FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING

M.E., EMBEDDED SYSTEMS

REVISED REGULATIONS & SYLLABI

(Students Admitted From the Academic Year 2018-2019)

VISION - MISSION STATEMENT

Vision

Empowering the community of students of Department of Electrical Engineering with very high morals, values, ethics, skills and technical knowledge through a rich curriculum blending the equal proportions of theoretical and hands-on experience by a process of transformation via hard-work and perseverance, with a view to serving the society in the role of socially responsible engineers so as to look after the needs of the nation and to elevate the standard of living of the people by incorporating innovation and sustained research.

Mission

- To attract the students to pursue not only the under graduation, but also up to the research level, with the exquisite infrastructure, learned faculties, state-of-the-art laboratories etc., from the Indian and International diasporas.
- To foster the global standards in learning, teaching and research that owes to an overall development of the department, faculties and students within the university and from across the globe as well.
- To enhance the calibre of students to be the most sought for, by the industrial and research entities.
- To enable for a diversified and challenging career that is ensued by the highest degree of professionalism, entrepreneurship, managerial and administrative expertise.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The core objectives of the M.E. programme in Embedded Systems are intended

PEO-1

To provide adequate opportunities for the students to gain knowledge in the area of embedded systems and the related disciplines and apply the same to do research to emulate new ideas.

PEO-2

To motivate the students to gain competency in the areas of modeling, design, programming and optimization to meet industrial challenges in the field of automotive electronics, robotics, communication, consumer electronics, and industrial process control.

PEO-3

To cultivate leadership qualities and communication skills in the students and make them competent to function effectively in multidisciplinary teams.

PEO-4

To inculcate in the minds of the students ethical responsibility towards serving the society and make them understand their role as engineers in improving the standard of life of the people

PROGRAMME OUTCOMES (PO)

PO-1

Ability to analyze the existing concepts and synthesize new concepts in the field of embedded systems and to integrate both for enrichment of knowledge.

PO-2

Ability to explore the area of embedded systems to arrive at critical decisions while carrying out research in appropriate domain.

PO-3

Ability to investigate complex embedded system application problems and arrive at feasible hardware and software models by applying the acquired knowledge

PO-4

Ability to employ state-of- the art techniques and research outcomes in the embedded systems learning process.

PO-5

Ability to integrate modern engineering tools for solution of embedded system problems with an understanding of the limitations.

PO-6

Ability to work as an effective team member in collaborative-multidisciplinary engineering tasks related to the field of embedded systems.

PO-7

Ability to efficiently manage embedded system applications after considering societal, environmental, economic and financial factors.

PO-8

Ability to inculcate lifelong learning and research with a high level of enthusiasm and commitment to facilitate global competence.

PO-9

Ability to develop effective presentation and communication skills during preparation of technical reports and design documentation.

PO-10

Ability to be a responsible professional with intellectual integrity, code of conduct and ethics of research and contribute towards the sustainable development of the society

Mapping of PEO with PO										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
PEO 1	✓	✓	✓							
PEO 2		✓	✓	✓	✓					
PEO 3				✓	✓	✓			✓	
PEO 4							✓	✓		✓

M.E., EMBEDDED SYSTEMS

SEMESTER I									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
EEESPC11	PC	Microcontroller Based System Design	3	-	-	25	75	100	3
EEESPC12	PC	Advanced Digital System Design	3	-	-	25	75	100	3
EEESPE13	PE	Program Elective-I	3	-	-	25	75	100	3
EEESPE14	PE	Program Elective-II	3	-	-	25	75	100	3
EEESMC15	MC	Research Methodology and IPR	2	-	-	25	75	100	2
EEESCP16	CP-I	Microcontroller Based System Design Lab	-	-	3	40	60	100	2
EEESCP17	CP-II	DSP Based System Design Lab	-	-	3	40	60	100	2
EEESAC18	AC	Audit Course-I	2	-	-	-	-	-	0
							Total		18

SEMESTER II									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
EEESPC21	PC	RISC and CSIC Processors	3	-	-	25	75	100	3
EEESPC22	PC	Embedded Control System Design	3	-	-	25	75	100	3
EEESPE23	PE	Program Elective-III	3	-	-	25	75	100	3
EEESPE24	PE	Program Elective-IV	3	-	-	25	75	100	3
EEESOE25	OE	Open Elective	-	-	3	40	60	100	3
EEESCP26	CP-III	ARM Based System Design Lab	-	-	3	40	60	100	2
EEESTS27	TS	* Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2
EEESAC28	AC	Audit Course-II	2	-	-	-	-	-	0
							Total		19

SEMESTER III									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
EEESPE31	PE	Wireless Sensor Networks/Wireless and Mobile Communication/FPGA Based Embedded System Design	3	-	-	25	75	100	3
EEESOE32	OE	Open Elective –II	3	-	-	25	75	100	3
EEESTH33	TH-I	Thesis Phase-I& Viva-voce	-	Pr 16	S 4	40	60	100	10
							Total		16

SEMESTER IV									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
EEESTH41	TH-II	Thesis Phase-II& Viva-voce	-	Pr 26	S 6	40	60	100	15
							Total		15

Note: * - Four weeks during the summer vacation at the end of II Semester.

L: Lecture,P: Practical,T: Thesis, CA: Continuous Assessment;FE: Final Examination

M.E.(EMBEDDED SYSTEMS)- PART-TIME

SEMESTER -I											
Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
1	PEES SPC11	PC	Microcontroller Based System Design	3	-	-	25	75	100	3	EEES PC11
2	PEEE SPC12	PC	Advanced Digital System Design	3	-	-	25	75	100	3	EEES PC12
3	PEEE SMC13	MC	Research Methodology and IPR	2	-	-	25	75	100	2	EEES MC15

4	PEEE SCP14	CP-I	Microcontroller Based System Design Lab	-	-	3	40	60	100	2	EEES CP16
	Total						115	285	400	10	

SEMESTER -II											
Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
1	PEEE SPC21	PC	RISC and CISC Processors	3	-	-	25	75	100	3	EEES PC21
2	PEEE SPC22	PC	Embedded Control System Design	3	-	-	25	75	100	3	EEES PC22
3	PEEE SOE23	OE	Open Elective - I	2	-	-	25	75	100	3	EEES OE25
4	PEEE SCP24	CP-III	DSP Based System Design Lab	-	-	3	40	60	100	2	EEES CP26
	Total						115	285	400	11	

S E M E S T E R – III											
Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Tota l	Credits	Equivalent Course Code in M.E. Full Time
1	PEEE SPE31	PE	Program Elective-I	3	-	-	25	75	100	3	EEES PC13
2	PEEE SPE32	PE	Program Elective-II	3	-	-	25	75	100	3	EEES PC14
3	PEEE SCP33	CP-II	ARM Based System Design Lab	-	-	3	40	60	100	2	EEES CP17
	Total						90	210	300	8	

S E M E S T E R – IV											
Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Tota l	Credits	Equivalent Course Code in M.E. Full Time
1	PEEE SPE41	PE	Program Elective-III	3	-	-	25	75	100	3	EEES PE23
2	PEEE SPE42	PE	Program Elective-IV	3	-	-	25	75	100	3	EEES PE24

3	PEEE STS43	TS	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2	EEES TS27
	Total						90	210	300	8	

S E M E S T E R –V											
Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
1	PEEE SPE51	PE	Program Elective-V	3	-	-	25	75	100	3	EEES PE31
2	PEEE SOE52	OE	Open Elective - II (From the Dept)	3	-	-	25	75	100	3	EEES OE32
3	PEEE STH53	TH-I	Thesis Phase-I& Viva-voce	-	Pr 16	S 4	40	60	100	10	EVES TH33
	Total						90	210	300	16	

S E M E S T E R –VI											
Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
1	PEEE STH61	TH-II	Thesis Phase-II & Viva-voce	-	Pr 26	S 6	40	60	100	15	EEES TH41
	Total						40	60	100	15	

PE – PROGRAM ELECTIVES

1. Advanced Digital Signal Processing
2. Distributed Embedded Computing
3. Real Time Operating System
4. VLSI for Embedded Applications
5. SCADA for Embedded Applications

6. Embedded Product Development Technologies
7. Digital Instrumentation
8. Medical Instrumentation
9. Micro Electro Mechanical Systems
10. Digital Image Processing
11. Software Technology for Embedded Systems
12. Robotics and Automation
13. Wireless Sensor Networks
14. Wireless and Mobile Communication
15. FPGA Based Embedded System Design

OE-OPEN ELECTIVES

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy

AUDIT COURSES

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

EEESPC11	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamentals of microcontroller based system design.
- To study the interfacing peripherals with microcontrollers.
- To learn the features, architecture and programming of PIC.
- To introduce PIC peripheral system design.
- To study on basic tool features for target configuration.
- To give case study experiences for microcontroller based applications.

Introduction

Need for Microcontroller based system design -Design cycle - Design problem - Hardware and software considerations - System

integration/Structure and characteristics-Interrupt structures-Programmable timers- Latency-Interrupt density-Interval considerations.

89C51 Processor

Review of architectures and instruction sets of 89C51 Processor - Coprocessor configuration - Closely coupled and loosely coupled configurations - Architecture and instruction set of I/O processor -I/O control -I/O timing - Data buffering with FIFO - Key boards and switches - Remote instrument control -Self test hardware - Key board parsing - Real time programming -Self test algorithm.

PIC Microcontroller

Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, -Peripherals of PIC -Timers – Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing –Flash and EEPROM memories.

Trouble Shooting and Development Systems

Logic analyzers, logic state analyzers, logic timing analyzers -Display modes - signature analysis - Error detection using signature analysis. Development systems -Basic features - Software development aids -Mass storage devices - Development system architecture -Emulators -System software.

