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:

B.E / B.Tech.-ELECTRONICS AND COMMUNICATION ENGINEERING
Full Time (4 Years)

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM

(Semester I to VIII)

VINAYAKA MISSION'S RESEARCH FOUNDATION
DEEMED TO BE UNIVERSITY, SALEM
CURRICULUM FOR REGULATION-2021

Credit Requirement for the Course Categories

DEPARTMENT OF ECE

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		48-55
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**	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.		Zero 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.**

B.E./B.TECH. – ELECTRONICS AND COMMUNICATION ENGINEERING - 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.		ENGLISH LANGUAGE LAB	ENG	FC-HS	0	0	4	2	NIL
4.		PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT LAB	ENG	FC-HS	0	0	2	1	NIL
5.		TOTAL QUALITY MANAGEMENT	MANAG	FC-HS	3	0	0	3	NIL
6.		UNIVERSAL HUMAN VALUES-UNDERSTANDING HARMONY	ENG	FC-HS	3	0	0	3	NIL

Basic Science Courses –Credits (18-25)

1.		ENGINEERING MATHEMATICS	MATH	FC-BS	2	1	0	3	NIL
2.		DIFFERENTIAL EQUATIONS AND TRANSFORMS	MATH	FC-BS	2	1	0	3	ENGINEERING MATHEMATICS
3.		PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	MATH	FC-BS	2	1	0	3	DIFFERENTIAL EQUATIONS AND TRANSFORMS
4.		NUMERICAL METHODS, RANDOM PROCESSES AND OPTIMIZATION	MATH	FC-BS	2	1	0	3	ENGINEERING MATHEMATICS, DIFFERENTIAL EQUATIONS AND TRANSFORMS
5.		PHYSICAL SCIENCES	PHY & CHEM	FC-BS	4	0	0	4	NIL
6.		SMART MATERIALS	PHY	FC-BS	3	0	0	3	NIL
7		NON-DESTRUCTIVE TESTING OF MATERIALS	PHY	FC-BS	3	0	0	3	NIL
8.		ENVIRONMENTAL SCIENCES	CHEM	FC-BS	3	0	0	3	NIL
9		PHYSICAL SCIENCES LAB	PHY & CHEM	FC-BS	0	0	4	2	NIL

Engineering Science courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc Credits –(18-24)

1.		BASICS OF CIVIL AND MECHANICAL ENGINEERING	CIVIL & MECH	FC-ES	4	0	0	4	NIL
2.		BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	EEE & ECE	FC-ES	4	0	0	4	NIL
3.		ENGINEERING GRAPHICS AND DESIGN	MECH	FC-ES	0	0	6	3	NIL
4.		PYTHON PROGRAMMING (THEORY AND PRACTICALS)	CSE	FC-ES	2	0	2	3	NIL
5.		FOUNDATIONS OF COMPUTING AND PROGRAMMING (THEORY AND PRACTICALS)	CSE	FC-ES	2	0	2	3	NIL
6.		PROGRAMMING FOR PROBLEM SOLVING	CSE	FC-ES	3	0	0	3	NIL

7.		BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	EEE & ECE	FC-ES	0	0	4	2	NIL
8.		ENGINEERING SKILLS PRACTICALS LAB	CIVIL & MECH	FC-ES	0	0	4	2	NIL

B.E./B.TECH. – ELECTRONICS AND COMMUNICATION ENGINEERING - SEMESTER I TO VIII

B. Professional

Professional Core Courses – Credits (48-55)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		SEMICONDUCTOR DEVICES	ECE	CC	3	0	0	3	NIL
2		ANALOG CIRCUITS	ECE	CC	3	0	0	3	SEMICONDUCTOR DEVICES
3		LINEAR INTEGRATED CIRCUITS (THEORY AND PRACTICALS)	ECE	CC	2	0	2	3	SEMICONDUCTOR DEVICES
4		SIGNALS AND SYSTEMS	ECE	CC	3	0	0	3	NIL
5		DIGITAL CIRCUITS DESIGN	ECE	CC	3	0	0	3	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING
6		CONTROL SYSTEMS	EEE	CC	3	0	0	3	DIFFERENTIAL EQUATIONS AND TRANSFORMS
7		MICROCONTROLLERS AND EMBEDDED SYSTEMS	ECE	CC	3	0	0	3	NIL
8		CMOS DESIGN	ECE	CC	3	0	0	3	DIGITAL CIRCUITS DESIGN
9		ANALOG AND DIGITAL COMMUNICATION (THEORY AND PRACTICALS)	ECE	CC	3	0	2	4	NIL
10		MICROWAVE AND OPTICAL COMMUNICATION SYSTEMS	ECE	CC	3	0	0	3	NIL
11		SIGNAL PROCESSING	ECE	CC	3	0	0	3	SIGNALS AND SYSTEMS
12		PRINCIPLES OF COMPUTER COMMUNICATION	ECE	CC	3	0	0	3	NIL
13		PRINCIPLES OF SENSORS AND DATA ACQUISITION	ECE	CC	3	0	0	3	NIL
14		JAVA AND C# .NET APPLICATION DEVELOPMENT	CSE	CC	3	0	0	3	NIL
15		SEMICONDUCTOR DEVICES LAB	ECE	CC	0	0	4	2	NIL
16		DIGITAL CIRCUITS DESIGN LAB	ECE	CC	0	0	4	2	NIL
17		ANALOG CIRCUITS LAB	ECE	CC	0	0	4	2	SEMICONDUCTOR DEVICES
18		SIGNAL PROCESSING LAB	ECE	CC	0	0	4	2	SIGNALS AND SYSTEMS
19		MICROCONTROLLERS AND EMBEDDED SYSTEMS LAB	ECE	CC	0	0	4	2	NIL
20		CMOS DESIGN LAB	ECE	CC	0	0	4	2	NIL

B.E./B.TECH. – ELECTRONICS AND COMMUNICATION ENGINEERING - SEMESTER I TO VIII

DETAILS OF ELECTIVE COURSES

C.Elective Courses

Professional Electives Credits-(12)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		COMPUTER VISION AND PATTERN RECOGNITION	ECE	EC-PS	3	0	0	3	NIL

2		SPEECH AND AUDIO PROCESSING	ECE	EC-PS	3	0	0	3	SIGNAL PROCESSING
3		INTRODUCTION TO MEMS	ECE	EC-PS	3	0	0	3	NIL
4		INTERNET OF THINGS FOR ELECTRONICS	ECE	EC-PS	3	0	0	3	NIL
5		ADAPTIVE SIGNAL PROCESSING	ECE	EC-PS	3	0	0	3	NIL
6		SATELLITE COMMUNICATION	ECE	EC-PS	3	0	0	3	NIL
7		WIRELESS AND MOBILE COMMUNICATION	ECE	EC-PS	3	0	0	3	ANALOG AND DIGITAL COMMUNICATION
8		WIRELESS SENSOR NETWORKS	ECE	EC-PS	3	0	0	3	DATA COMMUNICATION NETWORKS
9		HIGH SPEED ELECTRONICS	ECE	EC-PS	3	0	0	3	SEMICONDUCTOR DEVICES
10		WAVELET TRANSFORMS	ECE	EC-PS	3	0	0	3	SIGNAL PROCESSING
11		NANO ELECTRONICS	ECE	EC-PS	3	0	0	3	NIL
12		INFORMATION AND ERROR CONTROL CODING	ECE	EC-PS	3	0	0	3	ANALOG AND DIGITAL COMMUNICATION
13		COMMUNICATION NETWORK SECURITY	ECE	EC-PS	3	0	0	3	DATA COMMUNICATION NETWORKS
14		VIDEO PROCESSING	ECE	EC-PS	3	0	0	3	NIL
15		DATA SCIENCE FOR COMMUNICATION NETWORKS	ECE	EC-PS	3	0	0	3	NIL
16		PASSIVE NETWORK ANALYSIS AND SYNTHESIS	ECE	EC-PS	3	0	0	3	NIL
17		IOT SYSTEM DESIGN AND APPLICATIONS	ECE	EC-PS	3	0	0	3	NIL
18		SENSORS AND TRANSDUCERS FOR HEALTHCARE	ECE	EC-PS	3	0	0	3	NIL
19		DIGITAL IMAGE PROCESSING	ECE	EC-PS	3	0	0	3	NIL
20		PCB DESIGNING	ECE	EC-PS	3	0	0	3	NIL
Industry Designed/ Industry Supported/ Industry Offered/ Industry Sponsored courses - Credits-(6)									
1		REAL TIME OPERATING SYSTEMS DESIGN AND PROGRAMMING	ARM UNIVERSITY	EC-IE	3	0	0	3	NIL
2		ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	ARM UNIVERSITY	EC-IE	3	0	0	3	NIL
3		BUSINESS INTELLIGENCE AND ITS APPLICATIONS	INFOSYS	EC-IE	3	0	0	3	NIL
4		LEARNING IT ESSENTIALS BY DOING	INFOSYS	EC-IE	3	0	0	3	NIL
Open Electives – Electives from Innovation, Entrepreneurship, Skill Development etc. Credits -(6-9)									
1		LIFE SKILLS	MANAG	OE-IE	3	0	0	3	NIL
2		INTELLECTUAL PROPERTY RIGHTS	MANAG	OE-IE	3	0	0	3	NIL
3		ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL
4		FINANCE AND ACCOUNTING FOR ENGINEERS	MANAG	OE-IE	3	0	0	3	NIL
5		INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION	MANAG	OE-IE	3	0	0	3	NIL
6		NEW VENTURE PLANNING AND MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL

7		SOCIAL ENTREPRENEURSHIP	MANAG	OE-IE	3	0	0	3	NIL
Open Electives – Electives from other Emerging Areas Credits-(6-9)									
1		BIOSENSORS AND TRANSDUCERS	BME	OE-EA	3	0	0	3	NIL
2		PRINCIPLES OF BIOMEDICAL INSTRUMENTATION	BME	OE-EA	3	0	0	3	NIL
3		MUNICIPAL SOLID WASTE MANAGEMENT	CIVIL	OE-EA	3	0	0	3	NIL
4		DISASTER MITIGATION AND MANAGEMENT	CIVIL	OE-EA	3	0	0	3	NIL
5		GREEN POWER GENERATION SYSTEMS	EEE	OE-EA	3	0	0	3	NIL
6		INDUSTRIAL DRIVES AND AUTOMATION	EEE	OE-EA	3	0	0	3	NIL
7		3D PRINTING AND ITS APPLICATIONS	MECH	OE-EA	3	0	0	3	NIL
8		INDUSTRIAL ROBOTICS	MECH	OE-EA	3	0	0	3	NIL
9		INTRODUCTION TO BIOFUELS	BTE	OE-EA	3	0	0	3	NIL
10		FOOD AND NUTRITION TECHNOLOGY	BTE	OE-EA	3	0	0	3	NIL
11		INTRODUCTION TO INTERNET OF THINGS	CSE	OE-EA	3	0	0	3	NIL
12		FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	CSE	OE-EA	3	0	0	3	NIL
13		CYBER SECURITY	CSE	OE-EA	3	0	0	3	NIL
14		BIOMOLECULES – STRUCTURE AND FUNCTION	PE	OE-EA	3	0	0	3	NIL
15		PHARMACOGENOMICS	PE	OE-EA	3	0	0	3	NIL

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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	ECE	PI-P	0	0	16	8	NIL
2.		MINI PROJECT	ECE	PI-M	0	0	6	3	NIL
3.		INTERNSHIP	ECE	PI-I	3 WEEKS			3	NIL
4.		SEMINAR	ECE	PI-S	0	0	2	1	NIL

B.E./B.TECH. – ELECTRONICS AND COMMUNICATION ENGINEERING - SEMESTER I TO VIII

E. Mandatory Courses

MANDATORY COURSES (2 CREDITS)
(NOT INCLUDED FOR CGPA CALCULATIONS)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		YOGA AND MEDITATION	PHED	AC	0	0	2	0	NIL

ANY TWO COURSES

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		INDIAN CONSTITUTION	LAW	AC	0	0	2	0	NIL
2.		ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	GEN	AC	0	0	2	0	NIL
3.		NCC/NSS/RRC/YRC/STUDENT CLUBS/UNNAT BHARAT ABHIYAN/	GEN	AC	30 HOURS			0	NIL

		SWACTH BHARAT							
4.		SPORTS AND GAMES	PHED	AC	0	0	2	0	
5.		GENDER EQUITY AND LAW	LAW	AC	0	0	2	0	NIL

SPECIALIZATION – EMBEDDED SYSTEMS									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		ADVANCED PROCESSORS	ECE	EC-SE	3	0	0	3	NIL
2.		EMBEDDED CONTROL SYSTEMS	ECE	EC-SE	3	0	0	3	NIL
3.		EMBEDDED SYSTEMS ARCHITECTURE	ECE	EC-SE	3	0	0	3	NIL
4		REAL TIME OPERATING SYSTEMS	ECE	EC-SE	3	0	0	3	NIL
5		ADVANCED SYSTEM ON CHIP DESIGN	ECE	EC-SE	3	0	0	3	NIL
6		SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEM	ECE	EC-SE	3	0	0	3	NIL
7		EFFICIENT EMBEDDED SYSTEMS DESIGN AND PROGRAMMING	ECE	EC-SE	3	0	0	3	NIL
8		RAPID EMBEDDED SYSTEMS DESIGN AND PROGRAMMING	ECE	EC-SE	3	0	0	3	NIL
9		REAL TIME OPERATING SYSTEMS LAB	ECE	EC-SE	0	0	4	2	NIL
10		EFFICIENT EMBEDDED SYSTEMS DESIGN AND PROGRAMMING LAB	ECE	EC-SE	0	0	4	2	NIL
11		ADVANCED PROCESSORS LAB	ECE	EC-SE	0	0	4	2	NIL
SPECIALIZATION – INTERNET OF THINGS AND SENSORS									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		FIBER OPTIC SENSORS AND APPLICATIONS	ECE	EC-SE	3	0	0	3	NIL
2.		IOT IN AUTOMOTIVE SYSTEMS	ECE	EC-SE	3	0	0	3	NIL
3.		IOT FOR INDUSTRIAL SYSTEMS	ECE	EC-SE	3	0	0	3	NIL
4		RFID AND FLEXIBLE SENSORS	ECE	EC-SE	3	0	0	3	NIL
5		SMART IOT APPLICATIONS	ECE	EC-SE	3	0	0	3	NIL
6		WIRELESS SENSOR NETWORKS AND IOT	ECE	EC-SE	3	0	0	3	NIL
7		WIRELESS TECHNOLOGIES FOR IOT	ECE	EC-SE	3	0	0	3	NIL
8		CHEMICAL SENSOR LAB	ECE	EC-SE	0	0	4	2	NIL
9		SENSOR SYSTEMS LAB	ECE	EC-SE	0	0	4	2	NIL
10		WIRELESS SENSOR NETWORKS LAB	ECE	EC-SE	0	0	4	2	NIL
11		INTERNET OF THINGS	ECE	EC-SE	3	0	0	3	NIL
12		INTERNET OF THINGS LAB	ECE	EC-SE	0	0	4	2	NIL

	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	PSO 3
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 Faculty	Designation	Department	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

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

Preamble

Language is one of the most valued possessions of men. It acts as a repository of wisdom. Among all other languages English, the international language plays a vital role as a propeller for the advancement of knowledge in different fields and as a telescope to view the dream of the future.

Prerequisite : NIL

Course Objectives

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

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

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

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF LANGUAGE AND LISTENING SKILLS

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

SPEAKING SKILLS

Stress (Word Stress and Sentence Stress) Intonation- Difference between British and American English Vocabulary-Indianism-Compound Words (including Technical Terminology) Jargons- Technical and Business, Listening to TED Talks and discussion on the topic heard

READING SKILLS

Extempore**,** Speaking activities- pair and group designed by the faculty, Group Discussion-Types of Interviews, Watching Documentary Films and Responding to Questions, Reading Skills-Skimming, Scanning, Understanding Ideas and making Inferences–- FAQs –,Critical Reading-Book Review-Finding Key Information and Shifting Facts from Opinions, reading for pleasure (motivational, short novels, classical etc)

CORPORATE COMMUNICATION

What is Corporate Communication? Types of Office communications -Recommendation-Instruction-Check List- Circulars-Inter Office Memo- Minutes of Meeting and Writing Agenda - Discourse Markers , Technical Articles – Written communication Project Proposals- E - Mail Netiquette - Sample E – mails Making Presentations on given Topics -Preparing Power Point Presentations-Business Letters (Calling for Quotation, Placing Orders and Complaint Letters)

Text Books

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

Alternative NPTEL/SWAYAM Course – Nil

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

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr. Jennifer G Joseph	Professor & Head	English /AVIT	jennifer@avit.ac.in
2	Dr. P.Saradha	Associate Professor	English /VMKVEC	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

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

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

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

wise, Individual. Role Play

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

MODULE V: Case study of Etiquette in different scenario.

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

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

PREAMBLE:

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

PREREQUISITE: Nil

COURSE OBJECTIVES:

1. To understand the introduction about Quality and Total Quality Management.
2. To understand the TQM principles.
3. To understand the statistical process control
4. To impart the various TQM tools
5. To understand the quality systems.

COURSE OUTCOMES:

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

CO1: Understand the importance of quality and TQM at managerial level.	Understand
CO2: Explain the required tools to implement TQM.	Apply
CO3: Analyse various TQM parameters with help of statistical tools.	Analysing
CO4: Evaluating various TQM Techniques	Evaluate
CO5: Propose the Quality Management Systems in a different organization environment	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION

Quality: Definition - Dimensions - Planning- costs – Analysis Techniques for Quality Costs- Basic concepts of Total Quality Management- Historical Review- Principles - Leadership – Concepts- Role of Top Management- Quality Council – Quality Statements- Strategic Planning- Deming Philosophy- TQM Implementation – Barriers.

TQM PRINCIPLES

Customer satisfaction – Perception of Quality- Complaints- Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment - Teams- Recognition and Reward- Performance Appraisal- Benefits- Continuous Process Improvement – Juran's Trilogy- PDSA Cycle- 5S – Kaizen - Basic Concepts.

STATISTICAL PROCESS CONTROL (SPC)

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

TQM TOOLS

Benchmarking – Reasons - Process- Quality Function Deployment (QFD) – House of Quality- QFD Process- Benefits- Taguchi Quality Loss Function- Total Productive Maintenance (TPM) – Concept- Improvement Needs- FMEA – Stages of FMEA.

QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems- ISO 9000:2000 Quality System – Elements- Implementation of Quality System- Documentation- Quality Auditing- QS 9000- ISO 14000 – Concept- Requirements and Benefits.

TEXT BOOKS:

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

REFERENCES:

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

COURSE DESIGNERS:

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1	A. Mani	Associate Professor	Management Studies	asmanimba@gmail.com
2	B. Rajnarayanan	Assistant Professor	Management Studies	Rajsachin.narayanan@gmail.com

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

Course Objectives:

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

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

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

UNIT I Introduction

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

UNIT II Understanding Harmony in the Human Being

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

UNIT III Understanding Harmony in the Family and Society

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

UNIT IV Understanding Harmony in the Nature and Existence

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

UNIT V Holistic Understanding of Harmony on Professional Ethics

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

Total Hours : 45 Hours

Text Book

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

Reference Books

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

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

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

	ENGINEERING MATHEMATICS	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

The driving force in Engineering Mathematics is the rapid growth of technology and the sciences. Matrices had been found to be of great utility in many branches of engineering applications such as theory of electric circuits, aerodynamics, and mechanics and so on. Many physical laws and relation can be expressed mathematically in the form of differential equations. Based on this we provide a course in matrices, calculus and differential equations. Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To recall the advanced matrix knowledge to Engineering problems.
2	To equip themselves familiar with the functions of several variables.
3	To improve their ability in solving geometrical applications of differential calculus problems
4	To examine knowledge in multiple integrals.
5	To improve their ability in Vector calculus.

COURSE OUTCOMES

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

CO1. Apply the concept of orthogonal reduction to diagonalise the given matrix	Apply
CO2. Find the radius of curvature, circle of curvature and centre of curvature for a given curve.	Understand
CO3. Classify the maxima and minima for a given function with several variables, through by finding stationary points	Analyse
CO4. Find double integral over general areas and triple integral over general volumes	Understand
CO5. Apply Gauss Divergence theorem for evaluating the surface integral.	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	S	M	-	-	-	-	-	-	-	-	-	-	-	-
CO2	L	S	M	-	-	-	-	-	-	-	-	-	-	-	-
CO3	L	S	M	-	-	-	-	-	-	-	-	-	-	-	-
CO4	L	S	M	-	-	-		-	-	-	-	-	-	-	-
CO5	L	S	M	-	-	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

MATRICES:

Characteristic equation– Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof).

PARTIAL DERIVATIVES &DIFFERENTIAL CALCULUS:

Partial Derivatives – Total Differentiation – Maxima and Minima -Constrained Maxima and Minima by Lagrangian Multiplier Method,Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature.

ORDINARY DIFFERENTIAL EQUATIONS:

Solutions of second and third order linear ordinary differential equation with constant coefficients – Method of variation of parameters -Simultaneous first order linear equations with constant coefficients.

MULTIPLE INTEGRALS:

Introduction of multiple integration by examples ofDouble and Triple integral-Evaluation of double and Triple Integration(in both Cartesian and polar coordinates)-Change of order of integration

VECTOR CALCULUS:

Scalar and vector point functions, Gradient, divergence, curl Solenoidal and irrotational vectors, Vector identities (without proof),Normal and Directional derivatives, Solenoidal and irrotational field, Integration of vectors: Definition of Line, surface and volume integrals,Green's, Gauss divergence and Stoke's theorems (Statements only)

TEXT BOOKS:

1. "Engineering Mathematics", Department of Mathematics, VMKVEC (Salem) & AVIT (Chennai), (2017).
2. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
3. Kreyszig E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore (2012).

REFERENCES:

1. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Education Pvt, New Delhi (2011).
2. Dr.A.Singaravelu, "Engineering Mathematics I & II", 23rd Edition, Meenakshi Agency, Chennai (2016).
3. Kandasamy P, Thilagavathy K, and Gunavathy K., "Engineering Mathematics", Volumes I &II (10th Edition).

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. A.K.Bhuvaneswari	Asst. Professor	Mathematics	bhuvaneswari@avit.ac.in
2	Dr.G.Selvam	Asso. Professor	Mathematics	selvam@vmkvec.edu.in

	DIFFERENTIAL EQUATIONS AND TRANSFORMS	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

A signal is said to be a continuous time signal if it is available at all instants of time. A real time naturally available signal is in the form of time domain. However, the analysis of a signal is far more convenient in the frequency domain. These are three important classes of transformation methods available for continuous time systems. They are Laplace Transform, Fourier series and Fourier Transform. Similarly, Z- transform plays an important role in analysis of linear discrete time signals. Transform techniques are very important tool in the analysis of signals. Also To expose the students to the basics of wavelet theory and to illustrate the use of wavelet processing in engineering fields.

PREREQUISITE

Engineering Mathematics

COURSE OBJECTIVES

1	Learn to use Fourier series to represent periodical physical phenomena in engineering analysis
2	To understand how the Fourier series is extended to aperiodic signals in the form Fourier transform
3	To understand the properties of Z-Transform and associating the knowledge of properties of ROC in response to different operations on discrete signals.
4	To learn Laplace transform and it Inverse methods to solve differential transforms and integral transforms
5	To understand the terminology that are used in the wavelet's literature

COURSE OUTCOMES

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

CO1. Explain fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.	Evaluate
CO2. Demonstrate Fourier Transform as a tool for solving integral equations	Apply
CO3. Compute the Z transform of elementary sequences both from the definition and by using tables and use the appropriate theorems to calculate Z transforms and inverse Z transforms. Select and combine the necessary Z transform techniques to solve second-order ordinary difference	Apply
CO4. Calculate the Laplace transform of standard functions both from the definition and by using tables. Select and use the appropriate shift theorems in finding Laplace and inverse Laplace transforms. Understand the concept of Laplace transform and inverse Laplace transform of various functions and its application to solve ordinary differential equations.	Apply
CO5. Understand how to use the modern signal processing tools using signal spaces, bases, operators and series expansions.	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	-	-	-
CO2	S	S	S	S	-	-	-	M	-	-	-	M	-	-	-
CO3	S	S	S	S	-	-	-	M	-	-	-	M	-	-	-
CO4	S	S	S	S	-	-	-	M	-	-	-	M	-	-	-
CO5	S	S	S	S	-	-	-	M	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

Syllabus

FOURIER SERIES:

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.

FOURIER TRANSFORMS:

Fourier transform pairs - Fourier Sine and Cosine transforms – Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

Z – TRANSFORMS:

Z-Transform – Elementary Properties – Inverse Z-Transform – Convolution Theorem – Formation of Difference Equations – Solution of first and second order Difference Equations using Z-Transform.

LAPLACE TRANSFORMS:

Laplace transform – transform of elementary functions – basic properties – derivatives and integrals of transforms – transforms of derivatives and integrals – initial and final value theorems – Transform of periodic functions-Inverse Laplace transform – Convolution theorem – -Solution of linear ODE of second order with constant coefficients.

WAVELET TRANSFROMATION:

Classes of wavelets: Haar, Daubechies, bi-orthogonal. Continuous Wavelet Transform (CWT): CWT and its Properties, Discrete Wavelet Transform- Haar scaling function - Nested spaces - Wavelet function- Designing orthogonal wavelet systems: Daubechies – Coiflet - Symlet wavelet system coefficients- Signal decomposition using DWT.

TEXT BOOKS:

1. "Engineering mathematics I & II", by Department of Mathematics, VMKVEC (Salem) & AVIT (Chennai), (2017).
2. Dr. A. Singaravelu, "Engineering Mathematics I & II", 23rd Edition, Meenakshi Agency, Chennai (2016).
3. Dr. A. Singaravelu, "Transforms and Partial differential Equations", 18th Edition, Meenakshi Agency, Chennai

(2013).
4. K. P. Soman, K. I. Ramachandran, "Insight into Wavelets: From Theory to Practice", Third Edition, PHI (2004).

REFERENCES:

1. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
2. Kreyszig, E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore (2012).
5. R. M. Rao and Ajit S. Bopardikar, "Wavelet Transform, Introduction to theory and Applications", Addison-Wesley (1998).

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. L. Tamilselvi	Professor	Mathematics	ltamilselvi@avit.ac.in
2	Dr. M. Vijayarakavan	Associate Professor	Mathematics	vijayarakavan@vmkvec.edu.in

	PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

Impart knowledge about the subject of a single variable and multivariable. The focus of the course will be the study of the application of partial differential equations. The course also gives the opportunity to the learner to understand linear algebra and its application to engineering.

PREREQUISITE

Differential Equations and Transforms

COURSE OBJECTIVES

1	Equip themselves familiar with the functions of several variables
2	To familiar with applications of partial differential equations
3	To have the knowledge of vector space & subspaces
4	To have an idea of inner product spaces over the field of complex numbers
5	To compute the linear transformations and find matrices of general linear transformations

COURSE OUTCOMES

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

CO1. Distinguish between an ordinary differential equation, forming and solving PDEs.	Apply
CO2. Understanding the basic concepts in partial differential equations in vibration of strings, heat-passing rod and two-dimensional heat conduction problems	Apply
CO3. Understand the concept of vector space & subspace and to find the dimension of a vector	Apply
CO4. Understand inner product space concepts and apply the concept in various linear system related problems.	Apply
CO5. Understand linear transformation and its properties	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	L	-	-	-	L	-	-	-	L	-	-	-
CO2	S	S	M	L	-	-	-	L	-	-	-	L	-	-	-
CO3	S	S	M	L	-	-	-	L	-	-	-	L	-	-	-
CO4	S	S	M	L	-	-	-	L	-	-	-	L	-	-	-
CO5	S	S	M	L	-	-	-	L	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

PARTIAL DIFFERENTIAL EQUATIONS:

Formation - Solutions of standard types f(p,q) = 0 , Clairaut's form, f(z,p,q) = 0 , f(p,x) = g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients

APPLICATION OF PARTIAL DIFFERENTIAL EQUATIONS:

Method of separation of variables – Solutions of one-dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates

VECTOR SPACES:

Vectors in two-dimensional space and n dimensional space**,** subspaces and spanning sets properties of vector space, Linear combination of vectors, Linear independence and dependence of vectors, basis and dimension

INNER PRODUCT SPACES:

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations -Least square approximation

LINEAR TRANSFORMATION:

Linear transformations, linear operators, Properties of Linear Transformation, Algebra of Linear transformation, Matrix Representation of linear transformation, Linear map Associated with Linear Transformation

TEXT BOOKS:

1. Grewal, B.S., "Higher Engineering Mathematics", 35th Edition, Khanna Publishers, Delhi (2012).
2. Kennath M. Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition, Pearson India Publishing, New Delhi, (2015).
3. M.Artin, "Algebra", Prentice Hall of India Pvt. Ltd., New Delhi (2005).

REFERENCES:

1. A. Singaravelu, "Transforms and Partial Differential Equations", Meenakshi Agencies, Chennai (2015).
2. Kreyszig, E., "Advanced Engineering Mathematics", (8th Edition), John Wiley and Sons, (Asia) Pvt. Ltd., Singapore (2000).
3. Dr.Gunadhar Paria, "Linear Algebra", New Central Book Agency (P) Ltd (2009).

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.V.T.Lakshmi	Associate Professor	Mathematics	lakshmivt@vmkvec.edu.in
2	Ms. S.Sarala	Associate Professor	Mathematics	sarala@avit.ac.in

	NUMERICAL METHODS, RANDOM PROCESSES AND OPTIMIZATION	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

Numerical analysis naturally finds applications in all fields of engineering to solve differential equations. The purpose of the course is, to providing the required skill to apply the statistical tools in engineering problems. The optimization is the process of maximizing of a desired quantity or the minimizing of an undesired one. Further the course will develop problem solving skills.

PREREQUISITE

1. Engineering Mathematics
2. Differential Equations & Transforms

COURSE OBJECTIVES

1	To familiar with interpolation concepts.
2	To find numerical solutions of Ordinary differential equations.
3	To be thorough with probability concepts and Random Variables.
4	To be get exposed to the concepts of Random process.
5	To acquire skill on optimization techniques.

COURSE OUTCOMES

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

CO1. Apply various numerical methods to find intermediate numerical value & Polynomial of Numerical Data.	Apply
CO2. Solve the Initial value problems in ordinary differential equations using single step and multistep methods.	Apply
CO3. Understand the concepts of random variable, probability distribution, distribution function, expected value and probabilities associated with the distributions of random variables.	Apply
CO4. Apply concepts of probability, discrete and continuous random variables, Random processes in Electronics Engineering.	Apply
CO5. Apply optimization methods to realistic engineering problems, including developing a model, defining an optimization problem, applying optimization methods, exploring the solution, and interpreting results.	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	-	-	-	M	-	-	-
CO2	S	M	M	L	-	-	-	M	-	-	-	M	-	-	-
CO3	M	M	L	-	-	-	-	M	-	-	-	M	-	-	-
CO4	S	S	M	L	-	-	-	M	-	-	-	M	-	-	-
CO5	S	S	S	M	-	-	-	M	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTERPOLATION AND APPROXIMATION:

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

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:

Single Step Methods: Taylor Series Method, Euler and Modified Euler Method, Runge-Kutta method of fourth order -first and second order differential equations. Multistep Methods: Milne and Adam's-Bash forth predictor and corrector methods.

PROBABILITY AND RANDOM VARIABLES:

Discrete and continuous random variables-Moment generating functions - Standard distributions- Binomial, Poisson, Uniform and Exponential distributions – Joint distributions - Marginal and conditional distributions.

RANDOM PROCESSES:

Classification, Stationery and Markov process, Binominal process, Poisson process, Sine-wave process, Ergodic processes.

OPTIMIZATION:

LPP – Concave & convex steps, Global and Local optimization, Formation of LPP – Standard form of LPP, Graphical solution of LPP – Simplex method – Transportation and Assignment problems.

TEXT BOOKS:

1. Jain M.K., Iyengar S.R.K and Jain R.K., "Numerical Methods for Engineering and Scientific Computation (Fourth Edition)", New Age International (P) Ltd., New Delhi (2010).
2. Ross S.M., "Stochastic Processes", John Wiley & Sons, 3rd Edition (2010).
3. Sharma.J. K, "Operations Research: Theory and Applications", Macmillan India Ltd., Fourth Edition (2009).

REFERENCES:

1. Gerald C.F., Wheatley P.O., "Applied Numerical Analysis", (Fifth Edition), Addison – Wesley, Singapore (1998).
2. P.Kandasamy, K.Thilagavathy, K.Gunavathy "Probability, Random Variables and Random Processes", S.Chand & Company Ltd., New Delhi. (First Edition 2003).
3. Hamdy A. Taha, "Operations Research – An Introduction", Macmillan Co., Seventh Edition (2000).

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. L. Tamilselvi	Professor	Mathematics	ltamilselvi@avit.ac.in
2	Dr.S. Punitha	Asso. Professor	Mathematics	punitha@vmkvec.edu.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 BOOK

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

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

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

REFERENCE BOOKS

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

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

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

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

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

COURSE DESIGNERS

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

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

PREAMBLE

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

PREREQUISITE

NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

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

S- Strong; M-Medium; L-Low

Syllabus

UNIT – I: WATER TECHNOLOGY **9hrs**

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

UNIT – II: ELECTROCHEMISTRY, CORROSION AND BATTERIES **9hrs**

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

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

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

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

TEXTBOOK

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

REFERENCES

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

Course Designers:

S.No	Name of the Faculty	Mail ID
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2	Dr. R. Nagalakshmi	nagalakshmi.chemistry@avit.ac.in

	SMART MATERIALS	CATEGORY	L	T	P	C
	Total Contact Hours: 45					
	Prerequisite: N i l	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	9 Hours

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).

UNIT: II	SMART MATERIALS	9 Hours

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).

UNIT: III	NANO MATERIALS	9 Hours

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

UNIT: IV	MAGNETIC MATERIALS	9 Hours

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

UNIT: V	SUPER CONDUCTING MATERIALS	9 Hours

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, 2018.

