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:

M.E / M.Tech. – Embedded Systems Technologies
Full Time (2 Years)

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM

(Semester I to IV)

VINAYAKA MISSION'S RESEARCH FOUNDATION

(DEEMED TO BE UNIVERSITY), SALEM

CURRICULUM FOR REGULATION-2021

Credit Requirement for the Course Categories

M.E/M. Tech-Embedded Systems Technologies

(FULL TIME)

S. No	Category of courses	Type of courses	Suggested break up of credits
1.	A. Foundation courses(5 credits)	Mathematics/Applied Mathematics	3
		Research Methodology and IPR	2
2.	B. Program core courses(32 credits)	Core courses	32
3.	C. Elective courses(18 credits)	Program electives	15
		Open electives (Courses on emerging areas.)	03
4.	D. Employability Enhancement Courses and courses for presentation of Technical skills related to the specialization(20 credits)	Project work phase I	6
		Project work phase II	12
		Internship	1
		Technical Seminar	1
5.	E. Mandatory Courses/Audit courses	Any two courses on: 1. English for Research Paper Writing 2. Disaster Mitigation and Management 3. Value Education 4. Constitution of India 5. Pedagogy Studies 6. Personality Development Through Life Enlighten Skills	Zero credit
Total credits to be earned for the award of M.E/M.Tech degree			**75**

M.E./M.TECH. – EMBEDDED SYSTEMS TECHNOLOGIES - SEMESTER I TO IV

A. Foundation courses –Credits(05)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS	MATH	FC-BS	2	1	0	3	NIL
2.		RESEARCH METHODOLOGY AND IPR	ECE	FC-HS	2	0	0	2	NIL

M.E./M.TECH. – EMBEDDED SYSTEMS TECHNOLOGIES - SEMESTER I TO IV

Program Core Courses – Credits (32)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		MODERN DIGITAL PRINCIPLES AND DESIGN	ECE	CC	3	0	0	3	NIL
2		CONTROLLER BASED SYSTEM DESIGN	ECE	CC	4	0	0	4	NIL
3		DESIGN OF EMBEDDED SYSTEMS	ECE	CC	3	0	0	3	NIL
4		SOFTWARE FOR EMBEDDED SYSTEMS	ECE	CC	3	0	0	3	NIL
5		ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	ECE	CC	3	0	0	3	NIL
6		WIRELESS SENSORS AND NETWORKING DEVICES	ECE	CC	3	0	0	3	NIL
7		ARM RISC PROCESSORS AND ARCHITECTURE	ECE	CC	3	0	0	3	NIL
8		INTERNET OF THINGS FOR EMBEDDED SYSTEMS	ECE	CC	3	0	0	3	NIL
9		ADVANCED SYSTEM ON CHIP DESIGN	ECE	CC	3	0	0	3	NIL
10		EMBEDDED SYSTEMS LAB – I	ECE	CC	0	0	4	2	NIL
11		EMBEDDED SYSTEMS LAB – II	ECE	CC	0	0	4	2	NIL

M.E./M.TECH. – EMBEDDED SYSTEMS TECHNOLOGIES - SEMESTER I TO IV

C. Elective courses -Credits (18)

i. Program Electives-Credits 15

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		MEMORY TECHNOLOGIES	ECE	EC-PS	3	0	0	3	NIL
2		MEMS TECHNOLOGY	ECE	EC-PS	3	0	0	3	NIL
3		EMBEDDED LINUX	ECE	EC-PS	3	0	0	3	NIL
4		ADVANCED DIGITAL SIGNAL PROCESSING	ECE	EC-PS	3	0	0	3	NIL
5		PROGRAMMING IN PYTHON	ECE	EC-PS	3	0	0	3	NIL
6		EMBEDDED PRODUCT DEVELOPMENT	ECE	EC-PS	3	0	0	3	NIL
7		DISTRIBUTED EMBEDDED COMPUTING	ECE	EC-PS	3	0	0	3	NIL
8		SOFT COMPUTING AND OPTIMIZATION TECHNIQUES	ECE	EC-PS	3	0	0	3	NIL
9		CRYPTOGRAPHY AND NETWORK SECURITY	ECE	EC-PS	3	0	0	3	NIL
10		EMBEDDED SYSTEMS FOR AUTOMOTIVE ELECTRONICS	ECE	EC-PS	3	0	0	3	NIL
11		COMPUTER VISION AND IMAGE UNDERSTANDING	ECE	EC-PS	3	0	0	3	NIL

12		NANO ELECTRONIC SYSTEMS	ECE	EC-PS	3	0	0	3	NIL
13		ENTREPRENEURSHIP OPPORTUNITIES IN EMBEDDED SYSTEMS	ECE	EC-PS	3	0	0	3	NIL
14		RECONFIGURABLE PROCESSOR TECHNOLOGIES	ECE	EC-PS	3	0	0	3	NIL
15		ADVANCED ROBOTICS AND CONTROL	ECE	EC-PS	3	0	0	3	NIL
ii. Open electives(Courses on emerging areas)- Credits 3									
1		SOLAR AND ENERGY STORAGE SYSTEMS	EEE	OE-EA	3	0	0	3	NIL
2		METAL ADDITIVE MANUFACTURING	MECH	OE-EA	3	0	0	3	NIL
3		SUSTAINABLE BUILT ENVIRONMENT	CIVIL	OE-EA	3	0	0	3	NIL
4		ADVANCED CYBER SECURITY	CSE	OE-EA	3	0	0	3	NIL
5		WASTE TO ENERGY	BTE	OE-EA	3	0	0	3	NIL
6		BIOMEDICAL PRODUCT DESIGN AND DEVELOPMENT	BME	OE-EA	3	0	0	3	NIL
D. Employability Enhancement Courses And Courses For Presentation Of Technical Skills Related To The Specialization- Credits (20)									
1		PROJECT WORK PHASE I	ECE	EE-P	0	0	12	6	NIL
2		PROJECT WORK PHASE II	ECE	EE-P	0	0	24	12	NIL
3		INTERNSHIP	ECE	EE-PII	0	0	2	1	NIL
4		TECHNICAL SEMINAR	ECE	EE-S	0	0	2	1	NIL
E. Mandatory Courses/Audit courses- Zero credit									
1		ENGLISH FOR RESEARCH PAPER WRITING	HS	AC	0	0	2	0	NIL
2		DISASTER MITIGATION AND MANAGEMENT	CIVIL	AC	0	0	2	0	NIL
3		VALUE EDUCATION	HS	AC	0	0	2	0	NIL
4		CONSTITUTION OF INDIA	LAW	AC	0	0	2	0	NIL
5		PEDAGOGY STUDIES	HS	AC	0	0	2	0	NIL
6		PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEN SKILLS	ENG	AC	0	0	2	0	NIL

	APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS	Category	L	T	P	Credit
		FC-BS	2	1	0	3

PREAMBLE

Mathematics is fundamental for any field of technology. The aim of the subject is to impart essential mathematical topics for the PG courses in Electronics and Communication Engineering Department.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand the concepts of fuzzy logic.
2	To make the student learn different matrix methods and some of the applications.
3	To understand the concepts of random variables.
4	To make the student learn dynamic programming and their applications.
5	To understand the concepts of different queuing models.

COURSE OUTCOMES

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

CO1. Apply the Concepts of fuzzy sets, knowledge representation using fuzzy rules, fuzzy logic, fuzzy prepositions and fuzzy quantifiers and applications of fuzzy logic.	Apply
CO2. Apply the concept of diagonalisation of matrices in the field of electronics and communication engineering.	Apply
CO3. Conceptualize the computational procedure of PERT and CPM method.	Apply
CO4.Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.	Apply
CO5.Explain the basic characteristic features of a queuing system and acquire skills in analyzing queuing models	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES															
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--
CO2	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--
CO3	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--
CO4	S	S	S	L	--	--	--	M	--	--	--	M	--	--	--
CO5	S	S	M	M	L	--	--	M	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

FUZZY LOGIC

Classical logic – Multivalued logics – Fuzzy propositions – Fuzzy quantifiers

MATRIX THEORY

Some important matrix factorizations – The Cholesky decomposition – QR factorization – Least squares method – Singular value decomposition - Toeplitz matrices and some applications.

ONE DIMENSIONAL RANDOM VARIABLES

Random variables - Probability function – moments – moment generating functions and their properties– Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

DYNAMIC PROGRAMMING

Dynamic programming – Principle of optimality – Forward and backward recursion – Applications of dynamic programming – Problem of dimensionality.

QUEUEING MODELS

Poisson Process – Markovian queues – Single and Multi-server Models – Little's formula – Machine Interference Model – Steady State analysis – Self Service queue.

Text Books/ References Books :

1. George J. Klir and Yuan, B., Fuzzy sets and fuzzy logic, Theory and applications, Prentice Hall of India Pvt. Ltd., 1997.
2. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2000.
3. Richard Johnson, Miller & Freund's Probability and Statistics for Engineers, 7th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
4. Taha, H.A., Operations Research, An introduction, 7th edition, Pearson education editions, Asia, New Delhi, 2002.
5. Donald Gross and Carl M. Harris, Fundamentals of Queueing theory, 2nd edition, John Wiley and Sons, New York (1985).

COURSE DESIGNERS				
S.NO	Name of the Faculty	Designation	Department	Mail ID
1	Dr. S.Punitha	Associate Professor	Mathematics	punitha@vmkvec.edu.in
2	Ms. S. Sarala	Assistant Professor- Grade II	Mathematics	sarala@avit.ac.in

	RESEARCH METHODOLOGY AND IPR	Category	L	T	P	Credit
		FC-HS	2	0	0	2

PREAMBLE

This course is aimed at familiarizing students with the policies of Intellectual Property Rights (IPR) to help them integrate the IPR process in their research activities. This course is primarily meant for identifying his/her own protectable innovations and realizing the process of taking it from bench to market.

PREREQUISITE : Nil

COURSE OBJECTIVES

1	Illustrate research problem formulation
2	Acquire knowledge on legal aspects of plagiarism
3	Knowledge on technical report writing
4	Process of patenting and development procedure for granting patent
5	Analyze research related information and make use of patent information and databases

COURSE OUTCOMES

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

CO1. Define the scope and objectives of a research problem	Remember
CO2. Describe legal compliances of Plagiarism	Understand
CO3. Demonstrate technical report writing	Apply
CO4. Reframe the process of patenting and development procedure for granting patent	Analyze
CO5.Analyze research related information and make use of patent information and databases	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	M	M	-	-	-	-	-	-		-	-	M	M	M	-
CO2	M	M	M	-	M	-	-	-	M	-	-	M	M	M	-
CO3	M	M	M	-	M	-	-	-	M	-	-	M	M	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

Unit I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations**.**

Unit II

Effective literature studies approaches, analysis Plagiarism, Research ethics**.**

Unit III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee**.**

Unit IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications**,** New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc, traditional knowledge Case Studies, IPR and IITs.

Text Books/ References Books :

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill,1992.
6. Niebel, "Product Design", McGraw Hill,1974.