System Design Examples

LCR meter -True RMS meter -Temperature control -Thermistor transducer linearization - PID controller - Digital Weighing machine -Controller for washing machine -Discrete state process control -Digital notch filter.

REFERENCES:

1. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson Education 2011.
2. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey 'PIC Microcontroller Embedded Systems using Assembly and C for PIC18', Pearson Education 2008.
3. Raj Kamal,".Microcontrollers-Architecture, Programming, Interfacing & System Design", 2ed, Pearson, 2012.
4. Jonathan W.Valvano., "Embedded Microcomputer systems", Thomas Asia Pvt. Ltd, Singapore, 2001.
5. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000.

COURSE OUTCOMES:

1. Understand the fundamentals of microcontroller systems and interface, and have the ability to apply them.
2. Understand the architecture and capabilities of PIC microcontroller.
3. Learn importance of PIC in designing embedded application.
4. Learn use of hardware and software tools.
5. Develop interfacing to real world devices.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓					✓	✓	
CO2					✓					
CO3		✓	✓						✓	
CO4			✓				✓			
CO5	✓			✓		✓	✓			✓

EEESPC12	ADVANCED DIGITAL SYSTEM DESIGN	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- Review the analysis and design of combinational logic circuits.
- Establish the methods for the analysis, modeling and design of synchronous sequential circuits.
- Incorporate the analysis and design of asynchronous circuit and obtain the hazard free circuits.
- Implement the digital systems on reconfigurable programmable logic devices.
- Study the different fault diagnosis and test methods.

Introduction

Review of Combinational circuit analysis – Minimization and design – Top-down modular design – Decoders, Encoders – Multiplexer and Demultiplexer – Incompletely specified functions – Circuit design.

Sequential Circuit Design

Analysis of Clocked Synchronous Sequential Circuits – Modeling of Clocked Synchronous Sequential Circuits – State Assignment and Reduction – Design of Clocked Synchronous Sequential circuits – ASM chart – ASM realization – Incompletely specified functions – State Assignment and Reduction – Circuit realization.

Asynchronous Sequential Circuit Design

Analysis of Asynchronous Sequential Circuit – Flow table reduction – Races in Asynchronous Sequential Circuit – State Assignment. Problem and Transition table- Design of Asynchronous Sequential Circuit – Static and Dynamic hazards. Essential Hazards – Mixed operating mode – Pulse mode circuits.

Synchronous Design Using Programmable Devices

Programmable Logic Devices- Design of sequential circuit using EPROM, GAL Devices – Programmable gate arrays – State machine using PLDs – PLD timing specifications.

Fault Analysis

Fault models for basic gates – Methods for test pattern generation – Boolean Difference method – Path sensitization method – Fault table method – Design for testability – Fault injection methods – Sequential circuit testing – Built in Self-Test, Built in Logic Block Observer.

REFERENCES:

1. John F.Wakerly, "Digital Design principles and practices", *Prentice Hall*, Fourth Edition, 2005.
2. William I.Fletcher, "An Engineering approach to Digital Design" *PHI Learning* (2009)
3. Nripendra N Biswas, "Logic Design Theory" *Prentice Hall of India*, Digitized (2007).
4. Parag K Lala, "Digital System design using PLD" *BS Publications*, 2008.
5. M.Morris Mano & Michael D.Ciletti, " Digital Design" , *Pearson*, Fifth Edition, 2013
6. Parag K Lala, "Fault tolerant and fault testable hardware design" *BS Publications*, 2002.

COURSE OUTCOMES:

1. Gather a review of combinational circuit and analysis.
2. Develop the ability to analyze and design synchronous sequential circuits.
3. Equip the capability to design Asynchronous sequential circuits and realize hazard free circuit.
4. Gain knowledge on implementation of sequential circuits using PLDs.
5. Understand the concepts fault diagnosis and testability.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓			✓		✓	✓	
CO2	✓	✓		✓	✓	✓		✓	✓	✓
CO3	✓	✓		✓	✓	✓		✓	✓	✓
CO4	✓		✓	✓	✓	✓		✓	✓	✓
CO5		✓	✓	✓	✓	✓		✓	✓	

EEESMC15	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

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

Effective literature studies approaches, analysis-Plagiarism, Research ethics

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

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.

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and data bases.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.

REFERENCES:

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.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

COURSE OUTCOMES:

Students will be able to:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓	✓						
CO2	✓	✓	✓	✓	✓					
CO3					✓	✓		✓	✓	
CO4	✓		✓	✓	✓				✓	
CO5				✓		✓		✓		
CO6				✓		✓		✓	✓	

EEESCP16	MICROCONTROLLER BASED SYSTEM DESIGN LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES:

- To learn the working principles of 89C51 microcontroller and PIC Microcontroller.
- To understand the characteristics of real time systems.
- To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
- To instruct the concepts of algorithm development & programming on software tools and micro Controllers with peripheral interfaces.
- To practice through at least one of the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

List of Experiments

1. Study of Microcontrollers
(i) 89C51 Microcontroller
(ii) PIC 16F877 Microcontroller
2. Applications of 89C51 Microcontroller
(i) Frequency Measurement
(ii)Checking of Boolean Functions
3. Seven Segment LED Display Using 89C51 Microcontroller
4. Stepper Motor Control Using 89C51 Microcontroller
5. Seven Segment LED Display, ADC and PWM Generation using PIC 16F877 Microcontroller
6. Application of I^2C Logic for Character Display in PIC 16F877 Microcontroller
7. Realization of Real Time Clock using PIC16F877 Microcontroller
8. Serial Data Communication Using PIC16F877 Microcontroller
9. Temperature Measurement Using PIC16F877 Microcontroller
10. Voltage Measurement Using PIC 16F877 Microcontroller

COURSE OUTCOMES:

Upon completion of the course the student will be able to

1. Explain the architecture and operation of 89C51and PIC16F877 Microcontrollers
2. Identify and explain the operations of peripherals and memories typically interfaced with these controllers
3. Analyze instruction sets of 89C51 and PIC16F877 Microcontrollers.
4. Gain hands-on experience in doing experiments on 89C51 and PIC16F877 Microcontrollers, by using hardware kits in the laboratory and present the report.
5. Students should understand the hardware/software tradeoffs involved in the design of these Controllers

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓							
CO2	✓		✓	✓						
CO3			✓	✓						
CO4		✓	✓	✓			✓			
CO5			✓	✓	✓					

EEESCP17	DSP BASED SYSTEM DESIGN LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES:

- To provide an introduction to DSP Processors.
- To explain Embedded C language programming techniques.
- To study the Hardware interfacing circuits and DSP Processor applications.

List of Experiments

1. Study of DSP Processors
(i) TMS320F2812 Processor
(ii)TMS320C5416 Processor
(iii)TMS320C6713 Processor
2. Study of Code Composer Studio Software
3. Seven Segment LED Display Using DSP TMS320F2812 Processor
4. Linear and Circular Convolution using DSP TMS320C5416 Processor
5. Analog to Digital Conversion using DSP TMS320C5416 Processor
6. Digital to Analog Conversion using DSP TMS320C5416 Processor
7. Applications of DSP TMS320C6713 Processor
(i) Low Pass Filter
(ii) High Pass Filter
(iii) Band Pass Filter
(iv) Band Rejection Filter

8. Evaluation of FT, FFT and STFT using DSP TMS320C6713 Processor.
9 ADC and DAC Using DSP TMS320C6713 Processor
10 Computation of Power Density Spectrum of a sequence using DSP TMS320C6713 Processor

COURSE OUTCOMES:

Upon completion of the course the student will be able to

1. Explain the architecture and operation of various DSP Processors.
2. Identify and explain the operations of peripherals and memories typically interfaced with DSP Processors.
3. Analyze instruction sets of TMS320F2812, TMS320VC5416 and TMS320C6713 Processor.
4. Gain hands-on experience in doing experiments on TMS320F2812, TMS320VC5416 and TMS320C6713 Processor by using hardware kit in the laboratory and present the report.
5. Explain the hardware/software trade-offs involved in the design of DSP Processors.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓							
CO2	✓		✓	✓						
CO3			✓	✓						
CO4		✓	✓	✓			✓			
CO5			✓	✓	✓					

EEESPC21	RISC AND CISC PROCESSORS	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge about the features of advanced processors.
- To study the architectures of CISC processor.
- To discuss on memory management, application development of CISC processors.
- To discuss the architecture and instruction set of ARM processor.
- To learn the programming concept in ARM processor
- To study about ARM application.

Features of Advanced Processors

Instruction set - Data formats - Instruction formats - Addressing modes - Memory Hierarchy - register file - Cache - Virtual memory and paging - Segmentation - Pipelining : The instruction pipeline - pipeline hazards - Instruction level parallelism - reduced instruction set - Computer principles - RISC versus

CISC - RISC properties - RISC evaluation - On-chip register files versus cache evaluation.

Architecture of CISC Processors

PENTIUM: The software model - functional description - CPU pin descriptions - CISC concepts - bus operations - Super scalar architecture - pipe lining - Branch prediction instruction and caches - Floating point unit - protected mode operation - Segmentation - paging -Protection – Multi-tasking - Exception and interrupts – Input /Output - Virtual 8086 model -Interrupt processing - Instruction types - Addressing modes - Processor flags - Instruction set - Basic programs.

ARM Architecture

ARM: architecture - organization and implementation - instruction set - The thumb instruction set -Arcon RISC Machine – Architectural Inheritance – Core & Architectures - CPU cores.