COURSE DESIGNERS

Sl. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr. G. Suresh	Associate Professor	Physics	suresh.physics@avit.ac.in
2.	Dr. R. N. Viswanath	Professor	Physics	rnvishwanath@avit.ac.in
3.	Dr. B. Dhanalakshmi	Associate Professor	Physics	dhanalakshmi.phys@avit.ac.in

	NON-DESTRUCTIVE TESTING OF MATERIALS	Category	L	T	P	Credit
		FC-BS	3	0	0	3

PREAMBLE

Nondestructive testing is a wide group of analysis/techniques used in science and technology and in industries to evaluate the properties and quality of a material without causing damage. It is a highly valuable technique that can save both money and time in product evaluation, troubleshooting, and research.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the principles of visual inspection
2	To know about the procedure followed in liquid penetrant method
3	To learn the magnetic particle testing
4	To know about in radiographic testing
5	To learn about ultrasonic testing

COURSE OUTCOMES

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

CO1. Choose the NDT methods as per the conditions of the materials under study	Understand
CO2. Identify the defects by visual inspection methods	Apply
CO3. Locate the surface defects using LPT and Magnetic particle inspection	Apply
CO4. Identify the internal defects using X ray radiography and Ultrasonic flaw detector	Apply
CO5. Inspect the defects using various techniques	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	S			M	M							M		S	S
CO3	S	M	M	M	M							M		S	S
CO4	S	S	M	M	M							M		M	M
CO5	S	S	S	M	M							M		M	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I – OVERVIEW OF NDT & VISUAL INSPECTION:

Inspection of materials for defects and characterization - Non-Destructive versus Destructive Tests - different NDT methods and selection criteria for inspection - Visual Testing: Principle and conditions - Equipments and accessories: borescope, flexible fiber optic borescope, endoscopes or endoprobes, video imagescope - confocal laser scanning microscopy - optical coherence tomography - laser thermography. Visual inspection applied to construction materials

UNIT II – LIQUID PENETRANT TESTING:

Liquid penetrant testing: Introduction - Principle and equipments - test procedure - cleaning methods - interpretation of test results - characteristics and types of penetrants - developers - safety precautions, advantages and limitations - High

temperature penetrant testing - Low temperature penetrant testing - Industrial applications of LPT.

UNIT III – MAGNETIC PARTICLE TESTING:
Principle of magnetic particle testing - different methods to generate magnetic fields - magnetic particle testing equipment - magnetic particle testing procedures method of De-magnetization - advantages and limitations - codes and standard for MPI - magnetic particle test for welding, valves, crank shafts, etc.

UNIT IV – RADIOGRAPHIC TESTING:
X-ray radiography principle, equipment & methodology - Types of industrial radiation sources and application - Radiographic exposure factors and technique - Gama ray and X- ray equipment - Precautions against radiation hazards - applications of industrial radiography

UNIT V – ULTRASONIC TESTING:
Principle: Interaction of ultrasonic waves with matter - instrumentation - ultrasonic probes and types - ultrasonic testing methods and modes - data presentation: A-scan, B-scan and C-scan - advantages and limitations - determination of thickness of samples and defects in welded products.

TEXT BOOKS

1. Jean-Paul Balayssac and Vincent Garnier, "Non-destructive Test and Evaluation of Civil Engineering Structures", ISTE Press Ltd - Elsevier Inc., 2017.
2. Prasad J, Nair C G K, Non-destructive Testing and Evaluation of Materials, Tata McGraw Hill Education Private Limited, 2011(Second Edition)
3. Carles J Hellier, Handbook of Nondestructive Evaluation, McGraw-Hill, 2013

REFERENCES:

1. Nathan Ida and Norbert Meyendorf, "Handbook of Advanced Nondestructive Evaluation", Springer Int. Publishing Agency, 2019.
2. Baldev Raj, T.Jayakumar, M.Thavasimuthu, "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
3. Evgency N. Barkanov and Ivan A. Parinov, "Non-destructive Testing and Repair of Pipelines, Springer Int. Publishing Agency, 2018.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. B. Dhanalakshmi	Asso.Prof.	Physics	Dhanalakshmi.phy@avit.ac.in
2	Dr G. Suresh	Asso. Professor	Physics	Suresh.physics@avit.ac.in
3	Dr. R. N. Viswanath	Professor	Physics	rnviswanath@avit.ac.in

	ENVIRONMENTAL SCIENCES	Category	L	T	P	Credit
		FC-BS	3	0	0	3

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

PREREQUISITE

NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT –I ENVIRONMENT AND NATURAL RESOURCES 6 hrs

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

UNIT –II ECOSYSTEMS AND BIO – DIVERSITY 6 hrs

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

UNIT –III ENVIRONMENTAL POLLUTION 6 hrs

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

UNIT-IV SOCIAL ISSUES AND ENVIRONMENT 6 hrs

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

UNIT-V HUMAN POPULATION AND ENVIRONMENT 6 hrs

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

TEXT BOOK

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

2. Erach Bharucha "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India
3. Benny Joseph “Environmental Science and Engineering”, Tata Mc Graw- Hill, New Delhi

REFERENCES:

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

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
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2.	A. Gilbert Sunderraj	gilbertsunderraj@vmkvec.edu.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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

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

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

LAB MANUAL

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

COURSE DESIGNERS

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

	PHYSICAL SCIENCES PART B - ENGINEERING CHEMISTRY LAB	Category	L	T	P	Credit
		FC - BS	0	0	2	1

Engineering Chemistry Lab experiments explains the basics and essentials of Engineering Chemistry. It also helps the students to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives clear basic application oriented knowledge about electrochemistry. Water technology study gives the idea about hardness and its disadvantages. Now-a-days the practical and handling of equipments are needed for our fast growing life style.

PREREQUISITE

NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	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

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

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

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

Prerequisite –NIL

COURSE OBJECTIVE

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

COURSE OUTCOMES

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

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

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

Surveying:

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

Construction Materials:

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

Elements of Building Construction:

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

Text Books

1. Basic Civil and Mechanical Engineering, School of Mechanical Engineering Sciences, VMU, Salem
2. Civil Engg. Drawing by S. C. Rangwala Publication Charotar Pub. House Anand
3. Surveying Vol .I & II by Dr. B. C. Punamia Publication Laxmi Publication Delhi
4. Engineering Material, Author : Dr. S.C. Rangwala, Publisher: Charotar Pub. House
5. Building Construction, Author : Dr. B. C. Punamia, Publisher: Laxmi Pub. Delhi

COURSE DESIGNERS				
S.No	Name of Faculty	Designation	Department	Email id
1	C.Kathirvel	Associate Professor	Civil	kathirvel@vmkvec.edu.in

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

Preamble

This course provides a preliminary knowledge of the applications of mechanical engineering in our day to day life.

Prerequisite-NIL

CourseObjective

1	To demonstrate the principles of casting and metal joining processes in manufacturing
2	Understand the importance and uses of IC Engines, working principles of IC Engines .
3	Comprehend the working and use of various power plants

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

CO1.	Illustrate the application of casting and metal joining processes in manufacturing	Apply
CO2.	Demonstrate the operation of automotive engines and important components	Apply
CO3.	Understanding the construction and the working principle of conventional and non-conventional power generation	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	S	L	M										
CO2	S	M	M	L	L										
CO3	S	M	M	L	L										

S-Strong; M-Medium; L-Low

SYLLABUS

BASIC MANUFACTURING PROCESSES

Casting process-Introduction, Principle, Advantages, casting defects Forging process-introduction, forging, rolling, drawing, extrusion Welding process- introduction, principle, types-Gas and arc welding

IC ENGINES

The Importance and uses of Engines-Definition, Classification-I C & E C Engines- two stroke engines - four stroke engines - various parts and functions of I C engines-working of two stroke petrol engine and diesel engine with line sketches - working of four stroke petrol and diesel engines with line sketches - Comparison between two stroke and four stroke engines -S I and C I engines.

POWER PLANT ENGINEERING

Classification of power plants- Working of power plant with line Sketches-Steam power plant-Hydro- electric power plant - Diesel power plant -Nuclear power plant- merits and demerits. Nonconventional energy power plants – solar-wind-tidal- geo thermal, with line sketches- merits & demerits of various non conventional power plants

Text Books

1	Power plant Engineering, by G.R Nagpal
2	Internal combustion Engines by Ganesan
3	Workshop technology vol1, by S K Hajra Choudhury

Reference Books

1	Production technology, by P.C Sharma
2	Thermal Engineering by R.S.Khurumi
3	Power plant Engineering, by R.K Bansal

Course Designers

Sl.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Emailid**
1	R.MAHESH	AP(G-II)	MECH/AVIT	mahesh@avit.ac.in

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

PREAMBLE

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

PREREQUISITE – Nil

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS
ELECTRICAL CIRCUITS AND MEASUREMENTS

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

ELECTRICAL MACHINES

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

ELECTRICAL SAFETY AND INTRODUCTION TO POWER SYSTEM

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE DESIGNERS

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

	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING 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

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

	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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12	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 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.
5. N.D. Bhat and V.M. Panchal, Engineering Graphics, Charotar Publishers 2013
6. E. Finkelstein, "AutoCAD 2007 Bible", Wiley Publishing Inc., 2007
7. R.K. Dhawan, "A text book of Engineering Drawing", S. Chand Publishers, Delhi,2010.
8. DhananjayA.Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw Hill Publishing Company Limited, 2008.
9. G.S. Phull and H.S.Sandhu, "Engineering Graphics", Wiley Publications, 2014.

COURSE DESIGNERS

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

Alternative NPTEL/SWAYAM Course:

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

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

PREAMBLE

The purpose of this course is to introduce Python, a remarkably powerful dynamic programming language to write code for different operating systems along with application domain. Python has evolved on more popular and powerful open source programming tool

PRERQUISITE :NIL

COURSE OBJECTIVES

1.	To provide basic knowledge on Python programming concepts.
2.	To introduce different methods in list, string, tuple, dictionary and sets.
3.	To compute different programs using python control statements.
4.	To learn about different functions in python.
5.	To compute the exception handling functions and file concepts.

COURSE OUTCOMES

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

CO1. Learn python statements, comments and indentation, tokens, input and output methods using various example programs.	Understand
CO2. Apply the different methods involved in List, String, Tuples and Dictionary.	Apply
CO3. Design solutions for complex programs using decision making and looping statements.	Apply.
CO4.Apply the function programs with all the concepts like lambda and recursion.	Apply.
CO5. Compute the exception handling programs, file concept programs and understand the concepts .	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

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

DATA STRUCTURES

Strings-Lists-Tuples-Dictionaries-Sets

CONTROL STATEMENTS

Flow Control-Selection control Structure- iterative control structures.

FUNCTIONS

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

FILE HANDLING AND EXCEPTION HANDLING

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

LIST OF EXPERIMENTS

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

TEXT BOOKS:

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

REFERENCES:

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

COURSE DESIGNERS

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

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

PREAMBLE

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

PRERQUISITE – Nil

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

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

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

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

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

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

Lab Component -HTML programs

TEXT BOOKS:

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

REFERENCES:

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

COURSE DESIGNERS

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

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

PREAMBLE

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

PREREQUISITE–NIL

COURSEOBJECTIVES

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

COURSEOUTCOMES

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

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

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

COS	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PS01	PS02	PS03
CO1	M	M	M	M	-	-	-	-	-	-	-	-	M	M	M
CO2	M	M	M	M	-	-	-	-	-	-	-	-	M	M	M
CO3	M	M	S	M	-	-	-	-	-	-	-	-	M	M	M
CO4	S	M	M	M	-	-	-	-	-	-	-	-	M	M	S
CO5	S	M	M	M	-	-	-	-	-	-	-	-	M	M	S

S-Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: INTRODUCTION

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

UNIT – II: OPERATORS, EXPRESSIONS AND CONTROL STRUCTURES

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

UNIT – III: ARRAYS AND FUNCTIONS

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

UNIT – IV: STRINGS AND POINTERS

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

UNIT – V: STRUCTURES AND FILE HANDLING

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

TEXTBOOKS

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

REFERENCES

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

Course Designers:				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Mrs.R.Shobana	Assistant Professor	CSE	shobana@avit.ac.in
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	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB BASIC ELECTRICAL ENGINEERING	Category	L	T	P	Credit
		FC-ES	0	0	2	1

PREAMBLE

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

PRERQUISITE – NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

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

REFERENCES

1. Laboratory Reference Manual.

COURSE DESIGNERS

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

	ENGINEERING SKILLS PRACTICES LAB 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. Study the response of Amplitude Modulation.
8. Study the response of Amplitude Modulation.

COURSE DESIGNERS

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

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

PREAMBLE:

Engineering Skills Practice is a hands-on training practice to Mechanical, Civil and Mechatronics Engineering students. It deals with fitting, carpentry, sheet metal and related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

Prerequisite –NIL

COURSE Objective

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

COURSE OUTCOMES:

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

CO1. Prepare the different types of fitting.	Apply
CO2. Prepare the different types of joints using wooden material	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO1	S	M	L	L	M	M	L	-	L	L	-	-	-	-	-
CO2	S	M	L	L	M	M	L	S	M	M	M	M	L	-	-

S- Strong; M-Medium; L-Low

Syllabus

Buildings:

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

Plumbing Works:

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

Carpentry using Power Tools only:

7. Study of the joints in roofs, doors, windows and furniture.

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

Text Books

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

COURSE DESIGNERS

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

	ENGINEERING SKILLS PRACTICE LAB BASIC MECHANICAL ENGINEERING	Category	L	T	P	Credit
		FC-ES	0	0	2	1

Preamble

Workshop is a hands-on training practice to Mechanical Engineering students. It deals with fitting, carpentry, foundry and welding related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

Prerequisite –NIL

Course Objective

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

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

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

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

LIST OF EXPERIMENTS

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

Text Books

1	**BASIC MECHANICAL ENGINEERING, LAB MANUAL**

Reference Books

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

Course Designers

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

	SEMICONDUCTOR DEVICES	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course is designed to teach the physical principles and operational characteristics of semiconductor devices with emphasis on metal-oxide systems, bipolar, high-electron mobility, and field-effect transistors. The course provides advanced background in solid state electronic devices and is intended to help students to develop their basic analytical skills and continue advanced research in the varied branches of semiconductor devices.

PRERQUISITE NIL

COURSE OBJECTIVES

1	To emphasis the physics of semiconductors and the working of semiconductor devices with their applications.
2	To impart knowledge on working principle, configuration, operational characteristics and limitation of BJTs.
3	To understand the construction and Characteristics of JFETs and MOSFETs.
4	To familiarize the special semiconductor devices and understand their operational characteristics
5	To recognize and differentiate the power devices from others with reference to the power handling capacity

COURSE OUTCOMES

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

CO1. Apply the concept of diode operation to construct the circuits for various applications	Apply
CO2. Investigate the different configurations and derive the device model using Pi and h parameter models.	Apply
CO3. Differentiate the constructional diagram and characteristic significances of JFET, DMOSFET and EMOSFET.	Analyze
CO4. Describe the principle and operations of various special semiconductor devices like Schottky barrier diode, varactor diode and tunnel diode etc.	Analyze
CO5. Identify a proper device by referring their specifications for any applications used in power circuits and output stage of a system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	S	M	M	L	-	-	-	-	-	-	-	-	S	M	-
CO2	S	S	M	L	-	-	-	-	-	-	-	-	S	M	-
CO3	S	M	L	-	-	-	-	-	-	-	-	-	M	-	-
CO4	S	M	L	-	-	-	-	-	-	-	-	L	S	L	-
CO5	S	M	L	L	-	-	-	-	-	-	-	L	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

SEMICODUCTOR DEVICES AND ITS APPLICATIONS: Semiconductor materials - Ge, Si and GaAs- P type and N type materials - Semiconductor Diode - equivalent circuit - junction capacitance - switching characteristics, diode current equation- drift, diffusion current-Diode applications-Rectifiers-wave shaping circuits and voltage multipliers.

BIPOLAR JUNCTION TRANSISTORS: Transistor constructions – NPN - PNP Junctions - Early effect - Input and output characteristics of CE, CB and CC Configurations. Device Models - pi model and h parameter model - Multi emitter transistor.

JUNCTION FIELD EFFECT TRANSISTOTRS: Construction - operation of JFET - characteristics – pinch-off voltage and its significance - MOSFET characteristics - channel length modulation - DMOSFET-EMOSFET - equivalent circuit model

SPECIAL SEMICONDUCTOR DEVICES: Metal semiconductor junction - MESFET - Schottky barrier diode - Zener diode - varactor diode - Tunnel diode - Gallium arsenide diode - LASER .

POWER AND DISPLAY DEVICES: UJT, SCR, Diac, Triac - power BJT - MOSFET-DMOS - VMOS - Photo transistor – optocoupler - CCD - LCD – LED

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education, 11th Edition, 2013.

References:

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, “Electron Devices and Circuits”, Tata McGraw Hill, 2010.
2. David A Bell, “Fundamentals of Electronic Devices and Circuits”, Oxford Press, 2009.
3. B L Theraja, R S Sedha, “Principles of Electronic Devices and Circuits”, S.Chand, 2004.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.S.Selvaraju	Associate	ECE	selvaraju@vmkvec.edu.in

		Professor		
2	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in
3	Dr.C.Arunkumarmadhuvappan	Assistant Professor	ECE	arunkumarmadhuvappan@vmkvec.edu.in
4	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in

	ANALOG CIRCUITS	Category	L	T	P	Credit
		CC	**3**	**0**	**0**	**3**

PREAMBLE

Analog circuits enable the students to have an insight knowledge on fundamentals of various electronic circuits. The designed course makes the students to work on the various applications of the electronic devices. This subject helps the students to design, model and develop rectifier circuits, amplifier circuits, oscillator circuits and many other real time application circuits

PREREQUISITE

Semiconductor Devices

COURSE OBJECTIVES

1	To understand the small signal BJT/FET Models.
2	Identify the frequency response of BJT and FET.
3	Apply the basic concept and working of various types of feedback amplifiers and oscillators.
4	To understand the working different types of large signal amplifiers and tuned amplifiers.
5	To learn about various compound configurations of multivibrators.

COURSE OUTCOMES

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

CO1.Illustrate the small signal models of BJT/FET amplifiers	Apply
CO2.Design an amplifier for a given frequency response	Apply
CO3. Construct different oscillators, multivibrators & compound configurations and feedback amplifier circuits	Apply
CO4. Analyze various parameters of feedback amplifier (voltage series, voltage shunt, current series and current shunt) by using simulation tools	Analyze
CO5.Analyze the efficiency of large signal amplifiers and bandwidth of tuned amplifier by using simulation tools	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	-	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

BIASING CIRCUITS AND SMALL SIGNAL MODELS

Overview of DC analysis of BJT circuits - Overview of BJT models - AC analysis of Common-Emitter BJT amplifier configuration using hybrid-π model - BJT current sources: Cascode current source, Widlar current source. Overview of FET DC circuit analysis - AC analysis of Common-Source MOSFET amplifier configuration - FET current sources: 2-transistor MOSFET current source - FET current sources: Cascode current mirror and Wilson current mirror.

BJT AND JFET FREQUENCY RESPONSE

BJT amplifiers: CE, CB and CC amplifiers, FET amplifiers: CS, CG and CD amplifiers –designing BJT & FET amplifier networks Frequency response: low frequency response of BJT with RL, Low frequency response of FET amplifiers – Miller effect capacitance – high frequency response of BJT and FET amplifiers, Multistage frequencyeffect.

FEEDBACK AMPLIFIERS AND OSCILLATOR CIRCUITS

Classification of Amplifiers, Feedback Concepts, Effect of Negative Feedbacks, Voltage Series Feedback, Current Series Feedback, Voltage Shunt Feedback and Current Shunt Feedback, Oscillator basics, Types of Oscillators-RC oscillator, LC Oscillator and Crystal Oscillator.

LARGE SIGNAL AMPLIFIERS AND TUNED AMPLIFIERS

Class A Large Signal amplifier, Second Order Distortion, Push –Pull Amplifier, Class B, Class AB amplifiers, Class C amplifiers, Tuned amplifiers– single tuned – double tuned – synchronously tuned amplifiers –Real Time Applications of amplifiers.

WAVE FILTERS

Filters: Classification of Filters, Passive filters, Low-Pass filters - Low-Pass R-C Filter Circuit - Low-Pass R-L Filter Circuit, High-Pass Filters - High-Pass R-C Filter Circuit - High-Pass R-L Filter Circuit, R-C Band-pass Filter - R-C Band-stop (or Band-Elimination) Filter

TEXT BOOKS:

1. JacobMillman,ChristosCHalkias,SatyabrataJit,“ElectronDevicesandCircuits”,TataMcGraw Hill, 4TH Edition,2015.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education, 11th Edition,2013.

REFERENCE BOOKS:

1. Adel S Sedra,Kenneth C Smith,“Microelectronic Devices”,,Oxford University Press,7thEdition,2015.

2. David A Bell, “Fundamentals of Electronic Devices and Circuits”, Oxford University Press, 5th Edition,2008.

Jacob Millman, Christos C Halkias, Chetan D Parikh ,“Integrated Electronics”, Tata McGraw Hill, 2ndEdition, 2010.

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
2	Ms. R. Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	LINEAR INTEGRATED CIRCUITS (THEORY AND PRACTICALS)	Category	L	T	P	Credit
		CC	2	0	2	3

PREAMBLE

Linear Integrated circuits course is a design-oriented course aimed at understanding fabrication, parameters, and specifications of integrated circuits, MOSFETs, Op-Amps as well as their applications in the Analog domain. The designed course makes the students to work on the various applications of the Integrated Circuits. This subject helps the students to design, model and develop amplifier circuits, comparators, regulators, filters ,timer, D/A and A/D converters and PLL.

PREREQUISITE

Semiconductor Devices

COURSE OBJECTIVES

1	To Understand the different types of sources and basics of Integrated Circuits fabrication.
2	To get familiarized with operational amplifiers and its Characteristics.
3	To Construct various circuits using operational amplifier and analyze its performance.
4	To design and the working of regulators, filters and timers circuits.
5	To Understand the basic concepts of PLL, ADC and DAC.

COURSE OUTCOMES

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

CO1. The ability to understand the IC Technology and equipment used in fabrication.	Understand
CO2. Analyze the Operational Amplifier with its characteristics.	Analyze
CO3. Design and analyze the various applications of Operational Amplifier.	Analyze
CO4. Design and analyze regulators, filters and timers circuits.	Analyze
CO5.Discussion of concepts of PLL and its applications, ADC and DAC.	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	-	-	-	-	-	-	-	-	-	S	M	-
CO2	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO5	M	M	L	-	-	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

CIRCUIT CONFIGURATION FOR LINEAR ICs AND INTEGRATED CIRCUIT FABRICATION

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic Monolithic Integrated Circuits-Basic Planar Process-Transistors for monolithic circuits-Monolithic Diodes-Integrated Resistors-Integrated Capacitors and Inductors-Scale of Integration.

BASICS OF OPERATIONAL AMPLIFIER

Ideal Operational Amplifier - Operational Amplifier Internal Circuits – 741 op-amp and its features, modes of operation-inverting, non-inverting, differential. Examples of IC Op Amps – DC Characteristics – AC Characteristics – PSPICE Simulation Tools- Experiments

OPERATIONAL AMPLIFIER LINEAR AND NON-LINEAR APPLICATIONS

Basic Op Amp Applications – Instrumentation Amplifiers – V to I and I to V Converters –Adder/ Sub tractor – Multiplier and Divider – Differentiator and Integrator – Sign Changer, Scale Changer,Precision rectifier, peak detector, clipper and clamper—Log/Antilog Amplifiers –Comparators-Waveform Generators, Design of Op-amp based ECG signal Acquisition, Conditioning and Processing-Experiments

REGULATORS, FILTERS AND TIMERS

Series Op Amp Regulators – IC Voltage Regulators – 723 General Purpose Regulators – Active Filters: First & Second order high pass & low pass Butterworth filters. Band pass filters, all pass filters. Timer – Description of Functional Diagram – Monostable and Astable Operation – Schmitt Trigger- Experiments

PLL, D/A AND A/D CONVERTERS

PLL – Basic Principles – Phase Detectors/ Comparators – Voltage Controlled Oscillator – Low Pass Filter — PLL Applications – D-A Converters & its type – A–D Converters & its type - Experiments

Text Books:

1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 5th Edition 2018.
2. Jacob Millman,Chirstos C.Halkias,"Integrated Electronics",Tata Mc-GRAW Hill, Edition,3rd Edition, 2010

Reference Books:

1. Robert F Coughlin, Fredrick F.Driscoll," Operational Amplifiers and Linerar Integrated Circuits", Phi Learning,6th Edition,2009.
2. Sergio Franco,"Design with Operational Amplifiers and Analog Integrated Circuits", Tata Mc-GRAW Hill ,4th Edition, 2016.

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	R.Mohana Priya,	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in
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	SIGNALS AND SYSTEMS	Category	L	T	P	Credit
		CC	**3**	**0**	**0**	**3**

PREAMBLE

Signals and Systems arise in a wide variety of fields. These concepts and techniques associated with in areas of science and technology. Signals are functions of one or more independent variables contain information about the behavior or nature of some phenomenon. Signals vary continuous / discrete in time. Systems respond to particular signals by producing other signals (output) having some desired behavior. It introduces the students to analyze signals and systems and to design systems to enhance or restore signals that have been degraded in some way.

PREREQUISITE :NIL

COURSE OBJECTIVES

1	To understand the various classifications of Continuous time and Discrete time Signals and Systems.
2	To know about signalsampling and reconstruction techniques.
3	To determine the characteristics of continuous time and discrete time LTI systems using state variable formulations and equations.
4	To impart the knowledge in analysis and characterization of the CT and DT systems through Fourier transforms.
5	To learn about the analysis and characterization of the DT system through Z Transforms.

COURSE OUTCOMES

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

CO1. Classify the type of signals and systems.	Understand
CO2. Understand the signal sampling and reconstruction techniques.	Understand
CO3.Determine the characteristics of continuous and discrete time LTI systems using state variable formulations and equations.	Apply
CO4. Apply Fourier concepts to analyze the continuous time and discrete time systems.	Apply
CO5. Apply Z- transform to analyze the characteristics of discrete-time systems.	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	-	-	-	-	-	-	-	-	-	S	M	-
CO2	S	M	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	M	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	M	M	-	M	-	-	-	M	-	-	M	S	M	-
CO5	S	M	M	-	M	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO SIGNALS AND SYSTEMS

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

SAMPLING AND RECONSTRUCTION

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

FOURIER REPRESENTATION OF SIGNALS :

Representation of Fourier series, Continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.

Z–TRANSFORMS :

Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z- transform, properties of Z-transforms.

TEXT BOOKS:

1. Alan V.Oppenheim, Ronald W. Schafer, "Discrete time signal processing", Pearson education , 2nd edition, 2007.
2. John G. Proakis and Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", Pearson Education, 4thEdition, 2007.

REFERENCE BOOKS:

1. B.P. Lathi, "Linear Systems & Signals", Oxford Press, Second Edition, 2009.
2. Rodger E Ziemer, William H. Tranter, D. Ronald Fannin, "Signals and Systems – continuous and Discrete", Pearson Education, 4th Edition, 2009.
3. Douglas K Linder, "Introduction to Signals and Systems",Mc-Graw Hill, 1st Edition, 1999.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Muthumanickam	Professor & Head	ECE	muthumanickam@vmkvec.edu.in
2	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in
3	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in

	DIGITAL CIRCUITS DESIGN	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

One of the most important reasons for the unprecedented growth of Digital Electronics and systems is the advent of integrated circuits (ICs). Developments in the IC technology have made it possible to fabricate complex digital circuits such as microprocessors, memories and FPGAs etc. This course provides various methods and techniques suitable for a variety of digital system design applications.

PREREQUISITE

Basics of Electrical and Electronics Engineering

COURSE OBJECTIVES

1	To understand the various number systems and their conversions.
2	To learn the Boolean expressions, Boolean postulates and Karnaugh map method to reduce the
3	To impart the design knowledge of various combinational logic circuits and sequential circuits.
4	To understand the basics of hardware descriptive language.
5	To design the RTL for various logic circuits.

COURSE OUTCOMES

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

CO1. Explain the basic principles of digital system, Logic gates and Boolean laws.	Understand
CO2. Simplify Boolean expression using K-Map techniques.	Apply
CO3. Examine various Combinational circuits using logic gates.	Apply
CO4. Illustrate the operation of sequential circuits using Flip flops	Analyze
CO5.Analyze various digital circuits using HDL programming and Design various logic families.	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	L	-	-	-	-	-	-	-	-	L	S	-	-
CO2	S	M	M	L	L	-	-	-	-	-	-	L	S	M	-
CO3	S	S	M	M	M	-	-	-	-	-	-	L	S	M	M
CO4	S	S	M	M	M	-	-	-	-	-	-	L	S	M	M
CO5	S	S	M	M	M	-	-	-	-	-	L	L	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Basics of digital system:

About Digital system, Analog versus Digital systems, Advantages of processing information in digital form, Number Systems-Binary, Octal, Decimal & Hexadecimal & its Conversion methods, Complement Arithmetic, Signed Binary Numbers, Binary Codes, Binary Storage and Registers and its types, Fixed-Function Logic Devices.

Boolean Algebra, Logic Gates & Gate –Level Minimization:

Introduction to Boolean Algebra, basic theorem & properties of Boolean Algebra, Boolean functions, canonical & standard forms, logical operations, logic gates, Integrated circuits, Map method-upto four variable K- maps, Product of Sums (POS) & Sum of Products (SOP) simplification, don't care conditions, NAND & NOR implementations, Exclusive-OR Function, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method, Hardware Description Language(HDL).

Combinational logic:

Introduction to Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder, Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Code Converters, Encoders, Decoders, Multiplexers.

Synchronous Sequential Logic, Register & Counters:

Introduction to Sequential circuits, Storage elements: latches, flip flops, Analysis of clocked sequential circuits, Moore and Mealy circuits, state diagram, state reduction & Assignment, design procedure, shift registers, ripple counters, synchronous counters.

Design At the Digital Integrated Circuits & Register Transfer Level

Digital Integrated Circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS

Register Transfer Level Notation, Register Transfer Level In HDL, ASM, Sequential Binary Multiplier, Control Logic, HDL Description Of Binary Multiplier, Design With Multiplexers, Race Free Design, Latch Free Design.

Text books:

1. Morris Mano, "Digital Design (with an introduction to the verilog HDL)", Prentice-Hall of India.
2. John F. Wakerly, "Digital Design Principles & Practices", 4th edition, Prentice-Hall, 2005.

Reference Books:

1. Stephen D. Brown, and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design, 2nd Edition," McGraw Hill, June, 2007.
2. William Kleitz, "Digital Electronics: A Practical Approach with VHDL", Ninth Edition, Pearson, 2002.
3. Floyd T.L., "Digital Fundamentals ", Charles E. Merrill publishing Company, 1982.
4. Tokheim R.L., "Digital Electronics - Principles and Applications ", Tata McGraw Hill, 1999.
5. Jain R.P., "Modern Digital Electronics ", Tata McGraw Hill, 1999

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.G.Murali	Assistant Professor	ECE	muralig@vmkvec.edu.in
2	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	CONTROL SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course shall introduce the analysis and regulation of the output behaviors of dynamical systems subject to input signals. The course focuses primarily on using Laplace and frequency-domain techniques. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems. At the end of this course, one should possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function and use it for obtaining system response, analyze dynamic systems for their stability and performance, and design controllers (such as Proportional-Integral-Derivative) based on stability and performance requirements.

PREREQUISITE

Differential Equations and Transforms

COURSE OBJECTIVES

1	Understand the feedback and feed-forward control; apply representations of controlsystems.
2	To find time response of given control system model, various controllers design and simulation using MATLAB.
3	To understand the frequency domain analysis, use of frequency response methods for open loop and closed loop control systems.
4	To analyze the stability of systems using various methods and to designcompensators.
5	To develop and analyze the state space models.

COURSE OUTCOMES

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

CO1	Find Transfer function of systems.	Understand
CO2	Find the time response of given control system model and to design a controller.	Create
CO3	Find the frequency response of control system model using frequency response plots.	Analyze
CO4	Analyze the stability of the control system and design the suitable compensators.	Create
CO5	Apply state space techniques to model control systems.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CONTROL SYSTEMS

Basic elements in control systems – classifications of control systems – Mechanical Translational and Mechanical Rotational Systems, Electrical analogy– Transfer function – Block diagram reduction techniques – Signal flow graphs.

TIME RESPONSE ANALYSIS

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Effects of P, PI, PID modes of feedback control. Design and Simulation of time domain analysis using MATLAB.

FREQUENCY DOMAIN ANALYSIS

Frequency response analysis, Frequency domain specifications, Correlation between time and frequency responses, Bode Plot, Polar Plot, Constant M and N circles, Nichols chart, Design and Simulation of frequency domain analysis using MATLAB.

STABILITY ANALYSIS AND COMPENSATOR DESIGN

Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, Introduction to Root-Locus Techniques, Guidelines for sketching root locus , Nyquist stability criterion. Cascade Lag compensation, cascade Lead compensation and cascade Lag-Lead compensation

STATE VARIABLE ANALYSIS, AND APPLICATION OF CONTROL SYSTEMS

Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, Equivalence between transfer function and state variable representations, Digital control design using state feedback. Synchros – AC servomotors- DC Servo motors.

TEXT BOOKS

1. K. Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
3. C.J.Chesmond. "Basic Control System Technology", Viva low priced student edition, 1998.
4. R.C.Dorf and R.H.Bishop, "Modern Control Systems", Addison-Wesley, 1995 (MATLAB Reference).
5. M. Gopal, "Control Systems: Principles and Design", 3rd Edition, McGraw, Hill, 2008
6. Nise N.S , " Control Systems Engineering", 6th Edition , Wiley India , 2016.

REFERENCES

1. Benjamin C Kuo, "Automatic Control system", Prentice Hall of India Private Ltd., New Delhi, 2009.
2. R.C. Dorf and R.H. Bishop, "Modern Control Systems", 12th Edition, Prentice, Hall, 2010.
3. http://www.mathworks.com/access/helpdesk/help/toolbox/control/
4. Control Systems - N. K. Sinha, New Age International (P) Limited Publishers.
5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2nd Edition, Vikas Publishing, 2012.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-mail id
1	D.SARANYA	Assistant Professor (Gr-II)	EEE	dsaranya@avit.ac.in
2	R. SATHISH	Assistant Professor	EEE	sathish@vmkvec.edu.in

	MICROCONTROLLERS AND EMBEDDED SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Microcontroller is used as the main controller in most of the embedded systems nowadays. Due to the development inVLSI technology, microcontrollers evolvewhichfunctionsimilartomicroprocessorsbutthey havemostoftheperipherals built on-chip. This course makes the students to be familiar with the architecture and programming ofMicrocontrollers.ThiscoursealsointroducesthearchitectureandhardwarefeaturesofPIC16F877andARM7(LPC2148)microcontrollers.

PREREQUISITE–Nil

COURSEOBJECTIVES

1	Tolearntheconceptsofmicroprocessorsandknowledgeofinterfacingdevices.
2	TostudytheArchitectureof8051microcontroller
3	Todevelopskillinsimpleprogramwritingofmicrocontroller
4	Tostudytheinterfacing andapplicationsofmicrocontroller
5	Tostudythe concepts of Embedded Systems.

COURSEOUTCOMES

Onthesuccessful completionofthecourse, studentswill beable to

CO1.Explaintheconceptofmicroprocessorandinterfacingdevices.	Understand
CO2.Explainthearchitectureandfunctionof8051microcontroller	Apply
CO3.Designandimplementprogramson8051Microcontroller	Analyze
CO4.Designandimplementapplicationsusing8051Microcontroller	Analyze
CO5. Explainthearchitectureandfunctionof Embedded Systems	Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTEL8086MICROPROCESSOR&I/OINTERFACING

Introduction to 8086 - Architecture of 8086 - Register organization – Signal Description of 8086 - Addressing modes –Data Transfer Instruction – Arithmetic Instruction - Branching Instruction -Program Transfer Instruction – simpleprograms-ProgrammablePeripheralInterface8255–ProgrammableCommunicationInterface8251USART– ProgrammableInterruptController8259A–DirectMemoryAccessController8257- ProgrammableIntervalTimer8253Keyboard/DisplayController8279.