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.T.Muthumanicka m	Professor & Head	ECE	muthumanickam@vmkvec.edu.in

	MODERN DIGITAL PRINCIPLES AND DESIGN	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The primary aim of this course is to understand the fundamentals behind the digital logic design. From that students can gain the experience, to design any digital circuits and systems. The course includes fundamentals of Boolean algebra, combinational, sequential circuits and applications of digital electronics. Students can learn the basic programming concepts to implement digital circuits using hardware description language.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To expose the students to the fundamentals of sequential system design, Asynchronous circuits, switching errors.
2	To teach the fundamentals of modeling through comparative study on the classification of commercial family of Programmable Device.
3	To study on Fault identification in digital switching circuits.
4	To introduce logics for design of Programmable Devices.
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

COURSE OUTCOMES

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

CO1. Analyze and design sequential digital circuits.	Apply
CO2. Design and use programming tools for implementing digital circuits of industry standards.	Apply
CO3. Identify the requirements and specifications of the system required for a given application.	Remember
CO4. Acquire knowledge about HDL programming.	Understand
CO5. Improve employability and entrepreneurship capacity due to knowledge upgradation on recent trends in digital design for embedded 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	S	-	S	-	M	-	-	-	L	-	S	S	-	-
CO2	S	S	-	-	M	L	-	-	-	M	-	S	S	-	-
CO3	S	S	M	L	-	M	M	-	L	-	-	S	S	-	M
CO4	S	S	-	-	L	L	-	-	M	-	L	S	S	M	M
CO5	M	S	-	-	L	-	S	-	-	-	-	S	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I SEQUENTIAL CIRCUIT DESIGN

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State table Assignment and Reduction – Design of CSSN – ASM Chart – ASM Realization.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Designing Hazard free circuits

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS

Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques –Built-in Self Test

UNIT IV ARCHITECTURES &DESIGN USING PROGRAMMABLE DEVICES

Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence**.** Architecture of EPLD, Programmable Electrically Erasable Logic – Programming Techniques -Re-Programmable Devices Architecture- Function blocks, I/O blocks, Interconnects- Xilinx FPGA – Xilinx 2000 - Xilinx 4000 family

UNIT V HDL PROGRAMMING

Overview of digital design with VHDL, hierarchical modelling concepts, gate level modelling, data flow modelling, behavioural modelling, task & functions, logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, Test Bench Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions / Practice on Workbench : Logic Synthesis and Simulation for digital designs

REFERENCE BOOKS:

1. 1. Donald G. Givone, “Digital principles and Design”, Tata McGraw Hill 2002.
2. Stephen Brown and Zvonk Vranesic, “Fundamentals of Digital Logic with VHDL Deisgn”, Tata McGraw Hill, 2002
3. William J. Dally / Curtis Harting / Tor M. Aamodt,” Digital Design Using VHDL:A Systems Approach, Cambridge Univerity Press,2015.
4. Charles H. Roth Jr., “Digital Systems design using VHDL”, Cengage Learning, 2010.
5. Mark Zwolinski, “Digital System Design with VHDL”, Pearson Education, 2004
6. Parag K Lala, “Digital System design using PLD”, BS Publications, 2003
7. Stephen M.Trimberger,FPGA Technology,Springer,1994
8. Nripendra N Biswas, “Logic Design Theory”, Prentice Hall of India, 2001
9. Charles H. Roth Jr., “Fundamentals of Logic design”, Thomson Learning, 2004.
10. John V.Oldfeild ,Richard C.Dorf,”Field Programmable Gate Arrays”,Wiley India Edition,2008

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
2	Dr. L.K.Hema	Prof. & Head/ ECE	ECE	hodece@avit.ac.in

	CONTROLLER BASED SYSTEM DESIGN	Category	L	T	P	Credit
		CC	4	0	0	4

PREAMBLE

This course is to make the students to understand the architecture, programming and interfacing of system design of microprocessors and microcontrollers.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To introduce the fundamentals of microcontroller based system design.
2	To teach I/O and RTOS role on microcontroller.
3	To know Microcontroller based system design, applications.
4	To teach I/O interface in system Design
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired

COURSE OUTCOMES

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

CO1. 8-bit microcontrollers, learn assembly and C-programming of PIC.	Remember
CO2. Learn Interfacing of Microcontroller.	Remember
CO3. Learners will study about PIC microcontroller and system design.	Apply
CO4. Work and experiment with real time applications and project based learning.	Apply
CO5. Utilize effectively microcontroller software development tools such as a compiler, make files, or compile scripts.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I 8051 ARCHITECTURE

Architecture – memory organization – addressing modes – instruction set – Timers - Interrupts - I/O ports, Interfacing I/O Devices – Serial Communication

UNIT II 8051 PROGRAMMING

Assembly language programming – Arithmetic Instructions – Logical Instructions –Single bit Instructions – Timer Counter Programming – Serial Communication Programming, Interrupt Programming, LCD digital clock, thermometer – Significance of RTOS for 8051

UNIT III PIC MICROCONTROLLER

Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C – I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.

UNIT IV PERIPHERAL OF PIC MICROCONTROLLER

Timers – Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing – Flash and EEPROM memories.

UNIT V SYSTEM DESIGN – CASE STUDY

Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System

REFERENCE BOOKS:

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ' PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education 2008
2. Rajkamal,"Microcontrollers Architecture, Programming Interfacing,& System Design, Pearson,2012.
3. Muhammad Ali Mazidi, Sarmad Naimi ,Sepehr Naimi' AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education 2014.
4. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, 'The 8051 Microcontroller and Embedded Systems' Prentice Hall, 2005.
5. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000
6. Senthil Kumar,Saravanan,Jeevanathan,"microprocessor & microcontrollers,Oxford,2013.
7. Myke Predko, "Programming and customizing the 8051 microcontroller", TMcGraw Hill 2001.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
2	Dr. L.K.Hema	Prof. & Head/ ECE	ECE	hodece@avit.ac.in

	DESIGN OF EMBEDDED SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course aims to give the knowledge for students on all aspects of the design and development of an embedded system, including hardware and embedded software development.

PRERQUISITE

Nil

COURSE OBJECTIVES

1	To Know about the Basics of Embedded Systems and introduction to RTOS
2	To Implement embedded hardware & firmware using embedded-C for C51 to interface with different I/O.
3	To Demonstrate the embedded system design using ARM IP core with emphasis on its programming model
4	To discuss the various methods of Testing
5	To know about ARM Architecture

COURSE OUTCOMES

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

CO1. Define, Classify and Analyze embedded system product design with IC Technology	Analyze
CO2. Design & implement device drivers in embedded-C for C51 target MCU to interface I/O.	Create
CO3. Justify the hardware software codesign issues along with debugging techniques.	Apply
CO4. Propose serial & parallel protocols to design networked embedded systems	Analyze
CO5. Analyze ARM IP Core usage in design with its programming model	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

UNIT I: EMBEDDED DESIGN LIFE CYCLE **9**

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Selection Processes – Microprocessor Vs Micro Controller – Performance tools – Bench marking – RTOS Micro Controller – Performance tools – Bench marking – RTOS availability – Tool chain availability – Other issues in selection processes.

UNIT II: PARTITIONING DECISION **9**

Hardware / Software duality – coding Hardware – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization – System startup – Hardware manipulation – memory mapped access – speed and code density

UNIT III: INTERRUPT SERVICE ROUTINES **9**

Watch dog timers – Flash Memory basic toolset – Host based debugging – Remote debugging – ROM emulators – Logic analyser – Caches – Computer optimisation – Statistical profiling

UNIT IV: IN CIRCUIT EMULATORS & TESTING **9**

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers. Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

UNIT V: ARM CORE ARCHITECTURE: **9**

ARM Core Architecture: Introduction to RISC concepts with ARM as CPU, ARM engine Architecture, AMBA Bus, Core Registers, Programming Modes, Importance of Thumb Mode, CPSR, SPSR, Pipeline, Exceptions, Interrupts

TEXT BOOKS:

1. Introduction to Embedded Systems, Shibu K V, 2009, Tata McGraw Hill Education Private Limited, ISBN: 10: 0070678790
2. Embedded System Design, Steve Heath, 2004, Elsevier, 2nd Edition, ISBN 9780750655460
3. .Embedded Microcomputer Systems – Real Time Interfacing – Jonathan W. Valvano; Cengage Learning; Third or later edition

REFERENCE BOOKS:

1. Embedded Systems – A contemporary Design Tool, James K Peckol, 2008, John Weily, ISBN: 0-444-51616- 6.
2. Real-Time Concepts for Embedded Systems, Qing Li and Carolyn Yao, 2003, CMP Books, ISBN:1578201241

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Departm ent**	**Mail ID**
1	Mr.Vijay	Assistant Professor (G-II)	ECE	vijay.ece@avit.ac.in
2	Ms.Vanitha	Assistant Professor (G-II)	ECE	vanitha.ece@avit.ac.in

	SOFTWARE FOR EMBEDDED SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The primary aim of this course is to understand the design of embedded systems demands for one to understand the architectural features of a chosen microcontroller; the software development poses several specific challenges. Thus, this SDP topic is a blend of architectural studies of contemporary and the state-of-the- art microcontroller families of ARM, PIC, Intel, and Motorola and the software engineering practices applicable to the design of embedded systems.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To expose the students to the fundamentals of embedded Programming.
2	To Introduce the GNU C Programming Tool Chain in Linux.
3	To study basic concepts of embedded C , Embedded OS & Python Programming
4	To introduce time driven architecture, Serial Interface with a case study.
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

COURSE OUTCOMES

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

CO1. Use GNU C to develop embedded software.	Remember
CO2. Understand the fundamental embedded systems design paradigms.	Remember
CO3. Understand the architectures, possibilities and challenges, both with respect to software and hardware	Remember
CO4. Improve employability by knowledge up gradation on recent trends in embedded systems design	Apply
CO5. Improve entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I EMBEDDED PROGRAMMING

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT II. C PROGRAMMING TOOL CHAIN IN LINUX

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using *gprof* - Memory Leak Detection with *valgrind* - Introduction to GNU C Library

UNIT III EMBEDDED C

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts

UNIT IV EMBEDDED OS

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, UsingTimer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS- Memory requirements - embedding serial communication & scheduling data transmission - Case study: Intruder alarm system

UNIT V PYTHON PROGRAMMING

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C Programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment. Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process.

REFERENCE BOOKS:

1. 1. Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.
2. Michael J Pont, "Embedded C", Pearson Education, 2007.
3. Christian Hill, Learning Scientific Programming with Python , CAMBRIDGE UNIVERSITYPRESS ,2016.
4. Wesley J.Chun, "Core python application Programming 3rd Edition", Pearson Educat, 2016.
5. Mark J.Guzdial," introduction to computing and programming in python – a Multimedia approach ,4th edition, Pearson Education, 2015.
6. Stephen Kochan, "Programming in C", 3rd Edition, Sams Publishing, 2009.
7. Mark Lutz,"Learning Python,Powerful OOPs,O'reilly,2011.
8. Peter Prinzs, Tony Crawford, "C in a Nutshell",O'Reilly,2016.
9. Dr.Bandu Meshram, "Object Oriented Paradigm C++ BeginnersGuide C
10. David Griffiths, Dawn Griffiths, "Head First C", O'reilly,2015.

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
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	ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The primary aim of this course is to discuss the basic structure of a digital computer and to study in detail the organization of the Control unit, the Arithmetic and Logical unit, the Memory unit and the I/O unit..

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To educate the students to the fundamentals of parallel processing
2	To teach the fundamentals of network topologies for multiprocessors
3	To introduce different pipeline designs
4	To introduce features of parallel processors , memory technologies, OS for multi programmed computer
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

COURSE OUTCOMES

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

CO1. Understand the operations of multiprocessor and multicomputer systems.	Remember
CO2. Understand the various advanced processor technology, pipelining and scalable architectures	Remember
CO3. Know the working of superscalar pipeline, cache memory organization	Remember
CO4. Understand the principles of multithreading, multithread architecture, static and dynamic data flow	Understand
CO5. Improve Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	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	-	-	S	M	-
CO2	M	M	S	-	-	-	-	L	-	-	-	-	S	-	-
CO3	M	-	S	S	-	-	-	-	S	-	-	-	S	-	M
CO4	M	-	-	-	S	-	M	-	-	-	M	-	S	M	-
CO5	-	M	-	-	M	S	-	-	M	-	-	M	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I THEORY OF PARALLELISM

Parallel Computer models – the state of computing-introduction to parallel processing- parallelism in uniprocessors& Multiprocessors,-parallel architectural classification schemes-speedup performance laws- - Program and Network Properties-H/W-S/W Parallelism and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT II SYSTEM INTERCONNECT ARCHITECTURES

System interconnect Architectures-Network Properties and routing-Static Interconnection Networks- Dynamic Interconnection Networks-Multiprocessor System Interconnects-inter processor communication network-Structure of Parallel Computers; Hierarchical bus systems-Crossbar switch and multiport memory-multistage and combining network

UNIT III PIPELINING AND SUPERSCALAR TECHNOLOGIES

Pipeline principle and implementation-classification of pipeline processor-introduction of arithmetic, instruction, processor pipelining-pipeline mechanisms-hazards

UNIT IV HARDWARE TECHNOLOGIES

Introduction to features of advanced embedded processors through Basic Comparative study : of Architectures -addressing modes -instruction types-performance of- Parallel and scalable architectures, Multiprocessor and SIMD, MIMD computers, RISC, CISC, Superscalar, VLIW, Vector, Systolic processors of their unique features - Scalable, Multithreaded and data flow Architectures-inter PE communication-interconnection networks- Array & vector processors, vector instruction types performance modeling-design of vectorising compiler- case Architecture of Itanium processor, Pentium Processor, SPARC Processor.

UNIT V OS ISSUES FOR MULTI PROCESSOR

Introduction-Need for Preemptive OS – Synchronizing and Scheduling in Multiprocessor OS-, Usual OS scheduling Techniques, threads – Classification of multi-processor OS – Software requirements of multiprocessor OS, Distributed scheduler – PVM – PT Threads in shared memory systems

.