ARM Programming

Basic Assembly language program -The ARM Programmer's model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors.– Instruction cycle timings

ARM Application Development

Handling – Interrupts – Interrupt handling schemes- Firmware and boot loader – Example: Standalone - Embedded Operating Systems – Fundamental Components – 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.

REFERENCES:

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley, 2nd edition, 2000.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier, 2007.
3. Trevor Martin,'The Insider's Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd., 2005.
4. Gene. H. Miller, "Micro Computer Engineering", Pearson Education, 2003.

COURSE OUTCOMES:

1. Delivers insight into various embedded processors of RISC and CISC architecture with improved design strategies.
2. Introduces the recent advanced features in RISC and CISC processors.
3. Gives an idea about the instruction set in ARM processor
4. Explains the programming model in the processors.
5. Develops an overview about the application of the advanced processors.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓		✓					
CO2				✓		✓				
CO3				✓		✓				
CO4			✓		✓	✓				
CO5							✓	✓		✓

EEESPC22	EMBEDDED CONTROL SYSTEMS DESIGN	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To provide a clear understanding on the basic concept of embedded control system.
- To know the fundamentals of Real time operating system.
- To study the software and hardware design interface, SPI, RTC interfacing and programming.
- To teach the basic concepts of developing device driver-software –interfacing and porting using C & C++.
- To teach the application development on embedded controller.

Embedded System Organization

Embedded computing – characteristics of embedded computing applications – embedded system design challenges; Build process of Real-time Embedded system – Selection of processor; Memory; I/O devices-Rs-485, MODEM, Bus Communication system using I2C, CAN, USB buses, 8 bit –ISA, EISA bus;

Real-Time Operating System

Introduction to RTOS; RTOS- Inter Process communication, Interrupt driven Input and Output -Nonmaskable interrupt, Software interrupt; Thread – Single, Multithread concept; Multitasking Semaphores.

Interface with Communication Protocol

Design methodologies and tools – design flows – designing hardware and software Interface. –system integration; SPI, High speed data acquisition and interface-SPI read/write protocol, RTC interfacing and programming.

Design of Software for Embedded Control

Software abstraction using Mealy-Moore FSM controller - Layered software development - Basic concepts of developing device driver – SCI – Software - interfacing & porting using standard C & C++ ; Functional and performance Debugging with benchmarking Real-time system software – Survey on basics of contemporary RTOS – VXWorks, UC/OS-II.

Case Studies with Embedded Controller

Programmable interface with A/D & D/A interface; Digital voltmeter, control-Robot system; -PWM motor speed controller, serial communication interface.

REFERENCES:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computer Systems Design", Morgan Kaufmann Publishers, Second Edition, 2008.
2. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGrawHill, 2006.
3. Arnold S.Berger, "Embedded Systems Design: An Introduction to Processes, Tools, and Techniques", CMP Books, 2002.
4. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey, "PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18", Pearson Education, 2008.
5. Daniel W. Lewis, "Fundamentals of Embedded Software", Prentice Hall India, 2004.

COURSE OUTCOMES:

1. Understand the basic concept of embedded system such as memory, I/O devices, and bus communication system.
2. Design real time embedded systems using the concepts of RTOS.
3. Explain and design of software for embedded control.
4. Implement the real-time operating system principle.
5. Design simple A/D and D/A interface circuits.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓					✓				
CO2	✓	✓	✓		✓		✓		✓	
CO3			✓							✓
CO4	✓	✓		✓		✓		✓		✓
CO5							✓		✓	

EEESCP26	ARM BASED SYSTEM DESIGN LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES:

- To provide an introduction to various ARM Processors.
- To explain Embedded C language programming techniques.
- To study the Hardware interfacing circuits and ARM Processor applications.

List of Experiments

1. Study of ARM Processors LPC 2148
2. ADC and DAC using ARM Processor LPC 2148
3. LCD and Seven Segment LED Display usin ARM Processor LPC2148
4. Graphics LCD Display using ARM processor LPC2148

5. Interfacing Real Time Clock and Serial port with ARM processor LPC 2148
6. Stepper motor control using ARM processor LPC 2148
7. LCD Display Using Cortex M4 ARM processor
8. DAC using Cortex M4 ARM Processor
9. Study of SPARTAN 6 FPGA Processor
10. LCD and 7 segment LED Display using SPARTAN 6 Processor

COURSE OUTCOMES:

1. Upon completion of the course the student will be able to
2. Explain the architecture and operation of ARM Processors.
3. Identify and explain the operations of peripherals and memories typically interfaced with ARM Processors.
4. Analyze instruction sets of ARM LPC 2148 Processor.
5. Design and do experiments on ARM LPC 2148 Processor by using hardware kit in the laboratory and present the report.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓							
CO2	✓		✓	✓						
CO3			✓	✓						
CO4		✓	✓	✓			✓			
CO5			✓	✓	✓					

		L	T	P	C
EEESTS27	INDUSTRIAL TRAINING AND SEMINAR/MINI PROJECT	0	0	2	2

COURSE OBJECTIVES:

- To train the students in the Embedded Systems related areas and enable them to have a practical knowledge in carrying out Embedded Systems related works.
- To train and develop skills in solving problems during execution of certain works related to Embedded Systems.
- To work on a technical topic related to Embedded Systems and acquire the ability to make written and oral presentations
- To acquire the ability of writing technical papers for Conferences and Journals

The students should individually undergo a training program in reputed concerns in the field of Embedded Systems during the summer vacation (at the end

of second semester for full – time / fourth semester for part – time) for a minimum stipulated period of four weeks. At the end of the training, the students have to submit a detailed report on the training they had, within ten days from the commencement of the third semester for Full-time / fifth semester for part-time. The students will be evaluated, by a team of staff members nominated by Head of the department, through a viva-voce examination.

The students will work for two periods per week guided by student counsellor. They will be asked to present a seminar of not less than fifteen minutes and not more than thirty minutes on any technical topic of student's choice related to Embedded Systems and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation and the report and also on the interaction shown during the seminar.

COURSE OUTCOMES:

1. The students can face the challenges in the field with confidence.
2. The students will be benefited by the training with managing the situation that arises during the execution of works related to Embedded Systems.
3. The students will be getting the training to face the audience and to interact with the audience with confidence.
4. To tackle any problem during group discussion in the corporate interviews.
5. To enable the students capable of preparing reports based on what they have learnt in the industry

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1							✓	✓	✓	
CO2							✓	✓	✓	
CO3							✓	✓	✓	
CO4							✓	✓	✓	
CO5							✓	✓	✓	

EMETH33	THESIS PHASE – I AND VIVA VOCE	L	T	P	C
		0	0	10	10

COURSE OBJECTIVES:

- To carry out thesis Project work Phase – I which is an integral part of the thesis consisting of problem statement, literature review, thesis overview and scheme of implementation.

- To attempt the solution to the problem by analytical/simulation/experimental methods and validate with proper justification.

METHOD OF EVALUATION:

The student carries out literature survey and identifies the topic of thesis and finalizes it in consultation with Guide/Supervisor and prepare a comprehensive thesis report after completing the work to the satisfaction of the supervisor.

The progress of the thesis is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department.

Thesis report has to be submitted at the end of the semester.

The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:

1. Review quality of Literature survey and Novelty in the problem
2. Assess clarity of Problem definition and Feasibility of problem solution
3. Validate the relevance to the specialization
4. Acquire Knowledge on the clarity of objective and scope
5. Improve the quality of Written and Oral Presentation

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓		✓					
CO2	✓	✓	✓		✓	✓				
CO3	✓	✓			✓					
CO4	✓	✓	✓		✓		✓	✓		✓
CO5	✓	✓	✓		✓			✓		

EVESTH41	THESIS PHASE – II AND VIVA VOCE	L	T	P	C
		0	0	16	15

COURSE OBJECTIVES:

- To carry out Thesis work Phase – II which is the remaining part of the thesis.
- To attempt the solution to the problem by analytical/simulation/experimental methods and validate with proper justification.

METHOD OF EVALUATION:

The progress of the thesis is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department.

Thesis reporthais to be submitted at the end of the semester.

The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:

1. Identify the Embedded system problem
2. Analyze, design and implement solution methodologies
3. Apply modern engineering tools for solution
4. Write technical reports following professional ethics
5. Develop effective communication skills to present and defend their research work to a panel of experts.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓		✓					
CO2	✓	✓	✓		✓	✓				
CO3	✓	✓			✓					
CO4	✓	✓	✓		✓		✓	✓		✓
CO5	✓	✓	✓		✓			✓		

PROGRAM ELECTIVES

EEESPEXX	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To study the analysis of discrete random signals.
- To study the digital filter design.
- To study the applications of adaptive filtering.
- To study the analysis of speech signals.
- To study the multi-rate signal processing fundamentals
- To introduce the various types of transforms.

Discrete Random Signal Processing

Power spectral density – filtering random process, special types of random process – Signal modelling - Least Squares method - Prony's method, iterative Prefiltering - Finite Data records - Stochastic Models.

Adaptive Signal Processing

FIR adaptive filters – Newton's steepest descent adaptive filter – Adaptive filters based on steepest descent method - WidrowHoffLMS Adaptive algorithm – Adaptive channel equalization - Adaptive echo canceller - convergence of LMS algorithms – Application: noise cancellation –adaptive recursive filters – recursive least squares.

Speech Signal Processing

Digital models for speech signal - Mechanism of speech production – time domain processing of speech signal - Pitch period estimation - Linear predictive Coding – autocorrelation method – Durbin recursive solution.

Multirate Signal Processing

Mathematical representation of change of the sampling rate - Interpolation and Decimation -Decimation by integer factor – Interpolation by an integer factor - Direct form FIR filter structures – Single and multistage realization - Poly-phase realization – Application to sub band coding.