INTEL8051MICROCONTROLLER

Introduction to 8bit microcontroller–architecture of 8051-Signal descriptions of 8051-Role of PC and DPTR-Flagsand PSW-CPU registers- Internal RAM & ROM-Special Function Register-Counter & Timers-Serial Communication.

ASSEMBLYLANGUAGEPROGRAMOFINTEL 8051

Interrupt-Addressing Mode-Data Transfer Instruction-Arithmetic Instruction-Logical Instruction- Jump Loop& Call Instruction-I/O Port Programming.

INTERFACINGANDAPPLICATIONOFINTEL 8051

LCD Interfacing-A/D and D/A Interfacing-Sensor Interfacing-Relays and Opt isolators-Stepper Motor Interfacing-DCMotor Interfacing.

INTRODUCTION TO EMBEDDED SYSTEMS

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA — Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging

Text Books:

1. MuhammadAliMazidiandJanicaGilliMazidi,The8051microcontrollerandembeddedsystems,PearsonEducation ,5th Indian reprint, 2003.
2. Frank D.Petruzella. “ProgrammableLogicControllers”,McGraw–HillBook,Company,1989
3. Raj Kamal, “Embedded Systems-Architecture, Programming and Design”, TataMcGraw-Hill,2011.

Reference Books:

1. B.P.Singh,MicroprocessorsandMicrocontrollers,GalcotiaPublications(P)Ltd,Firstedition,NewDelhi,1997.
2. EmbeddedControllerHandbook, IntelCorporation,USA.
3. MicrocontrollerHandBook, INTEL,1984.
4. AjayV.Deshmukh,“Microcontrollers-Theoryandapplications”,TataMcGraw-Hill,publisher,2005.

COURSEDESIGNERS				
S.No.	**Name of theFaculty**	**Designation**	**Department**	**MailID**
1	Dr.R.Ramani	AssistantProfessor	ECE	ramani@vmkvec.edu.in
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3	Dr.L.K.Hema	Professor	ECE	hemalk@avit.ac.in

	CMOS DESIGN	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course deals comprehensively with all aspects of transistor level design of all the digital building blocks common to all CMOS microprocessors, DPSs, network processors, digital backend of all wireless systems etc. The focus will be on the transistor level design and will address all important issues related to size, speed and power consumption. The units are classified according to the important building and will introduce the principles and design methodology in terms of the dominant circuit choices, constraints and performance measures.

PREREQUISITE

Digital Circuits Design

COURSE OBJECTIVES

1	To understand the MOS transistor theory, CMOS technologies and the Layout.
2	To understand the concepts of designing combinational and sequential circuit using CMOS logic configuration.
3	To Learn the design of CMOS Logic circuits and subsystems.
4	To understand the concepts of VHDL programming.

COURSE OUTCOMES

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

CO1. Understand the fundamentals of CMOS circuits and its characteristics	Understand
CO2. Design combinational logic circuits using different CMOS logic circuits	Apply
CO3. Design various sequential logic circuits and analyze its design methodology.	Apply
CO4. Execute system level design using various VLSI system components.	Apply
CO5. Model the system using Hardware Description Language and apply concepts and methods of digital system design techniques through experiments	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	-	-	-	-	-	-	-	-	-	S	M	-
CO2	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO5	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MOS TRANSISTOR

Review of MOS transistor models, CMOS Inverter Logic and its Fabrication, Transistor scaling, Stick diagram

and Layout Design rules. Delay model: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.

COMBINATIONAL CIRCUIT DESIGN

Static CMOS design-complementary CMOS - static properties- complementary CMOS design, Power consumption in CMOS logic gates-dynamic or glitching transitions, Design techniques to reduce switching activity, Differential pass transistor logic, Dynamic CMOS design-Basic principles - Domino logic-optimization of Domino logic-NPCMOS-logic style selection.

SEQUENTIALCIRCUIT DESIGN

Static latches and registers - Bistability principle - multiplexer based latches-master slave edge triggered registers- non-ideal clock signals-low voltage static latches-static SR flip flop - Dynamic latches and registers C^2MOS register - Bistable sequential circuit-Schmitt trigger-mono stable -Astable -sequential circuit - choosing a clocking strategy.

DESIGN OF BUILDING BLOCKS AND SUB-SYSTEM

Multiplexers, Decoders, Comparators, Priority Encoders, Shift Registers, Arithmetic circuits, Ripple carry adder, Carry Look Ahead adder, High Speed adders, Multipliers, Physical design, Crosstalk, Floorplanning, Power and Clock distributions.

VERILOG HDL

VLSI design flow,Hierarchical modeling concepts, Basic Concepts: Data types ,Modules and ports, Gate Level Modeling, Data Flow Modeling, Behavioral Modeling, Switch level Modeling, Task and Function

Text Books

1. N.Weste, D.Harris, Ayan Banerjee "CMOS VLSI Design", Third Edition, 2005.
2. Douglas A. Pucknell, Kamran Eshraghian "Basic VLSI Design",Third Edition, 2011, Prentice Hall of India.
3. Samir Palnitkar, "Verilog HDL Guide to Digital Design and synthesis", 2nd Edition, Pearson Education 2003.

Reference Books

1. Jan Rabaey, Anantha Chandrakasan, B Nikolic, "Digital Integrated Circuits: A Design Perspective". Second Edition, Feb 2003, Prentice Hall of India.
2. Jacob Baker "CMOS: Circuit Design, Layout, and Simulation,Third Edition", Wiley IEEE Press 2010 3rdEdition.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
2	Dr.L.K.Hema	Professor	ECE	hemalk@avit.ac.in

	ANALOG AND DIGITAL COMMUNICATION (THEORY AND PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

This course aims at designing Analog and Digital communication systems that are used for the transmission of information from source to destination. A detailed quantitative framework for analog and digital transmission techniques is addressed. Practical session of this course gives hands on training to the students in understanding the theory of communications and practicing sessions used in analog and digital communication systems.

PREREQUISITE–

Nil

COURSE OBJECTIVES

1	To Familiarize students with the fundamentals of Analog and Digital Communication systems.
2	To learn the basic concepts behind the transmission and reception of Angle Modulation
3	To impart the knowledge about Analog to Digital Transition Systems &Information Theory
4	To Analyze & design the performance of various digital carrier transmission.
5	To Apply the knowledge of Digital Communication circuits in various fields.

COURSE OUTCOMES

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

CO1.Characterize the different analog modulation schemes in time and frequency domains.	Apply
CO2. Determine the minimum number of bits per symbol required to represent the source and the maximum rate at which reliable communication can take place over the channel.	Apply
CO3.Demonstrate the concept of various digital carrier modulation and determine their error probability.	Apply
CO4.Analyze the major classifications of spread spectrum techniques .	Analyze
CO5. Simulate and analyze the performance of various Analog & Digital Modulation schemes.	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	-
CO2	S	M	M	M	-	-	-	-	-	-	-	M	S	M	-
CO3	S	S	M	M	-	-	-	-	-	-	-	M	S	M	-
CO4	S	M	M	M	L	-	-	-	-	-	-	L	S	-	M
CO5	S	M	L	-	S	-	-	-	M	M	-	L	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

THEORY:

Amplitude Modulation Systems:

Amplitude Modulation-Expression for AM, Power relation , Double Side band Suppressed Carrier Modulation, Single side band Modulation, Vestigial Side band Modulation, AM Detectors, AM Transmitters & Receivers- Experiments

Angle Modulation - Frequency and Phase Modulation Systems :

Angle Modulation Systems: Expression for FM, Narrowband and wideband FM, Bandwidth of FM signal Generation and Demodulation of FM Signals, Phase Modulation systems, Comparison of AM & FM, FM Transmitters & Receivers.

Analog to Digital Transition Systems & Information Theory:

Pulse Amplitude Modulation, Pulse PositionModulation, Pulse Code Modulation, DPCM, Delta Modulation, Time Division Multiplexing. Uncertainty, Information and Entropy, source coding theorem, DiscreteMemory less channels, Mutual Information, Channel capacity, Channel coding theorem,Differential entropy, Information capacity theorem- Experiments

Baseband and Pass band transmission:

Inter Symbol Interference problem, Nyquist criterion, Raised cosine pulse, Binary Amplitude Shift Keying, Binary Phase Shift Keying, BinaryFrequency Shift Keying, Frequency Division Multiplexing, BER Analysis-Experiments

Spread Spectrum Modulation:

Pseudo noise sequences, Discrete sequence spreadspectrum with coherent BPSK, Signal space dimensionality and processing gain, Frequencyhop spread spectrum modulation.

Text Book

1. Simon Haykin and Michael Moher, "Communication systems" John Wiley &Sons,Fifth Edition, 2016.

Reference Books

1. Simon Haykin and Michael Moher, "An Introduction to Analog and Digital Communications", John Wiley&Sons, second Edition, 2006.
2. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, PHI, 2002
3. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", PearsonEducation,2001.
4. Leon W. Couch II, " Digital and Analog Communication Systems", Prentice Hall, 1997

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.B.Rajasekaran	Associate Professor	ECE	rajasekaran@vmkvec.edu.in
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3	Dr.S.Valarmathy	Associate Professor	ECE	valarmathy@vmkvec.edu.in

	MICROWAVE AND OPTICAL COMMUNICATION SYSTEMS	Category	L	T	P	Credit
		CC	**3**	**0**	**0**	**3**

PREAMBLE

Microwave pertains to the study and design of Microwave circuits, Components, and systems. Fundamental principles are applied to Analysis, Design and Measurement techniques in this field. This course makes the students to be familiar with the microwave measurements. Also to gain knowledge about different types of Optical Transmitters, Receivers, Emission and Detection techniques in Communication Systems.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To learn the terminology used in Microwave transmission system, Microwave components and their S-Parameters and its application in various fields
2	To learn the various Microwave sources, semiconductor devices and IC's.
3	To measure different parameters at microwave frequencies
4	To know the basics of solid state physics and understand the nature and characteristics of light And optical sources and amplifiers
5	To learn the principle of Optical Transmitters and Receivers.

COURSE OUTCOMES

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

CO1. Summarize the principles of Microwaves and Fiber Optics in Communication System.	Understand
CO2. Demonstrate the various Microwave Sources and Semiconductor Devices	Apply
CO3. Illustrate the different parameter measurements in Microwave Engineering.	Apply
CO4. Outline the optical fibers and sources used for Communication System.	Analyze
CO5. Analyze the optical transmitters, receivers, detectors and amplifiers used for Communication Systems.	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	S	M	-	-	-	-	-	M	M	M	M	S	-	-
CO3	S	S	M	-	-	-	-	-	M	M	M	M	S	M	-
CO4	S	S	-	M	-	-	-	-	-	M	-	M	S	M	M
CO5	S	S	M	M	-	-	-	-	M	M	M	M	S	M	M
S- Strong; M-Medium; L-Low															

SYLLABUS

INTRODUCTION TO MICROWAVES, COMPONENTS AND THEIR S-PARAMETERS

Microwave history, spectrum and band characteristics of microwaves-a typical microwave system. Applications of Microwaves: Traditional, industrial and biomedical fields, S-matrix – significance, formulation and properties. S-matrix representation of a multi port network, Waveguide Attenuators, Waveguide Multi port Junctions- E plane and H plane Tees, Magic Tee, and Hybrid Ring, Directional Couplers, Isolator, Circulator- S-matrix calculations.

MICROWAVE SOURCES-O AND M-TYPE TUBES,SEMICONDUCTOR DEVICES AND IC'S

Microwave tubes: O-type – Two cavity Klystron Amplifier, Reflex Klystron oscillator, M-type – cross-field effects, Magnetrons- types, HELIX TWT- types and characteristics of slow wave structures, structure of TWT and amplification process, Avalanche Transit Time Devices- principle of operation and characteristics of IMPATT and TRAPATT diodes, Schottky Barrier Diodes, IC'S:Monolithic Microwave Integrated Circuits (MMIC).

MICROWAVE MEASUREMENTS

Power, Frequency and impedance measurement at microwave frequency, Network Analyzers and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure.

OPTICAL FIBER CHARACTERISTICS

Introduction to Optical Fiber Modes and Configurations, Single Mode Fibers and Graded- Index Fiber Structures, Fiber Materials, Attenuation- Absorption, Scattering Losses, Bending Losses, Core and Cladding Losses.

OPTICAL TRANSMITTERS AND RECEIVERS

Materials for optical sources, Light-Emitting Diodes, Semiconductor laser diodes, power-current characteristics, noise, direct and external modulation, Laser sources and transmitters for free space communication – Receivers - Principles of optical detection, spectral responsivity, PIN, APD, Preamplifier types, receiver noises.

Text Books:

1. SamualY.Liao, "Microwave Devices and Circuits", PHI, 3rd Edition, 2003.
2. Collin R.E., "Foundation of Microwave Engineering", McGraw Hill, 2nd Edition, 2009.
3. Keiser. G, "Optical fiber communications", 4th Edition Tata McGraw-Hill, New Delhi, 2008
4. Franz & Jain, "Optical communication, Systems and Components", Narosa Publications, New Delhi, 2000.

Reference Books:

1. Microwave Principles – Herbert J.Reich, J.G.Skalnik, P.F.Ordung and H.L.Krauss, CBS Publishers and Distributors, New Delhi, 2004.
2. Peter A.Rizzi, "Microwave Engineering – Passive Circuits", PHI Publications.
3. Chatterjee.R, "Elements of Microwave Engineering", Affiliated East-West Press Pvt. Ltd.
4. John Gowar, "Optical Communication Systems", 2nd Edition Prentice Hall, 1993.

5. Agrawal. G.P, “Fiber-Optic Communication Systems” 3rd Edition John Wiley & Sons, 2002.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.S.Valarmathy	Associate Professor	ECE	valarmathy@vmkvec.edu.in
2.	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	SIGNAL PROCESSING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Signal processing is an area of science and engineering which has developed very rapidly over past few decades. It is method of extracting information from the signal which, in turn depends upon type of the signal and nature of information it carriers. Digital signal processing has a tremendous growth in today's techniques and is applied almost in every field because off numerous advantages. In fact digital circuits do not depend upon precise values of digital signal. Also digital circuits are less sensitive to changes in components values, and temperature. In a digital processor any accuracy can be achieved by changing number of bits assigned for the coefficient.

PREREQUISITE

Signals and Systems

COURSE OBJECTIVES

1	To learn the computation steps for the DFT and FFT algorithm.
2	To acquire knowledge in various design and implementation methods for IIR and FIR filters and realize the systems.
3	To identify the coefficient effects in finite word length registers.
4	To recognize the sampling rate conversion with filter design
5	To study the TMS320C5X DSP processor architecture and their addressing modes.

COURSE OUTCOMES

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

CO1: Compute DFT, FFT algorithms by using radix 2 DIT and DIF methods.	Apply
CO2. Design IIR digital filters in analog domain for given specifications and transforming to digital domain using transformation techniques and realize the filters in various ways.	Apply
CO3. Design FIR filter in digital domain using Fourier series, frequency sampling and windowing techniques	Apply
CO4.Illustrate the issues of finite word length effects.	Apply
CO5.Designa linear phase filter for implementing sampling rate conversion and describe the TMS320C5X DSP processor architecture and their addressing modes.	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	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	S	M	-	M	-	-	-	M	-	-	M	-	-	-
CO5	S	S	M	-	M	-	-	-	M	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems.

DISCRETE FOURIER TRANSFORMS & FAST FOURIER TRANSFORMS:

Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series.

DFT & FFT: Introduction to DFT, Efficient computation of DFT, properties of DFT, Linear Convolution of Sequences using DFT; FFT using DIT and DIF algorithms, Inverse FFT, Circular convolution.

DESIGN AND IMPLEMENTATION OF IIR FILTERS

Design of analog filters using Butterworth and Chebyshev approximations – IIR digital filter design from analog filter using impulse invariance technique and bilinear transformations-IIR Realizations.

DESIGN AND IMPLEMENTATION OF FIR FILTERS:

Linear phase response – Design techniques for FIR filters – Fourier series method and frequency sampling method –Design of Linear phase FIR filters using windows: Rectangular, Hanning and Hamming windows.

REALIZATION OF DIGITAL FILTERS:

Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS:

Fixed point arithmetic – effect of quantization of the input data due to Finite word length. Product round off – need for scaling – Zero input limit cycle oscillations - Limit cycle oscillations due to overflow of adders

TEXT BOOKS:

1. John .G. Proakis and Dimitris C. Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson Education, Fourth edition, 2007.
2. B.Venkataramani, M.Bhaskar, “Digital Signal Processors, Architecture, Programming and Application”, Tata McGraw Hill, New Delhi, 2003.
3. Alan V.Oppenheim, Ronald W. Schafer, “Discrete time signal processing”, Prentice Hall, Third Edition, 2009.

REFERENCE BOOKS:

1. Sanjit Mitra, “Digital Signal Processing – A Computer based approach”, Tata McGraw Hill, New Delhi, 2011.
2. M.H.Hayes, “Digital Signal Processing”, Tata McGraw Hill, New Delhi, Edition, 2009.

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in
2.	Dr.T.Muthumanickam	Professor	ECE	muthumanickam@vmkvec.edu.in

	PRINCIPLES OF COMPUTER COMMUNICATION	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course is to provide students with an overview of the concepts and fundamentals of computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

PREREQUISITE –

NIL

COURSE OBJECTIVES

1	To understand the different layers of ISO /OSI model and TCP/IP Network IEEE standards
2	To obtain knowledge about IP addressing methods
3	To obtain knowledge about QOS parameters.
4	To know the functions and congestion control mechanism of TCP
5	To know about application layer and network security

COURSE OUTCOMES

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

CO1. Explain the networks, topologies and layers of OSI model, compare with TCP/IP model.	Understand
CO2. Classify error control and flow control techniques and types of LAN technologies	Apply
CO3. Analyze different routing algorithms and methods to improve QOS	Apply
CO4. Summarize the transport layer protocols and congestion controls methods	Apply
CO5. Describe various application layer services and cryptographic techniques	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	-	S	-	-	-	-	-	-	-	-	-	S	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	S	M	-
CO3	M	-	S	S	-	-	-	-	-	-	-	-	S	-	-
CO4	S	M	-	-	M	-	-	-	-	-	M	M	S	S	-
CO5	M	M	S	-	-	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

DATA COMMUNICATION

ISO reference model, Open system standard, Transmission of Digital Data – Electrical Interface, MODEMS, Line Configuration, Encoding and Decoding, Multiplexing, Error Detection and Correction (CRC).

DATA LINK CONTROL AND PROTOCOLS

Flow control and error control, stop and wait, Sliding windows, Automatic Repeat (ARQ), Asynchronous Protocols, - X MODEM, Y MODEM, Synchronous protocols – Character Oriented and Bit oriented protocols (HDLC).

LOCAL AREA NETWORKS

IEEE 802 standards, LLC, MAC layer protocols – CSMA/CD Ethernet, Token Bus, Token Ring, FDDI, Distributed Queue Dual Bus, Switched Multimega Bit Data Service

.

WIDE AREA NETWORKS

Circuit Switch packet Switch, Message Switching, X .25 Protocols, Architecture And Layers of Protocol, Frame Delay, ISDN and ATM Protocol, Internetworking Device, Repeater, Bridge, Routes and Gateways, Routing algorithms.

UPPER OSI LAYERS

Session layer protocols, Presentation layer – Data Security, Encryption/Decryption, Authentication, Data Composition, Application layer protocols – MHS, File transfer, Virtual terminal, CMIP.

Text Books:

1. Behrouz A. Fehrouzan, "Data communication & Networking", Mc-Graw Hill, 4th Edition, 2007.
2. Andrew S. Tanenbaum, "Computer Networks", Pearson Education India, 3rd Edition, 2010.

Reference Books:

1. William Stallings, "Data & Computer Communication", Pearson Education India, 8th Edition, 2007.
2. Rarnier Handel, N.Huber, Schroder, "ATM Networks Concepts, Protocols Applications'', Addison Welsey, 3rd Edition, 2009

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr. Rajat Kumar Dwibedi	Assistant Professor (Gr-II)	ECE	rajatkumar.ece@avit,ac.in
2	Dr.L.K.Hema	Professor	ECE	hemalk@avit.ac.in
3	Mr.G.SureshKumar	Assistant Professor	ECE	sureshkumar@vmkvec.edu.in

	PRINCIPLES OF SENSORS AND DATA ACQUISITION	Category	L	T	P	Credits
		CC	3	0	0	3

PREAMBLE

To understand the Basic concepts of Sensors, Transducers, Aquatic Sensors- Data Acquisition Systems and Fiber Optic Measurements.

PRE REQUISITE:

Nil

COURSEOBJECTIVES

1	To understand the Fundamentals of Sensors.
2	To learn about the various Characteristics of Sensors and its construction.
3	To learn about the Construction and Characteristics of Transducers.
4	To understand the Fundamentals of Data Acquisition Systems.
5	To study the various Virtual Instrumentation Methods.

Course Outcomes

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

CO1.Understand the Fundamentals of Sensors	Understand
CO2.Design various Sensors for required applications.	Apply
CO3.Design various Transducers for the required applications.	Apply
CO4.Understand the fundamentals and concepts of Data Acquisition system.	Understand
CO5.Evaluate the various Virtual Instrumentation Devices.	Evaluate

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	M	-	-
CO2	S	L	M	-	L	-	-	-	-	-	-	L	S	M	-
CO3	L	S	M	-	L	-	M	-	-	-	-	L	S	S	-
CO4	S	S	S	-	M	M	M	-	-	-	-	L	M	M	-
CO5	S	S	S	-	M	M	M	M	-	-	-	L	S	M	M

S– Strong;M – Medium;L– Low

SYLLABUS

SENSOR- FUNDAMENTALS AND CHARACTERISTICS

Sensors –Classifications- Performance ad Types, Error Analysis Characteristics – Electronics and Optical Properties of Semiconductor as Sensors, LED, Semiconductor LASERs, Fiber Optic Sensors, Thermal detectors, CCDs, Photo Diodes and Photoconductive Devices.

TRANSDUCERS

Classification of Transducers, Selecting a Transducer, Straingauges, Displacement Transducers, Hall effect, magneto resistive, magneto strictive sensors. Fiber optic liquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor.

FLOW, TEMPERATURE AND ACOUSTIC SENSORS

Flow sensors: pressure gradient technique, thermal transport, ultrasonic, electromagnetic and Laser anemometer. Microflow sensor, coriolis mass flow and drag flow sensor. Temperature sensors-thermoresistive, thermoelectric, semiconductor and optical. Piezoelectric temperature sensor. Acoustic sensors- microphones-resistive, capacitive, piezoelectric, fiber optic, solid state - electric microphone.

FUNDAMENTALS OF DATA ACQUISITION

Essentials of computer interfacing –configuration and structure –interface systems-interface bus. Signal amplifiers, analog filters, digital and pulse train conditioning, two-wire transmitter, and distributed I/O - high speed digital transmitter, noise reduction and isolation

VIRTUAL INSTRUMENTATION

Virtual instrument and traditional instrument, Hardware and software for virtual instrumentation, Virtual instrumentation for test, control, and design, Graphical system design, Graphical and textual programming.

Text Books:

1. Albert D. Helfrickand WilliamD. Cooper –Modern Electronic, Prentice Hall of India, 2008
2. JosephJ.Carr, Elements of Electronics Instrumentation and Measurement,2nd Edition Pearsoneducation,2009.
3. Ramon Pallas-Areny and John G Webster, Sensors and Signal Conditioning, 2012, 2nd ed., Wiley India Pvt. Ltd.

Reference Books:

1. Alan.S.Morris, Principles of Measurements and Instrumentation, Prentice Hall of India,2nd edn.,2003.
2. Ernest O. Doebelin, Measurement Systems-Application and Design-TataMcGraw-Hill-2004.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr. R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
2	Mr.G.Ramachandran	Assistant Professor	ECE	ramachandran@vmkvec.edu.in

	JAVA AND C# .NET APPLICATION DEVELOPMENT	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course of study builds on the skills gained by students in Java Fundamentals and helps to advance Java programming skills. Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities and an introduction to the .NET framework and enable the student to program in C#.

PREREQUISITE

NIL

COURSE OBJECTIVES

1.	Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2.	Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3.	To study basic and advanced features of the C# language
4.	To create form based and web based applications
5.	To study the internals of the .NET framework

COURSE OUTCOMES

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

CO1.Knowledge of the structure and model of the Java programming language	Understand
CO2.Use the Java programming language for various programming technologies	Understand
CO3. To learn the basics of .net Frame work and C# language	Understand
CO4. To learn C# elements and OOPS concepts	Apply
CO5. To learn interface and inheritance concepts in C# language	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	-	S	-	-	-	-	-	-	-	S	M	-
CO2	S	M	M	-	M	-	-	-	-	-	-	-	M	M	M
CO3	S	M	M	M	M	-	-	-	-	-	-	-	M	-	-
CO4	S	M	M	L	L	-	-	-	-	-	-	-	M	M	M
CO5	S	M	S		M	-	-	-	-	-	-	-	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF JAVA

Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method.

OBJECT ORIENTED CONCEPTS IN JAVA

Arrays – Strings - Packages – Java-Doc comments –- Inheritance & its types – polymorphism – dynamic/ Static binding – final keyword – abstract classes – interfaces – Multi Threading – Exception handling – inner classes – proxies.

C# AND ITS FEATURES

Overview Of .Net-Advantages Of .Net Over Other Languages-Assemblies-.Net Architecture-The Role of C# In The .Net Enterprise Architecture-The Common Language Runtime-C# Basics-Objects And Types-Inheritance –Arrays

OBJECT ORIENTED ASPECTS OF C#:

Operators and Casts: Operators - Type Safety - Operator Overloading - User-Defined Casts. Delegates and Events: Delegates – Events. Strings and Regular Expressions: System. String -Regular Expressions. Collections: Collection Interfaces and Types – Lists - Queues – Stacks -Linked Lists - Sorted Lists – Dictionaries – Hash Set - Bit Arrays – Performance-Indexers

I/O AND NETWORK PROGRAMMING:

Tracing and events - threading and synchronization - .Net security – localization –Manipulating XML - Managing the file system – basic network programming.

TEXT BOOKS:

1. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, Eighth Edition, Sun Microsystems Press, 2008.
2. Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner, Karli Watson, Professional C# 2008, Wiley Publishing, Inc., 2008. ISBN: 978-8-126-51627-8.

REFERENCES:

1. K. Arnold and J. Gosling, “The JAVA programming language", Third edition, Pearson Education, 2000.
2. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

3. Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2005.
4. Herbert Schildt, “The Complete Reference: C#”, Tata McGraw-Hill, 2004.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.R.Bharanidharan	Associate Professor	CSE	bharanidharan@ vmkvec.edu.in
2.	Mrs.V. Subhapriya	Assistant Professor	CSE	subhapriya@avit.ac.in

	SEMICONDUCTOR DEVICES LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To reinforce learning in the accompanying semiconductor devices course through hands-on experience by examining the electrical characteristics of various semiconductor devices, such as diodes, BJTs and FETs. To provide the student with the capability for performing various analysis of semiconductor devices.

PREREQUISITE –

Nil

COURSE OBJECTIVES

1	To emphasize the practical, hands-on component of various semiconductor devices
2	To study experimentally the characteristics of diodes, BJT's and FET's.
3	To evaluate the operational characteristics of semiconductor devices
4	To verify practically the response of various special purpose electron devices
5	To provide students engineering skills by way of breadboard circuit design with electronic devices and components.

COURSE OUTCOMES

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

CO1. Identify various semiconductor devices	Apply
CO2. Interpret the characteristics of semiconductor devices.	Apply
CO3. Apply the basic knowledge semiconductor devices for basic switching applications.	Apply
CO4. Select a right semiconductor device for a given application.	Apply
CO5. Observe and validate the functioning under simulated environment.	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	-	S	-	-
CO2	S	M	M	-	-	-	M	-	M	-	M	-	S	-	-
CO3	S	M	M	-	-	-	M	-	M	-	M	-	S	-	-
CO4	S	M	M	-	-	-	M	-	M	-	M	-	S	-	-
CO5	S	M	M	-	-	-	M	-	M	-	M	-	S	-	-

S- Strong; M-Medium; L-Low

List of Experiments

1. Half Wave Rectifier and Full Wave Rectifier
2. Clipper and Clamper
3. Input/output Characteristics of CE Amplifier
4. Input/output Characteristics of CC Amplifier
5. Transfer Characteristics of JFET
6. Voltage Regulator
7. Determination of the V-I Characteristics of UJT.
8. Determination of the V-I Characteristics of SCR.
9. Determination of the V-I Characteristics of DIAC
10. Determination of the V-I Characteristics of TRIAC

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.C.ArunkumarMadhuvappan	Assistant Professor	ECE	arunkumarmadhuvappan@vmkvec.edu.in
2	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in

	DIGITAL CIRCUITS DESIGN LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The Course explores designs with combinational and sequential logic. Students work through design activities, which include testing and troubleshooting using lab instruments as well as simulation software.

PRERQUISITE

NIL

COURSE OBJECTIVES

1	To impart knowledge and to gain experience in developing complex digital systems.
2	To learn about design and analysis of sequential circuits using flip flops.
3	To Expose students about design and simulation of logic circuits using HDL.

COURSE OUTCOMES

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

CO1. Understand the principles and methodology of digital logic design at the gate and switch	Understand
CO2. Demonstrate the various combinational logic circuits by using discrete components	Apply
CO3. Analyze different sequential logic circuits by using discrete components.	Analyze
CO4. Test the various digital logic circuits by using simulation software.	Evaluate
CO5. Measure and record the experimental data for various digital circuits.	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	-	-	-	M	-	-	-	M	-	-	L	-	-	-
CO2	S	-	-	-	S	-	-	-	M	-	-	L	S	-	-
CO3	S	M	M	M	M	-	-	-	M	-	-	L	-	-	-
CO4	S	M	-	-	M	-	-	-	M	-	-	L	M	M	M
CO5	S	M	-	-	M	-	-	-	M	-	-	L	-	M	-

S- Strong; M-Medium; L-Low

List of Experiments

Hardware Experiments

1. Design and implementation of Adder and Subtractor using basic logic gates.
2. Design and implement 4-bit Parallel Adder/ Subtractor using IC 7483
3. Design and implementation of BCD to Excess -3 code converter using logic gates
4. Design and implementation of Binary to Gray code converter using logic gates
5. Design and implementation of 4 Bit Magnitude comparator using logic gates
6. Design and implementation of 4:1Multiplexer and 1:4 De-Multiplexer circuits using logic gates
7. Design and implementation of encoder and decoder using logic gates
8. Design and implementation of 3 bit synchronous up/down counter.
9. Realization of SR Flip Flop, D Flip Flop & T Flip Flop using logic gates.
10. Implementation of SISO, SIPO, and PISO shift registers using flip flops.

Software Experiments using HDL

1. Design and Simulation of Full adder circuit using Gate level modeling
2. Design and Simulation Up-Down counters using behavioural level modeling.

COURSE DESIGNERS

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1	Mr.B.Rajasekaran	Associate Professor	ECE	rajasekaran@vmkvec.edu.in
2	Mr.Rajat Kumar	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in

	ANALOG CIRCUITS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The goal of this lab is to supplement the theory course Analog Circuits. Students will gain experience in Analogcircuits design for given specification. They will analyze and test electronic circuits using simulation software and laboratory instruments.

PRERQUISITE

Semiconductor Devices

COURSEOBJECTIVES

1	To impart the design knowledge of various small signal amplifier circuits
2	To design the feedback amplifier and Oscillator
3	To study the characteristics of Power& Tuned amplifiers circuits

COURSEOUTCOMES

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

CO1.Design&Simulation of Compound configurations of analog circuits.	Apply
CO2. Apply the concepts of transistor biasing to study the small signal behavior of BJT for Amplification	Apply
CO3. Design and infer the frequency response and bandwidth of Feedback amplifiers.	Analyze
CO4.Investigate the concepts of Power& Tuned amplifiers	Analyze
CO5.Simulate& Estimate the frequency of LC and RC Oscillators	Evaluate

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

1. Design, Simulation andHardwarerealizationofSingleStageCommonEmitteramplifierforgivenspecification
2. Simulation&HardwarerealizationofFeedbackamplifiersanditsfrequencyanalysis
    a) VoltageSeries
    b) CurrentShunt
3. Design, Simulation andHardwarerealizationofSinusoidalwaveformgenerators.
    a) RCOscillators
    b) LCOscillators
4. DesignandsimulationofPoweramplifiers
5. FrequencyResponsecharacterizationofTunedamplifiercircuit.
    a) SingleTuned
    b) DoubleTuned
6. DesignandhardwarerealizationofMultistage Amplifierforgivenspecification
    a) Cascade
    b) Darlington
7. DesignandsimulationofDifferentialpair circuitwithactiveloadandcurrentreferencesanditsfrequencyanalysis.
8. Design Clipping Circuits
9. Design Clamping Circuits
10. Design and simulate filters
    a)Low Pass Filters
    b)High Pass Filters
    c) Band Pass Filters

COURSEDESIGNERS

S.No.	NameoftheFaculty	Designation	Department	MailID
1	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
2	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	SIGNAL PROCESSING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The purpose of this course is to give hands on training to the students in understanding the theory of signals and systems and practicing the algorithms used in digital signal processing. This will improve the understanding capability of the signal and system theory and simulation capability of the signal processing algorithms.

PREREQUISITE

Signals and Systems

COURSE OBJECTIVES

1	To generate the elementary signals/ waveforms.
2	To compute the convolution of signal.
3	To design different types of filters and obtain frequency response.
4	To compute magnitude and phase components using DFT.

COURSE OUTCOMES

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

CO1. Test the time and frequency domain representation of discrete time signals through simulation	Analyze
CO2. Analyze the time and frequency domain response of discrete time systems through simulation	Analyze
CO3. Analyze the effects of quantization error in the filter coefficients through simulation	Analyze
CO4. Develop FIR and IIR filter for the specification derived from the given problem and simulate the frequency response.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Generate different time signals and display the same.
2. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
3. Compute the linear convolution of a signal using DFT.
4. Compute the circular convolution of a given signal.
5. To find DFT / IDFT of given DT Signal
6. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
7. Implementation of FFT of given Sequence
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Design analog Chebyshev filters and apply bilinear transformation
11. Design analog Butterworth filters and apply bilinear transformation
12. Design analog Chebyshev filters and apply impulse invariance transformation
13. Design analog Butterworth filters and apply impulse invariance transformation
14. Design FIR filters using Fourier series method and frequency sampling methods
15. Design FIR filters using Different windowing techniques
16. Effect of quantization.