REFERENCE BOOKS:

1. Kai Hwang "Advanced Computer Architecture".Tata McGraw Hill 2000
2. Advanced Computer architecture , By Rajiv Chopra, S Chand , 2010
3. John L. Hennessy, David A. Petterson, "Computer Architecture: A Quantitative Approach", 4th Edition, Elsevier, 2007
4. Dezso Sima, Terence Fountain, Peter Kacsuk, "Advanced computer Architecture – A design Space Approach". Pearson Education,2003.
5. Sajjan G. Shiva "Advanced Computer Architecture", Taylor & Francis, 2008
6. Rajaraman, C.Siva Ram Murthy, "Parallel Computers- Architecture and Programming", Prentice Hall India, 2008
7. Carl Homacher, Zvonko Vranesic, Sefwat Zaky, "Computer Organisation", 5th Edition, TMH, 2002.
8. David E. Culler, Jaswinder Pal Singh with Anoop Gupta "Parallel Computer Architecture" ,Elsevier, 2004.
9. John P. Shen. "Modern processor design Fundamentals of super scalar processors", Tata McGraw Hill 2003.
10. Harry F. Jordan Gita Alaghaband, "Fundamentals of Parallel Processing". Pearson Education, 2003.
11. Richard Y. Kain, "Advanced computer architecture – A system Design Approach", PHI, 2003.

COURSE DESIGNERS				
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	WIRELESS SENSORS AND NETWORKING DEVICES	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The primary aim of this course is to efficiently disseminate observations gathered by individual sensor nodes to all the sensor nodes in the network. Simple protocols such as flooding and gossiping are commonly proposed to achieve information dissemination in WSNs

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To discuss the overview of wireless sensor networks.
2	To familiarize the architecture of different networks
3	To get knowledge about various physical layer and mac protocols
4	To acquire knowledge about different types of smart sensors used for designing the embedded system
5	To know about the implementation of protocols on WSN in various applications

COURSE OUTCOMES

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

CO1. Explain the basics of wireless sensor networks.	Understand
CO2. Discuss about the sensor network components, architecture and design principles of WSN.	Understand
CO3. Explain the need of Physical layer design challenges and MAC Protocols.	Remember
CO4. Design the Smart Sensors and Applications of WSN.	Apply
CO5. Improve employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II ARCHITECTURES

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing

UNIT IV INFRASTRUCTURE ESTABLISHMENT

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TEXT BOOKS:

1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007

REFERENCE BOOKS:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, And pplications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

COURSE DESIGNERS

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	ARM RISC PROCESSORS AND ARCHITECTURE	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

The primary aim of this course is to cover application and design of ARM (Advanced RISC Machine) systems. Topics include assembly and C language programming and an introduction to the control and interfacing of ARM based systems.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To teach the architecture of general AVR processor
2	To teach the architecture and programming of 8/16 bit RISC processor
3	To teach the implementation of DSP in ARM processor
4	To discuss on memeroy management, application development in RISC processor
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

COURSE OUTCOMES

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

CO1. Describe the programmer's model of ARM processor and create and test assembly level programming.	Remember
CO2. Analyze various types of coprocessors and design suitable co-processor interface to ARM processor.	Remember
CO3. Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.	Remember
CO4. Develop more understanding on the concepts ARM Architecture, programming and application development.	Understand
CO5. Learn the process delivers insight into various embedded processors of RISC architecture / computational processors with improved design strategies	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	-	M	L	-	-	-	-	-	M	L	-	-
CO2	M	L	L	-	M	L	-	-	-	-	-	M	L	-	-
CO3	M	L	L	-	M	L	-	-	-	-	-	M	L	-	-
CO4	M	L	L	-	M	L	-	-	-	-	-	M	L	-	-
CO5	M	L	L	-	M	L	-	-	-	-	-	M	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I AVR MICROCONTROLLER ARCHITECTURE
Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports – SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing

UNIT II ARM ARCHITECTURE AND PROGRAMMING `
Arcon RISC Machine – Architectural Inheritance – Core & Architectures -- The ARM Programmer's model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings.

UNIT III ARM APPLICATION DEVELOPMENT
Introduction to RT implementation with ARM – –Exception Handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Free RTOS Embedded Operating Systems concepts – example on ARM core like ARM9 processor.
.

UNIT IV MEMORY PROTECTION AND MANAGEMENT
Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

UNIT V DESIGN WITH ARM MICROCONTROLLERS
Assembler Rules and Directives- Simple ASM/C programs- Hamming Code- Division-Negation- Simple Loops –Look up table- Block copy- subroutines-application.

REFERENCE BOOKS:

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System
3. Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
4. Muhammad Ali Mazidi, Sarmad Naimi ,Sepehr Naimi' AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education 2014.
5. ARM Architecture Reference Manual, LPC213x User Manual
6. www.Nuvoton .com/websites on Advanced ARM Cortex Processors
7. Trevor Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers,
8. An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.,

COURSE DESIGNERS

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1	Mr.R. Karthikeyan	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
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	INTERNET OF THINGS FOR EMBEDDED SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This syllabus is intended for the Engineering students and enables them to lean about Embedded systems .This syllabus contains intelligent agent, Difference between IoT and M2M and application. Which is useful to how represent knowledge and in machine learning contain some important prediction method. Thus, this syllabus focuses on IO T systems Home Automation Agriculture.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand and gain complete knowledge about internet of things
2	To study about network protocol
3	To learn basic programming and IoT tools
4	To get a knowledge in Embedded programming
5	To familiarize the students in writing assembly programming and interfacing with Peripherals using PIC Microcontroller

COURSE OUTCOMES

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

CO1:. Understand the concepts of Internet of Things.	Understand
CO2: - Classify and analyze the various standards and protocols used for embedded interfaces	Apply
CO3: Design IoT applications in different domains	Analyze
CO4: Examine the various types of software unit testing necessary for embedded system design.	Evaluate
CO5: - Develop knowledge and skills necessary to develop a real time embedded system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	P06	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

NTRODUCTION TO EMBEDDED SYSTEM &IOT: Embedded system- characteristics of embedded system- categories of embedded system- requirements of embedded systems- challenges and design issues of embedded system- Defining IoT, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, Functional Blocks of IoT, and Communication Models & APIs, machine to machine, Difference between IoT and M2M, Software Define Network.

EMBEDDED SOFTWARE DEVELOPMENT AND TOOLS : Software architectures, Round - Robin, Round- Robin with Interrupts, Function Queue Scheduling architecture, Introduction to assembler - Compiler - Cross compilers, Linker/ Locators, Simulators- Embedded Firmware Design Approaches and Development Languages**.**

EMBEDDED SOFTWARE DEVELOPMENT AND TOOLS : Software architectures, Round - Robin, Round- Robin with Interrupts, Function Queue Scheduling architecture, Introduction to assembler - Compiler - Cross compilers, Linker/ Locators, Simulators- Embedded Firmware Design Approaches and Development Languages

EMBEDDED PROGRAMMING: Programming in assembly language (ALP) vs High Level Language - C Program elements:- Macros and functions, Use of Date Types, Structure, Pointers, Function Calls - Introduction to different IoT Tools, Developing Applications through IoT Tools, Developing Sensor based Application through Embedded System Platform, Implementing IoT concepts with Python.

DOMAIN SPECIFIC APPLICATIONS: IoT applications - Home Automation-Agriculture- Health care - Surveillance Applications - Smart Grid - Introduction to Industrial IoT (IIoT)

TEXT BOOKS:

1. Perry Lea, "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security", Packt, 2018.
2. David Hanes, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco press, 2017.

REFERENCES:

1. Samuel Greengard, "The Internet of Things", The MIT Press Essential Knowledge series, 2015. 4. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", 2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley, 2012.
3. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 2010.

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4	Dr. L.K.Hema	Prof. & Head/ ECE	ECE	hodece@avit.ac.in

	ADVANCED SYSTEM ON CHIP DESIGN	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course includes details for designing and developing an image processing demo application.

PREREQUISITE: NIL

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 .

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,

ARM Cortex-A9 Processor

Cortex- A9, Cortex-A9 MPCore, Cortex-A9 MPE Configuration, Cortex-A9 Media Processing Engine, 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

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),

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				
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2	ARM University Program			

	EMBEDDED SYSTEMS LAB I	Category	L	T	P	Credit
		CC	0	0	2	2

PREAMBLE

To provide the skill to develop Assembly language programming for various types of microcontroller and interfacing peripheral devices with microcontroller is vital due to the persisting real time application scenarios. Hence exposure to interface ADCs, DACs with

PRERQUISITE

NIL

COURSE OBJECTIVES

1	To write the programs for communication between microcontroller and peripheral devices
2	To write the programs for 16 but Micro Controllers
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 applications like arithmetic operations, interrupt and UART, etc	Analyze
CO2.Develop assembly language program for basic applications like arithmetic operations, interrupt and UART, etc	Analyze
CO3. Develop and execute program using ARM architecture.	Analyze
CO4. 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	--	--

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS:

1. Design with 8 bit Microcontrollers 8051/PIC Microcontrollers
   i) I/O Programming, Timers, Interrupts, Serial port programming
   ii) PWM Generation, Motor Control, ADC/DAC, LCD and RTC Interfacing, Sensor Interfacing
   iii) Both Assembly and C programming
2. Design with 16 bit Microcontrollers
   I/O programming, Timers, Interrupts, Serial Communication,
3. Design with ARM Processors.
   I/O programming, ADC/DAC, Timers, Interrupts,
4. Study of one type of Real Time Operating Systems (RTOS)
5. Electronic Circuit Design of sequential, combinational digital circuits using CAD Tools
6. Simulation of digital controllers using MATLAB/LabVIEW.
7. Programming with DSP processors for
   Correlation, Convolution, Arithmetic adder, Multiplier, Design of Filters - FIR based, IIR based
8. Design with Programmable Logic Devices using Xilinx/Altera FPGA and CPLD
   Design and Implementation of simple Combinational/Sequential Circuits
9. Network Simulators
   Simple wired/ wireless network simulation using NS2
10. Programming of TCP/IP protocol stack.

Reference:

1. Laboratory Reference Manual.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.Vijay	Assistant Professor (G-II)	ECE	vijay.ece@avit.ac.in
2	Ms.Vanitha	Assistant Professor (G-II)	ECE	vanitha.ece@avit.ac.in

	EMBEDDED SYSTEMS LAB-II	Categor y	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To learn programming concepts using VHDL and Xilinx. The students will learn design with simulators/experiments, in programming processor boards, processor interfacing using Rasberry Pi Microcontroller Board, ARM Processors & PIC Microcontrollers. To make students get familiarize with GUI Simulation tool for developing projects.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To Study Programming concepts using VHDL and Xilinx.
2	To understand the concepts of GUI simulation tools
3	To Learn the working of ARM processor & PIC Microcontroller
4	The students will learn design with simulators/experiments ,inprogramming processorboards,processorinterfacingusingRasberryPiMicrocontrollerBoard

COURSE OUTCOMES

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

CO1. Discuss the programming concepts using VHDL and Xilinx	Understand
CO2. Develop programs using GUI Simulation tools	Analyze
CO3. Demonstrate programs in ARM for a specific Application	Apply
CO4. Develop Program for different applications using Rasberry Pi Microcontroller Board	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS:

1. ATMEL CPLDs – Prochip designer a) Schematic entry b) VHDL entry

2. AT40K FPGA series – synthesis – design – simulation of application programs
3. Xilinx EDA design tools – device programming –PROM programming
4. Programming & Simulation in GUI Simulators /Tools
5. Code compressor studio for embedded DSP using Texas tool kit
6. Programming ARM processor :ARM7 / ARM9/ARM Cortex, Study on incircuit Emulators, cross compilers , debuggers
7. IPCORE usage in VOIP through SoC2 tools
8. Programming with Rasberry Pi Microcontroller Board : Study on incircuit Emulators, crosscompilers, debuggers
9. Third party tools for embedded java and embedded C++ applications through cadence tools.

REFERENCE

1. Laboratory Reference Manual

COURSE DESIGNERS

S. No	Name of the Faculty	Mail ID
1	Mrs. R.MohanaPriya, A.P(Gr-II), ECE	mohanapriya@avit.ac.in
2	Mr. Vijay, A.P(Gr-II),ECE	vijay.ece@avit.ac.in

	MEMORY TECHNOLOGIES	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

This course is helps in understanding various memory architectures and its fabrication processes.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To familiarize on various architecture and classifications on Volatile memory
2	Analyze and identify suitable nonvolatile memory
3	To analyze the various influencing parameters on semiconductor memory technology.
4	To understand the embedded logic architectures and its relations.
5	To learn about future trends in memory technologies.