Types of Transform

Fourier Transform – Short Time Fourier Transform (STFT) - Discrete Time Fourier Transform (DTFT) – Continuous Wavelet Transform (CWT) – Wavelet Transform (WT) – Recursive multi-resolution decomposition – Hilbert transform - applications and its limitations

REFERENCES:

1. John G.Proakis, DimitrisG.Manobakis, "Digital Signal Processing", Prentice Hall of India, Third edition, 2000.
2. Raghuveer. M. Rao, AjitS.Bopardikar, "Wavelet Transforms, Introduction to Theory and applications", Pearson Education, Asia, 2000.
3. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", Wiley, 2002
4. Roberto Crist, "Modern Digital Signal Processing",, Thomson Brooks/Cole 2004.

COURSE OUTCOMES:

Students should be able to:

1. To understand advanced digital signal processing algorithms
2. To design adaptive filters for a given application
3. To design multi-rate DSP systems.
4. To understand decimation and interpolation of discrete-time signals.
5. To understand advanced digital signal transforms and their algorithms

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1			✓							
CO2					✓				✓	
CO3			✓	✓	✓					
CO4			✓							
CO5					✓				✓	✓

EEESPEXX	DISTRIBUTED EMBEDDED COMPUTING	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To expose the students to the fundamentals of Network Management, Security and Communication Technologies.
- To understand the basics of internet with knowledge of internet server interfacing.
- To study Java based Networking.
- To get introduced to Embedded Network Routing Agents
- To study the Networking on-chip real time multiprocessor embedded systems.

Internet Hardware Infrastructure

Broad Band Transmission facilities – Open Interconnection standards – Local Area Networks – Wide Area Networks – Network management – Network Security – Cluster computers.

Internet Concepts

Capabilities and limitations of the internet – Interfacing Internet server applications to corporate databases HTML and XML Web page design and the use of active components.

Distributed Computing Using Embedded Java

Introduction to Embedded Java and its concepts - J2Micro Edition (J2ME) - IO streaming – Object serialization – Networking – Threading – RMI – multicasting – distributed databases – embedded java concepts – Wireless Java - case studies.

Embedded Agent

Introduction to the embedded agents – Embedded agent design criteria – Behaviour based, Functionality based embedded agents – Agent co-ordination mechanisms and benchmarks embedded - agent. Case study: Mobile robots.

Embedded Computing Architecture

Synthesis of the information technologies of distributed embedded systems – analog/digital co-design – optimizing functional distribution in complex system design – validation and fast prototyping of multiprocessor system-on-chip – a new dynamic scheduling algorithm for real-time multiprocessor systems.

REFERENCES:

1. Dietel&Dietel, “JAVA how to program”, Prentice Hall, 1999.
2. SapeMullender, “Distributed Systems”, Addison-Wesley, 1993.
3. George Coulouris, Jean Dollimore, “Distributed Systems – Concepts and Design”, Wesley, 1988.
4. “Architecture and Design of Distributed Embedded Systems”, edited by Bernd Kleinjohann C-lab, Universitat Paderborn, Germany, Kluwer Academic Publishers, Boston, April 2001, pp. 248.
5. David Reilly,MichaelReily, “Java Network Programming And Distributed Computing”, Addison-Wesley Professional,2002.
6. Mclaughlin, “Java & XML”, O’reilly Media, 3rd edition, 2006.

COURSE OUTCOMES:

1. Explains various network (hardware and security.
2. Explains basic concepts of internet database and webpage design.
3. Explains the distributed database computing using embedded Java.
4. Describes the embedded agent design and operation mechanism.
5. Explains the real time multiprocessor distributed embedded systems

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1			✓		✓					
CO2									✓	
CO3	✓			✓	✓	✓	✓			
CO4		✓				✓				✓
CO5	✓			✓	✓					

EEESPEXX	REAL TIME OPERATING SYSTEM	L	T	P	C
		4	0	0	3

- To impart students about the fundamentals of Real Time Systems and interaction with RTOS
- To teach the concepts of how process are created and controlled with RTOS.
- To study on programming logic of modeling and analyzing RTS
- To study about the services rendered by RTOS in an application.
- To acquire knowledge about the common problems in developing an RTOS.
- To discuss the application development using RTOS.

RTOS

Differences between General Purpose OS & RTOS, Real-time concepts, Hard Real time and Soft Real-time systems,Basic architecture of an RTOS, components in RTOS - kernel, objects, scheduler, Multitasking, context switch, Scheduling types - Preemptive priority based scheduling - Round-robin and preemptive scheduling - Task states - Task management.

Kernel Objects

Semaphores – Binary, counting, mutual exclusion (mutex) semaphores, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared- resource-access synchronization - message queue- Sending messages in FIFO or LIFO order- broadcasting messages. Common pipe- pipe operation- Select operation on multiple pipes-Pipes for inter-task- Synchronization - Event register - control block- Signals- Catch operation-Execution sequence of wait and signal operations.

RTOS Services

Overview- TCP/IP protocol- Stack- File system- Remote procedure calls- RTOS command shell-Exceptions and Interrupts- Programmable interrupt controller- Priority scheme- Task and stack- Interrupt nesting- Interrupt processing in two contexts.Timer and Timer Services - Real-time clock- Soft-timer- Servicing the timer interrupt in the task context- Timeout event handlers.

I/O Subsystem and Memory Management

Port-mapped I/O- Memory-mapped I/O- Write operation for a block-mode device- I/O function mapping- Associating devices with drivers-Memory allocation map, fragmentation, free operation, Management unit.

Typical RTOS

Introduction to RT Linux, Real-Time Linux Applications in Embedded system, Common Design Problems - Deadlock, priority inversion problem, Embedded RTOS forfault-Tolerant applications

REFERENCES:

1. Qing Li and Caroline Yeo, “Real Time Concepts for Embedded Systems”, Elsevier, 2011.
2. Krishna C.M and Kang G. Shin, "Real-time Systems" McGraw-Hill, new edition, 2009.
3. Stuart Bennett., "Real-time Computer Control: An Intoduction" Prentice - Hall, 2nd edition, 2011.
4. Laplante P.A. and Ovaska.S.J., "Real-time System Design and Analysis" IEEE Press, 4th edition, 2013.
5. 5.Jim Cooling, "Real-time operating systems", Lindentree Associates, First Edition, 2013.

COURSE OUTCOMES:

1. It acquires knowledge about Real Time Operating System.
2. It helps to understand the concept of real time programming.
3. It gives an idea about the services rented by an RTOS in a developed application.
4. It describes about I/O and memory management concepts
5. It provides a concept to design and develop application using RTOS.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2	✓	✓	✓					✓		✓
CO3	✓		✓	✓				✓		
CO4	✓							✓	✓	
CO5	✓	✓	✓		✓	✓	✓	✓		✓

EEESPEXX	VLSI FOR EMBEDDED APPLICATION	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To enlighten the student with the growth of integrated circuits and develop procedure for their design, simulation and implementation.
- The evolution and growth of integrated circuit, the methods of layout and the different approaches for their design are to be discussed.
- A detailed study of the fabrication techniques is to be made. Analysis of analog and digital VLSI circuits is to be carried out. The need for application of specific devices and their features along with examples are to be dealt.
- The course will refurbish the student to realign his ideas on a different plane. It will help the student to develop newer control strategies that can meet the desired performance more precisely.

VLSI Design Concepts

Evolution of VLSI - VLSI design process - Architectural design - Logical design - Physical design - Lay-out styles - Full custom - Semi custom approaches - Need for design rules - Types of design rules - Design for MOS & CMOS circuits - Simple layout examples - Sheet resistance, area capacitance, wiring capacitance - Dry capacitive loads.

VLSI Fabrication Techniques

Wafer fabrication - Wafer processing - Oxidation - Patterning - Silicon gate NMOS process - CMOS process - Nwell - Pwell - Twin tub - Silicon on insulator - CMOS Process enhancements - Analytical techniques - Ion beam techniques - Chemical methods - Package Fabrication technology - Reliability requirements - Field loss - Failure mechanism - Design automation.

Analog VLSI

Introduction to analog VLSI - Analog circuit building blocks - Switches, active resistors - Current sources and sinks - Current mirrors/amplifiers - MOS & BJT, inverting amplifiers - CMOS and BJT two stage op-amp - Analog signal processing circuits - Sensors - D/A and A/D converters.

Digital VLSI

Logic design - Switch logic - Gate logic - Dynamic CMOS logic - Structured design - Simple combinational logic design - Clocked sequential design - Sub-system design - Design of shifters - Arithmetic processors - ALU - Serial, Parallel and pipelined multiplier arrays.

FPGA Based Embedded Processor

FPGAs - Xilinx family. LCA - I/O block - programmable interconnect - Configuration memory. Hardware software task partitioning – FPGA fabric Immersed Processors – Soft Processors and Hard Processors – Tool flow for

Hardware/Software Co-design –Interfacing Processor with memory and peripherals – Types of On-chip interfaces – Wishbone interface, Avalon Switch Matrix, OPB Bus Interface, Creating a Customized Microcontroller - FPGA-based Signal Interfacing and Conditioning.