COURSE DESIGNERS

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1	Dr.SitaDeviBharatula	Associate Professor	ECE	Sitadevi.ece@avit.ac.in
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	MICROCONTROLLERS AND EMBEDDED SYSTEMS LAB	Category	L	T	P	Credit
		CC	**0**	**0**	**4**	**2**

PREAMBLE

To provide the skill to design linear integrated circuits using op-amp and other special purpose circuits. Assembly language programming for microcontroller and interfacing peripheral devices with microcontroller is vital due to the persisting real time application scenarios. Hence exposure to interface ADCs, DACs with microprocessor and acquiring knowledge about the real time applications like stepper motor control, key board etc., is essential.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To write the assembly language program for 8051 Microcontroller.
2	To write the programs for communication between microcontroller and peripheral devices
3	To write the programs using ARM Processors
4	To study one type of Real Time Operating Systems (RTOS)

COURSE OUTCOMES

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

CO1. Develop assembly language program for basic Arithmetic and Logical Operations	Analyze
CO2.Develop assembly language program for basic applications like arithmetic operations, interrupt and UART, etc	Analyze
CO3. Apply the practical knowledge of Microcontroller in designing various Circuit	Analyze
CO4. Develop and execute program using ARM architecture.	Analyze
CO5. Understand the concept of Real Time Operating Systems (RTOS)	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	-	L	-	M	-	M	-	-
CO2	M	L	-	-	-	-	M	-	L	-	M	-	M	-	-
CO3	M	L	-	-	-	-	M	-	M	-	M	-	M	-	-
CO4	M	L	-	-	-	-	M	-	M	-	M	-	M	-	-
CO5	M	L	-	-	-	-	M	-	M	-	M	-	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

LISTOFEXPERIMENTS:

MICROCONTROLLERSLAB

1. 8086&8051Assembly language program for Arithmetic Operations.
2. 8051Assembly language program for Logical, Interrupt & UART Operations.
3. Interfacing DAC to Microcontroller and generate Square, Triangular and Saw–tooth waveforms.
4. Interfacing ADC to Microcontroller.
5. Interfacing Stepper Motorto8051 and operate it in Clock wise and Anti-Clock wise directions.

EMBEDDED SYSTEMS LAB

1. Study of ARM Architecture.
2. Interfacing ADC and DAC.
3. Interfacing Real Time clock and Serial Port.
4. Interfacing Keyboard and LCD.
5. Study of one type of Real Time Operating Systems (RTOS)

REFERENCES

Laboratory Reference Manual.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
2	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
3	Ms.R.MohanaPriya	Assistant Professor(Gr-II)	ECE	mohanapriya@avit.ac.in

	CMOS DESIGN LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE - This lab-oriented course will focus on the design of large-scale system-on-a-chip (SOC) solutions within field-programmable gate arrays (FPGAs). Modern FPGA densities and commercially available cores enable a single developer to design highly complex systems within a single FPGA.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To learn Hardware Descriptive Language (Verilog/VHDL).
2	To implement the designed logic circuits in FPGA device.
3	To provide hands on design experience with professional design (EDA) platforms.

COURSE OUTCOMES

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

CO1. Design and simulation of digital logic circuits	Apply
CO2. Design and implement the combinational logic circuits in FPGA device	Evaluate
CO3. Design and implement several Sequential circuits in FPGA device	Evaluate
CO4. Develop complex logic circuits	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	M	L	-	M	-	-	-	-	M	M	S	L
CO2	S	M	S	L	M	-	-	-	-	-	-	M	M	L	-
CO3	S	S	S	S	L	-	M	-	-	-	L	M	S	S	L
CO4	S	M	L	L	L	-	-	-	-	-	-	M	M	L	-

S- Strong; M-Medium; L-Low

List of Experiments

1. Implementation of Logic Gates –Data flow model and Behavioral model.
2. Design a Adders and Subtractor using VHDL/Verilog Language.
3. Design a Multiplier (4 Bit Min) VHDL Language.
4. Design and simulate a CMOS inverter using digital flow
5. Design a Sequential circuit -Flip-Flops using HDL.
6. Design and simulate a 4-bit synchronous counter using a Flip-Flops
7. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
8. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
9. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
10. Stack and Queue Implementation using RAM.

COURSE DESIGNERS

S.No	Name of faculty	Designation	Department	Mail ID
1	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
2	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	COMPUTER VISION AND PATTERN RECOGNITION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Aim of computer vision and patter recognition is to analyze and interpret the environment available around us.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	To understand the various features of Image.
2	To impart knowledge on various issues in the design of computer vision and object recognition systems
3	To impart knowledge on the concepts of pattern recognition.

COURSE OUTCOMES

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

CO1.Identify basic concepts, terminology, theories, models and methods in the field of computer vision	Apply
CO2.Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition	Apply
CO3.Analyze and develop a design of a computer vision system for a specific problem	Analyze
CO4.Explain and distinguish procedures, methods and algorithms related to pattern recognition	Analyze
CO5.Evaluate quality of solution of the pattern recognition system	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

DIGITAL IMAGE FORMATION AND LOW-LEVEL PROCESSING

Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

DEPTH ESTIMATION AND MULTI-CAMERA VIEWS

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

FEATURE EXTRACTION

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

BAYES DECISION THEORY

Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features. Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case.

UNSUPERVISED LEARNING AND CLUSTERING

Criterion functions for clustering; Algorithms for clustering: K-Means, Hierarchical and other methods; Cluster validation; Gaussian mixture models; Expectation-Maximization method for parameter estimation; Maximum entropy estimation.

REFERENCE BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
4. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
5. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
6. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr. R. Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
2	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in

	SPEECH AND AUDIO PROCESSING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The aim of the Speech and Audio Processing subject is to spreads across a number of fundamental and direct application research areas including, for example, signal processing for separation, recognition, transcription, enhancement, coding, synthesis as well as applications to advanced fixed and wireless communication systems.

PREREQUISITE

Signal Processing

COURSE OBJECTIVES

1	Understand the fundamental concept of mechanics of speech and audio processing.
2	To obtain a thorough understanding of the statistical pattern recognition technology at the core of contemporary speech and audio recognition systems.
3	To understand the concepts of time and frequency domain methods for speech processing.
4	To study various audio coding and transform coders.

COURSE OUTCOMES

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

CO1.Understands the speech production apparatus and its models	Understand
CO2. Estimate the effect of the signal representations on sound quality.	Understand
CO3.Explain the main principles of common audio signal processing operations	Understand
CO4. Take into account the properties of acoustic signals and human hearing in the design of audio signal processing systems.	Apply
CO5. Design and Implement algorithms for processing audio and speech signals using Mat lab	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	-	-	-	-	-	-	-	-	-	-	S	-	-
CO2	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	S	-	-	-	-	-	-	-	-	-	L	-	-	-
CO4	S	S	M	M	-	-	-	-	-	-	-	L	-	-	-
CO5	S	S	S	M	M	-	-	-	M	-	-	M	-	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

MECHANICS OF SPEECH AND AUDIO

Introduction - Review Of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Non simultaneous Masking - Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

TIME-FREQUENCY ANALYSIS:FILTER BANKS AND TRANSFORMS

Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree- Structured QMF and CQF M-band

Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Preecho Control Strategies.

AUDIO CODING AND TRANSFORM CODERS

Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advanced, 4Audio Coding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder -Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization -MDCT with Vector Quantization.

TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING

Time domain parameters of Speech signal – Methods for extracting the parameters :Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods

LINEAR PREDICTIVE ANALYSIS OF SPEECH

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

Text Books:

1. Digital Audio Signal Processing, Second Edition, Udo Zölzer, A John Wiley& sons Ltd Publications
2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow.
3. Digital Processing of Speech signals – L. R. Rabiner and R.W. Schaffer - Prentice Hall – 1978

Reference Books:

1. Roederer, The Physics and Psychophysics of Music: An Introduction, 1995, Springer-Verlag.
2. Olson, Music, Physics and Engineering, 1967, Dover Publications.
3. Gardner, The Virtual Acoustic Room, 1992, Master's Thesis, MIT Media Lab.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.A.Malarvizhi	Assistant Professor	ECE	malarvizhi@vmkvec.edu.in
2	Dr.L.K.Hema	Professor	ECE	hemalk@avit.ac.in

	INTRODUCTION TO MEMS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The objective of this course is to make students to gain basic knowledge on overview of MEMS (Micro electro Mechanical System) and various fabrication techniques. This enables them to design, analysis, fabrication and testing the MEMS based components. And to introduce the students for various opportunities in the emerging field of MEMS.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	Understand the fundamental concept of MEMS and study the essential material properties.
2	To know the various fabrication and machining process of MEMS.
3	Build an understanding of microscale physics for use in designing MEMS applications.
4	To study various sensing and transduction technique.

COURSE OUTCOMES

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

CO1.Know the basics of MEMS fabrication technologies andPiezo resistance Effect, Piezoelectricity, Piezoresistive Sensor	Understand
CO2. Understandthe Mechanics of Beam and Diaphragm Structures	Understand
CO3. Use mechanics principles and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.	Apply
CO4. Know the concept of Electrostatic Actuation	Analyze
CO5. Understand the applications of MEMS in RF	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	-	-
CO2	S	M	M	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	M	M	-	-	-	-	-	-	-	-	-	-	-	-
CO4	S	S	M	-	-	-	-	-	-	-	-	-	-	-	-
CO5	S	S	S	M	M	-	-	-	M	-	-	M	-	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MEMS

MEMS fabrication technologies, Materials and substrates for MEMS, Process for Micromachining: Bulk Micromachining, Surface Micromachining, Characteristics, Sensors/Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.

MECHANICS OF BEAM AND DIAPHRAGM STRUCTURES

Hooke's Law, Stress and Strain of Beam Structures :Stress, Strain in a Bent Beam, Bending moment and the moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight

AIR DAMPING

Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynold's Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.

ELECTROSTATIC ACTUATION

Electrostatic Force, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.

APPLICATIONS OF MEMS IN RF

MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Micro resonator Modeling, Micromechanical Resonator Limitations.

Text Books

1. G. K. Ananthasuresh, K. J. Viinoy, S. Gopalakrishnan, K. N. Bhat and V .K. Atre, "Micro and smart systems". Wiley India,2010.
2. S. M. Sze, "Semiconductor Sensors", John Wiley & Sons Inc., Wiley Interscience Pub.
3. M. J. Usher, "Sensors and Transducers", Mc Millian Hampshire.

Reference Books

1. Nadim Maluf," An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
3. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002. Liu,"MEMS", Pearson education, 2007.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.A.Malarvizhi	Assistant Professor	ECE	malarvizhi@vmkvec.edu.in
2	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

	INTERNET OF THINGS FOR ELECTRONICS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics

PREREQUISITE –

Nil

COURSE OBJECTIVES

1	Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved
2	Understand IoT sensors and technological challenges faced by IoT devices, with a focus on IoT and M2M
3	Market forecast for IoT devices with a focus on sensors
4	Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi
5	To study the advanced internet of things for electronics

COURSE OUTCOMES

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

CO1. Explain the concept of Internet of Things.	Understand
CO2. Explain the IOT Sensors To Appear	Apply
CO3. Design and implement of technological sensors	Analyze
CO4. Design and implement applications using internet of things	Analyze
CO5. Explain the advanced internet of things used in different applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	-	-	-	-	M	-	-	-
CO2	L	S	S	-	M	-	-	-	-	-	-	M	-	-	-
CO3	S	M	M	-	L	M	-	-	-	-	-	M	-	-	-
CO4	S	L	L	-	L	S	-	-	-	-	-	M	-	-	-
CO5	M	M	S	-	M	L	-	-	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Internet of Things Promises–Definition–Scope–Sensors for IoT Applications–Structure of IoT–IoT Map Device

IoT AND M2M

Introduction, IoT Sensors –Description & Characteristics, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.

IoT PHYSICAL SERVERS AND CLOUD OFFERINGS

Wireless Sensor Structure, Introduction to cloud storage models and communication APIs,WAMP –AutoBahn for IoT, Xively cloud for IoT, case studies illustrating IoT design –home automation, smart cities, smart environment.

IOT DEVELOPMENT EXAMPLES

ACOEM Eagle –EnOcean Push Button –NEST Sensor –Ninja Blocks -Focus on Wearable Electronics

PREPARING IOT PROJECTS

Creating the sensor project -Preparing Raspberry Pi -Clayster libraries -Hardware-Interacting with the hardware - Interfacing the hardware-Internal representation of sensor values -Persisting data -External representation of sensor values -Exporting sensor data -Creating the actuator project-Hardware -Interfacing the hardware -Creating a controller-Representing sensor values -Parsing sensor data -Calculating control states - Creating a camera -Hardware -Accessing the serial port on Raspberry Pi -Interfacing the hardware -Creating persistent default settings -Adding configurable properties -Persisting the settings -Working with the current settings -Initializing the camera

Text Books

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Dévelopment Copyrights ,2014
2. Peter Waher, 'Learning Internet of Things', Packt Publishing,2015
3. Editors Ovidiu Vermesan Peter Friess,' Internet of Things –From Research and Innovation to Market
4. Deployment', River Publishers,2014
5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers,2014.

Reference Books

1.Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on-Approach”, VPT, 1stEdition, 2014

2.Matt Richardson, Shawn Wallace, “Getting Started with Raspberry Pi”, O’Reilly (SPD), 3rdEdition, 2014.

COURSE DESIGNERS				
S.No	**Name of Faculty**	**Designation**	**Department**	**Mail ID**
1	Mr.G.Ramachandran	Assistant Professor	ECE	ramachandrang@vmkvec.edu.in
2	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
3	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
4	Mr.G.Sureshkumar	Assistant Professor	ECE	sureshkumar@vmkvec.edu.in

	ADAPTIVE SIGNALPROCESSING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

An adaptive Signal processing is an area of science and engineering which has developed very rapidly. This method of extracting information from the adaptive signal which, in turn depends upon type of the signal and nature of information its carriers and adaptive Signal processing has a tremendous growth in today's techniques and is applied almost in every field because off numerous advantages.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To Interpret the computation steps for the Adaptive Systems
2	To perform knowledge in various implementation Linear optimum filtering
3	To Implement realization of LMS algorithm
4	To Distinguish about the Kalman filtering various Methods
5	To Develop the Complex-ValuedTechniques

COURSE OUTCOMES

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

CO1. Discuss about Adaptive Systems and its methods.	Understand
CO2. Illustrate and implementation methods for algorithm techniques.	Apply
CO3. Classify and realize and based Forms on Linear optimum filtering.	Apply
CO4. Predict the Kalman filtering various Methods. Predict	Analyze
CO5. Appraise the sampling rate conversion Complex-ValuedTechniques.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES															
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	-	-	-	-	-	-	M	-	-	-	-	-
CO2	S	M	L	-	-	-	-	-	-	M	-	-	-	-	-
CO3	S	M	L	-	-	-	-	-	-	M	-	-	-	-	-
CO4	S	M	M	-	-	-	-	-	-	L	-	-	-	-	-
CO5	S	S	S	M	-	M	-	-	-	S	-	-	-	-	-
S- Strong; M-Medium; L-Low															

SYLLABUS

Introduction To Adaptive Signal Processing

Adaptive Systems - Definition and characteristics – Properties - Applications and examples of an adaptive system. Stochastic Processes and Models: Characterization - Mean ergodic theorem - Correlation matrix - Stochastic models - Power spectral density - Properties of power spectral Density - Linear transformations - Power spectral estimation.

Wiener filters

Wiener filters - Linear optimum filtering - Minimum mean-square error - Wiener- Hop equations - Multiple linear regression model - Steepest-descent algorithm - Linear prediction - Forward linear prediction, Levinson-Durbin algorithm. Kalman filter - Extended kalman filter.

LMS Algorithm

Least-Mean-Square (LMS) adaptive filters - LMS algorithm, LMS adaptation algorithm - applications. Method of Least Squares - Data windowing, Normal equations and linear least square filters, Recursive least squares algorithm.

Kalman Filtering

Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Examples using Kalman filtering.

Complex-Valued Adaptive Signal Processing

Optimization in the Complex Domain, Widely Linear Adaptive Filtering, Nonlinear Adaptive Filtering with Multilayer Perceptrons, Complex Independent Component Analysis, Robust Estimation Techniques for Complex-Valued Random Vectors: Statistical Characterization of Complex Random Vectors, Complex Elliptically Symmetric (CES) Distributions, Tools to Compare Estimators, Scatter and Pseudo-Scatter Matrices Array Processing Examples, MVDR Beamformers Based on M-Estimators

Text Books/ References Books:

1. SimonHaykins, “Adaptive Filter Theory”, Pearson Education, Fifth Edition, 2013.
2. Tu¨layAdalı, SimonHaykin,” Adaptive Signal Processing”, John Wiley & Sons
3. Todd K. Moon, Wynn C. Stirling, “Mathematical Methods and Algorithms for Signal Processing” Prentice Hall, First edition, 1999.
4. John. R. Triechler, C. Richard Johnson (Jr), Michael. G. Larimore, “Theory and Design of Adaptive Filters”, Prentice Hall India Private Limited, 2004
5. Bernard Widrow and Samuel. D. Stearns, “Adaptive Signal Processing”, Pearson Education, 2001.
6. Adaptivesignalprocessing-TheoryandApplications-S.ThomasAlexander,1986, Springer– Verlag.

COURSE DESIGNERS				
S.NO	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Dr.P.M.MURALI.	Assistant Professor	ECE	muralipm@vmkvec.edu.in
2.	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	SATELLITE COMMUNICATION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Electronics and Communication engineer needs to learn about the basics of various types of Communication Systems. This subject also deals with Space & Earth Segment, Broadcasting, Uplink, Downlink and its services.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To obtain knowledge on orbital aspects involved in satellite communication.
2	To obtain knowledge on communication establishment in satellite systems.
3	To understand the space segment and earth segment.
4	To obtain knowledge on various Satellite Access methodology
5	To obtain knowledge of Broadcasting using Satellite

COURSE OUTCOMES

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

CO1.Explain the orbital and functional principles of satellite communications system	Understand
CO2.Design, interpret and identify the technologies for satellite communication systems	Apply
CO3. Illustrate the design of space segment and earth segment	Apply
CO4. Demonstrate the various methods of satellite access.	Apply
CO5. Design a various satellite application.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	S	M	-	-	-	-	-	-	-	-	-	-	M	-	-
CO2	S	S	M	L	M	-	L	-	L	-	-	-	S	M	-
CO3	S	S	M	L	L	-	-	-	-	-	-	L	S	-	-
CO4	S	M	L	-	M	-	-	-	-	-	-	L	S	S	-
CO5	S	S	M	M	S	-	L	-	M	-	M	M	S	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

SATELLITE ORBIT

Satellite orbits: Kepler's laws – Earth satellite orbiting satellite terms-Orbital elements – Orbital perturbations – Inclined Orbits – Sun synchronous orbit. **Constellation:** Geo stationary satellites – Non geostationary constellation – Launching of Geostationary satellites.

LINK DESIGN

EIRP – Transmission Losses – Power Budget equation – System Noise Carrier to noise ratio – Uplink – Downlink –Effects of rain – Inter modulation noise.

SPACE AND EARTH SEGMENT

Space Segment: Power Supply – Altitude control – Station keeping – Thermal Control – TT&C – Subsystems – Antenna subsystem –Transponders – Wideband Receiver. **Earth Segment:** receive only home TV system –

Community antenna TV system.

SATELLITE ACCESS

Single Access- Pre assigned FDMA – Demand Assigned FDMA – SPADE system- TWT amplifier operation – Downlink analysis – TDMA – reference bursts – Preamble – Postamble – Carrier recovery – Network synchronization – Pre assigned TDMA – Assigned –CDMA introduction.

BROADCAST AND SATELLITE APPLICATIONS

Broadcast: DBS – Orbital Spacings- Power ratings – Frequency and Polarization – Transponder Capacity – Bit rate – MPEG – Forward Error Correction. ODU-IDU – Downlink Analysis – Uplink – INTELSAT Series, INSAT, VSAT, GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Differential GPS, Direct Broadcast satellites (DBS/DTH).

Text Books:

1. Dennis Roddy, "Satellite Communications*",* Tata Mc-Graw Hill Publications, 4th Edition, 2008.
2. Dennis Roddy, Satellite Communication, 4th Edition, Mc Graw Hill International, 2006.
3. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication,2nd Edition, Wiley Publications,2002

Reference Books:

1. Madhavendra Richharia, Leslie David, "Satellite Systems for Personal Applications Concepts and Technology", Wiley- Blackwell, 2010.
2. Wilbur L.Prichard, Henry G. Suyerhood, Ropert A. Nelson, "Satellite Communication System Engineering", 2nd Edition, Pearson Education, 1993.
3. Pratt, Timothy, Charles W. Bostian, "Satellite Communication", John Wiley and Sons, 2nd Edition, New York, 1986.
4. Bruce R. Elbert, The Satellite Communication Applications, Hand Book, Artech House Bostan London, 1997.

COURSE DESIGNERS

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3	Mr.Rajat Kumar Dwibedi	Assistant Professor (Gr-II)	ECE	rajatkumar.ece@ avit.ac.in

	WIRELESS AND MOBILE COMMUNICATION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Wireless and Mobile Communication is an emerging technology. It has become much more significant in the wake of 5G. This course addresses the fundamentals of mobile communication and covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless networks, including past and future generation networks.

PREREQUISITE

Analog and Digital Communication

COURSE OBJECTIVES

1	To understand the cellular fundamentals and different types of radio propagation models.
2	To study the system architecture of 2G, 2.5 G and 3G.
3	To develop the concepts of emerging technologies for 4 G standards and beyond

COURSE OUTCOMES

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

CO1.Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems.	Apply
CO2.Classify different types of propagation models and analyze the link budget.	Apply
CO3.Illustrate the fundamentals and system architecture of GSM, 2.5G, IS-95, Concepts of 3G technologies of UMTS and CDMA 2000.	Apply
CO4.Elaborate the principles of 3GPP LTE	Apply
CO5.Identify the emerging technologies for upcoming mobile communication systems including 5G	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	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	S	M	-	M	-	-	-	M	-	-	M	-	-	-
CO5	S	S	M	-	M	-	-	-	M	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

Fundamentals of Mobile Communication

Introduction to wire1ess communication**:** Mobile radio telephony, Examples of Wireless Communication Systems, Related design problems. The Cellular Concept System Design Fundamentals: Frequency Reuse, Channel Assignment Strategies, Interference and system Capacity, Trunking and Grade of Service, Improving

Coverage and Capacity in Cellular Systems

Mobile Radio Propagation

Large scale fading:Free space propagation model, the three basic propagation mechanisms, reflection ,ground reflection(two-ray)model, diffraction, scattering, practical Link budget design using path loss models. Small scale fading: Small scale multipath propagation, parametersof mobile multipath channels, types of small-scale fading, Rayleigh and Ricean distributions.

2G Technologies

GSM:GSM Network architecture, GSM signaling protocol architecture, identifiers used in GSM system, GSM channels, framestructure for GSM, GSM speech coding, authentication and securityin GSM, GSM call procedures, GSM hand-off procedures, GSM services and features. GSM evolution: GPRS and EDGE-architecture, radios specifications,channels.IS-95:Architecture of CDMA system, CDMA air interface, power controlling CDMA system, power control, handoff ,rake receiver

3G Technologies

UMTS: Objectives, standardization and releases, network architecture, air interface specifications, channels, security procedure, W-CDMA air interface, attributes of W-CDMA system, W-CDMA channels CDMA2000 cellular technologies: Forward and Reverse Channels, Handoff And Power Control.

4G/LTE Technologies

LTE system overview: Frequency bands and spectrum flexibility, network structure, protocol structure. Physical l layer: Frames, slots, and symbols, modulation, coding, multiple-antenna techniques .Logical and Physical Channels: Mapping of data onto (logical) sub-channels. Physical layer procedures: Establishing a connection, retransmissions and reliability, scheduling, power control, handover. Multi-antenna Techniques: Smart antennas, multiple input multiple output systems

Introduction to 5G:

Historical Trend of Wireless Communication, Evolution of LTE Technology to Beyond 4G, Intro. To 5G & RF Front-End, Building Blocks of 5G, 5GArchitecture, 5G for IoT Applications, 5G features and roadmap.

TEXT BOOKS:

1. Theodore S. Rappaport ―wireless communications - principles and practice, PEARSON, Second edition.

2. T L Singal ―Wireless communications‖, Mc Graw Hill Education.

3. Andreas F. Molisch ―Wireless communications‖ WILEY INDIA PVT LTD, Second edition.

4. Jonathan Rodriguez - Fundamentals of 5G Mobile Networks

REFERENCE BOOKS:

1. UpenaDalal ―Wireless and Mobile Communications‖, Oxford university Press

2. Vijay K.Garg ―Wireless Communications and Networking

3. Morgan–Kaufmann series in Networking-Elsevier

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.SitaDeviBharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in
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	WIRELESS SENSOR NETWORKS	Category	L	T	P	Credits
		EC-PS	3	0	0	3

PREAMBLE

To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.

PREREQUISITE:

Data Communication Networks

COURSE OBJECTIVES

1	To understand the concepts of sensor networks.
2	To understand the MAC and transport protocols for ADHOC networks.
3	To learn about Wireless sensor Network and data retrieval in WSN.
4	To understand the security of sensor networks.
5	To understand and learn about Sensor Network Platforms and Tools.

Course Outcomes

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

CO1. Enumerate the basic operating procedure of ADHOC networks.	Understand
CO2. To understand and analyze the deployed wireless sensor networks.	Analyze
CO3. Analyze the network about its data transmission and retrievals in wireless networks.	Analyze
CO4. Analyze the various critical routing parameters of Wireless Sensor Networks.	Evaluate
CO5. Understand and develop the security protocols of wireless networks.	Evaluate

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	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	S	M	M	L	L	-	-	-	L	-	-	-	M	-	-
CO2	S	S	M	M	L	-	-	L	L	M	-	L	S	M	-
CO3	S	M	M	L	L	-	-	-	-	-	-	L	M	-	-
CO4	S	S	S	M	M	-	-	-	-	L	-	-	S	M	-
CO5	S	S	M	M	M	-	L	L	M	-	-	M	M	M	-

S – Strong; M – Medium; L – Low

SYLLABUS

INTRODUCTION

Introduction to ADHOC/sensor networks: Key definitions of ADHOC/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in ADHOC wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

NETWORK PROTOCOLS

Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4 and Zig Bee, Dissemination protocol for large sensor network.

ROUTING PROTOCOLS

Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

QOS AND ENERGY MANAGEMENT

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

SECURITY IN WSN

Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems. Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms.

REFERENCE BOOKS:

1. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2004.
2. Holger Kerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, John Wiley and Sons, 2005.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Network”, Elsevier, 1st Ed. 2004.
4. Kazem, Sohraby, Daniel Minoli, TaiebZanti, “Wireless Sensor Network: Technology, Protocols and Application”, John Wiley and Sons 1st Ed., 2007.
5. Security in Ad hoc and Sensor Networks, Raheem Beyah, et al., World Scientific Publications / Cambridge University Press, 2010.

COURSE DESIGNERS

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1	Mr. R. Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
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	HIGH SPEED ELECTRONICS	Category	L	T	P	Credit
		EC-PS	**3**	**0**	**0**	**3**

PREAMBLE

High Speed Electronics helps the students to have a wide knowledge on high performance devices in vast range of applications. This course is designed to impart knowledge on high-speed operation and their limitations.

PREREQUISITE

Semiconductor Devices

COURSE OBJECTIVES

1	To Understand Important parameters governing the high-speed performance of devices and circuits
2	Analyze and identify suitable materials for high-speed circuits.
3	Apply the basic concept of MOS devices.
4	To understand the different types High speed devices & its performances.
5	To learn about applications of High-Speed Circuits.

COURSE OUTCOMES

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

CO1. Understand the correlation between the parameters of devices and circuits to identify the performances.	Understand
CO2. Explore the material properties used for high-speed devices	Understand
CO3. Construct efficient source coding schemes based on the entropy of source and probability of input variables.	Apply
CO4. Apply the concepts of Advanced MOS devices to enhance the performance.	Apply
CO5.Analyze of various applications of High-Speed Circuits	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	-	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

PARAMETERS AND SILICON BASED MOSFET AND BJT CIRCUITS FOR HIGH SPEED OPERATION AND THEIR LIMITATIONS

Transit time of charge carriers, junction capacitances, ON-resistances and their dependence on the device geometry and size, carrier mobility, doping concentration and temperature. Contact resistance and interconnection/interlayer capacitances in the Integrated Electronic Circuits.
Emitter coupled Logic (ECL) and CMOS Logic circuits with scaled down devices. Silicon On Insulator (SOI) wafer preparation methods and SOI based devices and SOICMOS circuits for high-speed low power applications

MATERIALS PROPERTIES

Merits of III –V binary and ternary compound semiconductors (GaAs, InP, InGaAs, AlGaAs ETC.), silicon-germanium alloys and silicon carbide for high-speed devices, as compared to silicon-based devices. Brief outline of the crystal structure, dopants and electrical properties such as carrier mobility, velocity versus electric field characteristics of these materials. Material and device process technique with these III-V and IV – IV semiconductors.

MOS DEVICES & ADVANCEMENTS

Metal semiconductor contacts and Metal Insulator Semiconductor and MOS devices: Native oxides of Compound semiconductors for MOS devices and the interface state density related issues. Metal semiconductor contacts, Schottky barrier diode, Metal semiconductor Field Effect Transistors (MESFETs): Pinch off voltage and threshold voltage of MESFETs. D.C. characteristics and analysis of drain current. Velocity overshoot effects and the related advantages of GaAs, InP and GaN based devices for high-speed operation. Sub threshold characteristics, short channel effects and the performance of scaled down devices.

HIGH SPEED DEVICES

High Electron Mobility Transistors (HEMT): Hetero-junction devices. The generic Modulation Doped FET(MODFET) structure for high electron mobility realization. Principle of operation and the unique features of HEMT, In GaAs / InP HEMT structures: Hetero junction Bipolar transistors (HBTs): Principle of operation and the benefits of hetero junction BJT for high speed applications. GaAs and InP based HBT device structure and the surface passivation for stable high gain high frequency performance. SiGe HBTs and the concept of strained layer devices; High Frequency resonant – tunneling devices, Resonant-tunneling hot electron transistors.

HIGH SPEED CIRCUITS

GaAs Digital Integrated Circuits for high-speed operation- Direct Coupled Field Effect Transistor Logic (DCFL), Schottky Diode FET Logic (SDFL), Buffered FET Logic (BFL). GaAs FET Amplifiers. Monolithic Microwave

Integrated Circuits (MMICs). High Frequency resonant – tunneling devices. Resonant-tunneling hot electron transistors and circuits

Text Books:

1. C.Y. Chang, F. Kai, GaAs High-Speed Devices: Physics, Technology and Circuit Applications Wiley.

2. S.M. Sze, High Speed Semiconductor Devices, Wiley (1990) ISBN 0-471-62307-5.

Reference Books:

1. G.A. Armstrong, C.K. Maiti, TCAD for Si, SiGe and GaAs Integrated Circuits, The Institution of Engineering and Technology, London, United Kingdom, 2007,ISBN 978-0-86341-743-6.
2. David K. Ferry, Ed., Gallium Arsenide Technology, Howard W. Sams& Co., 1985.

COURSE DESIGNERS

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1	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
2	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in

	WAVELET TRANSFORM	Category	L	T	P	Credit
		EC-PS	**3**	**0**	**0**	**3**

PREAMBLE

To understand the basics of different types of wavelets and its theory and to illustrate the use of wavelet processing in different applications

PREREQUISITE –

Signal Processing

COURSE OBJECTIVES

1	To learn the various wavelet transform and explain importance of it
2	To gain knowledge of the different continuous and discrete wavelet transforms.
3	To compute different alternative wavelet representation.
4	To know the basics of lifting scheme and understand the different methods.
5	To learn the principle of Optical Transmitters and Receivers.

COURSE OUTCOMES

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

CO1. Understand wavelet basis and characterize continuous and discrete wavelet transforms in the field of Engineering.	Understand
CO2. Understand multi resolution analysis and identify various wavelets and evaluate their time- frequencyproperties.	Understand
CO3. Illustrate the discrete wavelet transforms with multirate digital filters.	Apply
CO4. Outline the computationally efficient wavelet-based methods for signal and image processing.	Analyze
CO5.Analyze certain classes of wavelets and justify the basis of the application of wavelet transforms to different fields.	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	M	M	M	-	-
CO2	S	S	-	-	-	-	-	-	-	-	M	M	M	-	-
CO3	S	S	M	-	-	-	-	-	-	-	M	M	M	M	-
CO4	S	S	M	M	-	-	-	-	M	M	M	M	S	M	M
CO5	S	S	M	M	M	-	-	-	M	M	M	M	S	M	M
S- Strong; M-Medium; L-Low															

SYLLABUS

Continuous Wavelet Transform

Introduction to Wavelet Transform - definition and properties ,Continuous time frequency representation of signals, Windowed Fourier Transform, Uncertainty Principle and time frequency tiling, Wavelets, specifications, admissibility conditions, Continuous wavelet transform, CWT as a correlation, CWT as an operator, Inverse CWT.

Discrete Wavelet Transform

Approximations of vectors in nested linear vector spaces, Example of an MRA, Formal definition of MRA, Construction of general orthonormal MRA, a Wavelet basis for MRA, Digital filtering interpretations- Decomposition and Reconstruction filters, examples of orthogonal basis generating wavelets, interpreting orthonormal MRA for Discrete time signals, Mallat algorithm.

Alternative wavelet representations

Biorthogonal Wavelets, biorthogonality in vector space, biorthogonal wavelet bases, signal representation using biorthogonal wavelet system, advantages of biorthogonal wavelets, biorthogonal analysis and synthesis, Filter bank implementation, Two dimensional Wavelets, filter bank implementation of two-dimensional wavelet transform.

Lifting scheme

Wavelet Transform using polyphase matrix factorization, Geometrical foundations of the lifting scheme, lifting scheme in the z- domain, mathematical preliminaries for polyphase factorization, Dealing with Signal Boundary.

Applications

Signal Compression – Image Compression techniques: EZW-SPHIT Coding Image denoising techniques- Noise estimation - Shrinkage rules - Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection. Curve and Surface Editing-Variation modeling and finite element method using wavelets.

Text Books:

1. Wavelet Transforms –Introduction and applications - Raguveer M. Rao and Ajit S. Bopardikar- - Pearson Education, 2008.

2.Insight into Wavelets from Theory to practice - K.P Soman, K. I. Ramachandran, PHI, 2006

3. Fundamentals of Wavelets: Thory, Algorithms and Applications- J C Goswamy and A K Chan, Wiley Inderscience Publications, John Wiley and Sons, 1999.

Reference Books:

1.A.Teolis, Computational Signal Processing with Wavelets, Birkhauser, 1998

2. R.M. Rao & A.S. Bopardikar, Wavelet Transforms, Addition Wesley, 1998.
3. J.C. Goswami & A.K. Chan, Fundamentals of Wavelets, John Wiley,1999.
4. L.Prasad&S.S.Iyengar, Wavelet Analysis with Applications to Image Processing, CRC Press, 1997.

