINI PROJECT	BTE	PII	0	0	0	3	NIL
3.		SEMINAR	BTE	PII	0	0	0	1	NIL
4.		INTERNSHIP IN INDUSTRY OR ELSEWHERE	BTE	PII	0	0	0	3	NIL