REFERENCES:

1. Pucknell D.A and Kamran Eshranghiaon., "Basic VLSI Design" Prentice Hall of India, New Delhi,3'rd Edition, 1994.
2. Bhaskar.J. "A VHDL Primer", PHI, 1999.
3. 3 Rahul Dubey, "Introduction to Embedded System Design Using Field Programmable Gate Arrays", Springer Verlag London Ltd., 2009
4. Fabricus E.D., "Introduction to VLSI Design" McGraw Hill International Edition,1990.
5. Haskard M.R, May L.C., "Analog VLSI design -NMOS and CMOS "Prentice Hall,1988.
6. C.Mead&L.Conway, "Introduction to VLSI systems", Addison-Wesley, USA, 1980.
7. PalmorJ.E,Perlman D.E., "Introduction to Digital systems" Tata McGraw Hill,1996.
8. Kevin skahill., "VHDL for programmable logic device" Addison Wesley,1996.
9. Smith., "Application specific Integrated circuits" Addison-Wesley, 2nd reprint, 2000.
10. David Pellaris, Douglas Taylor., "VHDL Made easy", PHI Inc, 1997.
11. AMAR Mukherjee., "Introduction to NMOS and CMOS VLSI system Design" Prentice Hall, USA, 1986.

COURSE OUTCOMES:

1. Obtain the knowledge of basic fundamentals of VLSI design concepts
2. Understand various fabrication process technologies used in VLSI devices.
3. Be able to analyze and design CMOS analog IC building blocks like MOS amplifiers,
4. Current mirrors and multistage differential amplifiers
5. Be able to analyze and design CMOS digital IC building blocks

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓						✓	
CO2	✓				✓			✓		✓
CO3	✓	✓	✓		✓		✓			
CO4	✓	✓	✓		✓			✓		✓
CO5	✓	✓	✓	✓			✓			✓

EEESPEXX	SCADA FOR EMBEDDED APPLICATIONS	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To understand basics of SCADA.
- To understand the concept of various components involved with SCADA.
- To acquire knowledge about SCADA communication protocols.
- To study about monitoring and control techniques related to SCADA.
- To obtain basic knowledge implementation of SCADA in embedded systems.
- To learn about the application of SCADA in Embedded system.

Introduction to SCADA

Introduction to SCADA, Data acquisition systems, Evolution of SCADA, SCADA definitions, Communication technologies, Elements of a SCADA system, SCADA Functional requirements, SCADA Hierarchical concept, SCADA architecture, General features of SCADA.

SCADA System Components

Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels.

SCADA Communication

SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC 61850 based communication architecture, Communication media like Fiber optic, PLCC, Interface provisions and communication extensions, synchronization with NCC, DCC.

SCADA Monitoring and Control

Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording, Control function - Station control, bay control, breaker control and disconnector control.

SCADA Applications

Utility applications in Embedded systems, monitoring, analysis and improvement. SCADA applications in Utility Automation and Industries-Case studies, Implementation, Simulation Exercises

REFERENCES:

1. Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition", ISA: Instrumentation, Systems, and Automation Society, 4th edition, 2009.
2. Gordon Clarke and Deon Reynders, "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.
3. William T. Shaw, "Cyber security for SCADA systems", PennWell Books, 2006.
4. David Bailey and Edwin Wright, "Practical SCADA for industry", Newnes, 2003
5. Stuart G. Mccrady, "Designing SCADA application software: A practical approach", Elsevier, 1st edition, 2013.

COURSE OUTCOMES:

1. Understanding the concept of SCADA.
2. Analyse various system components involved in SCADA system.
3. Acquires knowledge about monitoring and control methods in SCADA.
4. Helps to know about communication protocols in SCADA system.
5. Describes about application of SCADA in Embedded system.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1			✓	✓						
CO2	✓		✓					✓	✓	
CO3		✓	✓							
CO4					✓					
CO5									✓	✓

EEESPEXX	EMBEDDED PRODUCT DEVELOPMENTTECHNOLOGY	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To understand basics of product design and development.
- To acquire knowledge about testing methodologies.
- To understand the basic concepts of product development based on its reliability, cost, robustness
- To discuss about the need for CAE, CAD, CAM, IDE tools in product design.
- To obtain basic knowledge on industrial design.
- To understand the concept of developing products in an embedded system.

Concepts of Product Development

Need for PD - Product Development Process Phases - Product Development organization structures - Strategic importance of Product Planning process – Product Specifications-Target Specifications-Plan and establish product specifications - Understanding customer and behavior analysis. 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 – Product Architecture - component Standardization.

Product Design Phase

System design – design phases – design styles – design of safety critical systems – design diversity – design for maintainability. System engineering –

architecturing and engineering judgment – documentation – human interface – packaging and enclosures – grounding and shielding - circuit design – circuit layout – power – cooling – product integration, production and logistics.

Approaches in Product Development

Product development management - establishing the architecture - creation - 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 – Support tools for the benchmarking process, trend analysis- Setting product specifications- product performance analysis -Industrial Design- Robust Design – Testing Methodologies.

Industrial Design

Integrate process design - Managing costs - Robust design –need for Involving CAE, CAD, CAM, IDE tools - Prototype basics - Principles of prototyping - Planning for prototypes- Economic & Cost Analysis - Understanding and representing tasks-baseline project planning -accelerating the project execution.

Developing Embedded Product Design

Discussions on Creating Embedded System Architecture - Mobile Phone - Adaptive Cruise Controller, Architectural Structures- Criteria in selection of Hardware & Software Components, product design by Performance Testing, Costing, Benchmarking, specific product design.

REFRENCES :

1. Karl T.Ulrich and Steven D.Eppinger, "Product Design and Development", McGraw –Hill International Edns., 5th edition, 2011.
2. Tim Williams, “EMC for product designers”, Elsevier, 4th edition, 2007.
3. George E.Dieter, Linda C.Schmidt, “Engineering Design”, McGraw-Hill International Edition, 4th Edition, 2009.
4. Kevin Otto & Kristin Wood, “Product Design Techniques in Reverse Engineering and New Product Development”, Pearson Education (LPE), 2001.
5. YousefHaik, T. M. M. Shahin, “Engineering Design Process”, Cengage Learning, 2nd Edition, 2010.

COURSE OUTCOMES:

1. Gives an idea about an approach to concept creativity, selection and testing.
2. Provides an idea for designing a consumer specific product.
3. Gives knowledge up gradation on recent trends in embedded systems design.
4. Describes the economic analysis and the consideration while designing a product.
5. Helps to improve the integration of customer requirements in product design.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1			✓					✓		✓
CO2				✓				✓	✓	✓
CO3				✓		✓	✓			
CO4							✓			✓
CO5					✓			✓		✓

EEESPEXX	DIGITAL INSTRMENTATION	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To obtain the subject knowledge and ability to use basic Data acquisition system concepts.
- To familiarize the students the functioning of different types of instrument communication, interfacing and data transmission.
- To provide opportunity for students to work as part of teams on multi-disciplinary projects.
- To provide the P.G students with a sound foundation in the mathematical, scientific and engineering instruments to formulate, solve and analyze engineering problems and to prepare them for employability and higher studies.
- To promote student awareness of the lifelong learning and to introduce them to professional ethics and codes of professional practice.
- To prepare students for successful careers in industry that meets the needs of latest developments in industries as employable professionals.

Introduction

Data acquisition systems – Overview of A/D converter, types and characteristics – Sampling, Errors - Objective – Data acquisition interface requirements – Counters – Modes of operation – Frequency, Period, Time interval measurements, Prescaler, Heterodyne converter for frequency measurement, Single and Multi channel Data Acquisition systems.

Interfacing and Data Transmission

Microprocessor based system design – Peripheral Interfaces – Data transmission systems – Time Division Multiplexing (TDM) – Digital Modulation – Pulse Modulation – Pulse Code Format – Interface systems and standards, Instrument Drivers.

Instrument Communication

Introduction, Modern standards, Basic requirements of Instrument Bus Communications standards, interrupt and data handshaking, serial bus – Basics, Message transfer, Fault confinement – RS-232, USB, RS-422, RS-485, Ethernet Bus – CAN standards interfaces – Field bus: general considerations, network design with Use of field buses in industrial plants, functions, international standards, performance – use of Ethernet networks, field bus advantages and disadvantages – Instrumentation network design, advantages and limitations of open networks, HART network and Foundation field bus network general considerations, network design – Mod bus, PROFIBUS-PA: Basics, architecture, model, network design and system configuration.

Visual Instrumentation

Block diagram and Architecture – Data flow techniques – Graphical programming using GUI – Real time Embedded system – Intelligent controller – Software and hardware simulation of I/O communication blocks – peripheral interface – ADC/DAC – Digital I/O – Counter, Timer.

Case Studies

PC based DAS, Data loggers, PC based process measurements like flow, temperature, pressure and level development system, Programmable Logic Controllers, CRT interface and controller with monochrome and colour video display.

REFERENCES:

1. Mathivanan, "PC based Instrumentation Concepts and Practice", Prentice-Hall India, 2015.
2. H. S. Kalsi, "Electronic Instrumentation", Third Edition, Tata McGraw-Hill, 2010.
3. Joseph J. Carr, "Elements of Electronic Instrumentation and Measurement", Pearson Education, 2010
4. K. Padmanabhan, S. Ananthi, "A Treatise on Instrumentation Engineering', I K Publish, 2011.

COURSE OUTCOMES:

1. To enhance teaching & research contributions in Embedded System Technology particularly for PC based Instrumentation concepts.
2. An ability to design and conduct experiments as well as to organize, analyze and interpret data on multidisciplinary domains.
3. Be able to identify problems in major issues of Instrument Communication Systems, analyze problems & solve them using the base of Embedded Technology.
4. To provide guidance and to develop inter-process communication techniques based on hardware– software approaches for real time process automations.
5. An ability to effectively communicate technical information in speech, presentation, and in writing.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓		✓						✓
CO2		✓	✓						✓	
CO3			✓		✓					
CO4		✓					✓	✓	✓	
CO5								✓	✓	

EEESPEXX	MEDICAL INSTRUMENTATION SYSTEMS	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To understand basics of measurement system.
- To understand the concept of various biomedical instruments and technologies.
- To acquire knowledge about sensing devices used in biomedical instruments.
- To understand the biomedical instruments used in hospitals.
- To discuss about the reduction of noise in biomedical instruments.
- To obtain basic knowledge on medical imaging systems.