COURSE DESIGNERS

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

PREAMBLE

This course is offered for students to gain the knowledge in Nanoelectronics and various Nanotechnologies

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To learn the Fundamentals of Nano electronics.
2	To gain knowledge of the silicon MOSFET and Quantum Transport Devices.
3	To Know basic concepts of various Nanotechnology and applications of Nano Materials
4	To learn the fabrication of Carbon Nanotubes.
5	To study about the Molecular Electronics in Nanotechnology

COURSE OUTCOMES

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

CO1.Understand the basics of Nano electronics and quantum mechanics behind nanoelectronics	Understand
CO2.Explain the concepts of Silicon MOSFETS, quantum transport devices and tunneling effects.	Understand
CO3.Discuss the types of nanotechnology, molecular technology and the preparation of nano materials.	Understand
CO4.Illustrate the synthesis, interconnections and applications of carbon nano tubes.	Apply
CO5.Design and simulate the circuits using molecular electronic devicesand discuss their applications in MEMS and robots	Apply

MAPPINGTH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	-	-	-	-	-	-	L	S	M	-
CO2	S	M	M	-	-	-	-	-	-	-	-	L	M	L	-
CO3	S	M	M	-	-	-	-	-		-	-	L	S		-
CO4	S	S	M	-	M	-	-	-	L	-	-	L	S	M	-
CO5	S	M	M	-	M	-	-	-	M	-	-	M	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

Fundamentals Of Nanoelectronics

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation: - power dissipation limit – dissipation in reversible computation – the ultimate computer.

Silicon Mosfets& Quantum Transport Devices

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling, Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications: - Single electron devices – applications of single electron devices to logic circuits.

Introduction To Nanotechnology

Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope – scanning electron microscope– atomic force microscope – scanning tunnelling microscope – nanomanipulator – nano tweezers – atom manipulation – nano dots – self-assembly – dip pen nanolithography. Nanomaterials: preparation– plasma arcing – chemical vapor deposition – sol-gels – electrodeposition – ball milling – applications of nanomaterials;

Carbon Nanotubes

Carbon Nanotube: Fullerenes - types of nano tubes – formation of nano tubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications – prospects of all carbon nanotube nanoelectronics.

Molecular Electronics

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices.

Text Books:

1. Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, "Nanotechnology: Basic Science and Emerging Technologies", Chapman & Hall / CRC, 2002
2. Rainer Waser (Ed.), "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices", Wiley-VCH, 20032. T. Pradeep, NANO:"The Essentials–Understanding Nanoscience and Nanotechnology", TMH, 2007

References:

1. T.Pradeep, "NANO:The Essentials–Understanding Nanoscience and Nanotechnology", TMH, 2007.
2. W. Ranier, "Nano Electronics and Information Technology", Wiley, (2003).
3. K.E. Drexler, "Nano systems", Wiley, (1992).
4. M.C. Petty, "Introduction to Molecular Electronics"1995.
5. Vladimir V. Mitin, Vieatcheslov A. Kochelap, Micheal A. Stroscio, Introduction to Nanoelectronics, Cambridge University Press, London, 2008

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
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	INFORMATION AND ERROR CONTROL CODING	Category	L	T	P	Credit
		EC-PS	**3**	**0**	**0**	**3**

PREAMBLE

Information & Error Control Coding enables the students to have an insight knowledge on fundamentals of Information Theory & Error control Codes. The designed course makes the students to work on the various applications of the coding.

PREREQUISITE

Analog and Digital Communication

COURSE OBJECTIVES

1	Apply source coding procedure and calculate coding efficiency based on entropy and mutual information
2	To carry out implementation of different source coding and channel coding algorithms
3	Apply the basic concept of Error Control Codes
4	To understand the different types of Error Correcting Codes
5	To learn about various various applications of Error Control Codes

COURSE OUTCOMES

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

CO1. Evaluate the information content in a discrete memoryless source through parameters such as entropy and mutual information	Apply
CO2. Calculate channel capacity using Shannon's channel capacity theorem and construct efficient source coding schemes based on the entropy of source and probability of input variables	Apply
CO3. Develop channel error control codes using BCH and RS algorithms	Analyze
CO4. Determine advanced Error correcting codes in both encoding and decoding techniques	Apply
CO5.Analyze of various applications of Error Control Codes in data storage	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	-	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

INFORMATION THEORY AND SCHEMES FOR SOURCE CODING

Review of probability Theory - Random variables - Operations on single and multiple random variables-random process concept - Memoryless Finite Schemes- Self information measure - Entropy function - Conditional Entropies - Characteristics of Entropy function - Derivation of the noise characteristics of a channel - Mutual information - Redundancy - Efficiency and channel capacity - capacities of channels with symmetric noise structure.

CONTINUOUS CHANNELS

Definitions of different entropies - Mutual information - Maximization of the entropy of a continuous random variable - Entropy maximization problems - Channel capacity under the influence of additive white Gaussian Noise- Hartley Shannon's Law - Trade - off between Bandwidth and SNR - Comparison of different modulation methods- Information Capacity Theorem - Rate Distortion Theory.

ERROR CONTROL CODES

Hamming's single error correcting code - BCH codes - Reed-Solomon codes - Decoding BCH and RS codes - finding the Error Locator Polynomial - Non-binary BCH and RS Decoding - Erasure decoding for Non binary BCH and RS codes -Turbo codes - Encoding Parallel Concatenated codes - Turbo MAP decoding algorithm - BCJR algorithm - Log likelihood ratio decoding.

ERROR-CORRECTING CODES

Introduction - Linear Codes - Encoding and Decoding - Codes Derived from Hadamard Matrices, Cyclic Codes - Encoding and Decoding of Cyclic Codes - The Golay Code - Cyclic Redundancy Check Codes - Reed-Muller Codes, Convolutional Codes - The Viterbi Algorithm - Trellis Modulation

APPLICATIONS OF ERROR CONTROL CODES

Error control for computer main processor and control storages, Magnetic tapes, Magnetic Disks, Error control in IBM 3850 Mass Storage System, Other Data Storage Systems.

Text Books:

1. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003.

2. Shu Lin & Daniel Costello,"Error Control Coding Fundamentals and Applications", Prentice - Hill, 1983.

Reference Books:

1. Reza F M,"An Introduction to Information theory", McGraw Hill, 2000.

2. Thomas M Cover and Joy A Thomas, “Elements of Information Theory”, Second Edition John Wiley, 2006.

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in
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	COMMUNICATION NETWORK SECURITY	Category	L	T	P	Credits
		EC-PS	3	0	0	3

PREAMBLE

To introduce knowledge about the security issues in network and different algorithms used for digital data communication network.

PREREQUISITE

Data Communication Networks

COURSE OBJECTIVES

1	To understand the basic encryption standards.
2	To understand the advanced encryption methodologies.
3	To understand the knowledge of basic functioning of encryption algorithms.
4	To understand the concept of guided data security.
5	To understand the functioning of wireless data security.

COURSE OUTCOMES

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

CO 1. Understand the basic protocols in data security.	Understand
CO 2. Apply different encryption standards in data security.	Apply
CO 3. Design new algorithms for data security through multiple functions.	Apply
CO 4. Design different security practice for data communication.	Apply
CO 5. Analyze the issues in wireless security.	Analyze

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	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	L	-	-	-	L	-	-	-	-	-	-	M	M	-
CO2	S	S	L	-	-	L	-	-	-	-	-	L	S	M	-
CO3	L	S	S	S	-	L	-	S	L	-	-	M	S	S	-
CO4	M	S	S	-		L	-	S	S	-	-	L	M	-	M
CO5	L	L	M	L	S	L	-	-	L	-	-	S	M	M	-

S – Strong; M – Medium; L – Low

SYLLABUS

PHYSICAL NETWORK SECURITY & WEB SECURITY

Physical Layer Security - Copper Media, Optical Media, Wireless Media; Web Security Threats, Web Traffic Security Approaches; Overview of Secure Socket Layer and Transport Layer Security; Overview of Secure Electronic Transaction, Web and DNS security, Classical Ciphers: Services – Mechanisms and Attacks – OSI security Architecture – Model for Network Security – Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines– Stenography

PUBLIC KEY ENCRYPTION

Block Ciphers and Data Encryption Standard – Simplified DES – Block Cipher Principles, Data Encryption Standard – Strength of DES – Differential and Linear Crypt Analysis, Block Cipher Design Principles – Block Cipher Modes of Operation; Principles of Public Key Cryptosystems – RSA Algorithm, Key Management and other public key cryptosystems– Diffie–Hellman Key Exchange. Basics of ECC algorithm, Elliptic Curve Arithmetic – Elliptic Curve Cryptography.

ADVANCED ENCRYPTION STANDARD

Advanced Encryption Standard – Evaluation Criteria for AES, AES Cipher– Contemporary Symmetric Ciphers – Triple DES, Blowfish, RC5 – Characteristics of Advanced Symmetric Block Ciphers – RC4 Stream Cipher – Confidentiality using Symmetric Encryption – Placement of Encryption Function – Traffic Confidentiality – Key Distribution and Random Number Generation.

HASH & MAC FUNCTIONS

Message Authentication and Hash Functions – Authentication Requirements– Authentication Functions – Message Authentication Codes – Hash Functions and MACs; Hash Algorithms – MD5 Message Digest Algorithm, Secure Hash Algorithm RIPEMD 160, HMAC– Digital Signatures and Authentication Protocols – Digital Signature Standards.

NETWORK SECURITY PRACTICE

Authentication Applications – Kerberos – X.509 Authentication Service– Electronic Mail Security – Pretty Good Privacy – S/MIME– IP Security – IP Security Overview– IP Security Architecture – Authentication Header – Encapsulating Security Payload – Combining Security Associations – Web Security – Web Security Considerations – Secure Sockets Layer and Transport Layer Security – Secure Electronic Transaction. Wireless Network Security: Security Attack issues specific to Wireless systems: Worm hole, other attacks- Tunneling, Gray hole and Man-in-the-middle attack. Tunneling, DoS. WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor; Security issues & challenges in VANETs, Ad Hoc & Sensor networks, and IoT.

TEXT BOOKS:

1. William Stallings, "Network Security Essentials", 2nd edition, Prentice Hall of India New Delhi, 2004.
2. Charlie Kaufman, "Network Security Private Communication in Public World" 2nd edition, Prentice Hall of India New Delhi, 2004.

REFERENCE BOOKS:

1. William Stallings, "Cryptography and Network Security", 3rd edition, Prentice Hall of India, New Delhi, 2004.
2. R. K. Nichols and P. C. Lekkas ," Wireless Security" Mc Graw Hill 2002.

COURSE DESIGNER

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1	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in
2.	Mr.B.Rajasekaran	Associate Professor	ECE	rajasekaran@vmkvec.edu.in

	VIDEO PROCESSING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To introduce the fundamentals of digital video representation, filtering and compression, including popular algorithms for 2-D and 3-D motion estimation, object tracking, frame rate conversion, image enhancement, and the emerging international standards for image and video compression, with such applications as digital TV, web-based multimedia, videoconferencing, videophone and mobile image communications.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To learn the basic concepts of video processing
2	To provide the visualization of relationships between spatial and frequency.
3	To provide an idea of multimedia data
4	To learn the basic concepts of coding systems
5	To understand about the content dependent and scalable video coding techniques

COURSE OUTCOMES

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

CO1. Apply the knowledge gained during the course to solve various real time problems.	Apply
CO2. Apply video tracking algorithms for intelligent surveillance and medical applications	Apply
CO3. Distinguish various methodologies for motion estimation using coding	Analyze
CO4. Analyze to develop new state of the art image and video processing method.	Analyze
CO5. Analyze to choose right sensor for the right job	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC STEPS OF VIDEO PROCESSING

Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations

FORMATION OF VIDEO PROCESSING

Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two-dimensional motion models. Three Dimensional Rigid Motion, Approximation of projective mapping.

2-D MOTION ESTIMATION

Optical flow, general methodologies, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

MOTION ESTIMATION TECHNIQUES

Optical flow, motion representation, motion estimation criteria, optimization methods, pixel-based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion. Motion analysis applications: Video Summarization, video surveillance.

VIDEO COMPRESSION

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II - MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Packet Video.

TEXT BOOKS:

1. Yao Wang, Jorn O stermann, Ya-Qin Zhang, "Video Processing & Communication", Pearson Education - India, New Delhi, Prentice Hall, 2002.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.

REFERENCES:

1. M. Tekalp, Digital Video Processing, Prentice Hall, 1995.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.C.Arunkumar Madhuvappan	Assistant Professor	ECE	arunkumarmadhuvappan@vmkvec.edu.in
2	Dr.L.K.Hema	Professor	ECE	hemalk@avit.ac.in

	DATA SCIENCE FOR COMMUNICATION NETWORKS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To introduce the concepts of communication networks, in depth understanding of network architecture of different layers of data communications and its security protocols and implementing the concepts through simulations

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the physical layers of layered models.
2	To be exposed to error detection/correction & medium access controls.
3	To be familiar with Internet Protocols & current scenario
4	To understand the concepts of Transport & Application layers.
5	To be familiar with Network & Internet security.

COURSE OUTCOMES

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

CO1. Describe the basics and working of layered architecture	Understand
CO2.Differentiate different error control, Link control, access control and different LAN Technologies. Also to evaluate merits and demerits	Apply
CO3. Use the role of protocol to design it for appropriate routing mechanism.	Apply
CO4.Analyze the various transport and application layer protocols in real time.	Analyze
CO5. Explicate the functioning and methods of data and network security.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	S	M	-	-	L	-	-	-	L	-	-	L	M	L	-
CO2	S	S	M	M	M	-	-	-	-	L	-	-	S	M	-
CO3	S	S	M	M	M	-	-	-	L	L	L	-	S	M	-
CO4	S	S	L	-	-	-	-	-	L	L	L	L	S	M	L
CO5	S	L	L	-	-	-	-	-	-	-	-	L	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Fundamental of Data communications and Physical Layer.

Data Communications-Networks & its types-Standards-Networks models –Protocol layering-TCP / IP protocol suite-OSI model. Digital to Digital conversion-Analog to Digital Conversion-Transmission Modes-Digital to Analog conversion- Analog to Analog Conversion-Multiplexing-Spread spectrum-Guided and Unguided Transmission media-Switching-Circuit switched networks-Packet switching-Structure of Switch.

Data Link Layer.

Link layer addressing.

Error Detection & Correction: Block coding-Cyclic codes-Checksum-Forward error correction. Data link control: DLC services-Data link layer protocols-HDLC-PPP. Medium Access Control: Random Access-Controlled access-Channelization. Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee

Wired LANS: Ethernet protocol-Standard Ethernet-Fast Ethernet & Gigabit Ethernet. Wireless LANS: IEEE 802.11 project-WiMAX-Cellular Telephony-Satellite networks. Connecting devices, Virtual LANS.

Network Layer.

Network layer services-Packet switching-Performance-IPv4 Addresses. Internet Protocol, ICMPv4, Mobile IP. Unicast Routing: Routing algorithms-Unicast routing protocols. Multicast routing: Multicasting basis-Intra domain & Inter domain Multicast protocols, IGMP. Next Generation IP: IPv6 Addressing-IPv6 protocol-ICMPv6 protocol-Transition from IPv4 to IPv6.

Transport & Application Layer

Transport layer protocols-User Datagram Protocol-Transmission Control Protocol-SCTP. Client server programming-WWW & HTTP-FTP-Electronic mail-TELNET-SSH-DNS in the internet – Resolution- DNS Messages- Dynamic Domain Name System - SNMP-Compression- Multimedia Data & in the Internet- Real-Time Interactive protocol-P2P Networks-CHORD-PASTRY-KADEMLIA BITTORNET.

Network & Internet Security

Quality of Service: Data flow characteristics-Flow control to improve QoS-Integrated services Differentiated services. Cryptography: Introduction-Confidentiality-Other aspects of Security. Security In Networks: Threats in networks – Encryption – Virtual Private Networks – PKI – SSH – SSL – IPSec – Content Integrity – Access Controls – Wireless Security – Honeypots – Traffic Flow Security – Firewalls – Intrusion Detection Systems – Secure e-mail.

Text Books:

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, 2013

References:

1. 1. Andrew S. Tannenbaum, “Computer Networks”, Pearson Education, Fifth Edition, 2011.
2. James F. Kurose, Keith W. Ross, “Computer Networking- A Top -Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
3. Larry L. Peterson, Bruse S. Davie, "Computer Networks: A System Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
4. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.
5. Matt Bishop, “Introduction to Computer Security”, Addison-Wesley, 2004.

COURSE DESIGNERS

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	PASSIVE NETWORK ANALYSIS AND SYNTHESIS	Category	L	T	P	Credit
		EC-PS	**3**	**0**	**0**	**3**

PREAMBLE

A network refers to any interconnected set of objects. An 'electrical network' is an interconnection of electrical elements(Active and Passive)such as resistors, inductors, capacitors, transformers, diodes, sources, controlled sources and switches. Passive networks have interconnection of elements which cannot generate energy but can dissipate or stored energy. All electrical and electronic devices can be represented by electric circuits. So, formulation of equivalent circuit and the study of behavior of the devices such as filters and attenuators or networks is formulated by analyzing the equivalent circuit with network laws, theorem and graph theory.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand basic circuit concepts.
2	To study networks and solution of DC and AC circuits.
3	To understand series and parallel resonance concepts and analysis of coupled circuits.
4	To introduce different methods of circuit analysis using Network theorems, duality and topology.
5	To understand transient analysis of RL, RC and RLC circuits with DC and sinusoidal excitations.

COURSE OUTCOMES

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

CO1. Apply the knowledge of basic circuital law and simplify the network using reduction techniques	Understand
CO2. Infer and analyze transient response, Steady state response, network functions	Apply
CO3. Analyze circuits using ideal passive elements and controlled sources	Analyze
CO4. Synthesize one port and two port networks and devices	Analyze
CO5. Design of Constant K and m- derived Filter Network	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	-	M	-	-	-	S	-	-	M	S	M	-
CO2	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	S	M	-	M	-	-	-	M	-	-	M	S	M	M
CO5	S	S	M	-	M	-	-	-	M	-	-	M	S	M	_
S- Strong; M-Medium; L-Low															

SYLLABUS

BASIC CIRCUIT ANALYSIS AND NETWORK TOPOLOGY

Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence matrices –Trees – Cut sets - Fundamental cut sets – Cut set matrix – Tie sets - Link currents and Tie set schedules -Twig voltages and Cut set schedules, Duality and dual networks.

NETWORK THEOREMS AND TRANSFORMATIONS

Network theorems - Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem ,application of Network theorems - Network reduction: voltage and current division, source transformation – star delta conversion.

RESONANCE AND COUPLED CIRCUITS

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency -Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor -Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multi winding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

TRANSIENT ANALYSIS & TWO PORT NETWORKS AND SYNTHESIS

Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation. Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid (H) Parameters, Interconnection of two port networks

PASSIVE FILTERS

Symmetrical properties of T and TT networks-Characteristic Impedance of Symmetrical Networks- Filter fundamentals – Design of filters; Constant K- Low Pass, High Pass, Band Pass& Band Elimination, m-Derived sections – Low Pass, High Pass & Composite Filter

TEXTBOOKS:

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.
3. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2010.

REFERENCEBOOKS:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 9th Reprint 2015.
2. A. Bruce Carlson," Circuits: Engineering Concepts and Analysis of Linear Electric Circuits", Cengage Learning, India Edition 2nd Indian Reprint 2009.
3. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint 2013.

COURSE DESIGNERS				
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2	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in

	IOT SYSTEM DESIGN AND APPLICATIONS	Category	L	T	P	Credits
		EC-PS	3	0	0	3

PREAMBLE

This is a course about the new paradigm of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking and applications development.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand IoT concepts, terminology, technology
2	To learn about Smart Objects and IoT Architectures
3	To introduce the concept of M2M (machine to machine) with necessary protocols
4	To introduce the Python Scripting Language which is used in many IoT devices
5	To build simple IoT Systems using Arduino and Raspberry Pi.
6	To learn about various IOT-related protocols
7	To understand and develop IoT applications

COURSE OUTCOMES

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

CO 1. To understand the fundamentals of IoT	Understand
CO 2. To understand basics of IoT system Management and an introduction to python language	Apply
CO 3. To apply the suitable IoT communication protocols to different applications	Apply
CO 4. To be able to design and develop an IoT system	Apply
CO 5. To analyze the real time IoT applications	Analyze

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	PO 11	PO 12	PSO 1	PSO2	PSO3
CO1	M	L	-	-	-	L	-	-	-	-	-	-	M	M	-
CO2	S	S	L	-	-	L	-	-	-	-	-	L	S	M	-
CO3	L	S	S	S	-	L	-	S	L	-	-	M	S	S	-
CO4	M	S	S	-	-	L	-	S	S	-	-	L	M	-	M
CO5	L	L	M	L	S	L	-	-	L	-	-	S	M	M	-

S – Strong; M – Medium; L – Low

SYLLABUS

FUNDAMENTALS OF IoT

Evolution of Internet of Things – Enabling Technologies – Technologies that led to evolution of IOT, IOT and SCADA, IOT and M2M, IOT and Big Data, IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER INTRODUCTION TO PYTHON

Language features of Python, Data types, data structures, Control of flow, functions, modules,

packaging, file handling, data/time operations, classes, Exception handling Python packages – JSON, XML, HTTP Lib, URL Lib, SMTP Lib

IoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRa WAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

IoT SYSTEMS DESIGN AND DEVELOPMENT

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

IoT APPLICATIONS

Lighting as a service (case study), Intelligent Traffic systems (case study), Smart Parking (case study), Smart water management (case study), IOT for smart cities (case study), IOT in Indian Scenario: IOT and Aadhaar, IOT for health services, IOT for rural empowerment.

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCE BOOKS:

1. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Aves and. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

COURSE DESIGNER

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2.	Mr.B.Rajasekaran	Associate Professor	ECE	rajasekar@vmkvec.edu.in

	SENSORS AND TRANSDUCERS FOR HEALTHCARE	Category	L	T	P	Credit
		EC-PS	**3**	**0**	**0**	**3**

PREAMBLE

Sensors & transducers for healthcare course presents an overview of sensors and transducers of different types that have been proven in medical and home environments as being helpful in Quality of Life enhancement. Also emphasizes the need Home care.

PREREQUISITE:

NIL

COURSE OBJECTIVES

1	To Understand the basic concepts of sensors, sensor principles and its classification.
2	To use the basic concepts of transducers, electrodes and its classification.
3	To Study the cardiac, respiratory and muscular physiological systems and several other instruments for healthcare.
4	To outline the various biological components using biosensors.
5	To emphasize the need for home medicare system and provide the advance medical technology in home medicare.

COURSE OUTCOMES

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

CO1. Quantify the specification and characteristics of sensors	Understand
CO2. Describe the working principles of transducers.	Understand
CO3. Develop the knowledge for implementing different types of physiological parameter measurement using appropriate sensors.	Apply
CO4. Analyze the biological components using biosensors in various applications.	Analyze
CO5.Analyze the skills required for home Medicare for the elderly, the children and digital technical advancements with home Medicare.	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	S	S	-	-	-	-	-	-	-	S	M	-
CO2	M	L	-	M	-	M	-	-	L	-	-	M	-	M	-
CO3	S	S	M	M	L	M	-	M	M	M	-	S	M	M	S
CO4	S	S	L	S	-	S	M	M	S	-	-	S	S	M	M
CO5	S	S	M	M	L	M	-	M	M	M	-	S	M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

SENSOR FUNDAMENTALS AND SENSOR PRINCIPLES

Sensor Classification, Performance and Types, Electric charge, field and potentials, capacitor and dielectric constant, magnetism, Induction, resistance, Seebeck, peltier and thermal effects, Heat transfer, light and ultrasonic.

TRANSDUCERS AND ITS CLASSIFICATION

General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer, Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

BIOMEDICAL SENSORS AND PHYSICAL SENSORS IN BIOMEDICINE

Introduction to Biomedical Sensors-Classification-Temperature measurement: core temperature,-surface temperature-invasive. Blood flow measurement: skin blood- hot film anemometer- Doppler sonography- electromagnetic sensor - blood pressure measurement: noninvasive- hemodynamic invasive, Spirometry- sensors for pressure pulses and movement- ocular pressure sensor- acoustic sensors in hearing aid, tactile sensors for artificial limbs, sensors in ophthalmoscopy.

BIOSENSORS AND ITS APPLICATION

Biological elements, Immobilization of biological components, Chemical Biosensor, electrochemical sensor, chemical fibro sensors, blood glucose sensors, non-invasive blood gas monitoring, UREASE biosensor.

MEDICAL INSTRUMENTS AT HOME AND DIGITAL HOME CARE

Spectrophotometer, colorimeter, flame photometer, auto-analyzer, Medical devices at home and its implementation, Infant monitors, Medical alert services, Activity monitors, Home medicare management by videophone, Continuous home care through wireless bio-signal monitoring system Smart Wearables in Healthcare.

Text Books:

1. Jacob Fraden,"Hand book of modern sensors: Physics design and applications", Springer, 2003, 3rdedition, AIP press
2. J. G. Webster, J. G. Webster ,"Medical Instrumentation; Application and Design", John Wiley & Sons, Inc., New York,4th Edition, 2015.
3. Robyn Rice, "Home care nursing practice: Concepts and Application", Elsevier, 4th Edition, 2006.
4. Brain R Eggins, "Biosensors: An Introduction", John Wiley Publication, 1997.

Reference Books:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 3 rd edition , 2014.
2. H.S. Kalsi, "Electronic Instrumentation & Measurement", Tata McGraw HILL, 1995.

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	R.Mohana Priya,	Assistant Professor(Gr-II),	ECE	mohanapriya@avit.ac.in
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	DIGITAL IMAGE PROCESSING	Category	L	T	P	Credit
		EC-PS	**3**	**0**	**0**	**3**

PREAMBLE

Digital Image Processing has applications in all walks of present-day digital life. The student stands to gain knowledge of the basics of images, acquisition of images, enhancement of images, restoration of images, compression of images for efficient storage and transmission, color image processing, image segmentation and morphological image processing.

PREREQUISITE:

Nil

COURSE OBJECTIVES

1	To understand the mathematics behind image sampling, quantization and image transforms
2	To understand different filtering techniques both in the frequency domain as well as the time domain and analyze them
3	To understand noise removal and other restoration techniques and apply them.
4	To understand and apply multi resolution techniques for image compression
5	To understand morphological representation, image segmentation and representation

COURSE OUTCOMES

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

CO1. Understand the mathematics behind image acquisition, sampling and transforms and frequency domain	Understand
CO2. Understand the concepts of filtering in time domain	Understand
CO3. Apply the effect of different filters on removing different noises	Apply
CO4. Apply the different multi resolution techniques and morphological representation,	Apply
CO5. Apply image segmentation techniques for segmenting objects in given images	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction and Image transforms

Origin of digital image processes – Fundamental steps in digital image processing – Components of an image processing system – Elements of visual perception – Image sensing and acquisition – Image sampling and quantization – Basic relationships between pixels – Introduction to mathematical tools used in digital image processing – Fields that use digital image processing. Transforms for Image processing - Discrete Fourier transform – Discrete Cosine transform – Haar transform – Hadamard transform – Walsh transform.

Intensity transformations & Filtering

Basic intensity transformation functions – Histogram processing – Fundamentals of spatial filtering – Smoothing spatial filtering – Sharpening spatial filters – Fuzzy techniques for intensity transformations and spatial filtering

Basics of filtering in frequency transforms – Image smoothing using frequency domain filters - Image sharpening using frequency domain filters.

Image Restoration & Color Image Processing

Image restoration model – Noise parameters – Restoration in the presence of noise only –spatial filtering –Periodic noise reduction by frequency domain filtering – Degrading functions- Estimating the degradation function – Inverse filtering – Wiener filtering – Constrained least square filtering – Geometric mean filtering – Image reconstruction from projections

Color fundamentals – Color models – Pseudo color image processing – Color transformations – Color image Smoothing and sharpening – Color image segmentation – Noise in color images – Color image compression

Wavelets and Multi resolution processing & Image Compression

Background – Multi resolution expansion – Wavelet transform in one dimension – Fast wavelet transform – Wavelet transform in two dimensions- Wavelet packets

Image compression models – Huffman coding – Arithmetic coding – LZW coding – Run length coding – Bit plane coding – Block transform coding – Predictive coding – Wavelet coding

Morphological Processing, Segmentation & Representation

Morphological Processing - Erosion and dilation - Opening and closing – Basic morphological operations – Grey scale morphology. Image Segmentation - Point, Line and Edge detection – Thresholding – Region based segmentation – segmentation using morphological watersheds – use of motion in segmentation. Image Representation – Boundary descriptors – Regional descriptors

TEXT BOOKS:

1) "Digital Image Processing", Rafael C Gonzalez & Richard E Woods, Pearson Education International, Third Edition, 2008, ISBN 0-13-168728-x, 978-0-13-168728-8
2) "Fundamentals of Digital Image Processing" ,A.K. Jain, PHI, 1995.

REFERENCE BOOKS:

1) Digital Image Processing, Bernd Jahne, Springer -Verlag, Fifth Edition, 2002, ISBN 3-540 - 67754 - 2
2) The Essential Guide to Image Processing", Al Bowik,2009, Elsevier Inc, ISBN 978-0-12-374457-9
3) S. Jayarman, S. Esakkirajan and T. Veerakumar, "Digital Image Processing", Tata McGraw Hill, 2010.

COURSE DESIGNERS

S.NO	Name of the Faculty	Designation	Department	Email id
1	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
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	PCB DESIGNING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Printed circuit boards are inarguably one of the most influential inventions of the 20th century. Nearly every piece of technology today uses at least one of these devices, and they have played roles in historically significant events like world war II and space travels. To gain an appreciation for PCB technology, let's look at several significant moments in the history of circuit boards.

PREREQUISITE NIL

COURSE OBJECTIVES

1	To Understand the need for PCB and SMD.
2	To learn planning and PCB design consideration.
3	To obtain knowledge in Artwork generation and Printing process.
4	To obtain knowledge in Etchingand Multi-layer Boards
5	ToLearn Soldering Process of PCB and components Assembling Techniques.

COURSE OUTCOMES

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

CO1. Appreciate the necessity and evolution of PCB, types and classes of PCB.	Understand
CO2. Interpret varies planning and PCB design consideration.	Understand
CO3. Prepare PCB for any specific applications, using Artwork generations	Apply
CO4. Interpret varies techniques used in Etching and Multi-layer Boards	Apply
CO5. Soldering process of PCB and components Assembling rules on PCB.	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	-	-
CO2	S	M	L	-	-	-	-	-	-	-	-	-	S	-	-
CO3	S	M	M	-	M	-	-	-	M	-	-	M	S	M	L
CO4	S	M	M	-	M	-	-	-	M	-	-	M	S	M	L
CO5	S	M	M	-	M	-	-		M	-	-	M	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF PRINTED CIRCUIT BOARDS AND COMPONENTS: Classification of Printed Circuit Boards: Single-sided Printed Circuit Boards, Double-sided Printed Circuit Boards, Multi-layer Boards, Rigid and Flexible Printed Circuit Boards - Manufacturing of Basic Printed Circuit Boards: Single-sided Boards, Double-sided Plated Through-holes - Standards on Printed Circuit Boards. Surface Mount Devices: Surface Mount Devices, Surface Mounting Semiconductor Packages, Packaging of Passive Components as SMDs - Heat Sinks – Transformer- Relays – Connectors.

PLANNING AND DESIGN: General PCB Design Considerations - Mechanical Design Considerations -

Electrical Design Considerations - Conductor Patterns - Component Placement Rules -Fabrication and Assembly Considerations - Environmental Factors -Cooling Requirements and Packaging Density.

ARTWORK GENERATION AND PRINTING PROCESS:

Basic Approach to Manual Artwork -General Design Guidelines for Artwork Preparation- Automated Artwork Generation - Computer- Aided Design (CAD) - Manual versus Automation in PCB Design - PCB Design Checklist - Laminate Surface Preparation - Screen Printing - Printing Process.

ETCHING AND MULTI-LAYER BOARDS:

Etching solutions and chemistry, etching arrangements, Etching parameters, equipment's and techniques, Problems in etching. Multi-layer Boards:Interconnection Techniques - Materials for Multi-layer Boards - Design Features of Multi-layer Boards: Mechanical Design Considerations, Electrical Design Considerations - Fabrication Process for Multi-layer Boards

SOLDERING AND ASSEMBLY TECHNIQUES:

Theory of soldering, soldering variables, soldering materials, Soldering and brazing, soldering tools and other hand soldering tools,PCB assembly process: Leaded Through-hole Assembly, Surface Mount Assembly, Mass Soldering: Dip Soldering, Drag Soldering, Health and Safety Aspects.

Text Books

1. Printed Circuit Boards: Design, Fabrication, Assembly and Testing by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi , 2018.