COURSE OUTCOMES

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

CO1. Select architecture and design semiconductor memory circuits and subsystems.	Evaluate
CO2. Foster ability to understand the role of embedded systems in industry	Analyze
CO3. Analyze various types of advancement in semiconductor memories	Apply
CO4. Acquire knowledge about different embedded system memories	Analyze
CO5. Design and Evaluate state-of-the-art memory chip design	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

RAM TECHNOLOGIES

SRAM: Static Random Access Memories (SRAMs), SRAM Cell Structures, MOS SRAM Architecture, MOS SRAM Cell and Peripheral Circuit, Bipolar SRAM, Advanced SRAM Architectures, Application Specific SRAMs.

DRAM: DRAMs, MOS DRAM Cell, BiCMOS DRAM, Error Failures in DRAM, Advanced DRAM Design and Architecture, Application Specific DRAMs. SRAM and DRAM Memory controllers.

ROM TECHNOLOGIES

Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash Memories.

SEMICONDUCTOR MEMORY RELIABILITY AND RADIATION EFFECTS

General Reliability Issues, RAM Failure Modes and Mechanism, Nonvolatile Memory, Radiation Effects, SEP, Radiation Hardening Techniques. Process and Design Issues, Radiation Hardened Memory Characteristics, Radiation Hardness Assurance and Testing. -tunneling hot electron transistors.

EMBEDDED MEMORIES DESIGNS AND APPLICATIONS:

Embedded Memory Developments, Cache Memory Designs, Embedded SRAMDRAM Designs, DRAM ASICs, DRAM Processes with Embedded Logic Architectures, Embedded EEPROM and Flash Memories

FUTURE MEMORY DIRECTIONS: MEGABYTES TO TERABYTES

Future Memory Developments, Magnetoresistive Random Access Memories (MRAMs), Resonant Tunneling Diode-Based Memories, Single-Electron Memories, Phase-Change Nonvolatile Memories, Protonic Nonvolatile Memories

TEXT BOOKS:

1. Ashok K Sharma, "Advanced Semiconductor Memories: Architectures, Designs and Applications", Wiley Interscience.
2. Ashok K Sharma," Semiconductor Memories: Technology, Testing and Reliability, PHI

REFERENCE BOOKS:

1. Hidaka, Hideto (Ed.), Embedded Flash Memory for Embedded Systems: Technology, Design for Sub-systems, and Innovations, 2018, ISBN 978-3-319-55306-1
2. Joe Brewer, Manzur Gill "Nonvolatile Memory Technologies with Emphasis on Flash: A Comprehensive Guide to Understanding and Using Flash Memory Devices (IEEE Press Series on Microelectronic Systems Book 8)"

COURSE DESIGNERS

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	MEMS TECHNOLOGY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The objective of this course is to make students understand the concepts of MEMS material and its fabrication process. To design and get familiarized with electrostatic sensor, thermal sensor , piezoelectric sensors and actuators .To understand the concepts of MEMS devices & its characteristics and its application.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand properties of MEMS materials ,microstructure and fabrication methods.
2	To design and model the Electrostatic sensors and actuators.
3	To design and model the thermal sensors and actuators .
4	To understand the fundamentals of piezoelectric sensors and actuators through exposure to different MEMS
5	To Understand the basic concepts of MEMS devices and its characteristics

COURSE OUTCOMES

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

CO1. Understand about MEMS materials, microstructure and its fabrication	Understand
CO2. Explain the concept Electrostatic Sensors and actuators	Apply
CO3. Design and analyze Thermal Sensors and actuators	Analyze
CO4. Illustrate the application of piezoelectric sensors and actuators through different MEMS	Analyze
CO5. Explain the concept of MEMS devices and its characteristics	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	M	-	M	-	-	-	-	-	-	S	S	M	-
CO2	S	S	L	-	M	M	-	-	-	-	-	S	S	M	-
CO3	S	S	M	-	L	M	-	-	-	-	-	S	S	M	-
CO4	S	M	L	-	M	M	-	-	-	-	-	S	S	M	-
CO5	M	M	L	-	L	-	-	-	-	-	-	S	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

MEMS AND MICRO SYSTEM-FABRICATION, MATERIALS AND ELECTRO-MECHANICAL CONCEPTS

MEMS materials: Silicon, silicon compounds, polymers, metals**,** Micro fabrication process, Silicon and other material based fabrication processes, conductivity of semiconductors-Crystal planes and orientation-stress and strain- beam bending, torsional deflections-Intrinsic stress- resonant frequency and quality factor.

ELECTROSTATIC SENSORS AND ACTUATION

Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators - Applications

THERMAL SENSING AND ACTUATION

Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

PIEZOELECTRIC SENSING AND ACTUATION

Piezoelectric effect- -properties of piezoelectric materials-Applications,Piezoresistive sensors, Magnetic actuation, Micro fluidics applications

MEMS DEVICES AND ITS CHARACTERISTICS

Architecture, working and basic quantitative behaviour of Cantilevers, Microheaters, Accelerometers, Pressure Sensors, Piezoresistance, TCR, Stiffness, Adhesion, Vibration, Resonant frequency.

TEXT BOOKS:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. M.H.Bao "Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes",Elsevier, Newyork, 2000

REFERENCES:

1. Marc Madou , "Fundamentals of microfabrication",CRC Press, 1997.
2. Boston , "Micromachined Transducers Sourcebook",WCB McGraw Hill, 1998.

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1	R. Mohana Priya, A.P(Gr-II), ECE	mohanapriya@avit.ac.in
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	EMBEDDED LINUX	Category	L	T	P	Credit
		E **EC-PS** C	**3**	**0**	**0**	**3**

PREAMBLE

The objective of this course is to make students understand the concepts of Linux Operating System, GNU cross platform tool chain. To learn about Kernel. To get familiarized with different memory devices and file transfer method .

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the fundamentals of Linux Operating system, its basic commands and programming.
2	To get familiarized with embedded Linux GNU Cross Platform Tool Chain.
3	To analyze the performance of various different memory devices and file transfer .
4	To understand the fundamentals concepts of Configure Kernel.
5	To learn about Linux drivers

COURSE OUTCOMES

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

CO1. Explain the use Linux desktop and GNU tool chain with Eclipse IDE	Apply
CO2. Discuss on the concept of distributions and cross platform tool chain.	Understand
CO3. Analyze the performance of various different memory devices and file transfer.	Analyze
CO4. Illustrate the application of piezoelectric sensors and actuators through different MEMS.	Analyze
CO5. Discuss on Linux drivers and its application.	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	-	M	M	-	-	-	-	-		S	M	-
CO2	M	M	L	-	L	-	-	-	-	-	-		S	M	-
CO3	S	S	M	-	L	M	-	-	-	-	-		S	M	-
CO4	S	M	L	-	M	M	-	-	-	-	-		S	M	-
CO5	M	M	L	-	L	-	-	-	-	-	-		S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF LINUX

Linux System and its Working with Files and Directories - Linux File system - Partitions and File systems - Understanding Linux Permissions; Using Command Line Tools: Executing Commands from the Command Line - Getting to a Shell - Popular Command-Line Commands - Working with the Bash Shell

EMBEDDED LINUX

Introduction - Origin of Embedded Linux - Embedded Linux vs Desktop Linux - Commercial Embedded Linux and its Distribution- Architecture of Embedded Linux - Linux Kernel Architecture - GNU Cross Platform Toolchain

HOST-TARGET SETUP & ITS ARCHITECTURE

Real Life Embedded Linux Systems - Design and Implementation Methodology - Types of Host/Target Development Setups Debug Setups - Generic Architecture of an Embedded Linux System - System Startup - Types of Boot Configurations - System Memory - Processor Architectures - Buses and Interfaces - I/O – Storage

INTRODUCTION TO KERNEL & ITS CONFIGURATION

Introduction to Linux Kernel Modules- GNU Cross-Platform Development Toolchain - C Library Alternatives- - Eclipse: An Integrated Development Environment - Terminal Emulators - Kernel-Selection - configurationl - Compiling - Installing - Basic Root Files ystem Structure - Libraries - Modules and Images - - Application Demo: Building a Ranging Sensor Kernel Module

LINUX DRIVERS

Introduction in to basics on Linux drivers, introduction to GNU cross platform Toolchain-

TEXT BOOK:

1. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, and Philippe Gerum, 'Building Embedded Linux Systems 2nd Edition', SPD -O'Reilly Publications, 2008.
2. Robert Love,"Linux System Programming, SPD -O'Reilly Publications, 2010

REFERENCES:

1. P.Raghavan,Amol Lad,Sriram Neelakandan,"Embedded Linux System Design & Development,Auerbach Publications, 2012
2. William von Hagen, 'Ubuntu Linux Bible 3rd Edition', Wiley Publishing Inc., 2010
3. Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman, 'Linux Device Drivers 3rd Edition',SPD -O'Reilly Publications, 2011

COURSE DESIGNERS

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	ADVANCED DIGITAL SIGNAL PROCESSING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

This course aims to provide students with an understanding of digital image processing techniques, including image reconstruction and restoration, segmentation and enhancement, also colour and morphological image processing techniques.

PRERQUISITE

NIL

COURSE OBJECTIVES

1	To discuss comprehends mathematical description and modelling of discrete time random signals
2	To Analysis of signal processing methods and tools
3	To provide Knowledge of Filter Design method.
4	To familiar with estimation, prediction, filtering, multirate concepts and techniques
5	To discuss Method of leading algorithms for various applications

COURSE OUTCOMES

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

CO1. Formulate time domain and frequency domain description of Wide Sense Stationary process in terms of matrix algebra and relate to linear algebra concept	Apply
CO2. State W-K theorem, spectral factorization theorem, spectrum estimation, bias and consistency of estimators.	Apply
CO3. Apply Wiener filtering, LMS algorithms, Levinson recursion algorithm, applications of adaptive filters	Apply
CO4. Decimation, interpolation, Sampling rate conversion, Applications of multirate signal processing	Apply
CO5. Infer about the control instructions, interrupts, and pipeline operations	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I DISCRETE RANDOM SIGNAL PROCESSING

Discrete random processes – Ensemble averages – Wide sense stationary process – Properties - Ergodic process – Sample mean & variance - Auto-correlation and Auto-correlation matrices Properties – White noise process – Weiner Khitchine relation - Power spectral density – Filtering random process – Spectral Factorization Theorem – Special types of Random Processes – AR,MA, ARMA Processes – Yule-Walker equations.

UNIT II SPECTRUM ESTIMATION

Bias and Consistency of estimators - Non-Parametric methods – Periodogram – Modified Periodogram – Barlett's method – Welch's method – Blackman-Tukey method – Parametric methods – AR, MA and ARMA spectrum estimation - Performance analysis of estimators.

UNIT III SIGNAL MODELING AND OPTIMUM FILTERS

Introduction - Least square method – Pade approximation – Prony's method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Weiner Filter -– Mean square error – Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS

FIR Adaptive filters - Newton's steepest descent method – Widrow Hoff LMS Adaptive algorithm – Convergence – Normalized LMS – Applications – Noise cancellation - channel equalization – echo canceller – Adaptive Recursive Filters - RLS adaptive algorithm – Exponentially weighted RLS sliding window RLS.

UNIT V MULTIRATE SIGNAL PROCESSING

Decimation - Interpolation – Sampling Rate conversion by a rational factor I/D – Multistage implementation of sampling rate conversion – Polyphase filter structures – Applications of multirate signal processing.

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of a. India, New Delhi, 2005.
2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006.

REFERENCE BOOKS:

1. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992. a.
2. S. Kay," Modern spectrum Estimation theory and application", Prentice Hall, Englehood a. Cliffs, NJ 1988.

5. Simon Haykin, "A

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
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	PROGRAMMING IN PYTHON	CATEGORY	L	T	P	CREDIT
		EC-PS	3	0	0	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, file concepts and CSV and JSON.

COURSE OUTCOMES

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

CO1. Learn python statements, comments and indentation, tokens, input and output methods using various example programs.	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, decorators and generators.	Apply.
CO5. Compute the exception handling programs, file concept programs and understand the concepts of CSV and JSON.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT-1 INTRODUCTION

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

UNIT-2 DATA STRUCTURES

Strings-Lists-Tuples-Dictionaries-Sets

UNIT-3 CONTROL STATEMENTS

Flow Control-Selection control Structure-if-if-else-if-elif-else-Nested if iterative control structures-while loop,for loop and range.

UNIT-4 FUNCTIONS

Declaration-Types of Arguments-Fixed arguments, variable arguments, keyword arguments and keywordvariable arguments-Recursions-Anonymous functions: lambda- Decorators and Generators.

UNIT-5 EXCEPTION HANDLING

Exception Handling-Regular Expression-Calendars and clock files:File input/output operations-Dictionaryoperations-Reading and writing in structured files:CSV and JSON.