Medical Instrumentation Basics

Basic Medical Instrumentation system, General Constraints in design of medical instrumentation system, Classification of Biomedical Instruments, Biomedical Simulators, Sources of Bioelectric Potential and Electrodes- Resting and Action potential, Propagation of action potential, The bioelectric potentials: ECG, EEG, EMG, ERG, EOG, EGG; Digital Biosignals, Equipment standards and patient safety.

Sensing Devices for Biomedical Instruments

Resistive, Capacitive, Inductive, Piezoelectric, Thermocouple, Thermistors, Fiber, Optic Sensors, Radiation Sensors, Smart Sensors, Electro Chemical Sensors, Electrical Fibrosensors, Blood-Glucose Sensors.Operational Amplifiers, Inverting, Noninverting, Differential, Instrumentation Amplifiers, Pre amplifiers, Isolation Amplifiers, Active Filters.

Measurement Systems

Patient Monitoring Systems, Measurement of Blood Pressure, Heart Rate, Pulse Rate, Temperature, Heart Sounds, Blood Flow and Volume, Respiratory Systems, Cardiac Output Measurement, Blood pH, pO2 Measurement, Oximeters, Audiometers, Spectrophotometers. Introduction to telemetry & Telemedicine.

Artifacts and Noise In Medical Instrumentation

Examples of noise in medical instrumentation and biomedical signals – baseline wander, power line interference, electrode motion artifacts, Noise reduction with digital signal processing; QRS complex detection in ECG- Pan Tompkins Algorithm

Modern Medical Imaging Systems

Ultrasound and Ultrasonic imaging system – Ultrasound Doppler and flow detector, Echocardiogram; Physics of X-rays and X-ray machines, Information content of an Image, Radiography, Computed Radiography, Computer Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET).

REFERENCES:

1. John G.Webster, "Medical Instrumentation Application and Design", John Wiley &Sons,Inc Noida. 4thedition, 2010.
2. R.S.Khandpur, "Handbook of Biomedical Instrumentation", McGraw Hill Education,3rd edition, 2014.
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 4thedition, 2001.
4. Leslie Cromwell, Fred J. Weibell , Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Prentice Hall India Learning Private Limited, 2nd edition, 2015.

COURSE OUTCOMES:

1. Helps to learn about Biomedical Instruments.
2. Acquires knowledge about Electrodes, Sensors and Transducers for biomedical signal acquisition
3. Gives an idea about ECG, EEG and EMG recording techniques and their instrumentation
4. Helps to know about signal processing and filtering techniques for noise and artifact removal.
5. Describes the modern medical imaging modalities and instruments

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓	✓	✓			✓		✓
CO2	✓	✓	✓	✓	✓					
CO3	✓	✓		✓	✓				✓	
CO4	✓						✓	✓		
CO5	✓	✓	✓	✓	✓		✓	✓	✓	✓

EEESPEXX	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- This course intends to provide a conceptual understanding of micro fabrication techniques and the issues surrounding them.
- To know the major classes, components and applications of MEMS devices/systems and to demonstrate an understanding of the fundamental principles behind the operation of these devices/systems.
- To learn Bulk micromachining process and to understand the concept of different etching process and etching materials in fabrication process.
- To impart knowledge about surface micromachining process and to understand the types and concept of bonding process.
- To study and design of different types of MEMS actuators, Micro grippers, MEMS resonators and their applications.

Introduction To Micro Machined Devices

Microsystems vs. MEMS - Markets for Microsystems and MEMS, Scaling Principles- Materials for micromachining, Micromachining terms- mechanical properties of silicon-native oxides of silicon and other semiconductors-typical silicon wafer types.

Bulk Micro Machining

Wet etching of silicon-Isotropic etching-anisotropic etching, alkali hydroxide etchants-ammonium hydroxide- tetramethyl ammonium hydroxide (TMAH)-ethylene diaminepyrochatechol (EDP)-ultrasonic agitation in wet etching stop layers for dopant elective etchants. Porous-silicon formation – anistrophic wet etching of porous aluminum- anistrophic wet etching- quartz- vapour phase etches. RIE laser driven bulk processing.

Surface Micromachining

Thin film processes-nonmetallic thin film for micromachining –silicon dioxide – silicon nitride - silicon carbide – polycrystalline diamond - polysilicon and other semiconductors and thin film transition – wet etching of non-metallic thin film-metallic thin film for micromachining - Resistive evaporation – E-beam evaporation-sputter deposition-comparison of evaporation and sputtering – CVD of metals - adhesion layer for metals - electro deposition (E plating) – Electro deposition mechanism: - DC electroplating-pulsed electroplating-Agitation for electroplating-black metal film-electro less plating.

Bonding Processes

Anodic Bonding-Anodic bonding using deposited glass-silicon fusion bonding-other bonding and techniques - compound processes using bonding. Sacrificial Processes and other Techniques: Sticking problem during wet releasing prevention of sticking-phase change release methods-geometry-examples of sacrificial processes.

Mems Actuators And Their Applications

Actuation mechanisms–Electrostatic actuation–Electrostatic cantilever actuators–Torsional electrostatic actuators–Electrostatic comb drives–Feedback stabilization of electrostatic actuators -Electrostatic rotary micro motors - Electrostatic linear micro motors – Electrostatic micro grippers–Electrostatic relays and switches - Thermal actuation – Thermal expansion of solids – Thermal array actuators –Piezoelectric actuation–Cantilever resonators.

REFERENCES:

1. Chang Liu, Foundations of MEMS, Pearson Education,2nd edition, 2014.
2. Muhammad H. Rashid, Micro Electronic Circuits: Analysis and Design, Cenage Learning,2nd edition 2012.
3. Reza Ghodssi, Pinyen Lin, MEMS materials and processes Handbook, Springer science business media, 2011
4. Chang Liu, Foundations of MEMS, (ILLINOIS ECE Series), Pearson Education International, 2006.
5. Tai-Ran-Hsu, MEMS & Microsystems Design and Manufacture, Tata McGrawHill, New Delhi, 2002
6. Stephen D. Senturia, Microsystems Design, Springer International Edition, 2001.
7. Gregory T.A. Kovacs, Micro machined Transducers, WCB McGraw Hill, 1998.

COURSE OUTCOMES:

1. Understanding the concept of scaling laws that are used extensively in the design of micro devices and systems.
2. Analyze the basic principles and applications of micro-fabrication processes, such as photolithography, ion implantation, diffusion, oxidation, CVD, PVD, and etching.
3. Provide impart knowledge about thin film process and etchants used for isotropic and anisotropic etching.
4. Analyze semiconductor materials for common micro components and devices.
5. Understanding the types of bonding process and the techniques used for sacrificial process.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								
CO2	✓	✓			✓	✓				
CO3	✓		✓	✓			✓	✓		
CO4	✓	✓		✓			✓			
CO5		✓	✓		✓	✓		✓		

EEESPEXX	DIGITAL IMAGE PROCESSING	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To understand the image fundamentals and mathematical transforms necessary for image processing.
- To understand about Sampling Techniques.
- To know different transform and various algorithms to evaluate them
- To know the design of Digital filters
- To know different coding methods
- To understand the image segmentation techniques.

Digital Image Fundamentals and Image Transforms

Digital Image Fundamentals - Elements of digital image processing systems - Elements of visual perception –Image Sampling and Quantizations - Neighbours of a pixel - Distance measures - Color image fundamentals. Image Transforms Analysis of 1D DFT - 2D transforms – DFT – Discrete Cosine Transform – Walsh – Hadamard – SVD - Wavelet Transform.

Image Enhancement and Restoration

Basic Gray Level Transformations - Histogram Processing - Smoothing and Sharpening Spatial Filters- Smoothing and Sharpening -Frequency Domain Filters - Homomorphicfiltering- Image degradation/ restoration process model – Noise models- Restoration in the presence of noise only Spatial Filtering- Inverse filtering –Wiener filtering - Geometric transformations.

Image Compression

Need for data compression- Objective and subjective fidelity criteria – Image Compression models- Huffman - Run Length Encoding - Arithmetic coding - Vector Quantization - LZW coding - Error free compression – Lossy Compression- Transform Coding –Wavelet coding-Image Compression Standards – Introduction to fractal image compression.

Image Segmentation

Detection of Discontinuities – Point detection, Line detection, - Edge detection – Edge linking and Boundary Detection –Thresholding – Basic global and adaptive thresholding - Image segmentation by region growing - region splitting and merging -Basic formulation of Region oriented segmentation – Morphological operations - Clustering methods

Application of Image Processing

Image classification – Image understanding- Image recognition – Patterns and pattern classes - Matching by minimum distance classifier - Neural Network applications in image processing –Image fusion – Steganography - Digital image watermarking

REFERENCES:

1. Gonzalez R. C. and Woods R.E., "Digital Image Processing", Prentice- Hall, 3rd Edition, 2008.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", Pearson Education, 2003.
3. Jayaraman,Esakirajan,Veerakumar, "Digital Image Processing"; McGrawHill, 2013.
4. J.W. Woods, "Multidimensional Signal, Image, Video Processing and Coding", Academic Press, 2nd Edition, 2012.
5. Milan Sonka, Vaclav Hlavav, Roger Boyle, "Image Processing, Analysis and Machine Vision", Thomson Learning, 2nd Edition ,2001
6. William K. Pratt, "Digital Image Processing", John Wiley, 4th Edition, 2007.