Reference Books

1. Printed Circuit Boards: Design, Fabrication, and Assembly (McGraw-Hill Electronic Engineering-2006) by Raghbir Singh Khandpur
2. Electronic Product Design Volume-I by S D Mehta, S Chand Publications

COURSE DESIGNERS

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1	Mr.G.SureshKumar	Assistant Professor	ECE	sureshkumar@vmkvec.edu.in
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	REAL TIME OPERATING SYSTEMS DESIGN AND PROGRAMMING	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

This course provides foundational materials on RTOS for embedded applications, including task scheduling, memory allocation and resource management.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	To acquire knowledge on Real-Time Operating Systems Design and Programming
2	To acquire knowledge on Task scheduling and memory allocation, File system and data management
3	To acquire knowledge and understanding of parallel programming principles

COURSE OUTCOMES

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

CO1 - Understand the basic concepts of RTOS, task and threads	Understand
CO2 - To choose between different programing techniques in RTOS-based applications	Analyze
CO3 – to evaluate implementation results (e.g. speed, cost, power) and correlate them with the corresponding programing techniques	Analyze
CO4 - to use commercial tools to develop RTOS based applications	Create
CO5 - to optimize the RTOS to satisfy given user specifications	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

Syllabus

Introduction To The Course

Brief History, Suggested Reading, How Did The Os Came Into Existence, Os Does The Plumbing, An Example: Writing To Disk, More Examples, Os Resource Management, A Dynamic Topic

Os Overview

Os Components, Process, Memory, Files And I/O, Operating System Structure, Monolithic, Microkernel, Operating System Structure, Types Of Operating Systems, Embedded Operating Systems, Rtos On Embedded System Vs Super Loop, Rtos For This Course

Process, Task And Thread

An Instance Of A Running Program, Memory Layout Of An Executing Program, Process – The Abstraction, Process Control Block, Linux Example, Rtx Example, Process Creation, Process Termination, Context Switching, Process States, State Transition, Process State, Rtx Example

Scheduling

Process State Model, Levels Of Scheduling, What Makes A Good Scheduling Algorithm, Behavior Patterns Of Process, Non – Preemptive Algorithms (Fcfs, Sjf), Exponentially Weighted Averaging, Preemptive Algorithms (Rr, Srt), Quantum Size, How Does Priority Help, A Feedback Example, A Practical Problem: How To Evaluate The Performance, Real Time Scheduling, A Periodic Real Time Scheduling

Concurrency

Multiprocessing And Flynn's Taxonomy, Operating Systems On Multiprocessing Concurrency, The Read – Write Problem Caused By Sharing, Mutual Exclusion, Solutions, Hardware Mutex, Software Mutex, Dekker's Algorithm, Semaphore, How Do Semaphores Prevent Busy – Waiting, Producer – Consumer Problem, Message – Passing/Mailbox, Deadlock, Coffman Conditions For Deadlock, Dealing With Deadlock, Bankers Algorithm

Memory

Memory Hierarchy, Cpu Cache- Why Do We Use Cache, Cpu Cache Hierarchy, Cache Entries, Some Cache Metrics, Decreasing The Miss Penalty, Cache Blocks, Placement, Direct Mapped Cache, N – Way Set Associative Cache, Fully Associative Cache, Associativity Trade – Off, Block Replacement Policy, Memory Management, Process Need Memory, What Does Memory Management Do?, Address Binding, Relocation Register, Memory Partitioning, Buddy Memory Allocation, Paging, Translation Lookaside Buffer, Multilevel Page Table, Segmentation With Paging

Virtual Memory

Memory Hierarchy, Pages>Frames?, Virtual Memory, What Does (Virtual) Memory Management Do, Handling A Page Fault, Fetching And Prefetching Pages, Policies For Replacing Pages, Fifo Replacing, Lru Replacing, Clock – Like Replacing, Dynamic Locality And Working Set, Working Set Model, Virtual Memory And Multiprogramming

File System And I/O

The Extended Data Storage, File System, File Structure, Directory Structure, File, File Attributes, Open File, Allocation Methods, Accessing A File, Disk, Disk Scheduling Or I/O Scheduling, I/O, Direct Control, Interrupt, Interrupt Example For Discovery, Dma, I/O Channels

RTOS And RTX

Real Time Operating Systems, Why Rtos On Embedded Systems?, A Case In Point, Super-Loop, Rtx, Rtx Structure, Rtx Files, Rtl.H, Rtx_Conf_Cm.C, Source Code Of Rtx, Cmsis And Cmsis-

Rtos, Cmsis-Rtos And Rtx, To Setup Rtx

Rtx Task And Simple Time Management

Tasks In Rtx, Task State, Task Creation And Deletion, Advanced Real Time Scheduling, Periodic Task Model, Periodic Scheduling, Earliest Deadline First, Rate Monotonic, System Performance During Transient Overload, Our Assumptions, Prioritized Scheduling, Preemptive Critical Section, Non-Preemptive Critical Section, Priority Inheritance, Deadlock Caused By Priority Inheritance, Priority Celing, Task Priority Scheme In Rtx, Rtx Scheduling Options, Simple Time Management Apls, Other Rtx Control Functions

Sharing Data On Rtx

Inter-Task Communication, Events, And & Or Events, After Event, Interrupt And Event, Mutex Routines, Semaphore, Semaphore Routines, MutexesVs Semaphore, Mailboxes And Messages In Rtx, Creating Mailboxes, Sending Messages, Receiving Messages, Dynamic Memory Allocation, Rtx Dynamic Memory Allocation, A Working Example, Sharing Data Safely, Data Race Bug: Timestamp Data Structure, Atomicity Arm Is A And Shared Memory, Reentrancy And Data Sharing, General Solutions Based On Rtx

Performance Evaluation And Os-Aware Debugging

After You Code, Functional Debugging, Performance Evaluation Time, Finding The Wcet, Examing Object Code, Control Flow Graphs And Call Graphs, Cfg Formation Ruler, Call Graph Details, Static Timing Analysis Procedure, How Long Does An Instruction Take?, Measure A Real System, Example-Measuring Execution Time, Timing Data Analysis, Repeatability, Histogram Showing Distribution Execution Times, Evaluating Responsiveness, Os Aware Debugging, Optimizations

Reference:

1. Embedded and Real-Time Operating Systems by Wang, K.C.
2. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu.
3. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison: https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family-and-comparison

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Dept	Mail ID
1	R. Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
2				

	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Category	L	T	P	Credit
		EC-IE	3	0	0	3

PREAMBLE

This syllabus is intended for the Engineering students and enables them to lean about Artificial Intelligence. This syllabus contains intelligent agent, Knowledge Representation and Machine learning, and application. This is useful to how represent knowledge and in machine learning contain some important prediction method. This syllabus focuses on to know about AI and its concepts, application.

PREREQUISITE – NIL

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 Designs of 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.	Analyze
CO4: To know about extension of condition probability and how to apply in the real time environment.	Evaluate
CO5:To lean about Information Retrieval and Speech Recognition	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction: Artificial Neural Network (ANN)- Deep Neural Network (DNN)- Supervised Learning- Unsupervised Learning- Linear regression- logistic regression- Back-propagation.

Object Detection: Armv8-A processor-object detection with PyArmNN- ARMNN- PyArmNN –OPENCV- packages on Raspberry Pi and Odroid N2- application developers- Arm Mali GPU using the OpenCL drive- Basics of Raspberry Pi and Odroid N2+.

Image Classification: Image Classification with MobilenetV2-Arm NN, and Tensor Flow Lite Delegate pre-built binaries- most popular deep learning problems- 64-bit Arm device- Code deep dive section.

Automatic Speech Recognition: Key Word Spotting (KWS)-Natural Language Processing (NLP)-Beam forming-Noise Suppression-Machine Translation-Speech Synthesis.

Classification and Case study: Intel – AI for cardiology treatment- Machine learning for tumour detection and genome research-Improving agriculture and farming with AI- Using AI for real-time sports analytics-AI for data analysis on traffic safety

TEXT BOOKS:

1. Michael J. Aminoff, et. al., “A min off,, select rodiagnosis in Clinical Neurology”, Sixth Edition, Elsevier Saunders, 2012.
2. Kim E. Baretteet. al., “Ganong„s review of Medical Physiology”, 23rd Edition, McGraw Hill Medical, 2010.

REFERENCES:

1. https://developer.arm.com/solutions/machine-learning-on-arm.
2. https://www.arm.com/glossary/machine-learning-solutions.
3. https://www.arm.com/resources/dummies-guide/embedded-machine-learning
4. Eric R. Kandelet. al., **“**Principles of Neural Science”,McGraw-Hill, New York,2012R. Cooper, et. al, “Techniques in Clinical Neurophysiology: A Practical Manual” , Elsevier, Amsterdam, The Netherlands, 2005.
5. Holodny, Andrei I., et al, “Functional neuro imaging: a clinical approach”, Inform a Health Care,2008.

S.No.	Name of the Faculty	Designation	Department	Mail ID
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	INTELLECTUAL PROPERTY RIGHTS	Category	L	T	P	Credit
		OE -IE	3	0	0	3

PREAMBLE

To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

PRE-REQUISITE–Nil

COURSEOBJECTIVES

1	To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
2	To disseminate knowledge on copyrights and its related rights and registration aspects
3	To disseminate knowledge on trademarks and registration aspects
4	To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
5	To aware about current trends in IPR and Govt. steps in fostering IPR

COURSEOUTCOMES

Onthesuccessful completionofthecourse, studentswill beable to

CO1.The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works.	Understand
CO2.Comprehend the applicable source, scope and limitations of Intellectual Property within the purview of engineering domain.	Apply
CO3. Knowledge and competence related exposure to the various Legal issues pertaining to Intellectual Property Rights with the utility in engineering perspectives.	Analyze
CO4. Enable the students to have a direct experience of venture creation through a facilitated learning environment	Analyze
CO5. It allows students to learn and apply the latest methodology, frameworks and tools that entrepreneurs use to succeed in real life.	Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

Introduction:

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property)

Trade Marks:

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

Industrial Design, Copy Right&Intellectual property and cyberspace:

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

Trademarks:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks – Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

IPR Legislations and Case Studies:

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

Case Studies on – Patents (Basumatirice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXTBOOK

1. Subbaram N.R. “Handbook of Indian Patent Law and Practice “, S. Viswanathan(Printers and Publishers) Pvt. Ltd., 1998.

REFERENCES

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].

COURSEDESIGNERS				
S.No.	**Name of theFaculty**	**Designation**	**Department**	**Mail Id**
1.	Mr. J. Vijay	Asst. Professor Gr. II	ECE	vijay.ece@avit.ac.in
2.	Dr.T.Sheela	Asso.Professor	ECE	sheela@vmkvec.edu.in

	ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE:

A startup is a company initiated by individual creator 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: Nil

COURSE OBJECTIVES:

1. To understand the Startups Management basics and its components.
2. To impart the startups fund management practices
3. To inculcate the various kinds of stocks and employment considerations in startups.
4. To inculcate the importance of intellectual property rights and its procedures.
5. Explore the entrepreneurial mindset and culture that has been developing in companies of all sizes and industries.

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.	Apply
CO3: Analyze the various kinds of stocks and employment opportunities consideration in startups business.	Apply
CO4: Compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.	Apply
CO5: Explore the entrepreneurial mindset and culture that has been developing in companies of all sizes and industries.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

Elements of a successful Start up:

Create Management Team and Board of Directors – Evaluate market and Target Customers – Define your product or service –Write your Business Plan

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 – Headhunters – Equity Ownership – Form of Equity incentive vehicles – 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.

Entrepreneurship:

Entrepreneurship - Introduction to Technology Entrepreneurship and Technology Ventures – Engineers as Entrepreneurs, The Mindset of the Entrepreneurial Leader, Creating and Selling the Entrepreneurial Value Proposition - Essentials of Successful Entrepreneurs – Social environment in entrepreneurial development – Economic environment in entrepreneurial development.

Text Book:

1. James A. Swanson & Michael L. Baird, "Engineering your start-up: A Guie for theHigh-Tech Entrepreneur" 2nd ed, Professional Publications.inc
2. Donald F Kuratko, " Entreprenuership – 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. Palaniappan	Asso. Professor	Management Studies	Palani.sunn@gmail.com
2.	Dr. G. Murugesan	Professor	Management Studies	selvasahana.m@gmail.com

	FINANCE AND ACCOUNTING FOR ENGINEERS	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE:

Engineers are in a position to do Decision Making during every activity in the industry. The activities ranging from Operation to Non-Operation during the routine functions of the organization. Especially, Finance and Accounting also becomes the part of responsibility of every engineer to do data analysis activities. His interpretation through data analysis and reporting in every transaction helps the organization to do decision making to run the organization effectively and efficiently. Finance and Accounting Practices enable the engineers to handle the resources to do cost and Financial decisions with optimum resources for the betterment of the organization.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the concepts and conventions to prepare Income Statement, and Balance Sheet.
2. To apply the various methods to claim depreciation.
3. To practice fundamental investment decision through capital budgeting techniques.
4. To analyse cost-volume profit analysis for decision making and analyse standard costing techniques.
5. To estimate the working capital requirements for day-to-day activities and handling inventories with economic ordering quantities.

COURSE OUTCOMES:

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

CO1: Understand the importance of recording, book keeping and reporting of the business transaction.	Understand
CO2: Identify and Apply suitable method for charging depreciation on fixed assets.	Apply
CO3: Analyse the various methods of capital budgeting techniques for investment decision.	Apply
CO4: Justify the scope of cost-volume-profit analysis, standard costing, and marginal costing techniques for decision making.	Analyse
CO5: Estimation of working capital requirements of the organization.	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	S	M	-	S	-	M	M	L	M	L	M
CO2	L	-	-	L	M	-	L	L	-	-	L	M	L	L	-
CO3	-	M	-	M	L	-	-	L	S	M	-	L	-	L	M
CO4	L	L	-	S	-	-	L	-	-	L	M	L	M	L	M
CO5	L	-	L	S	L	-	-	M	M	L	-	L	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS:

Introduction: Business Environment – Book Keeping and Accounting – Accounting Concepts and Conventions – Double entry system – Preparation of journal, ledger and Trial balance – Final Accounts.

Deprecation: Meaning – Causes - Methods of Calculating Depreciation: Straight Line Method, Diminishing Balance Method and Annuity Method.

Capital Budgeting Decisions: Meaning – Nature & Importance of Investment Decisions – Types - Financial statement analysis and interpretation - Types of Analysis - Objectives - Tools of Analysis - Ratio Analysis: Objectives, Uses and Limitations - Classification of Ratios: Liquidity, Profitability, Financial and Turnover Ratios - Funds Flow Analysis and Cash Flow Analysis: Sources and Uses of Funds, Preparation of Funds Flow statement, Uses and Limitations: Pay Back Period – Accounting Rate of Return – NPV – IRR - Profitability Index.

Marginal Costing: Marginal Cost - Breakeven Analysis - Cost Volume Profit Relationship - Applications of Standard and marginal Costing Techniques.

Working Capital Management: – Types of Working Capital – Operating Cycle – Determinants of Working Capital - Receivables Management – Inventory Management – Need for holding inventories – Objectives – Inventory Management Techniques: EOQ & Reorder point – ABC Analysis - Cash Management – Motives for holding cash.

Text Book

1. Kesavan, C. Elenchezhian, and T. Sunder Selwyan, "Engineering Economics and Financial Accounting", Firewall Media, 2005.
2. Kasi Reddy .M and Saraswathi.S, "Managerial Economics and Financial Accounting", PHI Learning Pvt., Ltd. 2007.

Reference Book

1. Periyasamy .P, "A Textbook of Financial, Cost and Management Accounting", Himalaya Publishing House, 2010.
2. Palanivelu V.R., "Accounting for Managers", Lakshmi Publications, 2005.
1. Mark S Bettner, Susan Haka, Jan Williams, Joseph V Carcello, "Financial and Management Accounting", Mc-Graw-Hill Education, 2017

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	Mail ID
1	M.Manickam	Associate Professor	Management Studies	manickam@vmkec.edu.in
2	Dr. Rajeshkumar	Assistant Professor	Management Studies	Rajesh.mba@avit.ac.in

	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 matchingtechnological 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 andOrganizational 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, OxfordUniversity Press.
3. Michael G. Luchs, Scott Swan, Abbie Griffin (2015), Design Thinking: New Product DevelopmentEssentials from the PDMA, Wiley-Blackwell.
4. John Boardman, Brian Sauser (2013), Systemic Thinking: Building Maps for Worlds of Systems, 1stedition, Wiley.
5. Rich Jolly (2015), Systems Thinking for Business: Capitalize on Structures Hidden in Plain Sight, SystemsSolutions Press

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

	NEW VENTURE PLANNING AND MANAGEMENT	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE

Contemporary methods and best practices for the entrepreneur to plan, launch, and operate a newventure 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 ShopTitan, Ron Chernow, Random House
2. Osterwalder, A. and Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, GameChangers, and Challengers, Hoboken, NJ: John Wiley & Sons

Reference Books:

1. Blackwell, E. (2011). How to Prepare a Business Plan: Create Your Strategy; Forecast Your Finances;Produce That Persuasive Plan. Kogan Page Publishers.
2. Levi, D. (2014). Group Dynamics for Teams. Sage Publications, Inc. Thousand Oaks.
3. Rajeev Roy, „Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. Business Model Generation by Osterwalder and Pigneur.

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

		Category	L	T	P	Credit
	SOCIAL ENTREPRENEURSHIP	**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, EdwardElgar 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 futuredirections.
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, OxfordUniversity Press, 2010.

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

	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).
3. 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

	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.
2. 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

	MUNICIPAL SOLID WASTE MANAGEMENT	Category	L	T	P	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

S.No.	Name of the Faculty	Designation	Department	E-Mail ID
1	Mr.C.Kathirvel	Asso. Professor & Head	Civil / VMKVEC	kathirvel@vmkvec.edu.in
2				

	DISASTER MITIGATION AND MANAGEMENT	Category	L	T	P	Credit
		OE-EA	3	0	0	3

Preamble

This course deals with the various disasters and to expose the students about the measures, its effect against built structures, and Hazard Assessment procedure in India. This course also deals with the methods of mitigating various hazards such that their impact on communities is reduced.

Prerequisite

NIL

Course Outcomes

1	To Understand basic concepts in Disaster Management
2	To Understand Definitions and Terminologies used in Disaster Management
3	To Understand the Challenges posed by Disasters
4	To understand Impacts of Disasters

COURSE OUTCOMES

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

CO1. Understand the various types of disaster viz Hydrological, Coastal and Marine Disasters, Atmospheric Disasters, Geological, Mass Movement and Land Disasters, Wind and Water Driven Disasters.	Understand
CO2. Identify the potential deficiencies of existing buildings for Earthquake disaster and suggest suitable remedial measures.	Understand
CO3.Derive the guide lines for the precautionary measures and rehabilitation measures for Earthquake disaster.	Apply
CO4. Derive the protection measures against floods, cyclone, land slides	Apply
CO5. Understand the effects of disasters on built structures in India	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	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

Course Designers

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 forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

DISASTER MANAGEMENT MECHANISM: Concepts of risk management and crisis management ; Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness; Planning for relief, Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster

DISASTER RESPONSE: Mass media and disaster management; Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and Stress Management; Rumour and Panic Management; Minimum Standards of Relief; Managing Relief; Funding.

DISASTER MANAGEMENT IN INDIA: Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake- holders

TEXT BOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
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. Abarquez I. & Murshed Z. Community Based Disaster Risk Management: Field Practitioner's Handbook, ADPC, Bangkok, 2004.
2. Goudie, A. Geomorphological Techniques, Unwin Hyman, London 1990.
3. Goswami, S. C. Remote Sensing Application in North East India, Purbanchal Prakesh, Guwahati, 1997.
4. Manual on Natural Disaster Management in India, NCDM, New Delhi, 2001.
5. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. National Policy on Disaster Management, NDMA, New Delhi, 2009.
7. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Ms.S.Ispara Xavier	Assistant Professor	Civil / AVIT	isparaxavier.civil@avit.ac.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	-
CO6	S	-	-	-	M	-	L	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.

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
2	Mr. R. Sathish	Assistant Professor	EEE	sathish@vmkvec.edu.in
3	Mr. V.Rattankumar	Assistant Professor	EEE	rattankumar@avit.ac.in

	INDUSTRIAL DRIVES AND AUTOMATION	Category	L	T	P	C
		OE-EA	3	0	0	3

Preamble

To introduce foundation on the principles of drives & automation and their elements with the implementation.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To explore the various AC,DC & Special Machine Drives for industrial Application
2	To study about the various Open loop and closed loop control schemes for drives
3	To know about hardware implementation of the controllers using PLC
4	To study the concepts of Distributed Control System
5	To understand the implementation of SCADA and DCS

COURSE OUTCOMES

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

CO 1	To understand working principles of various types of motors, differences, characteristics and selection criteria.	Understand
CO 2	To apply the knowledge in selection of motors, heating effects and braking concepts in various industrial applications	Apply
CO 3	To explain control methods of special drives	Understand
CO 4	To carry out programming using PLC and use of various PLCs to Automation problems in industries.	Understand
CO 5	To discuss supervisory control and data acquisition method and use the same in complex automation areas	Understand
CO6	To understand and use logical elements and use of Human Machine Interfacing devices to enhance control & communication aspects of Automation	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. 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

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

	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, selection of material and equipment and develop a product using this technique in Industry 4.0 environment.

Prerequisite – NIL

Course Objective

1	To discuss the basic concepts and procedure followed in 3D printing methods
2	To construct a CAD model for a required product
3	To identify the use of different material and support structures
4	To experiment with different 3d printing process
5	To identify the defects.

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

CO1.	Demonstrate the various 3D Printing methods	Understand
CO2.	Develop CAD Models ,Import and Export CAD data and generate .STL file.	Apply
CO3.	Select a specific material for the given application.	Apply
CO4.	Select a 3D printing process for an application.	Apply
CO5.	Able to identify the Product defects after post processing	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

3D PRINTING & CAD FOR ADDITIVE MANUFACTURING (7 Hrs.)
Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications. CAD Data formats, Data translation, Data loss, STL format.
ADDITIVE MANUFACTURING TECHNIQUES (12Hrs.)
Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, HealthCare, Defence, Automotive, Construction, Food Processing, Machine Tools
MATERIALS (8 Hrs.)
Polymers, Metals, Non-Metals, Ceramics. Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. Support Materials
ADDITIVE MANUFACTURING EQUIPMENT (10 Hrs.)
Process Equipment- Design and process parameters, Governing Bonding Mechanism Common faults and troubleshooting, Process Design
POST PROCESSING & PRODUCT QUALITY (8 Hrs.)
Post Processing Requirement and Techniques , Product Quality Inspection and testing , Defects and their causes
Text Books

1	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies:Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2	Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.
Reference Books	
1	CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
2	Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3	J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the**	**Email id**
1	L.Prabhu	Associate Professor	Mech / AVIT	prabhu@avit.ac.in

Alternative NPTEL/SWAYAM Course:

S. No.	**NPTEL Course Name**	**Instructor**	**Host Institute**
1	Rapid Manufacturing	Dr. Amandeep Singh, Prof. J. Ramkumar	IIT Kanpur

		Category	L	T	P	Credit
	INTRODUCTION TO BIOFUELS	**OE-EA**	**3**	**0**	**0**	**3**

PREAMBLE

This course will provide an overview of existing energy utilization, production and infrastructure. We will also cover the consequences of our energy choices on the environment. The topics covered will include the chemistry of biofuels, the biology of important feedstocks, the biochemical, genetic and molecular approaches being developed to advance the next generation of biofuels and the economical and global impacts of biofuel production.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the different types and differences between existing energy resources.
2	To understand the improcurement, utilization and their impacts on society and environment
3	To gain knowledge about the existing different biofuels and the methods of production from different sources
4	To introduce the techonologies involved in the production, characterization of biofuels
5	To impacrt the knowledge and applications of biofuel in various sectors and their beneficial aspects to the society.

COURSE OUTCOMES

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

CO1. Understand the existing and emerging biomass to energy technologies	Remember
CO2. Understand the concept of 1st generation, 2nd generation and advance biofuels	Understand
CO3. Appraise the techno-economic analyses of biofuel conversion technologies	Understand
CO4. To articulate the concept of a biorefinery system and be able to develop major unit operations of an integrated biorefinery	Apply
CO5. Illustrate the environmental implications	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	-	L	-	M	-	S	L	-	-	-	-	S	-	L
CO2	-	S	S	-	M	-	L	-	-	-	-	-	-	S	L
CO3	S	M	-	M	-	M	-	L	L	-	-	-	S	-	L
CO4	-	S	M	-	M	L	L	-	-	-	-	-	-	S	M
CO5	-	-	-	-	-	-	-	S	M	-	-	-	-	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF BIOFUELS

Generation of biofuels − Development of biological conversion technologies − Integration of biofuels into biorefineries − Energy security and supply − Environmental sustainability of biofuels − Economic sustainability of biofuels.

BIODIESEL

Biodiesel − Microorganisms and raw materials used for microbial Oil production − Treatment of the feedstocks prior to production of the Biodiesel − Current technologies of biodiesel production − Purification of biodiesel; Industrial production of biodiesel − Biodiesel production from single cell oil.

BIOETHANOL

Bioethanol – Properties – Feedstocks − Process technology − Pilot plant for ethanol production from lignocellulosic feedstock − Environmental aspects of ethanol as a biofuel.

BIOMETHANE AND BIOHYDROGEN

Biomethanol − Principles, materials and feedstocks − Process technologies and techniques − Advantages and limitations − Biological hydrogen production methods − Fermentative hydrogen production − Hydrogen economy − Advantages and limitations.

OTHER BIOFUELS

Biobutanol production − Principles, materials and feedstocks − Process technologies – Biopropanol – Bioglycerol − Production of bio-oils via catalytic pyrolysis − Life-Cycle environmental impacts of biofuels and Co-products.

TEXT BOOKS:

1. Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing Limited 2011 2. Gupta, V, K. and Tuohy, M, G. Biofuel Technologies, Springer, 2013 3. Moheimani, N. R., Boer, M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015

REFERENCES:

1.Eckert, C, A. and Trinh, C, T. Biotechnology for Biofuel Production and Optimization, Elsevier, 2016 2. Bernardes, M, A, D, S. Biofuel production – recent developments and prospects, InTech,2011

COURSE DESIGNERS

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

	FOOD AND NUTRITION TECHNOLOGY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The course aims to enable the students to understand the physicochemical, nutritional, microbiological and sensory aspects, To familiarize the students about the processing and preservation techniques. To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	Understand the tradition food processing techniques and the basics concept of food biochemistry
2	Demonstrate the product development technique, quality and contaminant check
3	To articulate their technical knowledge for industrial purpose
4	Describe national food laws and standards
5	Laws and qualities of standard for food products

COURSE OUTCOMES

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

CO1: Recall the processing techniques practiced in olden days and the biological process	Remember
CO2. Illustrate the methods for animal product development, quality control and also screen the contaminant	Understand
CO3.Transfer the techniques in scaling up for industrial needs	Apply
CO4. Interpret and Troubleshoot instruments to maintain accuracy	Apply
CO5. Develop standards for food additives	Apply

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FOOD BIOTECHNOLOGY

Introduction, History and scope of food Biotechnology, development and prospects of biotechnology in animal products, ancient and traditional food processing techniques; Biochemical and metabolic pathways of biological systems used in food production.

METHODS IN FOOD BIOTECHNOLOGY: Role of biotechnology in productivity of livestock, Modern biotechnological methods and processes in animal product development, chemical and physical factors required for growing microbial cultures in nutritive substrate; Meat species identification, Quality control, Screening products for contaminants

BIOTECHNOLOGY METHODS IN FOOD PROCESSING:

Use of biotechnology in the production of food additives, use of biotechnological tools for the processing and preservation and foods of animal origin, use of biotechnology improved enzymes in food processing industry, Basic principles of the industrial use of bio-reactions for production of biomass-upstream and downstream processing application of microorganisms as starter cultures in meat industry, microbial production of food ingredients; Biosensors and novel tools and their application in food science.

HURDLE TECHNOLOGY:

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology

FOOD SAFETY & SECURITY:

Consumer concerns about risks and values, biotechnology & food safety, Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; Future and applications of food biotechnology in India.

TEXT BOOKS:

1. Potter, Norman. M. Food Science, 5th Ed. Springer US

2. Manay, S.; Shadakshara Swamy, M., (2004). Foods: Facts and Principles, 4 th Ed. New Age Publishers.

3. B. Srilakshmi., (2002) Food Science, New Age Publishers.

REFERENCES:

1. Meyer, (2004). Food Chemistry. New Age

2. Deman JM. (1990) Principles of Food Chemistry. 2 nd Ed. Van Nostrand Reinhold, NY

3. Ramaswamy H and Marcott M. Food Processing Principles and Applications. CRC Press

COURSE DESIGNERS

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

		Category	L	T	P	Credit
	INTRODUCTION TO INTERNET OF THINGS	**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**	**PSO**
CO1	S	S	M	M	L	S	S	M	S	L	S	-	**S**	M	S
CO2												M	M	M	S
CO3	M	S	M	M	M	S	S	M	S	M	M	-	M	-	S
CO4												M	M	S	M
CO5	S	S	S	S	M	S	S	S	S	M	S	S	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I –INTRODUCTION to IoT

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

.

UNIT II- IoT & M2M

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

UNIT III – Network & Communication aspects

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

UNIT IV – Domain specific applications of IoT

Design challenges, Development challenges, Security challenges, Other challenges

UNIT V – Reflection, Low-Level Programming

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

TEXT BOOKS

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

REFERENCES

1. Macro Schewartz, "Internet of Things with the Arduino Yun" Packet Publishing, 2014.

COURSE DESIGNERS

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

		Category	L	T	P	Credit
	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	**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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	PSO2	PSO3
CO1	M	M	M	M	M	-	-	-	-	-	-	M	S	M	-
CO2	M	M	L	M	L	-	-	-	-	-	M	M	S	M	M
CO3	M		S	M	M	-	-	-	-	-	-	M	S	-	M
CO4	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	M	M	M	M	-	-	-	-	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

INTRODUCTION
What is AI? – AI Problems – What is an AI technique – Defining the problem as a state space search – Production system - Production system – Characteristics – Problem Characteristics?
HEURISTIC SEARCH TECHNIQUES
Generate and test – Hill Climbing – Best first Search – Problem Reduction – Constraints satisfaction – Means end analysis.
KNOWLEDGE REPRESENTATION
Propositional Logic-First Order Predicate Logic-Prolog Programming-Unification-Forward Chaining- Backward Chaining-Ontological Engineering-Categories and Objects-Events-Mental Events and Mental Objects.
REPRESENTING KNOWLEDGE USING RULES
Procedural versus – Declarative Knowledge – logic Programming – Forward versus Backward Reasoning – Matching
GAME PLAYING
The Minimax search procedure – Adding Alpha Beta cut offs – Addition Refinements – Waiting for Quiescence – Secondary Searches – Using Book moves.
TEXT BOOKS
1. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2015 Bratko, I., Prolog Programming For Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th Edition, 2011..
REFERENCES
1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: A Logical Approach", Oxford University Press, 2004. 2. G. Luger, "Artificial Intelligence: Structures and Strategies For Complex Problem Solving", Fourth Edition, Pearson Education, 2002. 3. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publishers, 1998.

COURSE DESIGNERS

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2	Dr.M.Jayachandran	Professor	CSE	jayachandran@avit.ac.in

	CYBER SECURITY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

To understand the need for Cyber Security in real time and to study techniques involved in it.

PREREQUISITE : NIL

COURSE OBJECTIVES

1.	To understand the fundamentals of Cyber Security and issues
2.	To study various cyber crimes and legal remedies
3.	To apply various privacy and security
4.	To study E-Commerce and digital payments
5.	To study the basic security aspects related to Computer and Mobiles

COURSE OUTCOMES

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

CO1: Able to understand the concept of Cyber security and issues and challenges associated with it.	Understand
CO2: Able to understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures	Apply
CO3: Able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.	Apply
CO4: Able to understand the basic concepts related to E-Commerce and digital payments.	Apply
CO5: Able to understand the basic security aspects related to Computer and Mobiles.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CYBER SECURITY **9 hours**
Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.
CYBER CRIME AND CYBER LAW **9 hours**
Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.
SOCIAL MEDIA OVERVIEW AND SECURITY **9 hours**
Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.
E - C O M M E R C E AND DIGITAL PAYMENTS **9 hours**
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007.
DIGITAL DEVICES S E C U R I T Y , TOOLS AND TECHNOLOGIES FOR CYBER SECURITY 9 hours
End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.
REFERENCES
1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010. 2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011) 3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001) 4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd. 5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers. 6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd. 7. Fundamentals of Network Security by E. Maiwald, McGraw Hill

COURSE DESIGNERS

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

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2	Mr. B. Sundharamurthy	Assistant Professor	CSE	sundharamurthy@vmkvec.edu.in

	BIOMOLECULES- STRUCTURE AND FUNCTION	Category	L	T	P	Credit
		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-mosaic model. 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

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

PREAMBLE

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

PREREQUISITE - 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	Remember
CO2. Describe the role of single nucleotide polymorphism as a biomarker for the	Understand
CO3. Utilize and manage the new genomics based tools as they become available as	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 Society of 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

	PROJECT WORK	Category	L	T	P	Credit
		PI-P	**0**	**0**	**16**	**8**

PREAMBLE

The project provides learners with the opportunity to explore a problem or issue of particular personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member. The project demonstrates the learner's ability to synthesize and apply the knowledge and skills acquired in his/her academic program to real-world issues and problems. This final project affirms learners' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To provide learners with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem or issue.
2	To allow learners to extend their academic experience into areas of personal interest, working with new ideas, issues, organizations, and individuals.
3	To encourage learners to think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve these issues.
4	To provide learners with the opportunity to refine research skills and demonstrate their proficiency in written & oral communication skills.
5	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.

COURSE OUTCOMES

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

CO1. Apply the knowledge and skills acquired in their courses to a specific problem or issue.	Apply
CO2. Extend their academic experience into areas of personal interest, working with new ideas, issues,organizations, and individuals.	Analyze
CO3. Think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve theseissues.	Analyze
CO4. Refine research skills and demonstrate their proficiency in written & oral communication skills	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	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO2	S	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO3	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO4	S	M	M	M	M	M	M	M	M	M	M	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. The project is a major component of our engineering curriculum: it is the culmination of the program of study enabling the learners to showcase the knowledge and the skills they have acquired during the previous four years, design a product/service of significance, and solve an open-ended problem in engineering.
2. Each student must register to the project course related to his or her program
3. Project course consists of one semester and would be allowed to register only during the final year of study.
4. Project may be initiated during the pre-final semester but will be assessed and credits transferred only during the last semester of study, upon completion of all other degree requirements. Generally the undergraduate project is a team based one.
5. Each team in the major course will consist of maximum of 5 learners.
6. Each project will be assigned a faculty, who will act as the supervisor.
7. The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability.
8. Each group must document and implement a management structure. Group leadership roles must be clearly identified including who has responsibility for monitoring project deliverables and group coordination.
9. A group project may be interdisciplinary, with learners enrolled in different engineering degrees, or in Engineering plus other faculties such as Management, Medical and Health Sciences, Science and Humanities.
10. Each student team is expected to maintain a log book that would normally be used to serve as a record of the way in which the project progressed during the course of the session.
11. Salient points discussed at meetings with the supervisor (i.e., suggestions for further meetings, changes to experimental procedures) should be recorded by the student in order to provide a basis for subsequent work.
12. The logbook may be formally assessed;
13. The contribution of each individual team member will be clearly identified and the weightage of this component will be explicitly considered while assessing the work done.
14. A project report is to be submitted on the topic which will be evaluated during the final review.
15. Assessment components will be as spelt out in the regulations.
16. The department will announce a marking scheme for awarding marks for the different sections of the report.
17. The project report must possess substantial technical depth and require the learners to exercise analytical, evaluation and design skills at the appropriate level.

COURSE DESIGNERS

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2	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in

	MINI PROJECT	Category	L	T	P	Credit
		PI-M	**0**	**0**	**6**	**3**

PREAMBLE

To obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To conceptualize a novel idea / technique into a product
2	Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component
3	To understand the management techniques of implementing a project
4	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work

COURSE OUTCOMES

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

CO1. Apply the knowledge and skills acquired in their courses to a specific problem or issue.	Apply
CO2. Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component	Apply
CO3. Take the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

- Minor design project identification, the objective and methodology and expected outcome of the proposed work.
- Presentation of the proposed work design, implementation and partial result
- Presentation of complete project work with results and discussion Demonstration of project work
- Minor Project Report

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Muthumanickam	Professor & Head	ECE	muthumanickam@vmkvec.edu.in
2	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in

Course Code	Course Title	category	L	T	P	C
	INDIAN CONSTITUTION	**AC**		**0**	**2**	**0**

Course Objectives:

On completion of this course, the students will be able:

1 To understand the nature and the Philosophy of the Constitution.

2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.