TEXT BOOKS:

1. Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", 1st Edition, O'ReillyMedia, 2014.
2. Programming With Python Book 'Himalaya Publishing House Pvt Ltd
3. "Dive Into Python" by Mark Pilgrim

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
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	EMBEDDED PRODUCT DEVELOPMENT	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Embedded product development course enables the students to integrate knowledge in design, development and industry integrity of the cycle.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To analyze and learn various aspects of product development.
2	Design & development of concept generation and its related methods
3	Architectures in product development and various approaches to be studied.
4	Integration of various tools for simulation for industry applications.
5	To study about the complete Embedded Product Development Life Cycle

COURSE OUTCOMES

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

CO1. Analyze various strategies used for product development	Analyze
CO2. Apply structural approach to concept generation, creativity, selection and testing.	Apply
CO3. Understand various aspects of design such as industrial design, design of Consumer specific product, its Reverse Engineering manufacture, economic analysis and product architecture.	Apply
CO4. Tools & techniques used for industry design in manufacturing.	Analyze
CO5. Analyze the complete cycle of EDLC	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	M	M	M	-	-	-	-	-	-	M	S	M	M
CO3	S	S	M	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	S	M	S	M	-	-	-	-	-	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

PRODUCT DEVELOPMENT

Need for PD- Generic product Development Process Phases- Product Development Process Flows- Product Development organization structures-Strategic importance of Product Planning process – Product Specifications-Target Specifications-Plan and establish product specifications - integration of customer, designer, material supplier and process planner, Competitor and customer - Understanding customer and behavior analysis.

DESIGN AND DEVELOPMENT

Concept Generation, Five Step Method-Basics of Concept selection- Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition. Embedded System development environment - IDE, Types of file generated on cross compilation, disassembler / decompiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

APPROACHES IN PRODUCT DEVELOPMENT

Product development management - establishing the architecture - creation - Product Architecture changes - variety – component standardization, clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications-Portfolio Architecture- competitive benchmarking-Approach for the benchmarking process

INDUSTRY DESIGN

Design for manufacturing - Industrial Design-Robust Design – Prototype basics - Principles of prototyping - Planning for prototypes- Economic & Cost Analysis - Testing Methodologies- Product Branding. Role of Integrating CAE, CAD, CAM tools for Simulating product performance and manufacturing processes electronically- Basics on reverse engineering – Reverse engineering strategies – Finding reusable software components – Recycling real-time embedded software-based approach and

its logical basics- Incorporating reverse engineering for consumer product development –case study

EMBEDDED SYSTEM APPLICATION DEVELOPMENT

Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC), Case studies on Smart card- Adaptive Cruise control in a Car -Mobile Phone software for key inputs.

TEXT BOOKS:

1. "Product Design and Development", Anita Goyal, Karl T Ulrich, Steven D Eppinger, McGraw –Hill International Edns.1999/ Tata McGraw Education, ISBN-10- 007-14679-9.

2. R.G. Kaduskar and V.B. Baru, "Electronic Product Design", Wiley, 2014.

3. KEVIN OTTO & KRISTIN WOOD, "Product Design and Development", 4th Edition,2009, Product Design Techniques in Reverse Engineering and New Product Development, Pearson Education (LPE),2001/ISBN 9788177588217

REFERENCE BOOKS:

1. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7

2. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.Vanitha	Assistant Professor (G-II)	ECE	vanitha@avit.ac.in
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	DISTRIBUTED EMBEDDED COMPUTING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Sound knowledge on fundamentals of Networking and Embedded Systems. The designed course makes the students to work on the various applications of the coding.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To enhance the knowledge in distributed system and internet-based networking
2	Design & analyze the concepts of distributed embedded systems
3	Security and testing of embedded protocols with cost and performance implications
4	To understand the distributed computing with its model.
5	To learn about various security, threads & networks in web services.

COURSE OUTCOMES

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

CO1. Internet based network distribution in embedded domain	Apply
CO2. Real time embedded system model, analysis and performance can be determined.	Apply
CO3. Security and testing of embedded protocols and to identify fault tolerance.	Apply
CO4. Authentication of the distributed models.	Analyze
CO5. Threads, Firewall and various other security measures in web services are focused.	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

INTRODUCTION TO DISTRIBUTED SYSTEM

Introduction- Communication in distribution system-Client/Server Model-Synchronization in distributed system. Parallels between the large-scale (Internet-based) and small-scale networked distributed embedded system domains

DISTRIBUTED EMBEDDED SYSTEMS

Real-time systems, models, communication and scheduling, design and validation, implementation, performance, power and cost, embedded network protocols.

SECURITY AND TESTING

Basics of embedded system security, distributed cyber physical systems that includes integration of protocols, middleware services, and tools into a common architecture with layered, reusable, secure, fault-isolating components, project case studies for distributed embedded systems

DISTRIBUTED COMPUTING

Definition of distributed computing - Model of distributed computation- Distributed shared memory- Authentication in distributed system

SECURITY IN COMPUTING

Security meaning- Threads in networks- Network security control- Firewall- Authentication- E-mail security- Security in web services- Case studies

TEXT BOOKS:

1. Hermann Kopetz, "Real-Time Systems - Design Principles for Distributed Embedded Applications", Springer, Second Edition, 2011

2. Ajay D Kshemkalyani, Mukesh Singhal, "Distributed Computing" – Principles, Algorithm and systems, Cambridge university press 2008.

3. Charles P. Pfleeger, "Security in Computing", Pearson 2009.

REFERENCE BOOKS:

1. Steve Heath, "Embedded System Design", Newnes, 2003.

2. Peter Marwedel, "Embedded System Design - Embedded System Design Foundations of Cyber - Physical Systems", Springer, Second edition, 2011.

3. Wayne Wolf, "Computers as Components", Second edition, Morgan Kaufmann, 2008

COURSE DESIGNERS

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1	Ms.Vanitha	Assistant Professor(G-II)	ECE	vanitha@avit.ac.in
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	SOFT COMPUTING AND OPTIMIZATION TECHNIQUES	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

This course focus on giving introduction to some new fields in soft computing with its principal components of fuzzy logic and GA which helps students to differentiate traditional and genetic algorithm. This course gives insightful study about problems incurred in various domains and the comprehensive soft computing techniques provides solution to these problems benefiting the students for the pursuit of allied research

PREREQUISITE – nil

COURSE OBJECTIVES

1	To understand the fundamental concepts of soft computing, artificial neural networks and optimization techniques
2	To Familiarize with recent advancements in Artificial neural networks and optimization techniques
3	To know the operation of neuro-fuzzy systems
4	To know Optimization Techniques
5	To involve in different types of Advanced Optimization Techniques

COURSE OUTCOMES

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

CO1. Comprehend the fundamentals of artificial neural network, fuzzy systems and Optimization techniques	Remember
CO2. Understand the significance of various optimization algorithms applied to engineering problems.	Remember
CO3. Be capable of developing ANN-based models.	Apply
CO4. Be capable of choosing appropriate optimization techniques for engineering applications.	Apply
CO5. Be capable of choosing appropriate advanced optimization techniques tools for engineering applications.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS

Introduction to soft computing: soft computing vs. hard computing – various types of soft computing techniques, from conventional AI to computational intelligence, applications of soft computing.
Fundamentals of neural network: biological neuron, artificial neuron, activation function, single layer perceptron – limitations. Multi-layer perceptron – back propagation algorithm.

UNIT II ARTIFICIAL NEURAL NETWORKS

Radial basis function networks – reinforcement learning. Hopfield / recurrent network – configuration –stability constraints, associative memory and characteristics, limitations and applications. Hopfield vs. Boltzmann machine. Advances in neural networks – convolution neural networks. Familiarization of Neural network toolbox.

UNIT III FUZZY LOGIC AND NEURO FUZZY SYSTEMS

Fundamentals of fuzzy set theory: fuzzy sets, operations on fuzzy sets, scalar cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition. Fuzzy membership functions. Fundamentals of neuro-fuzzy systems – ANFIS. Familiarization of ANFIS Toolbox.

UNIT IV INTRODUCTION TO OPTIMIZATION TECHNIQUES

Classification of optimization problems – classical optimization techniques. Linear programming – simplex algorithm. Non-linear programming – steepest descent method, augmented Lagrange multiplier method – equality constrained problems.

UNIT V ADVANCED OPTIMIZATION TECHNIQUES

Simple hill climbing algorithm, Steepest ascent hill climbing – algorithm and features. Simulated annealing – algorithm and features. Genetic algorithm: working principle, fitness function. Familiarization with Optimization Toolbox.

.

REFERENCES:

1. Laurene V. Fausett, "Fundamentals of neural networks, architecture, algorithms and applications, Pearson Education, 2008.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and soft computing",Prentice Hall of India, 2003.
3. Simon Haykin, "Neural Networks – A comprehensive foundation", Pearson Education, 2005.
4. David E. Goldberg, "Genetic algorithms in search, optimization and machine learning",Pearson Education, 2009.
5. Singiresu S. Rao, "Engineering Optimization – Theory and Practice", 4th edition, John Wiley & Sons, 2009.
6. Thomas Weise, "Global Optimization algorithms – Theory and applications", self-published, 2009

COURSE DESIGNERS

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	CRYPTOGRAPHY AND NETWORK SECURITY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To understand the concepts in cryptography and network security and their applications in real time

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the basic concepts in understanding cryptography and network security
2	To know about various encryption techniques.
3	To understand the concept of Public key cryptography.
4	To study about message authentication and hash functions
5	To impart knowledge on Network security

COURSE OUTCOMES

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

CO1: Classify the symmetric encryption techniques	Understand
CO2: Illustrate various Public key cryptographic techniques	Apply
CO3: Evaluate the authentication and hash algorithms.	Apply
CO4: Discuss authentication applications	Apply
CO5: Summarize the intrusion detection and its solutions to overcome the attacks.	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	-	M	-	-	-	-	-	-	M	M	-	-
CO2	S	M	L	-	M	-	-	-	-	-	-	M	M	-	-
CO3	S	M	L	-	M	-	-	-	-	-	-	M	M	-	-
CO4	S	M	L	-	M	-	-	-	-	-	-	M	M	M	M
CO5	S	L	L	-	M	-	-	-	-	-	-	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS INTRODUCTION

Security trends – Attacks and services – Classical crypto systems – Different types of ciphers – LFSR sequences – Basic Number theory – Congruences – Chinese Remainder theorem – Modular exponentiation – Fermat and Euler's theorem – Legendre and Jacobi symbols – Finite fields – continued fractions.

METHODS

Simple DES – Differential cryptanalysis – DES – Modes of operation – Triple DES –AES – RC4 – RSA – Attacks – Primality test – factoring

TECHNIQUES

Discrete Logarithms – Computing discrete logs – Diffie-Hellman key exchange –ElGamal Public key cryptosystems –Hash functions – Secure Hash – Birthday attacks -MD5 – Digital signatures – RSA – ElGamal – DSA.

AUTHENTICATION

Authentication applications – Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET.

SECURITY AND FIREWALLS

System security – Intruders – Malicious software – viruses – Firewalls – Security Standards

TEXT BOOKS

1. Dr. S. Bose and Dr.P. Vijayakumar, "Cryptography and Network Security", First Edition, Pearson Education, 2016.
2. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd ed, Pearson, 2007.
3. William Stallings, "Cryptography and Network Security Principles and Practices", Pearson/PHI, 6th edition, 2013.

REFERENCES

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition – Prentice Hall of India, 2006.

COURSE DESIGNERS

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	EMBEDDED SYSTEMS FOR AUTOMOTIVE ELECTRONICS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Embedded product development course enables the students to integrate knowledge in design, development and industry integrity of the cycle.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To analyze and learn various aspects of product development.
2	Design & development of concept generation and its related methods
3	Architectures in product development and various approaches to be studied.
4	Integration of various tools for simulation for industry applications.
5	To study about the complete Embedded Product Development Life Cycle

COURSE OUTCOMES

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

CO1. Analyze various strategies used for product development	Analyze
CO2. Apply structural approach to concept generation, creativity, selection and testing.	Apply
CO3. Understand various aspects of design such as industrial design, design of Consumer specific product, its Reverse Engineering manufacture, economic analysis and product architecture.	Apply
CO4. Tools & techniques used for industry design in manufacturing.	Analyze
CO5. Analyze the complete cycle of EDLC	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	M	M	M	-	-	-	-	-	-	M	S	M	M
CO3	S	S	M	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	S	M	S	M	-	-	-	-	-	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

REVIEW OF EMBEDDED SYSTEMS

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories -Devices & buses for devices network – serial communication using I2C, CAN, USB buses – parallel communication using ISA, PCI – device drivers in a system – Serial port & parallel port

INTRODUCTION TO AUTOMOTIVE ELECTRONICS

Body and convenience electronics, Vehicle power supply controllers and lighting modules, Door control modules Safety electronics: Active safety systems such as ABS, ASR& ESP etc., Passive safety systems such as restrained systems and their associated sensor in an automobile. Power train electronics: Petrol Engine Management, Infotainment electronics: Dashboard /Instrument cluster, car audio, telematics system, navigation system, multimedia systems etc. Cross application technologies:42-volt vehicle power supply system

EMBEDDED COMMUNICATIONS

Embedded Communications A Review of Embedded Automotive Protocols, Dependable Automotive CAN Networks, Flex Ray Protocol

HARDWARE MODULE

Hardware Modules MC9S12XD family features Modes of operation: functional block diagram overview, Programming model Map Overview Pulse width Modulator (PWM) On chip ADC serial communication protocol: SCI, SPI, IIC, CAN

VEHICLES MANAGEMENT SYSTEM & ELECTRONIC DIAGNOSIS

Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition-Vehicle cruise control- speed controlanti-locking braking system-electronic suspension - electronic steering, wiper control. System diagnostic standards and regulation requirements –On board diagnosis of vehicles electronic units & electric units-Speedometer, oil and temperature gauges, and audio system.