COURSE OUTCOMES:

1. Explain different transform and various algorithms to evaluate them
2. Implement the design of Digital filters
3. Implement the different coding methods
4. Apply the basic concepts of Image segmentation,
5. Explain image recognitions and the applications

	Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		PO10
CO1	✓	✓			✓						
CO2					✓	✓	✓				
CO3	✓		✓	✓				✓			
CO4		✓		✓		✓	✓				
CO5			✓				✓		✓		✓

EEESPEXX	SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To expose the students to the fundamentals of embedded Programming.
- It aims at familiarizing the students in embedded concepts and programming in 'C'.
- This module covers the advanced topics in 'C'
- To learn Memory management and Data structures which are of high relevance in embedded software is considered in depth.
- The syllabus also covers the topic 'scripting languages for embedded systems'.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Programming Embedded Systems

Embedded Program – Role of Infinite loop – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Toper of memory – Memory testing – Flash Memory.

Embedded C Programming

Review of data types – scalar types - Primitive types - Enumerated types - Subranges, Structure types - character strings – arrays – Functions. Introduction to Embedded C - Introduction, Data types Bit manipulation, Interfacing C with Assembly. Embedded programming issues - Reentrancy, Portability, Optimizing and testing embedded C programs.Modelling Language for Embedded Systems: Modeling and Analysis of Real-Time and Embedded systems.

Embedded Applications Using Data Structures

Linear data structures – Stacks and Queues Implementation of stacks and Queues - Linked List - Implementation of linked list, Sorting, Searching, Insertion and Deletion, Nonlinear structures – Trees and Graphs Object Oriented programming basics using C++ and its relevance in Embedded systems.

Scripting Languages for Embedded Systems

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.

Embedded Software Development Tools

Host and target machines – Linkers / Locators for Embedded Software – Debugging techniques – Instruction set simulators Laboratory tools – Practical example – Source code.

REFERENCES:

1. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003.
2. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.
3. Michael J Pont, "Embedded C", Pearson Education, 2007.
4. Mark Lutz,"LearningPython,PowerfulOOPs,O'reilly, 2011.
5. Robert Lafore, "Object_Oriented programming in C++", Galgotia publications, 2002.
6. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education, 2002.

COURSE OUTCOMES:

1. The learning process delivers insight into various programming languages / softwares compatible to embedded process development with improved design & programming skills.
2. Develop advanced programs in Embedded C.
3. Get knowledge in data structure and OOP.
4. Develop programs using scripting languages.
5. Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓			✓						
CO2	✓		✓							
CO3	✓				✓					
CO4	✓			✓						
CO5					✓		✓			

		L	T	P	C
EEESPEXX	ROBOTICS AND AUTOMATION	4	0	0	3

COURSE OBJECTIVES:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot.
- To learn manipulators and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot.
- To know about the electronic systems in automation of mechanical operations.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Introduction

Specifications of Robots - Classifications of robots – Work envelope - Flexible automation versus Robotic technology – Applications of Robots. Robot KineMaticsAnd Dynamics - Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations – Transformation Arithmetic - D-H Representation - Forward and inverse Kinematics Of Six Degree of Freedom Robot Arm – Robot Arm dynamics.

Robot Drives and Power Transmission Systems

Robot drive mechanisms, hydraulic – electric – servomotor - stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems – Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

Manipulators

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators.

Industrial Automation

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating.Types of production and types of automation, automation strategies, levels of automation.

Programmable Automation

Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.

REFERENCES:

1. Deb S. R. and Deb S., "Robotics Technology and Flexible Automation", Tata McGraw Hill Education Pvt. Ltd, 2010.
2. John J.Craig, "Introduction to Robotics", Pearson, 2009.
3. Mikell P Groover, "Automation Production Systems and Computer - Integrated Manufacturing" Pearson Education, New Delhi, 2001.
4. WemerDepper and Kurt Stoll, "Pneumatic Application", KemprathReihe, Vogel BuchVerlagWurzbutg, 1987.
5. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
6. Steve F Krar, "Computer Numerical Control Simplified", Industrial Press, 2001.

COURSE OUTCOMES:

1. Explain the basic concepts of working of robot.
2. Analyze the function of manipulators in the robot.
3. Use robots in different applications.
4. Knowledge of industrial automation by transfer lines and automated assembly lines.
5. Ability to understand the electronic control systems in metal machining and other manufacturing processes.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓			✓						
CO2		✓	✓							
CO3						✓	✓			
CO4			✓			✓				
CO5						✓	✓			

EEESPEXX	WIRELESS SENSOR NETWORKS	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- To introduce the basic concepts in communication networks and the protocols used in the networks.
- To give an exposure to sensor networks and different architectures of Wireless Sensor Networks.
- To familiarise the students about the various multiple access techniques available in the communication systems and introduce the different clustering algorithms for WSNs.
- To acquire knowledge on security management systems and security protocols for WSN and distributed sensor systems.
- To give an idea about power and energy level management techniques available for WSNs.

Networks Fundamentals

Introduction to wireless network and M computing – Fading and shadowing communication – Mobile IP – overview – Network elements - packet delivery – registration – Tunneling and encapsulation – optimization –Traditional TCP and inspection on Mobility – indirect and snooping TCP – 2G/3G networks – enhancing process.

Architecture

Introduction to sensor networks – Architectures – design factor – sensor network classifications - characteristics – Modeling of sensor network - WSN as Embedded system – Tiered architectures in sensor network – Forming of tiered network - Draw backs - Power efficient topology in WSN- Issues – Assumptions.

Protocols

MAC- Hidden/Exposed terminals – Near/Far terminals – SDMA, FDMA, TDMA and CDMA – infrared transmission – MAC Layer synchronization – power management – roaming – SMACS and EAR algorithm – CSMA –Hybrid TDMA/FDMA – Error control – Adhoc networks – Clustering Algorithm – Leach – Teen – Peach Technique.

Security System

Security Protocols –Authentication – Network layer – Security techniques – Security in WSN – Adhoc network – Search Technique – Security management technique - Reliability issues in WSN – Distributed sensor systems – Distributed services – Dynamic adaption – Fault tolerance - pre limiters – classic fault.

Energy Management

Introduction – Different power management technology – Design in EEMAC – Reduce communication – Node level energy management – Node Level Processor Oriented Energy Management – Node level I/O device oriented Energy Management – Energy aware routing.

REFERENCES:

1. Mohammed Ilyas and Imadmahgoub, "Handbook of sensor networks, compact wireless and wired sensing systems", CRC press, 2005.
2. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley & Sons Publications,2007.
3. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", John Wiley & Sons Publications, 2010.
4. Rappaport T.S, "Wireless Communication Principles and Practice", Prentice Hall, Second Edition, 2014.
5. Taub H. and Schilling D.L, "Principle of Communication" Tata McGraw-Hill Education, 2008.

COURSE OUTCOMES:

1. Describe and explain the working of communication protocols and the evolution of 2G/3G networks.
2. Understand the characteristics, architectures and modeling of WSNs.
3. Explain the concepts of multiple access techniques and the working of various clustering algorithms and their usefulness for routing in WSNs.
4. Describe the different security management techniques and security protocols defined for WSNs.
5. Elucidate the design issues related to the energy and power management techniques for WSNs.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓							✓		
CO2				✓	✓	✓				
CO3	✓			✓		✓		✓		
CO4		✓		✓	✓		✓			
CO5		✓		✓	✓	✓	✓			

EEESPEXX	WIRELESS MOBILE COMMUNICATION	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- Expose the students to the fundamentals of wireless communication technologies.
- Teach the fundamentals of cellular concepts.
- Study the concepts of mobile radio propagation.
- Explore various modulation techniques used.
- Introduce network routing protocols.
- Study the various multiple access techniques.

Introduction

Brief history of wireless communication - elements of wireless communication systems- radio frequency spectrum and bandwidth requirements - Universal Mobile Communication Systems- Personal Communication systems- emerging trends in wireless communications Wireless systems and standards: AMPS and ATACS systems- 2G, 2.5G, 3G and B3G systems and standards.

Cellular Concept

Frequency Reuse – Channel Assignment and Handoff Strategies – Interference and System Capacity – Trunking and Grade of Service – Improving Coverage and Capacity in cellular Systems – Radio wave Propagation: Basic Propagation Mechanisms – Reflection – Diffraction - Scattering – Free Space Propagation Model - Outdoor and Indoor Propagation Models – Signal Penetration in Buildings – Ray Tracing and Site Specific Model - Practical Link Budget Design.

Mobile Radio Propagation

Small Scale Multipath Propagation – Impulse Response Model of a Multi Path Signal - Parameters of Mobile Multi Path Channels – Types of Small Scale Fading – Statistical model for Multi Path Channels – Multi Path Shape Factors for Small Scale Fading Wireless Channels.

Modulation Technique for Mobile Radio

Amplitude Modulation – Angle Modulation – Digital Modulation - Line Coding – Pulse Shaping Techniques – Geometric Representation of Modulation Signals – Linear Modulation Techniques – Constant Envelope Modulation – Combined Linear and Constant Modulation Techniques – Spread Spectrum Modulation – Modulation Performance in Fading and Multi Path Channels.

Multiple Access Techniques

Fundamentals of Equalization – Equalizers in Communication Receiver – Linear Equalizer, Non Linear Equalisation – Algorithm for Adaptive Equalisation – Training a Generic Adaptive Equalizer – Fractional Equalizer – Diversity Techniques- Rake Receiver – Interleaving - Frequency Division Multiple Access (FDMA), Spread Spectrum Multiple Access – Space Division Multiple Access (SDMA) - Packet Radio.