3 To Analyse Panchayat Raj institutions as a tool of decentralization.

4 To Understand and analyse the three wings of the state in the contemporary scenario.

5 To Analyse Role of Adjudicatory Process.

5 To Understand and Evaluate the recent trends in the Indian Judiciary.

Course Content

UNIT I

The Constitution - Introduction

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

UNIT II –Government of the Union

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

UNIT III –Government of the States

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

UNIT IV – Local Government

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

UNIT V – Elections

Powers of Legislature -Role of Chief Election Commissioner-State Election Commission

TEXTBOOKS AND REFERENCE BOOKS:

1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition
Suggested.

Total Hours: 30 hours

Software/Learning Websites:

1. https://www.constitution.org/cons/india/const.html

2. http://www.legislative.gov.in/constitution-of-india

3. https://www.sci.gov.in/constitution

4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of india/ **Alternative NPTEL/SWAYAM Course:**

S.NO	NPTEL ID	NPTEL Course Title	Course Instructor
1	12910600	CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS	PROF. M. K. RAMESH NATIONAL LAW SCHOOL OF INDIA UNIVERSITY

COURSE DESIGNER				
S.NO	**NAME OF THE FACULTY**	**DESIGNATION**	**NAME OF THE INSTITUTION**	**MAIL ID**
1	Dr.Sudheer	Principal	AV School of Law	Sudheersurya18@gmail.com

	ADVANCED PROCESSORS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

Microcontroller is used as the main controller in most of the embedded systems nowadays. Due to the development in VLSI technology, microcontrollers evolve which function similar to microprocessors but they have most of the peripherals built on-chip. This course makes the students to be familiar with the architecture and programming of Microcontrollers. This course also introduces the advanced processors and hardware features and ARM 32 bit, MSP430 processors.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To teach the fundamentals on design attributes of functional units of embedded systems.
2	To Understand advanced architectures.
3	To Understand the advanced features like memory management unit, exception handling
4	To Build real time DSP system using ARM/DSP processors
5	To develop an integrated development environment in embedded system

COURSE OUTCOMES

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

C01.Develop efficient C codes and assembly codes for ARM architecture	Understand
C02.Differentiate Floating point and fixed-point DSP processors	Apply
C03.Solve real life problem using ARM and DSP processors	Analyze
C04.Explain the usage memory management unit for virtual memory concept, an ability to apply knowledge of mathematics, science, and engineering	Analyze
C05.An ability to identify, formulate, and solve engineering problems, an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	-	-	-	-	M	-	-	-
CO2	L	S	S	-	M	-	-	-	-	-	-	M	-	-	-
CO3	S	M	M	-	L	M	-	-	-	-	-	M	-	-	-
CO4	S	L	L	-	L	S	-	-	-	-	-	M	-	-	-
CO5	M	M	S	-	M	L	-	-	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

Embedded electronic systems and microcontrollers

Introduction to Embedded System, and microcontrollers, Anatomy of a typical small microcontroller, Memory, Software, where does the MSP430 fit

Texas MSP430

Architecture of the MSP430, Memory, Addressing modes, Constant generator and emulated instructions, Instruction set, Reflections on the CPU instruction set, Reset, Clock system, Exceptions: Interrupts and resets

Arm -32 Bit Microcontroller Family

Architecture of ARM Cortex M3 –General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register,. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3. Exceptions Programming. Advanced Programming Features. Memory Protection. Debug Architecture.

A simple tour of the MSP430

First program on a conventional desktop computer, Light LEDs in C, Light LEDs in assembly language, Read input from a switch, Automatic control: flashing light by software delay, Automatic123control: Use of subroutines, Automatic control: Flashing light by polling Timer A, Header files and issues that have been brushed under the carpet.

Embedded System Development Environment

The Integrated Development Environment (IDE), Types of Files Generated on Cross compilation, Disassembler/ELDompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Text Books

1. Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2009
2. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, Newnes, (Elsevier), 2008.
3. James K Peckol, “Embedded Systems – A contemporary Design Tool”, John Weily, 2008.
4. C.P. Ravi Kumar,MSP430, Micro controller in Embedded system Projects, TI, Nov. 2012
5. Steve Furber, “ARM System-on-Chip Architecture”, 2nd Edition, Addison Wesley, 2000.
6. David Seal, “ARM Architecture Reference Manual”, 2nd Edition, Addison Wesley, 2007

Reference Books

1. Alex Van Someran and Carol Attack, “The ARM RISC Chip: A Programmer’s Guide”, Addison Wesley, 1993.
2. Trevor Martin, The insider’s guide to Philips ARM1-basedmicrocontroller.www.hitex.co.uk/arm
3. Sen. M. Kuo, Woon-Seng Gan, Digital signal processors architectures, Implementation and applications Pearson education, 2005
4. John Davies, Newnes, MSP430 Microcontroller Basics, 2008
5. Chris Nagy, Embedded system design using the TI MSP430 series, Elsevier Publications, Sept 2003

COURSE DESIGNERS				
S.No	**Name of Faculty**	**Designation**	**Department**	**Mail ID**
1.	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
2.	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	EMBEDDED CONTROL SYSTEMS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

To introduce the basic concepts of control systems and its embedded implementation.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To learn the basics of control systems.
2	To learn control theory as used in embedded systems.
3	To learn application of control systems.
4	To learn I/O devices used in control systems.

COURSE OUTCOMES

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

CO1.Understand the basic mathematical model for the function	Understand
CO2.Implement the basic control algorithms for embedded system.	Analyze
CO3.Understand and develop new testing procedures for embedded systems.	Create
CO4.Remember and use the various input devices appropriate embedded system.	Remember and Evaluate
CO5.Understand the output device requirement of embedded systems.	Evaluate
CO6.Analyze the required components for the embedded systems	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	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	S	S	-	-	-	-	-	-	-	-	-	-	-	-
CO4	S	S	S	M	M	-	-	-	-	-	-	L	-	-	-
CO5	S	S	M	-	L	-	-	-	-	-	-	L	-	-	-
CO6	S	S	S	S	L	-	-	M	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

Syllabus

CONTROL SYSTEM BASICS

Z-transforms – performance requirements - block diagrams - analysis and design - sampling theory – difference equations.

CONTROL SYSTEM IMPLEMENTATION

Discretization method – Fixed point mathematics – Nonlinear controller elements – Gain scheduling – Controller implementation and testing in Embedded Systems. - A case study of robotic control system.

CONTROL SYSTEM TESTING

Software implications - Controller implementation and testing in embedded systems - Measuring frequency response.

INPUT DEVICES

Keyboard basics - Keyboard scanning algorithm - Character LCD modules - LCD module display Configuration - Time-of-day clock - Timer manager - Interrupts - Interrupt service routines - Interrupt-driven pulse width modulation. Triangle waves analog vs. digital values - Auto port detect - Capturing analog information in the timer interrupt service routine - Automatic, multiple channel analog to digital data acquisition..

OUTPUT DEVICES AND SENSORS

H Bridge – relay drives - DC/ Stepper Motor control – optical devices. Linear and angular displacement sensors: resistance sensor – induction displacement sensor – digital optical displacement sensor – pneumatic sensors. Speed and flow rate sensors : electromagnetic sensors – fluid flow sensor – thermal flow sensor. Force sensors: piezoelectric sensors – strain gauge sensor – magnetic flux sensor – inductive pressure sensor – capacitive pressure sensor. Temperature sensors: electrical – thermal expansion – optical Case Study- Examples for sensor, actuator, control circuits with applications..

Text Books:

1.Jim Ledin, "Embedded control systems in C/C++", CMP Books, 2004.
2.TimWiscott, "Applied control for embedded systems", Elsevier Publications, 2006.

Reference Books:

1.Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme, 2011.
2.Ball S.R., "Embedded microprocessor Systems - Real World Design", Prentice Hall, 2002.
3.Lewin A.R.W. Edwards, "Open source robotics and process control cookbook", Elsevier Publications, 2005.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. R. Karthikeyan	Assistant Professor	ECE	rrmdkarthikeyan@avit.ac.in
2	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in

	EMBEDDED SYSTEMS ARCHITECTURE	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

To understand the components that make up an embedded system's architecture and to reap the benefits of architectural modeling in embedded design

PREREQUISITE:

Nil

COURSE OBJECTIVES

1	To introduce students to the embedded systems, its hardware and software.
2	To introduce devices and buses used for embedded networking.
3	To explain programming concepts and embedded programming in C and C++
4	To introduce the software development tools in embedded systems.
5	To introduce the concepts of Real Time Operating System

COURSE OUTCOMES

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

CO1. Introduce the concepts of embedded system design and design process	Understand
CO2.Suggest the networking of different devices and communication between two nodes	Apply
CO3. Illustrate the Programming concepts and embedded programming	Apply
CO4. Explain the Real time operating system concepts and basic design	Apply
CO5. Interpret software development tools for embedded system	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

Syllabus:

Introduction to Embedded System Architecture
Embedded Systems – Processor embedded into a system – Embedded hardware units and devices in a system – Embedded Software in a system – Embedded System on Chip – Design process in embedded system – Introduction to embedded system architecture – Embedded Systems model – Standards and Networking

Embedded Hardware
Embedded Board and the von Neumann Model - Powering the Hardware - Basic Hardware Materials - Common Passive Components on Boards and in Chips - Semiconductors and the Active Building Blocks of Processors and Memory

Embedded Processors
ISA Architecture Models - Internal Processor Design - Processor Performance - Reading a Processor's Datasheet – Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and Performance

Board I/O, Buses and Device Drivers
Managing Data: Serial versus Parallel I/O, Interfacing the I/O Components, I/O and Performance, Board Buses - Bus Arbitration and Timing, Integrating the Bus with Other Board Components, Bus Performance Device Drivers for Interrupt handling – Memory Device Drivers – On board device drivers

Device Drivers and Embedded Operating Systems
Embedded Operating Systems – Process – Multi tasking and Process Management – Memory Management – I/O and File System Management – OS Performance Guidelines – Middleware and Application Software Implementation and Testing : Implementing the Design, Quality Assurance and Testing of the Design

Textbooks:

1) "Embedded Systems Architecture – A comprehensive Guide for Engineers and Programmers", 2nd Edition, Tammy Noergaard, Elsevier, 2012,
2) "Embedded Systems- Architecture, Programming and Design", 2nd Edition, Rajkamal, Tata McGrawhill, 2008,

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in
2	Mr.S.Kannan	Assistant Professor	ECE	kannan@vmkvec.edu.in

	REAL TIME OPERATING SYSTEMS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The use of real time operating systems has become a necessity to build complex embedded systems, this subject is provided. To make the student learn fundamentals of Operating Systems, implementation aspects of real time Concepts and few applications on RTOS.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand the basics of an operating system
2	To understand the concept of real time operating systems and applications
3	To understand real time models and applications

COURSE OUTCOMES

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

CO1 Understand the basic of operating systems, design and implementation of an operating system	Understand
CO2 Understand the concept of Real Time Operating Systems	Understand,
CO3 Understand the components of an real time models and languages	Apply
CO4 Understand and analyze the design issues with case studies	Analyze
CO5 Understand different RTOS application domains and case studies	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

Syllabus:

REVIEWOFOPERATINGSYSTEMS

Basic Principles- Operating System structures–System Calls–Files–Processes– Design and Implementation of processes–Communication between processes–Introduction to Distributed operating system–Distributed scheduling.

OVERVIEWOFRTOS

RTOS Task and Task state-Process Synchronization-Message queues–Mail boxes-pipes–Critical section–Semaphores– Classical synchronization problem– Deadlocks

REALTIMEMODELSANDLANGUAGES

Event Based–Process Based and Graph based Models–Real Time Languages–RTOS Tasks–RT scheduling-Interrupt processing– Synchronization– Control Blocks–Memory Requirements.

REALTIMEKERNEL

Principles–Design issues–Polled Loop Systems–RTOS Porting to a Target–Comparison and study of various RTOS like QNX– VX works–PSOS– C Executive– Case studies.

RTOSAPPLICATIONDOMAINS

RTOS for Image Processing–Embedded RTOS for voice over IP–RTOS for fault Tolerant Applications–RTOS for Control systems

Text Book

1.Raj Kamal,"Embedded Systems-Architecture, Programming and Design"TataMcGrawHill,2006.

2. Herma K.," Real Time Systems–Design for distributed Embedded Applications",Kluwer Academic,1997.

3 Charles Crowley," Operating Systems-A Design Oriented approach" Mc Graw Hill 1997.

Reference Books

1 C.M.Krishna ,Kang, G.Shin," Real Time Systems",Mc Graw Hill,1997.

2. Raymond J.A. Bhur, Donald L. Bailey," An Introduction to RealTimeSystems",PHI1999.

3.Mukesh Sighal and NGShi" Advanced Concept sin Operating System", Mc Graw Hill2000.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. MohanaPriya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in
2	Mr.G.Ramachandran	Assistant Professor	ECE	ramachandrang@vmkvec.edu.in

	ADVANCED SYSTEM ON CHIP DESIGN	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE
This course includes details for designing and developing an image processing demo application.

PREREQUISITE: Basics of Programming

COURSE OBJECTIVES

1	To create high level functional specifications to design
2	To implement and test on real hardware using standard hardware description and software programming languages
3	To design and develop image processing demo application

COURSE OUTCOMES

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

CO1 –Understand the design of Arm Cortex-A based SoCs in a standard hardware description language	Understand
CO2 –Use and choose between different techniques for digital system design and capture	Apply
CO3 – Evaluate implementation results (e.g. speed, area, power) and correlate them with the corresponding high level design and capture	Analyze
CO4 - Use commercial tools to develop Arm Cortex-A based SoCs	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Programmable SoCs, ARM Processor
SoC Design, Moore's Law, Scaling, Design Productivity Gap, Bridging the Design Productivity Gap, Example Arm-based SoC, SoC v Microcontroller v Processor, SoC Design Flow, SoC Example: NVIDIA Tegra 2, SoC Example: Apple SoC Families,

Arm Processors,Arm Processor Families, Arm Processors vs Arm Architectures, Arm and Thumb Instruction Sets, AAPCS, Processor modes, Vector table ,Memory model, Memory types example Cached Arm Macrobell, Data Alignment, Endianness, Coprocessors, PMU, Trust Zone, Virtualization, Arm Cortex-A Series Processors, Arm Cortex-A9 Processor, Cortex-A9 MP Core, NEON, NEON Registers.

Arm DS-5 Arm 7

Arm DS-5 Development Studio Overview, ARM DS-5 Code, ARM DS-5 Build, ARM DS-5 Debug, Debug Hardware, Virtual Debug Interface – VSTREAM, ARM DS-5 Analyser – Streamline, ARM DS-5 Analyser – Energy Probe, ARM DS-5 Simulation, ARM DS-5 Device Configuration Database

ARM assembler file syntax, Single/ Double register data transfer, Addressing Memory, Pre- and Post -Indexed Addressing, Multiple Register Data Transfer, Data Processing Instructions, Shift/Rotate Operations, Instructions for loading constants, Multiply/Divide, Bit Manipulation Instructions, Byte Reversal, Flow control, Branch instructions, Interworking, Compare and Branch if zero, Conditional Instructions, If Then, Coprocessor instructions, PSR access, DSP instructions overview, Saturated Maths and CLZ, Saturation, SIMD

ARM Cortex-A9 Processor

Cortex- A9, Cortex-A9 MPCore, Cortex-A9 MPE Configuration, Cortex-A9 Media Processing Engine, Register Renaming, Virtual Flags Registers, Small Loop Mode, Program Flow Prediction, Performance Monitoring Unit (PMU), Cortex A9 supports ARMv7-A Architecture, caches, Data Cache, Memory Management Unit, ARM v7 Architecture Effects

AMBA AXI4 Bus Architecture

What is a Bus, Bus Types, Bus Terminology, Bus Operation, Communication Architecture Standards, ARM AMBA System Bus, AMBA 3 AXI Interface, AMBA 4 Specifications, AXI Components and Topology, Transcation Channels, Basic Signals, Clock and Reset, Channel Timing Example, Relationship Between the Channels

AXI4-Lite GPIO Peripheral and DDR Memory Controller

AMBA AX14-Lite, AXI Low Power Interface, GPIO Overview, AX14-Lite GPIO, Computer Memory, Memory Accessing, Volatile vs Non Volatile Memory, Types of Memory, Static RAM, Dynamic RAM, Non -Volatile Memory, Memory Controller, The Roles of a Memory Controller, Single Discription example Timing

AXI UART and AXI4-Stream Peripherals

Serial Communication, Serial Communication vs Parallel Communication, Types of Serial Communication, UART Overview, UART Protocol, Character- Encoding Scheme, ASCII Encoded Characters, AXI UART Implementation, UART Control, UART Register Block, First In First Out(FIFO), UART FIFOs, Stream Data Transmission, AX-14 Stream Protocol, Data Streams, Global Signals, Master Signals, Slave Signals, Clock and Reset, Handshake, Packet Boundaries

AXI4-Stream with VGA Output Peripheral

VGA Overview, How VGA Signals Work?, VGA Timing, VGA Interface, Utilization of FIFO, Hardware Implementation

AXI4-Stream with HDMI Input Peripheral

HDMI Overview, HDMI Interface, HDMI Signals: TMDS Channels, TMDS Timing, Data Display Channels, Consumer Electronics Control, Hot Plug Detect, AX14- Stream HDMI Input Peripheral, TMDS Deserialization and Decoding in Xilinx FPGA, Utilization of FIFO, TVALID / TUSER / TLAST Logic

Final Application: Image Processing

Edge Detection, Image Scaling, Gray Scale, Intensity Gradient Magnitude, Software Programming: Edge Detection Algorithm

Reference Books:

1. ARM System-on-Chip Architecture by Steve B. Furber

2. ARM Assembly Language: Fundamentals and Techniques by William Hohl
3. Cortex-A Series Programmer's Guide for ARMv7-A by Arm http://infocenter.arm.com/help/topic/com.arm.doc.den0013d/index.html
4. The Zynq Book Tutorials for Zybo and ZedBoard by Louise H Crockett (Author), Ross A Elliot (Author), Martin A Enderwitz.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Dept	Mail ID
1	R. Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
2				

	SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEM	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The subject introduces the students to the modern technologies used in developing embedded software for better software quality. The introduction is both theoretical and practical. The subject shows why modern embedded software systems are complex, it lists the consequences of complexity, and details how we handle complexity in this context, and how we define and increase software quality. The subject then iterates through the modern solutions available to keep control over the software development process, and how we can increase software quality.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To learn the concepts of software architecture, analysis, design & maintenance.
2	To study the Data representation.
3	To study the mixing C and assembly
4	To study the input and output programming
5	To study the memory management

COURSE OUTCOMES

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

CO1. Explain the concept of software architecture, analysis, design & maintenance.	Understand
CO2. Explain the different Data representation.	Understand
CO3. Design and implement the mixing C and assembly language programming	Analyze
CO4. Explain the concept of input and output programming	Understand
CO5. Explain the memory management	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	S	-	M	-	-	-	-	-	-	M	-	-	-
CO2	L	L	M	-	M	-	-	-	-	-	-	M	-	-	-
CO3	L	M	S	-	L	M	-	-	-	-	-	M	-	-	-
CO4	M	M	L	-	L	S	-	-	-	-	-	M	-	-	-
CO5	M	M	S	-	M	L	-	-	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

Software Technology:

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

Introduction To Data Representation:
Data representation, Two's complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in - Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

Mixing C and Assembly:
C and assembly, Programming in assembly ,Register Usage Conventions ,Typical use of Addressing Options, Instruction Sequencing , Procedure Call and Return , Parameter passing ,Retrieving Parameters , Everything in pass by value ,Temporary variables

Input/Output Programming:
I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

Memory Management:
Direct Memory Access, Local and Global Scope, Automatic and Static Allocation, Distinguishing Static from Automatic Object Creation, Initialization and Destruction, Dynamic Allocation

Text Books:

1. Daniel W.Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education.
2. Hassan Gomma, "Designing concurrent, distributed, and real time applications with UML", Pearson Education, 2000

Reference Books:

1. C.M. Krishna, Kang G. Shin, "Real Time Systems", McGraw - Hill International Editions, 1997
2. By Albert M. K. Cheng , "Real-time systems: scheduling, analysis, and verification" wiley

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
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	EFFICIENT EMBEDDED SYSTEMS DESIGN AND PROGRAMMING	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The course aims to produce students who are capable of designing and programming Arm-based embedded systems and implementing them in low-level hardware using standard C and assembly language

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To enable the students to understand embedded-system programming.
2	To apply that knowledge to design and develop embedded solutions.
3	To Program ARM microcontroller to perform various tasks.

COURSE OUTCOMES

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

CO1 – Understand Arm-based microcontrollers as modern embedded computing platforms	Understand
CO2 –Choose between different programing techniques for embedded system design	Apply
CO3 – Evaluate implementation results (e.g. speed, cost, power) and correlate them with the corresponding programing technique	Analyze
CO4 –Use commercial tools to develop Arm-based embedded systems	Analyze
CO5 –Build an Arm-based embedded system and program to satisfy given user specifications	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO EMBEDDED SYSTEMS DESIGN

Introduction, Options for Building Embedded Systems, Example Embedded System: Bike Computer, Gasoline Automobile Engine Control Unit, Benefits of Embedded Computer Systems, Embedded System Functions, Attributes of Embedded Systems, Example Analog Sensor - Depth Gauge, Microcontroller vs. Microprocessor, Attributes of Embedded Systems, MCU Hardware & Software for Concurrency, Concurrent Hardware & Software Operation, Attributes of Embedded Systems,

Constraints, Impact of Constraints, Curriculum Overview, Target Board - FRDM-KL25Z

SOFTWARE DESIGN BASICS: CONCURRENCY, SOFTWARE ENGINEERING AND CMSIS APIS

MCU Hardware & Software for Concurrency, Concurrent Hardware & Software Operation, CPU Scheduling, Definitions, Scheduling Approaches, Event-Triggered Scheduling using Interrupts, Bike Computer Functions, A More Complex Application, Application Software Tasks, How do we schedule these tasks?, Static Schedule (Cyclic Executive), Static Schedule Example, Dynamic Scheduling, Dynamic RTC Schedule, Task State and Scheduling Rules, Dynamic Preemptive Schedule, Comparison of Response Times

Common Schedulers – (Cyclic executive - non-preemptive and static, Run-To-Completion Scheduler, Preemptive Scheduler)

Task State and Scheduling Rules, What's an RTOS?, Comparison of Timing Dependence, Comparison of RAM Requirements

Software Engineering FOR Embedded Systems - Good Enough Software, Soon Enough, What happens when the plan meets reality?, Risk Reduction, Software Lifecycle Concepts, Product Development Lifecycle, Requirements, Design Before Coding, Development Models, Waterfall (Idealized), Waterfall (As Implemented), Agile Development: SCRUM, V Model Overview, Example Postmortem Structure

CORTEX-M0+ PROCESSOR CORE

Microcontroller vs. Microprocessor, Cortex-M0+ Core, Architectures and Memory Speed, ARM Processor Core Registers, ARM Processor Core Registers (32 bits each), Operating Modes, Memory Maps For Cortex M0+ and MCU, Endianness, ARMv6-M Endianness, ARM, Thumb and Thumb-2 Instructions, Instruction Set, Assembler Instruction Format, Instruction Set Summary, Load/Store Register, Modes for Addressing Memory, Loading/Storing Smaller Data Sizes, In-Register Size Extension, Load/Store Multiple, Load Literal Value into Register, Move (Pseudo-)Instructions, Stack Operations, Add Instructions, Add Instructions with Stack Pointer, Address to Register Pseudo-Instruction, Subtract, Multiply, Logical Operations, Compare, Shift and Rotate, Reversing Bytes, Changing Program Flow – Branches, Condition Codes, Changing Program Flow – Subroutines, Special Register Instructions, Other

C CODE AS IMPLEMENTED IN ASSEMBLY LANGUAGE

Programmer's World: The Land of Chocolate!, Processor's World, Program Translation Stages, Examining Assembly Code before Debugger, Examining Disassembled Program in Debugger, A Warning About Code Optimizations, Application Binary Interface

Using Registers - AAPCS Register Use Conventions, AAPCS Core Register Use

Memory requirements - Program Memory Use, Activation Record, Type and Class Qualifiers, Linker Map File, C Run-Time Start-Up Module

Accessing data in Memory - Accessing Data, Static Variables, Automatic Variables Stored on Stack, Automatic Variables, Addressing Automatic Variables, Automatic Variables

Using Pointers - Using Pointers to Automatics, Using Pointers to Statics

Array Access - Array Access, Accessing 1-D Array Elements, Accessing 2-D Array Elements, Code to

Access 2-D Array

Function Prolog and Epilog - Prolog and Epilog, Return Address, Function Prolog and Epilog, Activation Record Creation by Prolog, Activation Record Destruction by Epilog
Calling Functions - Function Arguments and Return Values, AAPCS Core Register Use, Return Values, Call Example: Calling Function, Call and Return Example

Control Flow - Control Flow: Conditionals and Loops, Control Flow: If/Else, Control Flow: Switch, Iteration: While, Iteration: For, Iteration: Do/While

INTERRUPTS
Exception and Interrupt Concepts - Example System with Interrupt, How to Detect Switch is Pressed?, Interrupt or Exception Processing Sequence, Interrupts, Example Program Requirements & Design, Example Exception Handler, Use Debugger for Detailed Processor View
Entering an Exception Handler - CPU's Hardwired Exception Processing
Exiting an Exception Handler - Execute instruction triggering exception return processing, Select return stack, restore context from that stack, Resume execution of code at restored address
Cortex-M0+ Interrupts - Types of interrupts, Interrupt service routine (ISR)
Example Using Port Module and External Interrupts - Refresher: Program Requirements & Design, KL25Z GPIO Ports with Interrupts, FREEDOM KL25Z Physical Set-up, Building a Program – Break into Pieces, Where Do the Pieces Go?, Configure MCU to Respond to the Interrupt, Port Module, Pin Control Register, CMSIS C Support for PCR, Switch Interrupt Initialization, Main Function, Write Interrupt Service Routine, ISR, Evaluate Basic Operation, Examine Saved State in ISR, At Start of ISR, Step through ISR to End, Return from Interrupt to Main function
Timing Analysis - Visualizing the Timing of Processor Activities, Big Picture Timing Behavior, Interrupt Response Latency, Maximum Interrupt Rate
Program Design with Interrupts - Program Design with Interrupts, How Much Work Is Done in ISR? Sharing Data Safely between ISRs and other Threads

GENERAL PURPOSE DIGITAL INTERFACING
Basic Concepts, KL25Z GPIO Ports, GPIO Port Bit Circuitry in MCU, Control Registers, PDDR: Port Data Direction, Writing Output Port Data, Reading Input Port Data, Pseudocode for Program, CMSIS - Accessing Hardware Registers in C, Accessing Hardware Registers in C (2), Coding Style and Bit Access, Using Masks, C Code, Clocking Logic, Connecting a GPIO Signal to a Pin, Pin Control Register, CMSIS C Support for PCR, Resulting C Code for Clock Control and Mux

Interfacing - Inputs, Outputs, Output Example: Driving LEDs, Output Example: Driving a Speaker, Additional Configuration in PCR

ANALOG INTERFACING
Introduction, Converting Between Analog and Digital Values, The Big Picture – A Depth Gauge, Getting From Analog to Digital, Digital to Analog Conversion, Waveform Sampling and Quantization, Forward Transfer Function Equations, Inverse Transfer Function.

Analog to Digital conversion concepts - A/D – Flash Conversion, ADC - Successive Approximation Conversion, A/D - Successive Approximation, ADC Performance Metrics, Sampling Problems, Inputs, Sample and Hold Devices

KL25 Analog Interfacing Peripherals - Sources of Information, KL25Z Analog Interface Pins, Freedom KL25Z Analog I/O, Using a Pin for Analog Input or Output, Pin Control Register to Select

MUX Channel

Digital to Analog Converter - DAC Overview, DAC Operating Modes, DAC Control Register 0: DACx_C0, DAC Control Register 1: DACx_C1, DAC Data Registers, Example: Waveform Generator
Analog Comparator - Example: Power Failure Detection, Comparator Overview, CMP Control Register 1 CMPx_CR1, MUX Control Register CMPx_MUXCR, Comparator Output Processing, Comparator Interrupt, Programmable Threshold for Comparator, DAC Control Register CMPx_DACCR

Analog to Digital Converter - ADC System Overview, ADC System Fundamentals, Using the ADC, Clock Configuration, Clock Configuration Registers, Voltage Reference Selection, Conversion Trigger Selection, Hardware Trigger Sources, Input Channel Selection, Special Input Channels, Conversion Options Selection, Conversion Completion, Result Registers, Output Averaging, Automatic Compare, Conversion Time Requirements, Using ADC Values

TIMERS
Timer Peripherals - KL25 Timer Peripherals, Timer/Counter Peripheral Introduction, Periodic Interrupt Timer, Timer/PWM Module (TPM), Low Power Timer (LPTMR),

SERIAL COMMUNICATION
Overview, Software Structure – Handling asynchronous Communication, Software Structure – Parsing Messages, KL25Z and Freedom Specifics, Asynchronous serial (UART) Communications, SPI Communications, I2C Communications, Protocol Comparison

USING DIRECT MEMORY ACCESS TO IMPROVE PERFORMANCE
Basic Concepts, DMA Peripherals in Cortex-M0+, DMA Applications

References:

1. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean
   https://www.arm.com/resources/education/textbooks/efficient-embedded-systems
2. The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach by Trevor Martin
3. The Definitive Guide to the ARM Cortex-M0 by Joseph Yiu
4. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu
5. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison:
   https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family-and-comparison

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	RAPID EMBEDDED SYSTEMS DESIGN AND PROGRAMMING	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

To explain the characteristics of an embedded system and evaluate its benefits and challenges

PREREQUISITE: Basic C/C++ programming

COURSE OBJECTIVES

1	To acquire knowledge on ARM Processor Architecture
2	To acquire knowledge on Arm-based microcontrollers as modern embedded computing platforms
3	To acquire knowledge on higher level programming on ARM Processors.

COURSE OUTCOMES

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

CO1 –Understand High-level programming API as a prototype tool for rapid development of embedded applications	Understand
CO2 - Choose between different programming techniques for embedded system design	Apply
CO3 – To evaluate implementation results (e.g. speed, cost, power) and correlate them with the corresponding programming techniques	Analyze
CO4 - To build an Arm-based embedded system and program to satisfy given user specifications	Create
CO5 - To use commercial API and tools to accelerate the development cycle of Arm-based embedded systems	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Embedded Systems

Embedded system, components and applications -role of embedded systems in the Internet of Things (IoT) and the context of ubiquitous computing-Incorporating embedded devices into IoT systems -Microcontroller-based embedded systems - trade-offs of embedded systems including cost and performance

The Arm Cortex-M4 Processor
Architecture-features of Arm architectures and processors-layout of the Arm Cortex-M4 processor-structure and purpose of specific registers in the Arm Cortex-M4 processor

Introduction to Arm Cortex-M4 Programming
Comparison of C and Assembly programming languages-program-generation flow, compilation and program images-different data formats-mixed assembly and C programming.

Introduction to the Mbed Platform and CMSIS
Mbed platform and its importance in rapid embedded systems design-functions and benefits of the Mbed software development kit (SDK) and hardware development kit (HDK)-high-level and low-level programming-Cortex Microcontroller Software Interface Standard (CMSIS)

Digital Input and Output (IO)
Relationship between electrical voltages and logic values-key features of GPIOs (General Purpose I/O pins) and control peripherals-elements of GPIO design in relation to microcontrollers-Compare register-level GPIO programming to GPIO programming with the Mbed API

Interrupts and Low Power Features
Purpose of interrupts and their interaction with the processor- procedure of exception processing, including entering and exiting the exception handler-the main types of microcontroller interrupts and priorities.

Analog Input and Output
Theory of analog signal to digital signal conversion and vice versa-common type of digital-to-analog converters (DAC)-common types of analog-to-digital converters (ADCs)-properties of analog-to-digital conversion including range, resolution, quantization and sampling-Mbed API can be used to capture and generate analog signals

Timer and Pulse-width Modulation
Function of a timer and compare the functionality of a hardware and software timer-components of a standard timer-operation modes of a timer-operation of an Mbed timer and ticker-pulse-width modulation and the Mbed API usage on peripherals.

Serial Communication
Common methods for serial communication; such as UART, SPI, and I2C-concept of serial communication-difference between synchronous and asynchronous serial communication-Mbed API.

Real-Time Operating System
Operating system, features, and types-Outline features of a real-time operating system (RTOS)-Mbed RTOS and identify functions provided by the Mbed API-concurrency tools such as threads, mutex and semaphores

Reference Books:

1. The Definitive Guide to the ARM Cortex-M0 by Joseph Yiu
2. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean

https://www.arm.com/resources/education/textbooks/efficient-embedded-systems

3. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison: https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family-and-comparison

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	REAL TIME OPERATING SYSTEMS LAB	Category	L	T	P	Credit
		EC-SE	**0**	**0**	**4**	**2**

PREAMBLE

To give knowledge in real time operating system (RTOS) and its memory Management.

PREREQUISITE

COURSE OBJECTIVES

1	To acquire knowledge about concepts related to such as Scheduling techniques, threads, inter-thread communications and memory management.
2	To Perform Multithreaded Programming in RTOS Platform.
3	To Acquire the Knowledge on working of Interrupts and Writing ISRs.

COURSE OUTCOMES

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

CO1. Do the basic programming for the real time operating systems scheduling.	Understand
CO2. Programin Con RTOS win32 scheduling.	Create
CO3. Demonstrate task management and inter task communication.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

Syllabus

1. Study of serial data Communication between two computers.
2. Write the pseudo code in Linux using C/C++ to perform FCFS scheduling
3. Write the pseudo code in Linux using C/C++ to perform Round Robin scheduling
4. Write the pseudo code in Linux using C/C++ to perform Priority Based scheduling
5. Write the pseudo code in Linux using C/C++ to perform Print parent process ID & child process ID using Fork()

6. Study of POSIX thread &Write appropriate the pseudo code in Linux using C/C++
7. Study of Semaphore & Write appropriate the pseudo code in Linux using C/C++
8. Study of Raspberry pi &Write appropriate the pseudo code for blinking of LED and keypad in Linux using python
9. Write appropriate the pseudo code for Pipe in Linux
10. Study of Dining Table philosophy problem and write appropriate pseudo code for the same

COURSE DESIGNERS

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1.	Mr. R. Karthikeyan	Assistant Professor	ECE	rrmdkarthikeyan@avit.ac.in
2.	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in

	EFFICIENT EMBEDDED SYSTEMS DESIGN AND PROGRAMMING LAB	Category	L	T	P	Credit
		EC-SE	0	0	4	2

PREAMBLE

To learn to design and program Arm-based embedded systems and implementing them in low-level hardware using standard C and assembly language

PREREQUISITE:

COURSE OBJECTIVES

1	To understand the ARM processor Architecture.
2	To understand theArm-based microcontrollers as modern embedded computing platforms.
3	To understand the Software design basics, software engineering principles.