TEXT BOOKS:

1. William B. Ribbens," Understanding Automotive Electronics", Elseiver,2012.
2. Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection – Ford
3. Jurgen, R., Automotive Electronics Hand Book

REFERENCE BOOKS:

1. Tom Denton, "Automotive Electricals / Electronics System and Components", 3rd Edition, 2004.
2. Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 4thEdition,2004.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
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	COMPUTER VISION AND IMAGE UNDERSTANDING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The intent of this course is to familiarize the students to explain the fundamental concepts/issues of Computer Vision and Image Processing, and major approaches that address them. This course provides an introduction to computer vision including image acquisition and image formation models, radiometric models of image formation, image formation in the camera, image processing concepts, concept of feature extraction and selection for pattern classification/recognition, and advanced concepts like motion estimation and tracking, image classification, scene understanding, object classification and tracking, image fusion, and image registration, etc.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To introduce students the fundamentals of image formation.
2	To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition
3	To develop an appreciation for various issues in the design of computer vision and object recognition systems.
4	To gain the knowledge about machine learning.
5	To provide the student with programming experience from implementing computer vision and object recognition applications.

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.	Remember
CO2. describe known principles of human visual system and image formation.	Understand
CO3. describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.	Understand
CO4. Learners can acquire knowledge about machine learning.	Apply
CO5. suggest a design of a computer vision system for a specific problem.	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	-	-	-	-	-	-	-	-	-	-	S	-	-
CO2	M	M	L	L	L	-	-	-	-	-	L	-	S	-	-
CO3	L	S	S	S	S	S	-	-	-	-	S	S	S	-	M
CO4	-	-	M	M	M	-	-	-	-	-	M	-	S	M	-

CO5	S	S	S	S	S	L	-	-	-	-	S	1	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I: Introduction to Computer Vision and Basic Concepts of Image Formation:
Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts. Radiometry, Geometric Transformations, Geometric Camera Models. Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.

UNIT II: Image Processing Concepts:
Image Transforms, Image Enhancement. Image Filtering, Colour Image Processing, Image Segmentation.

UNIT III: Image Descriptors and Features:
Texture Descriptors, Colour Features, Edges/Boundaries. Object Boundary and Shape Representations .Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features,Saliency.

UNIT IV Fundamentals of Machine Learning:
Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.

UNIT V : Applications of Computer Vision:
Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Auto encoders. Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments.

REFERENCE BOOKS:

1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education.
2. M.K. Bhuyan , " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, ISBN 9780815370840 - CAT# K338147.
3. Richard Szeliski, "Computer Vision- Algorithms & Applications", Springer

COURSE DESIGNERS

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	NANO ELECTRONIC SYSTEMS	Category	L	T	P	Credit
		EC - PS	3	0	0	3

PREAMBLE

This course enables students about the fundamental understanding of Nanoelectronics followed by the advancements in MEMS and NEMS systems. It also provides an advanced level vast understanding on MOSFETS & and molecular electronics.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To provide a better understanding of nanotechnology with nanomaterials.
2	To deploy better knowledge on Spintronics and Quantum Computing.
3	To have a good exposure on different types of microscopes and molecular electronics
4	To provide a deep understanding of MEMS & NEMS systems.

COURSE OUTCOMES

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

CO1. Expose technical knowledge in one or more areas of specialization.	Understand
CO2. Discuss the types of nanotechnology, molecular technology and the preparation of nano materials.	Analyze
CO3. Explain the fundamental of the devices such as logic devices, field effect devices, and spintronics.	Understand
CO4. Distinguish various types of MEMS and NEMS devices.	Analyze
CO5. Analyze the Quantum transport devices and single electron devices .	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	-	L	-	-	M	S	-	-	S	-	S	-	M	-
CO2	S	-	S	-	S	-	L	S	L	S	M	-	S	-	-
CO3	S	S	L	L	S	M	S	-	S	L	S	-	L	S	-
CO4	S	-	L	-	M	-	S	S	-	M	-	L	-	S	-
CO5	M	S	L	M	-	M	S	-	L	L	-	-	L	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Need for 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. Fundamentals of logic devices : Requirements – dynamic properties – threshold gates - physical limits to computations - Spintronics – Quantum cellular automata – Quantum computing.

MICROSCOPES & NANO MATERIALS

Electron Microscope – Scanning Electron Microscope – Atomic Force Microscope –Scanning Tunneling Microscope - Preparation –Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position – Ball Milling –Applications Of Nanomaterials

MoSILICON 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.

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

MEMS & NEMS : Introduction to MEMS and NEMS, working principles, micro sensors , micro actuators, Pizoresistivity, Pizoelectricity and thermoelectricity, MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition.

TEXT BOOKS :

1. Stephen D. Sentaria, Microsystem Design, Kluwer Academic Press, 2019.
2. Marc Madou, Fundamentals of microfabrication & Nanofabrication., 2018
3. T. Fukada & W.Mens, Micro Mechanical system Principle & Technology, Elsevier, 1998.
4. Julian W.Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices, 2001.

REFERENCE BOOKS:

1. Nano Technology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springer, 2020
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill, 2019.
3. Spin Electronics by M. Ziese and M.J. Thornton, 2019.
4. Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices by Karl Goser, Peter Glosekotter, Jan Dienstuhl.

COURSE DESIGNERS

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	ENTREPRENEURSHIP OPPORTUNITIES IN EMBEDDED SYSTEMS	Category	L	T	P	Credit
		EC - PS	3	0	0	3

PREAMBLE

This course is designed to have better viability towards the embedded system products & design and also it emphasis the different possibilities of product development with scope and market demand of the embedded products.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To provide a clear understanding on the basic concepts, Building Blocks of Embedded Systems
2	To develop an understanding on business promotion process.
3	To impart embedded system technology based entrepreneurship.
4	To provide basic concepts of product design, product features and its architecture with common features and also to incorporate them suitably in product

COURSE OUTCOMES

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

CO1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems	Remember
CO2. Manage people, processes, and resources within a diverse organization	Evaluate
CO3. Analyze the internal/external factors affecting a business/organization to evaluate business Opportunities	Analyze
CO4. Understand the integration of customer requirements in product design	Understand
CO5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	S		L		M		S		S			L		
CO2	L	S		M	M		S		L		S			S	
CO3		S	M		L			S		M		S		M	
CO4	M		S			M		S		S		M		M	
CO5	S	L		S		S		L		S		S	S		

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF EMBEDDED SYSTEMS : Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock.

APPROACHES IN PRODUCT DEVELOPMENT : Product development management - establishing the architecture - creation - Product Architecture changes - variety – component standardization , clustering -geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications-Portfolio Architecture competitive benchmarking- Approach for the benchmarking process-Design for manufacturing - Industrial Design-Robust Design – Prototype basics - Principles of prototyping - Planning for prototypes - Economic & Cost Analysis - Testing Methodologies - Product Branding

ELECTRONIC PRODUCT DEVELOPMENT STAGES : Product Development Stages-Embedded product modeling- Linear, Iterative, Prototyping, Spiral - Selection of Sensor, Voltage Supply, Power supply protection, Grounding and noise elimination methods, Thermal protection with heat management – PCB design steps – Software design and testing method – documentation.

SCOPE OF EMBEDDED PRODUCTS : Embedded systems design, modeling, Feasibility study on embedded system products- Entrepreneurial skills for embedded system hardware and software architecture, software and hardware co- design and challenges; problems of entrepreneurship in Embedded system field.

MARKET DEMAND OF EMBEDDED SYSTEMS : Embedded system Product development- feature driven development- release management-market pull product search, Entrepreneurial case studies: Mobile phone development- automation components-Washing machine- Food Processing system and devices- High Performance embedded computers- Industrial Controllers

TEXT BOOKS :

1. Peckol, "Embedded system Design",JohnWiley&Sons,2019
2. Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill,2015
3. Jeffry Timmons, New Ventrure creation, McGraw Hill, 1999
4. James K.peckol ," Embedded Systems: A contemporary Design Tool", Wiley,2014

REFERENCE BOOKS:

1. Kuratko, Enmterpreneurship : A Contemporary Approach, Thomson Learning, 2019.
2. Thomas Zimmerer et.al., Essentials of Entrepreneurship and small business Management 3rd Ed. Pearson Education, 2016
3. Greene, Entrepreneurship: Ideas in Action, Thomson Learning, Mumbai, 2000
4. LyLa B. Das "Embedded Systems: An Integrated Approach" Pearson, 2013

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.V.Prabhakaran	Assistant Professor (G-II)	BME	prabhakaran.bme@avit.ac.in
2	Ms.Mohana Priya	Assistant Professor (G-II)	ECE	mohanapriya@avit.ac.in

	RECONFIGURABLE PROCESSOR TECHNOLOGIES	Category	L	T	P	Credit
		EC - PS	3	0	0	3

PREAMBLE

This course is designed to induce fundamental knowledge and understanding of the principles and practice in reconfigurable architecture and computing. In addition, this course will enhance the understanding of FPGA and SOC applications in HDL perspective.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To Introduce Software and Hardware Tools used in Processor Technology.
2	To Design VLSI Subsystems using Verilog HDL.
3	To Implement the Arithmetic and Logical Unit on FPGA.
4	To Understand the Reconfigurable processors with SOC Applications.

COURSE OUTCOMES

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

CO1. Understand reconfigurable processors, which makes it an important IP in modern System-on-Chips (SoCs)	Understand
CO2. Analyze predominant Reconfigurable processors across embedded, general-purpose, and high-performance application domains	Analyze
CO3. Enhance Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design	Analyze
CO4. Evaluate the Reconfigurable processor with SOC applications	Evaluate
CO5. Analyze the Intellectual Property based HDL design	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	L	-	M	L	-	S	-	L	-	S	-	S	-	L
CO2	M	-	S	-	S	-	L	-	S	-	S	S	-	L	-
CO3	-	L	-	S	-	S	-	L	-	M	-	S	M	-	-
CO4	S	S	-	L	L	S	S	-	M	M	-	-	L	M	-
CO5	S	-	M	-	-	L	-	S	-	-	M	-	-	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Introduction to reconfigurable processor- Reconfigurable Computing-Programming elements and Programming Tools for Reconfigurable Processors, ASIC design flow- Hardware/Software Codesign- FPAA Architecture Overview- recent trends in Reconfigurable Processor & SoC.

PROGRAMMABLE LOGIC DEVICES CPLD : Introduction to Programmable logic devices, SPLDs, CPLD building blocks- Architectures and features of Altera:MAX 7000, MAX V- Xilinx XC 9500, Cool Runner-II.

LOGICS OF FPGA : FPGA architecture overview- Challenges of FPGA processor design-Opportunities of FPGA processor design-Designing Soft Core Processors – Designing Hardcore Processors –hardware/software co-simulation- FPGA to multi core embedded computing- FPGA based on-board computer system

RECONFIGURABLE PROCESSORS & SOC APPLICATIONS : SoC Overview –Architecture and applications of Xilinx Virtex II pro ,Zynq-7000, Altera Excalibur, Cyclone V -Triscend A7, E5- Atmel FPSLIC- Multicore SoCs. Reconfigurable processor based DC motor control- digital filter design- mobile phone development- High Speed Data Acquisition -Image Processing application-controller implementation for mobile robot.

PROGRAMMING & INTELLECTUAL PROPERTY BASED DESIGN : HDL Based Programming and High level Synthesis using C, Partial Reconfiguration, Soft core, Firm core and Hard Core, Software tools

TEXT BOOKS :

1. S. Hauck ,"Reconfigurable Computing: Theory and practice of FPGA based Computation", Morgan Kaufmann, 2018.
2. Simon, "Programming FPGA's : Getting started with Verilog:, McGraw – Hill Education,2016.
3. Wayne Wolf, "FPGA-Based System Design", Pearson Education, 1e, 2005.