REFERENCES:

1. Rappaport T.S., Wireless Communications Principles and Practices, Second Edition, Pearson Education, Asia, 2002
2. John G. Proakis, Digital Communication, McGraw Hill International, Fourth edition. 2000.
3. Simon Haykin, Communication systemsThird Edition, John wiley, 2002
4. Edware Lee and David Messerschmitt, Digital Communication, Kluwer Academic Publications, 2012.
5. T. G. Palanivelu, Wireless and Mobile Communication, PHI Learning, Pvt. Ltd., 2008
6. EzioBiglieri, Katie Wilson and Stephen Wilson,Academic Press Library in Mobile and Wireless Communications, Academic Press, Elsevier, 2016

COURSE OUTCOMES:

1. Fundamental concepts of wireless communication and its standards have been brought out.
2. Cellular concepts and various radio propagation models have been pointed out.
3. Architecture of various mobile radio models have been understood.
4. Various mobile radio modulation techniques have been described.
5. Different access techniques have been learnt.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓			✓					✓	
CO2		✓			✓				✓	✓
CO3	✓	✓	✓							✓
CO4	✓			✓		✓	✓			
CO5			✓		✓				✓	

EEESPEXX	FPGA BASED EMBEDDED SYSTEM DESIGN	L	T	P	C
		4	0	0	3

COURSE OBJECTIVES:

- Gain knowledge on various processors
- Acquire an exposure on system development.
- Understand the architecture of latest processors.
- Design different application circuits using a single FPGA chip.
- Program the FPGA to do specific work.
- Create embedded systems using FPGA.

ASICS, CMOS Logic and ASIC Library Design

Types of ASICs – Design Flow – CMOS transistors, CMOS design rules – Combinational Logic Cell – Sequential logic cell – Data path logic cell – Transistors as Resistors – Transistor Parasitic Capacitance – Logical effort – Library cell design –Library architecture.

Programmable Logic Cells and I/O Cells

Digital clock Managers-Clock management- Regional clocks- Block RAM – Distributed RAM-Configurable Logic Blocks-LUT based structures – Phase locked loops- Select I/O resources –Anti fuse - static RAM - EPROM and EEPROM technology – PREP bench marks – Actel ACT – Xilinx LCA – Altera FLEX – Altera MAX DC & AC inputs and outputs – Clock and power inputs – Xilinx I/O blocks.

Architectures

Architecture - FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance - Apex, Cyclone FPGAs and Quartus

architectures - case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs.

Design Entry and Testing

Verilog and VHDL - logic synthesis - Types of simulation – Faults - Fault simulation - Boundary scan test - Automatic test pattern generation. Built-in self test – scan test.

Partitioning and Routing

Embedded system partition - FPGA partition - partition methods - floor plan - placement - physical design flow - global routing - detailed routing - special routing - circuit extraction – Design Rule Checking (DRC) - Embedded System Design Examples using ALTERA FPGAs – Traffic light Controller, Real Time Clock.

REFERENCES:

1. Wolf Wayne, "FPGA Based System Design", Pearson Education India, 2004.
2. M.J.S. SMITH, "Application Specific Integrated Circuits", Addison Wesley Longman Inc., 2001.
3. Mohammed Ismail, Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.
4. N.H.E.Westeetal, "CMOS VLSI Design" Pearson, Third Edition, 2005.
5. N. Jha, S.D. Gupta, "Testing of Digital Systems", Cambridge, 2003.
6. Design manuals of Altera, Xilinx and Actel. (From the web).

COURSE OUTCOMES:

1. Underlying fundamental concepts of VLSI have been brought out.
2. Memory management and input/output technology of various processors have been pointed out.
3. Architecture of various processors have been understood.
4. Softwares for the processors have been learnt.
5. Some basic design examples using VLSI processors have been described.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓									
CO2		✓								
CO3				✓						
CO4			✓							
CO5						✓	✓			✓

OPEN ELECTIVES

EEESOEXX	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Manage business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression.

Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, News vendor Model, Overbooking Model, Cash Budget Model.

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making- Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

REFERENCES:

1. Business analytics-Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, Pearson'sEducation.

COURSE OUTCOMES:

Students will

1. Demonstrate knowledge of data analytics.
2. Studentswill demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Studentswill demonstrate the ability to translate data into clear, actionable insights.

Mapping with Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓							
CO2	✓	✓	✓			✓				
CO3	✓		✓		✓	✓				
CO4	✓		✓		✓	✓		✓		

EEESOEXX	INDUSTRIALSAFETY	L	T	P	C
		3	0	0	3

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication

methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,

Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets,

Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

REFERENCES:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, McgrewHillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman &HallLondon.

		L	T	P	C
EEESOEXX	OPERATIONSRESEARCH	3	0	0	3

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Scheduling and sequencing - single server and multiple server models - deterministic inventory models Probabilistic inventory control models - Geometric Programming.

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

REFERENCES:

1. H.A. Taha, Operations Research, An Introduction, PHI,2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi,1982.

3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub.2009
5. Pannerselvam, Operations Research: Prentice Hall of India2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India2010

At the end of the course,the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuousvariables.
2. Students should able to apply the concept of non-linearprogramming
3. Students should able to carry out sensitivityanalysis
4. Student should able to model the real world problem and simulateit.

EEESOEXX	COST MANAGEMENT & ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

Introduction and Overview of the Strategic Cost Management Process- Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost.Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning

Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

REFERENCES:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management &CostAccounting

4. AshishK. Bhattacharya, Principles & Practices of CostAccountingA. H. Wheelerpublisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

EEESOEXX	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Reinforcements: preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepress – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hydrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

REFERENCES:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of CompositeMaterials-ed-Lubin.
4. Composite Materials – K.K.Chawla.
5. Composite Materials Science and Applications – Deborah D.L.Chung.
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

EEESOEXX	WASTE TO ENERGY	L	T	P	C
		3	0	0	3

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers,digesters.

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifierengine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programmeinIndia.

REFERENCES:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd.,1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,199

AUDIT COURSES

EEESACXX	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

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

Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

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

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Key skills that are needed when writing a Title, key skills are needed when writing an Abstract, key skills that are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Skills that are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills that are needed when writing the conclusion.

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

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks) Model Curriculum of Engineering & Technology PG Courses [Volume-I] [41]
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'sbook.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011

EEESACXX	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming.

Introduction Disaster

Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade

Disasters: Difference, Nature, Types And Magnitude.

Repercussions Of Disasters And Hazards

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters:

Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And

Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills,

Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas

Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Disaster Preparedness And Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Disaster Mitigation Meaning

Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal bookCompany.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep&Deep Publication Pvt. Ltd., NewDelhi.

EEESACXX	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects
- Enhancing the memory power
- The engineering Scholars equipped with the Sanskrit will be able to explode the huge knowledge from ancient literature.

Alphabets in Sanskrit, past/ present/ future tense, simple sentences.order, Introduction of roots technical information about Sanskrit literature.

Technical concepts of Engineering – electrical, mechanical, architecture, mathematics

REFERENCES

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, NewDelhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, RashtriyaSanskritSansthanam, New DelhiPublication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

COURSEOUTCOMES:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a global language, will help to develop logic in students.
4.

EEESACXX	VALUE EDUCATION	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

Values and self-development –Social values and individual attitude and work ethics, Indian vision of humanism.Moral and non- moral valuation.Standards and principles.Valuejudgements.

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.

Personality and Behavior Development - Soul and Scientific attitude.PositiveThinking.Integrity and discipline.Punctuality, Love and Kindness. Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood

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

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

REFERENCES

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice",Oxford University Press, NewDelhi.

COURSE OUTCOMES

Students will be able to

1. Knowledge of self-development.
2. Learn the importance of Human values
3. Developing the overall personality

EEESACXX	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

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.

HISTORY OF MAKING OF THE INDIAN CONSTITUTION: HISTORY, DRAFTING COMMITTEE, (COMPOSITION&WORKING)

PHILOSOPHY OF THE INDIAN CONSTITUTION PREAMBLE, SALIENT FEATURES

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.

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.

Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: 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.

REFERENCES:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
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 OUTCOMES:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct.
4. Elections through adult suffrage in the Indian Constitution.
5. Discuss the passage of the Hindu Code Bill of1956.

EEESACXX	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

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.

Thematic overview

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

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.eachers' attitudes and beliefs and Pedagogic strategies.

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 classsizes.

Research gaps and future directions

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

REFERENCES:

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 of Curriculum Studies, 36 (3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher Education research project (MUSTER) country report 1. London:DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary Education Oxford and Boston:Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE OUTCOMES:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developingcountries.
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population oflearners.
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effectivepedagogy.

EESACXX	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To achieve overall health of body and mind
- To overcome stress

Definitions of Eight parts of yoga.(Ashtanga) Yam and Niyam

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay,ishwarpranidhan

Asan and Pranayam

i) Various yoga poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

REFERENCES:

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal,Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department),Kolkata.

COURSE OUTCOMES:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

EEESACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride &heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's) Approach to day to day work anddutiesShrimadBhagwadGeeta :
- 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.

Statements of basic knowledge.ShrimadBhagwadGeeta:

- Chapter2-Verses 56, 62,68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. ShrimadBhagwadGeeta:
- Chapter2-Verses 17, Chapter 3-Verses36,37,42,
- Chapter 4-Verses 18,38,39
- Chapter18 – Verses37,38,63

REFERENCES:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram(PublicationDepartment),Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) byP.Gopinath,
3. Rashtriya Sanskrit Sansthanam, NewDelhi.

COURSE OUTCOMES:

Students will be able to:

1. Study of Shrimad - Bhagwad- Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students