COURSE OUTCOMES

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

CO1 – Understand the various programming structures and architectures	Understand
CO2 –Write the program to interface and access the various components of ARM Processors	Apply
CO3 – Build the specific application with the ARM processors.	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	-	-	-	-	-	-	-	S		-
CO2	-	-	M	-	-	S	-	-	M	-	S	-	-	M	-
CO3	S	-	-	S	-	-	S	-	-	M	-	-	-	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Processing text in assembly language
2. Stack use and timing behaviour
3. General purpose I/O exercise: basic user interface
4. Analog to Digital Converter (ADC): Voltage Monitor
5. Comparator: Voltage Monitor
6. Digital to Analogous Converter (DAC): Signal Generator
7. Timer: signal generator with precision timing and buffering
8. Serial communications: performance analysis
9. DMA: Copy Speed Analysis

References:

1. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean https://www.arm.com/resources/education/textbooks/efficient-embedded-systems
2. The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach by Trevor Martin
3. The Definitive Guide to the ARM Cortex-M0 by Joseph Yiu
4. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu
5. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison: https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family-and-comparison

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	ADVANCED PROCESSORS LAB	Category	L	T	P	Credit
		EC-SE	0	0	4	2

PREAMBLE

This course makes the students to be familiar with the architecture and programming of Microcontrollers. This course also introduces the architecture and hardware features of PIC 16F877 and ARM7 (LPC2148) microcontrollers.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To enable the student to write basic assembly programming of 8085 processor.
2	The student will be able to write program to do logical operations.
3	To gain practical knowledge how to write 32-bit program.
4	To write real time application programs.
5	To learn various interfacing techniques.

COURSE OUTCOMES

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

CO1. Understand the basic operations of 8085.	Understand
CO2. Apply the programming knowledge to do mathematical operations.	Apply
CO3. Analyze the programming knowledge to do logical operations.	Analyze
CO4. Analyze the know-how to carry out interfacing.	Analyze
CO5. Analyze mixed language programming.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	-	-	-	-	M	-	-	-
CO2	L	S	S	-	M	-	-	-	-	-	-	M	-	-	-
CO3	S	M	M	-	L	M	-	-	-	-	-	M	-	-	-
CO4	S	L	L	-	L	S	-	-	-	-	-	M	-	-	-
CO5	M	M	S	-	M	L	-	-	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Use of programming tools (Debug/TASM/MASM/8086kit) to perform basic arithmetic operations on 8bit/16 bit data
2. Assembly programming for 16-bit addition, subtraction, multiplication and division (menu based)
3. Assembly program to display the contents of the flag register.
4. Program for device driver (printer/mouse/keyboard)
5. Program based on 32 bit architecture (e.g. Switching from real mode to protected mode using DPMI driver, 32bit multiplication)
6. Program and interfacing using 8255/ 8253

7. Program and interfacing of ADC/ DAC/ Stepper motor
8. Mixed Language program to increment, decrement the size of the cursor and also to disable it.
9. Assembly program to sort numbers in ascending/ descending order

REFERENCE

1. Advanced Processors lab

COURSE DESIGNERS:

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1.	Dr.L.K.Hema	Professor	ECE	hemalk@avit.ac.in
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	FIBRE OPTIC SENSORS AND APPLICATIONS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

A fiber optic sensor is a sensor that uses optical fiber either as the sensing element or as a means of relaying signals from a remote sensor to the electronics that process the signals. Fibers have many uses in remote sensing, depending on the application, fiber may be used because of its small size, and no electrical power is needed at the remote location. Many sensors can be multiplexed along the length of a fiber by using light wavelength shift for each sensor, or by sensing the time delay as light passes along the fiber through each sensor

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To familiarize about fiber optic sensor technology.
2	To study about Optical resonators.
3	To acquire knowledge about magnetic sensors.
4	To know about Chemical and Biosensors.
5	To gain knowledge about smart structures.

COURSE OUTCOMES

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

CO1. Recognize and classify the structures of Optical fiber and types	Understand
CO2. Describe the performance of sensors based on relative movement of opposed Grating	Understand
CO3. Recognize the sensor types for measuring various effects due to magnetic Fields	Understand
CO4. Interface hardware with relevant sensorfor measuring pH level, Hydrogen, CO2, Ammonia, chloride and Oxygen etc	Apply
CO5.Develop a Architecture with proper sensors foe various Application like Temperature,Pressure, fluid level, rotation and Current -voltage measurements.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	-	-	-	-	M	M	-	-
CO2	S	S	S	-	M	-	-	-	-	-	-	M	M	-	-
CO3	S	M	M	-	L	L	-	-	-	-	-	M	M	-	-
CO4	S	L	L	-	L	L	-	-	-	-	-	M	S	M	-
CO5	S	M	M	-	M	L	-	-	-	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

SENSOR TECHNOLOGY

The Emergence of Fiber Optic Sensor Technology-Optical Fibers-Light Sources-Optical Detectors- Optical Modulators- Intensity-Based and Interferometric Sensors-Fabry perot, Mach Zender, Michelson and Sagnac

GRATING SENSORS

Multimode Grating andPolarization Sensors-Sensors Based on Relative Movement of Opposed Gratings-Grating Period Modulation-Sensors Based on the Photo-elastic Effect-Retardation Plates- Fiber Grating Sensors

DISTRIBUTED AND MAGNETIC SENSORS

Fiber Optic Distributed and Magnetic Sensor-Distributed Sensing- Basic Principles of Sensor Multiplexing-Interferometric Sensor Multiplexing- Faraday effect sensors-Magneto strictive – Lorentz force sensors-Evanescent Field Absorption Sensors

CHEMICAL AND BIOSENSOR

Fiber Optic Chemical and Biosensor: Reagent Mediated sensor-Humidity sensor – pH sensor – Hydrogen sensor – CO2 sensor – Ammonia sensor – Chloride sensor – Glucose sensor – Oxygen sensor – Surface Plasmonic Resonance based sensor

APPLICATIONS

Industrial Applications of Fiber Optic Sensors : Temperature – Pressure – fluid level – flow – position – vibration – rotation measurements – Current -voltage measurement – Chemical analysis. Introduction to smart structures – Applications –skins.

References:

1. Eric Udd, William B. Spillman, Jr., “Fiber Optic Sensors: An Introduction for Engineers and Scientists”, John Wiley & Sons 2011
2. Bhagavānadāsa Gupta, Banshi Das Gupta, “Fiber Optic Sensors: Principles and Applications”, New India Publishing 2006
3. David A. Krohn, “Fiber optic sensors: fundamentals and applications”, ISA Publishing 2000
4. Francis T.S. Yu, Shizhuo Yin, Paul B. Ruffin, “Fiber Optic Sensors”, CRC Press Publisher 2010
5. B.Culshaw and J.Daykin, “Optic fiber Sensors Systems and Applications”, Artech House 1989
6. KTV Grattan & BT Meggit, “Optical fiber sensor technology & Applications”, Kluwer Academic 2000

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	IOT IN AUTOMOTIVE SYSTEMS	Category	L	T	P	Credit
		EC-SE	**3**	**0**	**0**	**3**

PREAMBLE

To explore the interconnection and integration of the physical devices with the internet to make vehicle automation for various parameters.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To recognize the building blocks of Internet of Things and characteristics.
2	To understand the basic architecture of IOT.
3	To know the fundamental technologies used in IOT.
4	To recognize the application areas of IOT.
5	To acquire knowledge about the design constraints in IOT.

COURSE OUTCOMES

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

CO1. Recognize Physical design and Logical design of IoT with machine to machine communication models	Understand
CO2. Describe main design principles and needed capabilities for building a relevant IoT architecture	Understand
CO3. Explain the MAC protocol and routing protocols with Sensor deployment in IOT technology	Apply
CO4. Develop a architecture with relevant IOT devices for vehicle automation and visual surveillance	Analyze
CO5.Design a communication module by considering design constraints for IOT based automation	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	L	L	-	L	-	-	-	-	-	-	M	-	-	-
CO2	L	S	S	-	M	-	-	-	-	-	-	M	-	-	-
CO3	S	M	M	-	L	M	-	-	-	-	-	M	-	-	-
CO4	S	L	L	-	L	S	-	-	-	-	-	M	-	-	-
CO5	M	M	S	-	M	L	-	-	-	-	-	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 - Machine to Machine - Difference between IoT and M2M

Architectural Overview

Building an architecture - Main design principles and needed capabilities - IoT architecture outline standards-considerations.

IoT Technology Fundamentals

Wireless medium access issues - MAC protocol survey - Survey routing protocols - Sensor deployment & Nodediscovery - Data aggregation and dissemination

Applications of IoT

IOT devices and sensors for vehicle Automation – GPS, GSM, Bluetooth. Sensors: level sensor,motion sensor, position sensor and object sensor. Surveillance applications –CCTV - Other IoT applications

Real-World Design Constraints

Introduction - Technical Design constraints - Data representation and visualization - Interaction and remotecontrol**.**

Text Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1st Edition, Orient Black swan Private Limited, 2015.

References:

1. Peter Waher, "Learning Internet of Things", Packt publishing, 2015

2. David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age ofIntelligence", 1st Edition, Academic Press, 2014

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	IOT FOR INDUSTRIAL SYSTEMS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The objectives of this course are to provide in-depth understanding of the underlying concepts of Internet of things, building blocks, domain-specific IoTs, and Design methodology for IOT. Also the course provides knowledge on Python coding to embed the coding in various open source hardware such as Raspberry Pi and Arduino. Eventually the course extends the students‟ knowledge up to the level of building cost effective IOT system for real world scenario with the open source hardware and software tool chains

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To assess the vision and introduction of IoT
2	To Understand IoT Market perspective.
3	To Implement Data and Knowledge Management and use of Devices in IoT Technology
4	To Understand State of the Art -IoT Architecture.
5	To classify Real World IoT Design Constraints, Industrial Automation in IoT

COURSE OUTCOMES

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

CO1. Recollect the terms and definitions of embedded system and networking	Remember
CO2. Understand the details and functionality of architecture of IOT	Understand
CO3. Identify different hardware and software tools for the IOT implementation	Understand
CO4. Design an IOT system for the given scenario and able to evaluate the constraints of the system	Apply
CO5 Choose the suitable hardware and software tools chains for the given real world scenario to fulfill the IOT requirements	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	-	S	-	-	L	M	L	-	-	L	-	-
CO2	M	L	-	M	S	-	-	L	M	L	-	-	L	-	-
CO3	M	L	-	M	S	-	-	L	M	L	-	L	L	-	L
CO4	S	M	L	-	S	-	-	L	M	L	-	L	M	-	L
CO5	S	M	L	-	S	-	-	M	L	L	-	L	M	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO IOT:

Introduction, Characteristics, Physical design, Protocols, logical design, Enabling technologies and IoT Levels. Domain Specific IoTs. IoT vs M2M.

DESIGN METHODOLOGY:

IoT systems management with NETCONF-YANG. IoT Design Methodology. IOT design Specifications, Model, Level and view Specifications, Device & Component Integration and Application Development.

LOGICAL DESIGN& PHYSICAL DEVICES:

Python packages of interest for loT, Cloud for loT, python web application framework. Basic building blocks of a loT Device.

OPEN SOURCE HARDWARE:

Raspberry PI physical devices, Raspberry Pi Interfaces, Programming, APIs / Packages. Web services. Intel Galileo-Arduino-Interfaces, Arduino Programming with IOT APIs.

CASE STUDIES:

Real time applications of IoT-Connecting IoT to cloud.

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things –A hands-on approach", Universities Press, 2015
2. Peter Waher "Learning Internet of Things", Packt Publishing,UK, 2015.
3. Miguel de Sousa",Internet of Things with Intel Galileo"", Packt Publishing,UK, 2015

Reference Books:

1. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things",Wiley Publishing,2015
3. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014)

COURSE DESIGNERS

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	RFID AND FLEXIBLE SENSORS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The integration of sensor and radio frequency device (e.g., RFID tags) data into IT applications. This framework is applied to the area of healthcare applications because data quality is important to improving patient care while reducing overall costs. Real-time, high quality data are critical for emergency medical applications, telemedicine, and preventive care, which sensor based applications can provide. Methods This is a theory-based approach, illustrated with examples from the healthcare industry. Results While the benefits of sensor-enabled applications are clear, the many design decisions faced by designers are complex. A sensor design framework is presented that links the requirements of the application with the capabilities of the many types of sensors available for healthcare. Conclusion This framework highlights the design decisions between technology, architecture, and algorithmic solutions. This provides the tools needed to design and implement effective and efficient flexible sensor.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To Understand the RFID used in IT applications and indicate their advantages and limitations.
2	To apply the programming the RFID devices and modes of operation.
3	To apply flexible Sensors
4	To design Sensor Principles in resistance and capacitance.
5	To apply and develop Sensor Interfacing and Sensor various type of systems.

COURSE OUTCOMES

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

CO1. Define sensors and RFID its principles	Remember
CO2. Exemplify the characteristics of sensors	Understand
CO3. Sensor measurements and error calculations	Apply
CO4. Exemplify the functionality of sensors in instruments	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	L	S	S	-	-	-	-	-	L	-	-	-	-
CO2	L	L	L	S	S	-	-	-	-	-	L	-	-	-	-
CO3	M	M	L	S	S	-	M	M	M	-	M	-	-	-	-
CO4	M	M	M	S	S	S	S	S	S	-	S	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

History and Practice of RFID:

RFID Systems and Terminology, Types of RFID, Frequency Bands for RFID, Tags-Passive, Semi passive, and Active Tags. Radio Basics for UHF RFID -Signal Voltage and Power, Information, Modulation, and Multiplexing, Backscatter Radio Links, Link Budgets, Effect of Antenna Gain and Polarization on Range, Propagation in the Real World.

Introduction to Sensors:

Sensor signals and systems, classification and measurement units. Sensor Characteristics: Transfer function, measuring parameters.

Sensor Principles:

Electric charge, field and potentials, capacitor and dielectric constant, magnetism, Induction, resistance, Seebeck, peltier and thermal effects, Heat transfer, light and ultrasonic.

Sensor Interfacing:

Op-amp and Instrumentation amplifier, Excitation circuits, A/D and D/A converters and bridge circuits. Noises in sensor circuits.

Sensor systems:force, strain, Inductive, capacitive, magnetic, level, Flow, pressure, acoustic, humidity, moisture, temperature, ultrasonic, chemical,image and bio sensors. Position, displacement, motion, velocity, acceleration sensors based system.

Smart sensors:

Piezo, Shape memory alloys, MR and ER fluids, optical, IOT and MEMS sensors

Text Books :

1.Daniel M. Dobkin-The RF in RFID: UHF RFID in Practice–Elsevier/Newness, U.S./India –2012(2ndEdition) – ISBN: 97801239458

2.Jacob Fraden,“Hand book of modern sensors: Physics design and applications”, Springer, 2003, 3rdedition, AIP press

Reference Books :

1.Ian R. Sinclair, “Sensors and transducers”, Newness, Oxford, 2001, 3rdedition.

2.Doebelin E.O. and Manik D.N., “Measurement Systems”, 6th Edition, Tata McGraw-HillEducation Pvt. Ltd., 2011.

3.John P. Bently, “ Principle of measurement systems”, Pearson education, Prentice Hall publication, 2004, 4thedition.

4.S.Renganathan, “Transducer Engineering”, Allied publishers,New Delhi 2003.

5.Neubert, H.K.P., “Instrument Transducers –An Introduction to their Performance and Design”, Oxford University Press, Cambridge, 2003

COURSE DESIGNERS				
S.No	**Name of faculty**	**Designation**	**Department**	**Mail ID**
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2	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in

	SMART IOT APPLICATIONS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

This course aims at providing a basic understanding of Internet of Things, exemplifying the application areas where Internet of Things can be applied and enables designing prototypes of Internet-connected products using appropriate tools.

PREREQUISITE –

Nil

COURSE OBJECTIVES

1	To learn the basic issues, policy and challenges in the Internet
2	To understand the components and the protocols in Internet
3	To build a small low cost embedded system with the internet
4	To understand the various modes of communications with Internet.
5	To learn to manage the resources in the Internet.

COURSE OUTCOMES

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

CO1. Appreciate the significance of IoT,WoT and Cloud of Things	Understand
CO2. Describe the general IoT architecture and connected domains	Understand
CO3. Analyze the requirement to figure out the suitable communication technology and protocols required for an IOT application	Analyze
CO4. Explain the challenges in wearable computing, components of wearable technology and types of wearable	Understand
CO5. Establish the communication to the cloud through Wi-Fi / Bluetooth	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	M	-	L	-	L	M	-	-	-	-	L	-	-	-
CO4	M	-	-	-	L	-	L	-	-	-	-	L	-	-	-
CO5	S	M	S	-	L	L	M	L	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO IOT:

Overview and Introduction, Internet of Things (IoT), Web of Things (WoT), Cloud of Things, Need for IoT on Cloud, Services in the Cloud for the Internet of Things, Applications of IoT –Detailed Domain Model.

IOTARCHITECTURE:

IoT Architecture, Sensor Layer, Gateway and Network Layer, Management Service Layer, Application Layer, IoT Enabling Technologies, Addressing Schemes, Data Storage and Analytics, Visualization. Connected Domains –Connected Home, Connected Worker, Connected Automobile, Connected Industry.

PROTOCOLS SUPPORTING IOT:

Wireless Protocol for IoT, Communication Technologies -NFC, Bluetooth, Bluetooth LE, ANT, Wi-Fi, ZigBee, Z-wave, KNX Wireless, HART, 6LoWPAN, WiMAX, 2.5–4G Protocols in Different Layers, Architecture, Features & Functions of CoAP, MQTT, OAuth2, XMPP, CoAP vs HTTP, CoAP Structure Model, Security Protocol and Application for CoAP.

WEARABLE TECHNOLOGY:

History of wearable computing, Challenges of wearable computing, Fundamental components of wearable technology, Design for Excellence, Touch Point Analysis, Types of Wearables –Digital Eyewear, Ring, Band, Frameworks for wearable, Android Wear, Qualcomm Vuforia, Virtual Continuum, Augment Reality, Augmented Virtuality, Virtual Reality, Mixed Reality in Wearables.

IOT PLATFORMS DESIGN METHODOLOGY :

IoT Systems –Intel IoT Framework, Qualcomm IoT Framework, Microsoft IoT Framework, ARM IoT Framework, Logical Design, Programming IoT platform (eg: Python, Mono C# , Objective-C, Ruby), Program for Firmware –Case Studies

Text Books:

1.Olivier Hersent,David Boswarthick andOmar Elloumi, The Internet of Things: Key Applications and Protocols, Second Edition, Wiley Publisher, 2012

2.Uckelmann, Dieter, Mark Harrison, and Florian Michahelles,Architecting the Internet of Things. Springer Science & Business Media, 2011.

3.Jean-Philippe Vasseur, Adam Dunkels, Interconnecting Smart Objects with IP: The Next Internet, Morgan Kuffmann, 2010

4.Jonathan L. Zittrain, The Future of the Internet, Yale University Press & Penguin UK 2008.

5.Samuel Greengard, The Internet of ThingsThe Internet of Things (The MIT Press Essential Knowledge series), MIT Press, 2015

Reference Books:

1.Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands on Approach, 2014
2.Doukas, Charalampos,Building internet of things with the Arduino, CreateSpace Independent Publishing Platform, 2012.
3. Lu, Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems, CRC Press
4. Massimo Banzi, Getting Started with Arduino (Make: Projects). O'Reilly Media. 2008

COURSE DESIGNERS

S.No	Name of faculty	Designation	Department	Mail ID
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2	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in

	WIRELESS SENSOR NETWORKS AND IOT	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

To understand the fundamental concepts of wireless sensor networks and Internet of Things, have an enhanced knowledge of the various protocols with Internet of Things in the real-world scenario.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To understand the various sensor network concepts
2	To know the physical layer issues and analyze Medium Access Control Protocols
3	To identify with the IoT Reference Architecture and Real World Design Constraints
4	To recognize the various IoT Protocols (Datalink, Network, Transport, Session, Service)
5	To understand IoT value chain structure (device, data cloud), application areas and technologies involved

COURSE OUTCOMES

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

CO1. Describe and explain radio standards and communication protocols for wireless sensor networks	Understand
CO2. Explain the function of the node architecture and use of sensors for various applications.	Understand
CO3. Expose the architectures, functions and performance of wireless sensor networks Systems and platforms.	Understand
CO4. Describe the basic concepts in IoT.	Understand
CO5. Develop web services to access/control IoT devices	Apply
CO6. Deploy an IoT application using Raspberry Pi.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	-	-	-	-	M	M	-	-
CO2	L	S	S	-	M	-	-	-	-	-	-	M	M	-	-
CO3	S	M	M	-	L	M	-	-	-	-	-	M	M	-	-
CO4	S	L	L	-	L	S	-	-	-	-	-	M	M	-	-
CO5	M	M	S	-	M	L	-	-	-	-	-	M	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO WIRELESS SENSOR NETWORKS

Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters

INTRODUCTION TO NS-3

Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.

MEDIUM ACCESS CONTROL PROTOCOL DESIGN

Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis (Markov Chain)

FUNDAMENTALS OF IOT

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies –IoT Levels – Domain Specific IoT – IoT vs. M2M.

IOT DESIGN METHODOLOGY & BUILDING IOT WITH RASPBERRY PI

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development. Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services

Text Books :

1. W. Dargie and C. Poellabauer (2010). Fundamentals of Wireless Sensor Networks –Theory and Practice. Wiley.
2. Arshdeep Bahga, Vijay Madisetti (2015). Internet of Things – A hands-on approach. Universities Press.

Reference Books :

1. KazemSohraby, Daniel Minoli and TaiebZnati (2007). Wireless sensor networks - Technology, Protocols, and Applications. Wiley Inter science.
2. Manoel Carlos Ramon (2014). Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers.
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann (2010). Wireless Sensor Network Technologies for the Information Explosion Era. Springer.
4. Marco Schwartz (2014). Internet of Things with the Arduino Yun. Packet Publishing

COURSE DESIGNERS

S.No	Name of faculty	Designation	Department	Mail ID
1	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in
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	WIRELESS TECHNOLOGIES FOR IOT	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The course follows the evolution of mobile and wireless security, and the underlying principles. The course is designed to educate the purpose of defending systems from unauthorized wireless attacks. This course also discovers the latest security standards and practices in mobile and wireless network.

PREREQUISITE –

Nil

COURSE OBJECTIVES

1	Understand the wireless technologies, wireless network standards.
2	Gain the knowledge on wireless networks, denial of service attacks and client-side threats.
3	Build an understanding of mobile data network standards.
4	To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)
5	To classify Real World IoT Design Constraints, Industrial Automation in IoT.

COURSE OUTCOMES

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

CO1. Knowledge on various wireless technologies, wireless network standards and their threats.	Understand
CO2. Identify how hackers and auditors alike test wireless networks for vulnerabilities such as rogue access points, denial of service (DoS) attacks and client-side threats	Understand
CO3.Ability to understand the mobile data network standards and its challenges.	Understand
CO4Discover the vulnerabilities and mis-configurations at wireless transport layer.	Apply
CO5. Show how an attacker might attempt to subvert and bypass Wireless security measures in Bluetooth and WiFi.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	M	L	-	L	-	-	-	-	-	-	-	-	-	-	-
CO5	M	M	L	L	L	-	-	L	M	L	L	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

MOBILE & WIRELESS TECHNOLOGIES:

Introduction to wireless technologies-Mobile cellular networks -Personal Area Networks -Transmission Media – WLAN standards, controllers -Securing WLAN -Countermeasures -Wired Equivalence Protocol(WEP).

WIRELESS THREATS:

Kinds of security breaches-Eavesdropping -Communication Jamming -RF interference -Covert wireless channels -DOS attack –Spoofing -Theft of services -Traffic Analysis-Cryptographic threats -Wireless security Standards.

MOBILE NETWORKS SECURITY:

Wireless Device security issues -CDPD security (Cellular Digital Packet Data)-GPRS security (General Packet Radio Service) -GSM (Global System for Mobile Communication) security –IP security -3G / 4G security.

WIRELESS TRANSPORT LAYER SECURITY:

Secure Socket Layer -Wireless Transport Layer Security -WAP Security Architecture -WAP Gateway -Wireless Intrusion Detection and Prevention Systems (WIDS/WIPS)

BLUETOOTH & WIFI SECURITY:

Basic specifications -Pico nets –Scatter nets -Bluetooth security architecture –Security at the baseband layer and link layer –Frequency hopping –Security manager –Authentication –Encryption -WiFi Hot spot architecture -Wireless honey pots -Security in IEEE 802.11.

WIRELESS SENSOR NETWORK SECURITY

Attacks on wireless sensor network and Preventive mechanisms: authentication and traffic analysis, Case study: centralized and passive intruder detection Case studies:

Case Study1- Public safety wireless networks, Case study 2 –Satellite communications systems , Case study 3 –Wide Area Wireless Data Services (CDPD, GPRS, etc.), Case study 4–Wireless LANs (802.11, etc.), Case study 5 –Wireless Metropolitan Area Networks (e.g., 802.16)

Reference Books

1.Wireless and Mobile Network Security-Security basics, Security in On-the-shelf and emerging technologies, Hakima Chaouchi, Maryline Maknavicius, ISBN: 9781848211179,2010.

2.Wireless Security-Models, Threats and Solutions,Nichols and Lekka, Tata McGraw –Hill, New Delhi, 2006.

3.Wireless Security, Merritt Maxim and David Pollino, Osborne/McGraw Hill, New Delhi, 2005.

4.Mobile and Wireless Network Security and Privacy, Springer, ISBN: 0387710574, edition 2007.5.Wireless Network Security: Theories and Applications, Springer,ISBN:978-3642365102, 2013

COURSE DESIGNERS

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2	Mr.R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in

	CHEMICAL SENSOR LAB	Category	L	T	P	Credit
		EC-SE	0	0	4	2

PREAMBLE - A chemical sensor is a device that transforms chemical information (composition, presence of a particular element or ion, concentration, chemical activity, partial pressure.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	The course focuses on sensors for physical, chemical and biological properties.
2	The terminologies of electrochemical sensors and their applications in industry
3	Locate different type of sensors used in real life applications and paraphrase their importance

COURSE OUTCOMES

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

CO1. Describe the working principles of different types of sensors.	Apply
CO2. Evaluate the technological and physical limitations of a specific sensor.	Evaluate
CO3. Design an integrated sensor system with different types of sensors.	Evaluate
CO4. Predict correctly the expected performance of various sensors	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	M	L	-	M	-	-	-	-	M	M	S	L
CO2	S	M	S	L	M	-	-	-	-	-	-	M	M	L	-
CO3	S	S	S	S	L	-	M	-	-	-	L	M	S	S	L
CO4	S	M	L	L	L	-	-	-	-	-	-	M	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Sensor classification and characteristics.
2. Physical principles of sensing.
3. Working principles and applications of different types of sensors:
4. Presence, displacement and level.
5. Velocity and acceleration.
6. Force and strain.
7. Pressure and flow.
8. Acoustic.
9. Humidity and moisture.
10. Light and radiation.
11. Temperature.
12. Chemical and biological.
13. Sensor materials and technologies.
14. ORP(Oxidation-Reduction Potential) Sensor
15. O2 Gas Sensor
16. Ethanol Sensor
17. Blood Pressure Sensor

COURSE DESIGNERS

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	SENSOR SYSTEMS LAB	Category	L	T	P	Credit
		EC-SE	0	0	4	2

PREAMBLE

The IoT is an environment where smart devices sense, anticipate, and respond to our needs as we manage them remotely. These smart devices often act as the gateway between our digital and physical world.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To provide adequate knowledge in sensors
2	The IoT touches many aspects of life including transportation, health care, safety, environment, energy, and more.

COURSE OUTCOMES

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

CO1. Understand the characteristics of sensors	Apply
CO2. Demonstrate the working of various Sensors	Evaluate
CO3. Analyze and understand various sensors based on its classification and working principle	Evaluate
CO4. Identify the various sensors used for clinical applications	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	M	L	-	M	-	-	-	-	M	M	S	L
CO2	S	M	S	L	M	-	-	-	-	-	-	M	M	L	-
CO3	S	S	S	S	L	-	M	-	-	-	L	M	S	S	L
CO4	S	M	L	L	L	-	-	-	-	-	-	M	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Read Temperature and Relative Humidity value from the sensor.
2. Read Light intensity value from light sensor
3 Read atmospheric pressure value from pressure sensor
4. Proximity detection with IR LED.
5. Generation of alarm through Buzzer
6. Plot the characteristics curve of Thermocouple, Thermistor and RTD.
7. Verify the characteristics of Load cell
8. Verify the characteristics of Opto-coupler
9. Plot the characteristics of Electrodes
10. Verify the characteristics of strain gauge

COURSE DESIGNERS

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2	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	WIRELESS SENSOR NETWORKS LAB	Category	L	T	P	Credit
		EC-SE	0	0	4	2

PREAMBLE

The Wireless Sensor Network Lab hosts a state-of-the art experimental research facility for WS&AN. The test-bed facility is used for the prototyping and evaluation of developed protocol solutions and serves as a basis for the development of novel mobile context aware services and applications.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To learn the wireless sensor network and its applications.
2	To analyze the TCL script for transmission between nodes.
3	To examine the TCL script for UDP and CBR traffic in WSN Nodes.
4	To analyze the implementation of routing protocol in NS2.

COURSE OUTCOMES

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

CO1. Explain the techniques used for Wireless Sensor Network and its Applications in Engineering.	Understand
CO2. Demonstrate the installation procedure of Network Simulator, Communication established between mobile nodes and sensor nodes	Apply
CO3. Illustrate the TCL script used for transmission between mobile nodes and sensor nodes	Apply
CO4. Analyze the TCL script for UDP and CBR traffic in WSN	Analyze
CO5. To pertain the routing protocol in NS2 forAODV, DSR, TORA	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	-	-	-	-	-	-	M	-	-	-
CO2	S	M	-	-	M	-	-	-	-	M	-	M	M	M	-
CO3	S	M	L	-	M	-	-	-	-	L	-	M	M	M	-
CO4	S	S	M	M	M	-	-	-	-	L	-	M	S	M	-
CO5	S	S	S	S	M	-	-	-	-	L	-	M	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Introduction of Wireless sensor network applications and its Simulation.
2. Network Simulator installation of wireless sensor network.
3. Write TCL script for transmission between mobile nodes.
4. Write TCL script for sensor nodes with different parameters.
5. Generate tcl script for udp and CBR traffic in WSN nodes.
6. Generate tcl script for TCP and CBR traffic in WSN nodes.
7. Implementation of routing protocol in NS2 for AODV protocol.
8. Implementation of routing protocol in NS2 for DSR protocol.
9. Implementation of routing protocol in NS2 for TORA protocol.
10. Study other wireless sensor network simulators

COURSE DESIGNERS

S.No	**Name of faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.S.Valarmathy	Associate Professor	ECE	valarmathy@vmkvec.edu.in
2	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	INTERNET OF THINGS	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The purpose of this course is to produce students who can specify, design, and program modern connected electronic systems in response to the ever-growing number of connected devices. To impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview .

PREREQUISITE - C , C++

COURSE OBJECTIVES

1	To outline the concepts of the Internet of Things (IoT) and key challenges involved in building an IoT based application
2	To identify different IoT architectures and the scope of different standardization bodies
3	Explore the concept of embedded systems design and design considerations in their development
4	To outline different wireless technologies: Bluetooth, BLE, LoRaWAN, NB-IoT and IEEE 802.11 protocols used in IoT
5	Explore on the current and future trends which will enhance IoT technology

COURSE OUTCOMES

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

CO1. Explain the fundamentals of Internet of Things.	Understand
CO2. Explain the IOT and Embedded architechture .	Understand
CO3. Design and implement of Android and Embedded application Programming .	Apply
CO4. Design and implement applications using Connectivity and networking technologies .	Apply
CO5. Explain the advanced IOT security and cloud computing .	Analyze

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO IOT & EMBEDDED SYSTEMS

Internet of Things - Key elements - Evolution of IOT –Challenges and opportunities - IOT architecture- Cloud,Fog and Edge Computing - Standardization bodies- Definition Of Embedded Systems- Functions and attributes .

HARDWARE PLATFORMS

Concepts and Influencing Design - Sensors and its types- A2D and DAC conversion - Arm processor families - Arm process Architecture - Cortex M4 processors - Mbed platform - CMSIS - Mbed SDK & HDK

IOT CONNECTIVITY

Bluetooth technology - low energy bluetooth protocols - Bluetooth 5 Specifications - Zigbee-IEEE 802.11. protocols- LPWAN technology - LoRaWAN technology - NB-IOT - Interrupts and exception handling - Program Design.

THE CLOUD & IOT SECURITY

Virtualization Concept - MQTT , CoAP protocols - Data processing pipelines - Arm Pelion platform - IOT security - Threat modelling methods - Code signing and encryption - Encryption Algorithms.

CURRENT AND FUTURE IOT TRENDS

Future Adoption of IOT technology - Role of AI/ML- Edge computing - Role of Platform Security architecture.

REFERENCE BOOKS:

1. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison:https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family-and-comparisonThe
2. Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu
3. Cortex-A Series Programmer's Guide for ARMv7-A by rmhttp://infocenter.arm.com/help/topic/com.arm.doc.den0013d/index.html

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. Sita Devi Bharatula	Associate Professor	ECE	sitadevi.ece@avit.ac.in

	INTERNET OF THINGS LAB	Category	L	T	P	Credit
		EC-SE	0	0	4	2

PREAMBLE

The purpose of the course is to produce students who can specify, design, and program modern connected electronic systems in response to the ever-growing number of connected devices

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To Implement a program to control peripherals on a microcontroller
2	To Design a simple Android application to display the data received from a BLE device on the screen
3	To Develop a program to read values from on-board sensors
4	To Demonstrate a simple program using the Mbed platform
5	To create and debug a simple Android app

COURSE OUTCOMES

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

CO1. Develop a program to read values from on-board sensors	Apply
CO2. Analyze the graphical program for coding	Analyze
CO3. Implement a program to send sensor values from a device to a device management platform	Evaluate
CO4. Create a simple neural network model in the cloud	Create
CO5. Design and implement some experiments using IOT	Create

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Demonstrate a simple program using Mbed OS
2. Implement a program to control LEDs that works with GPIOs
3. Create and debug a simple Basic Mobile Android app.
4. Implement a simple BLE program that emulates a heart rate monitor
5. Design a simple Android app to display the data received from a BLE device on the screen
6. Develop a program to read values from the on-board sensors
7. Implement a program that sends the on-board sensor values to a mobile app for weather Station.
8. Implement a program to send sensor values from a device to the Arm Pelion platform .
9. Create a simple neural network model in the cloud which predicts different class of activities using the sensors on-board in real time.

REFERENCES:

1. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph YiuCortex-A Series Programmer's Guide for ARMv7-A by Arm

2. http://infocenter.arm.com/help/topic/com.arm.doc.den0013d/index.html

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