REFERENCE BOOKS:

1. Nurmi, Jari (Ed.) "Processor Design System-On-Chip Computing for ASICs and FPGAs" Springer, 2017.
2. Ian Grout , "Digital system design with FPGAs and CPLDs" Elsevier, 2008.
3. Joao Cardoso, Michael Hübner, "Reconfigurable Computing: From FPGAs to Hardware/Software Codesign" Springer, 2011.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.V.Prabhakaran	Assistant Professor (G-II)	BME	prabhakaran.bme@avit.ac.in
2	Ms.R.Mohana Priya	Assistant Professor (G-II)	ECE	mohanapriya@avit.ac.in

	ADVANCED ROBOTICS AND CONTROL	Category	L	T	P	Credit
		EC - PS	3	0	0	3

PREAMBLE

This course is designed to enlighten the students with advanced process control of robotics in static and dynamic states by clearly enlightening differential motion and path planning. In addition, is also enhances the concept of micro and nano robotics.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To introduce robot terminologies and robotic sensors To educate direct and inverse kinematic relations
2	To educate on formulation of manipulator Jacobians and introduce path planning techniques
3	To educate on robot dynamics
4	To introduce robot control techniques

COURSE OUTCOMES

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

CO.1 Understand the components and basic terminology of Robotics	Understand
CO2. Model the motion of Robots and analyze the workspace and trajectory panning of robots	Create
CO3. Develop application based Robots	Evaluate
CO4. Formulate models for the control of mobile robots in various industrial applications	Create
CO5. Evaluate all the mechanics involved in the robotics	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	-	S	-	L	L	M	L	M	S	-	-	S	-	L
CO2	M	-	-	S	-	M	L	S	M	-	S	-	L	-	M
CO3	S	S	-	M	-	S	-	M	-	S	-	M	-	M	-
CO4	-	M	S	-	S	-	L	-	M	-	L	-	M	L	-
CO5	S	-	L	-	M	-	M	-	S	-	L	-	S	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates-Reference frames-workspace-Robot languages-actuators-sensors-Position, velocity and acceleration sensors-Torque sensors-tactile and touch sensors-proximity and range sensors- vision system-social issues..

KINEMATICS : Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics solution and programming-degeneracy and dexterity

DIFFERENTIAL MOTION AND PATH PLANNING : Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian- Robot Path planning

DYNAMIC MODELLING & ROBOT CONTROL SYSTEM : Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation – Newton-Euler formulation – Inverse dynamics - Linear control schemes- joint actuators- decentralized PID control- computed torque control – force control- hybrid position force control- Impedance/ Torque control

MICRO & NANO ROBOTICS : Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach-Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system

TEXT BOOKS :

1. R.K. Mittal and I J Nagrath, " Robotics and Control", Tata MacGraw Hill, Fourth edition.
2. Saeed B. Niku ,''Introduction to Robotics '', Pearson Education, 2018.
3. Fu, Gonzalez and Lee Mcgrahill ,''Robotics ", international edition.

REFERENCE BOOKS:

1. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering, An Integrated approach",Prentice Hall of India, 2018
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated Approach", Phi Learning., 2019.
3. Francis N. Nagy, Andras Siegler, "Engineering Foundation of Robotics", Prentice Hall Inc., 2018.
4. Janaki Raman .P.A, "Robotics and Image Processing an Introduction", Tata McGraw Hill Publishing company Ltd., 2018.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.V.Prabhakaran	Assistant Professor (G-II)	BME	prabhakaran.bme@avit.ac.in
2	Ms.Mohana Priya	Assistant Professor (G-II)	ECE	mohanapriya@avit.ac.in

	SOLAR AND ENERGY STORAGE SYSTEMS	Category	L	T	P	C
		OE-EA	3	0	0	3

PREAMBLE

This subject deals with the general concept of Solar and Energy Storage Systems, and improvement.

PREREQUISITE : Nil

COURSE OBJECTIVE

1.	To explain basics of solar photovoltaic systems and energy storage system
2.	To understand the concepts and various components of stand-alone system
3.	To gain the sound knowledge about grid connected PV system
4.	To know the design of various PV-interconnected systems.
5.	To provide the knowledge about the various applications of solar system

COURSE OUTCOMES

On the successful completion of the course, students will be able to	Understand
CO1: Describe the basics of solar system.	Understand
CO2:Recognize the concepts of standalone PV system.	Analysis
CO3: Design the grid connected system for various applications.	Analysis
CO4: Select the suitable storage system for particular applications.	Analysis
CO5: Recognize the various applications of solar 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	S	M	-	-	M	S	S	M	-	-	L	-	M	-	M
CO2	S	S	-	-	M	S	S	M	-	-	L	-	L	-	L
CO3	S	S	L	-	S	S	S	M	-	-	M	-	M	L	L
CO4	S	M	L	M	S	S	M	M	-	-	M	-	M	-	-
CO5	S	M	L	M	S	S	M	L	L	-	M	-	M	-	M

S-STRONG ,M-MEDIUM,L-LOW

Introduction
Characteristics of sunlight: the sun and its radiation, Solar radiation, Direct and diffusion radiation, greenhouse effect, solar isolation data and estimation-semiconductors and P-N junctions: semiconductors and types, absorption of light, recombination and PN junctions –behavior of solar cells – cell properties: efficiency and losses, Top contact design, Laser grooved, Buried contact solar cell – PV cell interconnection: Module and circuit design, Environmental and thermal protection.

Stand-alone PV System
Solar modules – storage systems: Types, applications, requirements, efficiency, Lead acid batteries – power conditioning and regulation: Diodes, Regulators, Inverters- Balance of system components - protection – standalone PV systems design – sizing: Reliability maps, sizing for high reliability, existing methods.

Grid Connected PV Systems
PV systems in buildings – Utility applications for photo voltaic – design issues for central power stations – safety– Economic aspect – Efficiency and performance - International PV programs – Integration of PV and Wind –Indian Specific Standard for Integration.

Energy Storage Systems
Impact of intermittent generation: Wind, gas and coal integration, impacts of cycling, PSCO case studies – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage.

Applications
Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

Total Hours = 45

Text book(s):
1. Solar Energy – S.P. Sukhatme, Tata McGraw Hill, 2017.
2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2011.

Reference(s):
1. Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2017.
2. S. Sumathi, “Solar PV and Wind Energy Conversion Systems (Green Energy and Technology)”, L. Ashok Kumar , P. Surekha, 2015.
3 https://nptel.ac.in/courses/112/105/112105051/
4 https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf

COURSE DESIGNERS

S.No	Name of the faculty	Designation	Department	Mail-id
1.	Mr.A.Balamurugan	AP	EEE	balamurugan@vmkvec.edu.in
2.	Mr.V.Rattan Kumar	AP(Gr-II)	EEE	rattankumar@avit.ac.in

	METAL ADDITIVEMANUFACTURING	Category	L	T	P	Credit
		OE-EA	3	0	0	3

Prerequisite:-Nil

Course Objective

1	Understand the basic principles, methods, areas of usage, possibilities and limitations and the environmental effects of the metal additive manufacturing
2	Select suitable materials for developmentof parts using additive manufacturing with sound mechanical properties
3	Select suitable processes from various metal additive manufacturing processes as per the product requirement
4	Develop and select suitable parameter for manufacturing and post processing techniques for metal additive manufacturing parts
5	Design the parts for metal additive manufacturing

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

CO1.	Understand the basic principles, applications and limitations metal additive manufacturing system	Understand
CO2.	Understand how to select suitable materials from the existing or develop new materials for additive manufacturing	Understand
CO3.	Understand the working principle of various methods in MAM and their applications and limitation	Understand
CO4.	Produce a defect free MAM parts with suitable material selection and post processing techniques	Apply
CO5.	Understand the design and optimization techniques to design and develop parts using MAM techniques	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	M	-	-	-	M	-	M	-	-	-	-	L	L	-	-
CO2	M	-	-	-	M	-	M	-	-	-	-	L	L	-	-
CO3	M	-	-	-	M	-	M	-	-	-	-	L	L	-	M
CO4	M	-	-	-	M	-	M	-	-	-	-	L	L	-	M
CO5	M	-	-	-	M	-	M	-	-	-	-	L	L	-	M

S-Strong;M-Medium;L-Low

Syllabus

Module 1	Introduction	9

Introduction to metal additive manufacturing – classification and challenges – applications- CAD for additive manufacturing – file formats, CAD CAM software, modelling and data processing – STL format – slicing – design consideration- machine set up

Module 2	Materials and properties of AM printed parts	9

Manufacturing of metallic materials - Conventional vs AM process - Solidification of Metals
Equilibrium and Non-equilibrium phases for solidification for AM
Phase diagrams - Iron-Carbon - Aluminum alloy - Titanium alloy - Nickel alloy
Methods of Powder Particles Production and Powder Properties- Wire Properties for Direct Energy Deposition - Mechanical properties of AM printed parts

Module 3	Basic processes in metal additive manufacturing	9

Powder bed fusion – direct energy deposition – binder jetting – metal extrusion – material jetting - sheet lamination
Laser theory - Continuous vs pulsed laser - Laser types - Laser beam properties
Basics of electron beam - Electron beam powder bed fusion and mechanism
Powder feeders and their classification - Delivery Nozzles - Powder bed delivery and spreading systemWire Fed Systems - Positioning Devices - Print-heads

Module 4	AM process parameters	9

Beam Scanning Strategies and Parameters for PBF and DED - Powder Properties for PBF, DED, and BJ- Ambient Parameters for PBF and DED - Geometry-Specific Parameters, Support Structures (PBF)
Defects in AM Printed Parts - Need of Post Processing - Need for Surface Finishing
Common Post Processing for MAM - Potential Hazards of Additive Manufacturing – economics of MAM

Module 5	Design for Additive Manufacturing	9

Fundamentals and principle -design techniques and steps - design optimization, material selection and consideration in application field- Part decomposition and Decomposition methods
Topology optimization techniques - Overhangs, and Bridging and cavities in design
Key characteristics and considerations in topology optimization - Topology optimization under material uncertainty and manufacturability - Industry 4.0 future with AM

TextBooks

1	Milewski, J.O., 2017. Additive manufacturing of metals. Cham: Springer International Publishing.
2	Balasubramanian, K.R. and Senthilkumar, V. eds., 2020. Additive Manufacturing Applications for Metals and Composites. IGI Global.

ReferenceBooks

1	Leach, R. and Carmignato, S. eds., 2020. Precision Metal Additive Manufacturing. CRC Press.
2	Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003

3	Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
4	Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

CourseDesigners

S.No	**FacultyName**	**Designation**	**Department/ College**	**Emailid**
1	Mr.A.Elanthirayan	Asst. Prof. G-II	AVIT	aleanthirayan@avit.ac.in

	SUSTAINABLE BUILT ENVIRONMENT	CATEGORY	L	T	P	CREDIT
		OE-EA	3	0	0	3

PREAMBLE

Approaches towards energy saving methods through utilization of sustainable materials. Energy management by monitoring of CO2 consumption and emission in buildings.

PREREQUISITE NIL

COURSE OBJECTIVES

1	Explaining the role of sustainable architecture to avoid soil erosion & pollution control measures.
2	Efficiency of waste management with respect to water balance and water efficiency.
3	Impartknowledgeongreenconceptsindesign,construction&operationofbuildings.
4	Intending the exposure to the latest Green Building trends & technologies to the students.
5	To learn about the importance and Need of Indoor air quality management.

COURSE OUTCOMES

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

CO1.Understand the importance of site selection in achieving sustainable environment.	Understand
CO2. Applying the efficient water balance concept to achieve the water efficiency.	Apply
CO3. Applying the energy efficiency methods to achieve energy efficiency in building.	Apply
CO4. Analyzing the sustainable building materials in achieving energy efficiency in building.	Analyze
CO5. Analyzing the Internal air quality with respect to the Indian Codes and its Standards. various expression 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	S	L	M	L	-	S	-	M	-	-	-	-	L	L	L
CO2	S	M	L	L	-	S	L	-	-	-	-	-	M	L	--
CO3	S	M	M	L	-	S	-	-	-	-	-	-	S	L	--
CO4	S	L	S	L	-	S	-	-	M	-	-	-	-	-	M
CO5	L	M	L	L	-	M	-	-	L	-	-	-		-	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I

INTRODUCTION TO GREENBUILDINGDESIGN:

Universal Design :Key accessibility issues and Design guidelines – Integrated Approach for Green Building design :Factors for Site selection, Understanding the importance of Site Ecology & Site Analysis - Microclimate: Factors affecting micro climate & heat Islands – Strategies to handle heat island in built environment, Designing Green Spaces and Enhancing Biodiversity inbuilt environment.

UNIT II

WATER RESOURCE AND WASTEWATER MANAGEMENT

Rain water harvesting and utilization, Ground water recharge techniques: Design considerations – Water Balance and approach for water efficiency:3R Approach for water efficiency–Efficiency towards waste water management – Waste water treatment & reuse, waste water treatment technologies.

UNIT III

ENERGY EFFICEINECY IN SUSTAINABLE BUILDINGS

Introduction, Performance Evaluation and Approach for Energy Efficiency in Buildings – Energy Efficiency Standards & Codes:ECBC2017& EPI, ASHRAE90.1, ASHRAE62.1, ASHRAE 55,ASHARE 170, ISHRAE1001, Star labelling for appliances – Efficient Building Envelope: Heating loads in buildings ,Building orientation and form, Envelope Heat Transfer & Material Specifications.

UNIT IV

SUSTAINABLEBUILDINGMATERIALS

Attributes of Sustainable Building Materials: Recycled content, Regional material ,Renewable material, Embodied energy, Embodied carbon, Material performance ,Recyclability ,Elimination of hazardous materials - Waste management during construction & post-occupancy: Segregation strategies, Types of waste management –organic, inorganic, e-waste, hazardous waste.

UNIT V

INDOORENVIRONMENTALQUALITY

Indoor Air quality: Codes and Standards, Fresh air requirements, Design considerations – Approach for improving-Indoor air quality: Measure store ducesick building syndrome, Demand control ventilation, CO2 monitoring in buildings, Air quality monitoring – Enhancing occupants ' Comfort, Health and Wellbeing: Thermal Comfort, Visual Comfort, Acoustics, Ergonomics, Olfactory Comfort.

TEXT BOOKS:

1. Guide on Green Built Environment, IGBC, 2021.
2. IGBC Green Homes rating system, IGBC, 2019.
3. IGBC Green New Buildings rating system, IGBC, 2016.

REFERENCES:

1. ECBC, Bureau of Energy Efficiency, 2017.
2. National Building Code, Bureau of Indian Standards, Bureau of Indian Standards, 2016.
3. ASHRAE 90.1, 62.1, 55, ASHRAE, 2010.

COURSE DESIGNERS

S.NO.	NAME OF THE FACULTY	DESIGNATION	DEPARTMENT	MAIL ID
1	Dr.S.P.Sangeetha	Professor	Civil	sangeetha@avit.ac.in

	ADVANCED 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 basic terminologies related to cyber security and current cyber security threat landscape.
2.	To understand the cyber attacks that target computers, mobiles and persons
3.	To understand the legal framework that exist in India for cyber crimes and penalties and punishments for such crimes
4.	To study the data privacy and security issues related to Social media platforms.
5.	To understand the main components of cyber security plan

COURSE OUTCOMES

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

CO1: able to understand the basic terminologies related to cyber security and current cyber security threat landscape.	Understand
CO2: Able to complete u n d e r s t a n d i n g of the cyber attacks that target computers, mobiles and persons	Apply
CO3: Able to understand the legal framework that exist in India for cyber crimes and penalties and punishments for such crimes, It will also expose students to limitations of existing IT Act,2000 legal framework that is followed in other countries and legal and ethical aspects related to new technologies.	Apply
CO4: Able to get insight into the Data Protection Bill,2019 and data privacy and security issues related to Social media platforms.	Apply
CO5:Able to understand the main components of cyber security plan.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO1	PSO 2	PSO 3
CO 1	M	M	M	M	-	-	-	-	-	-	-	-	M	M	M
CO 2	M	M	M	M	M	-	-	-	-	-	-	-	M	M	M
CO 3	M	M	S	M	M	-	-	-	-	-	-	-	M	M	M
CO 4	S	M	M	M		-	-	-	-	-	-	-	M	M	S
CO 5	S	M	M	M	S	-	-	-	-	-	-	-	M	M	S

S- Strong; M-Medium; L-Low

Overview of Cyber security	**9 hours**
Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies.	
Cyber crimes	**9 hours**
Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cybersquatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake newscyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.	
Cyber Law	**9 hours**
Cyber crime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.	
Data Privacy and Data Security	**9 hours**
Defining data, meta-data, big data, nonpersonal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.	
Cyber security M a n a g e m e n t , Compliance and Governance	**9 hours**
Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.	

REFERENCES

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.

2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.

3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.

4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.

5. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.

6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.

COURSE DESIGNERS				
S. No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Dr.R.Jaichandran	Assistant professor G-II	CSE	rjaichandran@avit.ac.in
2.	Mr. B. Sundharamurthy	Assistant Professor	CSE	sundharamurthy@vmkvec.edu.in

	WASTE TO ENERGY	Category	L	T	P	Credit
		OE-EA	2	0	0	2

PREAMBLE

This course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To enable students to understand of the concept of Waste to Energy.
2	To link legal, technical and management principles for production of energy form waste.
3	To learn about the best available technologies for waste to energy.
4	To analyze of case studies for understanding success and failures.

COURSE OUTCOMES

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

O1: Understand the knowledge about the operations of Waste to Energy Plants.	Understand
O2: Analyse the various aspects of Waste to Energy Management Systems.	Analyze
O3: Carry out Techno-economic feasibility for Waste to Energy Plants	Apply
O4: Evaluate planning and operations of Waste to Energy plants.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

WASTE SOURCES & CHARACTERIZATION

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

TECHNOLOGIES FOR WASTE TO ENERGY

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

WASTE TO ENERGY OPTIONS

Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel

resources for other useful energy applications Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery. Energy Recovery from wastes and optimization of its use, benchmarking and standardization. Energy Analysis.

CASE STUDIES - WASTE TO ENERGY PLANTS

Success/failures of waste to energy Global Best Practices in Waste to energy production distribution and use. Indian Scenario on Waste to Energy production distribution and use in India. Success and Failures of Indian Waste to Energy plants. Role of the Government in promoting 'Waste to Energy'. Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

EFERENCES

1. Lee, James M., "Biochemical Engineering." PHI, 1st Edition, 1992. Yeh W.K., Yang H.C., James R.M., "Enzyme Technologies: Metagenomics, Biocatalysis and Biosynsthesis", Wiley- Blackwell, 1st Edition, 2010. Blanch H.W., Clark D. S., "Biochemical Engineering", Marcel Dekker, Inc. 2nd Edition, 1997.
2. Palmer, Trevor. "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry." 2nd Edition, East West Press, 2008.

Course Designers

S.No.	Name of the faculty	Designation	Department	Mail ID
1.	Dr.R. Kirubakaran	Assistant Professor	Department of Biotechnology	kirubakaran@vmkvec.edu.in
2	Dr.M.Sridevi	Professor	Biotechnology	hodbte@vmkvec.edu.in

	ENGLISH FOR RESEARCH PAPER TECHNICAL WRITING	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

This course is designed to improve the writing skills, level of readability of the learner and skills for writing the title.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	Understand that how to improve your writing skills and level of readability
2	Learn about what to write in each section
3	Understand the skills needed when writing a Title
4	Ensure the good quality of paper at very first-time submission

COURSE OUTCOMES

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

CO1. Understand how to improve your writing skills with conciseness so as to and removing redundancy	Understand
CO2. Classify the sections involved in research paper writing	Understand
CO3. Interpret the sequence of research findings with results	Apply
CO4. Use various paraphrasing method to provide good quality paper at very first-time submission	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check, key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

Unit IV

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit V

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books/ References Books :

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman‟s book
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1				

	DISASTER MITIGATION AND MANAGEMENT	Category	L	T	P	Credit
		AC	0	0	2	0

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etcDos and Don'ts during various types of Disasters.

RISK ASSESSMENT AND VULNERABILITY ANALYSIS: Response time, frequency and forewarning levels ofdifferent 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.
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.

Course Designers

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms.S.Ispara Xavier	Assistant Professor	Civil / AVIT	isparaxavier.civil@avit.ac.in

	VALUE EDUCATION	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

The course highlights the importance of values and ethics for human life and organization.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand value of education and self- development
2	To inculcate good values in students to make them patriotic with humanity
3	To groom the personality with positive thinking with universal brotherhood and religious tolerance.
4	To impart the value of true friendship and happiness
5	To enhance the character and competence for developing into self-control person

COURSE OUTCOMES

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

CO1. Identify the value of education and self- development with work ethics	Remember
CO2. Interpret sense of duties with good values in students to make them patriotic with humanity	Understand
CO3. Explain the integration, scientific attitude, overall personality with labor dignity	Understand
CO4. Discuss the value of true friendship and happiness	Understand
CO5. Paraphrase the character and competence for developing into self-control person	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, value judgements

Unit II

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature, Discipline

Unit III

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline., Punctuality, Love and Kindness, avoid fault Thinking, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance

Unit IV

True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, doing best for saving nature

Unit V

Character and Competence –Holy books vs Blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, all religions and same message, mind your Mind, Self-control, Honesty, Studying effectively

Text Books/ References Books :

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford UniversityPress, New Delhi

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID

	CONSTITUTION OF INDIA	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

This course is designed to understand more about the historical background of the constitution making and its importance for building a democratic India. To acquire knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

PREREQUISITE Nil

COURSE OBJECTIVES

1	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
2	To address the growth of Indian opinion regarding modern Indian intellectuals‟ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism
3	To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

COURSE OUTCOMES

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

CO1. Describe the history in formation of India constitution	Understand
CO2. Discuss the Philosophy of the Indian Constitution, Preamble, Salient Features	Understand
CO3. Interpret the constitutional and fundamental Rights & Duties of citizens	Apply
CO4. Sketch the Powers and Functions of various governing bodies	Apply
CO5. Contrast the Local Administration, District‟s Administration head duties	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

History of Making of the Indian Constitution, History, Drafting Committee, (Composition & Working)

Unit II

Philosophy of the Indian Constitution, Preamble, Salient Features

Unit III

Contours of Constitutional Rights & Duties, Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties

Unit IV

Organs of Governance, Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit V

Local Administration, District‟s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPachayat., Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy, Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books/ References Books :

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID

	PEDAGOGY STUDIES	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

The course is designed to provide pedagogical practices towards academic, research activities and professional developments.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To provide theories and methodologies related to curriculum development and research framework
2	To familiarize with pedagogical practices in formaland informal classrooms in developing countries
3	To identify evidence on the effectiveness of the pedagogical practices for enhancing teaching and learning methods
4	To understand the learning and resource barriers while handling large classes
5	To identify critical evidence gaps to guide the development

COURSE OUTCOMES

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

CO1.Identify theories and methodologies related to curriculum development and research framework	Remember
CO2.Interpret pedagogical practices in formaland informal classrooms in developing countries	Understand
CO3.Draw a chart on the effectiveness of the pedagogical practices for enhancing teaching and learning methods	Apply
CO4.Explore the learning and resource barriers while handling large classes	Analyze
CO5.Examine critical evidence gaps to guide the development	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	-	-	-	-	-
CO2	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	L	L	M	-	-	-	-	-	-	-	-	L	L	L	-
CO4	L	S	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	L	S	M	-	-	-	-	-	-	L	-	-	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Introduction and Methodology, Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and searching.

Unit II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Unit III

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy, Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers‟ attitudes and beliefs and Pedagogic strategies.

Unit IV

Professional development: alignment with classroom practices and follow up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit V

Research gaps and future directions, Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Text Books/ References Books :

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245- 261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher educationresearch

project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning ofbasic maths and reading in Africa: Does teacher preparation count? International JournalEducational Development, 33 (3): 272–282.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID

	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEN SKILLS	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

The main objective of the course is to develop the personality and achieve the highest goal in life so as to lead the nation with

mankind and prosperity

PREREQUISITE Nil

COURSE OBJECTIVES

1	To learn to achieve the highest goal happily
2	To become a person with stable mind, pleasing personality and determination
3	To awaken wisdom in students

COURSE OUTCOMES

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

CO1. Classify the development of versatile personality of students	Understand
CO2. Extract the information from Bhagwad-Geeta to lead the nation and mankind with peace and prosperity	Understand
CO3. Paraphrase the information from Neetishatakam to develop inter-personality skills	Understand
CO4. Articulate the highest goal in life	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue)

Unit II

Approach to day to day work and duties, Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48,Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,Chapter 18-Verses 45, 46, 48.

Unit III

Statements of basic knowledge, Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13,
14, 15, 16,17, 18, Personality of Role model.

Unit IV

Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63

Unit V

Verses- 52,53,59 (dont‟s), Verses- 71,73,75,78 (do‟s)

Text Books/ References Books :

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari‟s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID