Programme Structure

Sharda School of Engineering &Technology

Department of Electrical, Electronics and Communication Engineering

M.Tech in Electronics and Communication Engineering with Specialization in Digital Communication/VLSI Technology/Electronic System Designing and Management/Embedded Systems

Programme Code: SET0502

Batch :2023-25

Sharda School of Engineering & Technology
M.Tech in ECE
Batch: 2023-25
TERM: I

S. No.	Subject Code	Subjects	L	T	P	Credits	Pre-Requisite/Co Requisite	Type of Course[1]: 1. CC 2. AECC 3. SEC 4. DSE
THEORY SUBJECTS								
1.	ECE824	Sensors and Network	3	1	0	4	Sensors	AECC
2.	ECE830	Advance Signal Processing	3	1	0	4	DSP	AECC
3.		Department Elective -1	3	0	0	3	NA	DSE
4.		Department Elective -2	3	0	0	3	NA	DSE
5.		Department Elective -3	3	0	0	3	NA	DSE
6.	MRM001	Research Methodology	1	0	2	2	NA	
7.	RBL001	RBL - 1	-	-	-	-		
Practical/Viva-Voce/Jury								
6.	ECP830	Advanced Signal Processing Lab	0	0	2	1	DSP	AECC
7.		Department Elective -1 Lab	0	0	2	1		DSE
TOTAL CREDITS						**21**		

[1] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Sharda School of Engineering & Technology
M.Tech in ECE
Batch: 2023-25
TERM: II

S. No.	Course Code	Course	L	T	P	Credits	Pre-Requisite/Co Requisite	Type of Course[2]: 1.CC 2. AECC 3. SEC 4. DSE
THEORY SUBJECTS								
1.	ECE615	Internet of Things and Applications	3	0	0	3	Sensors	AECC
2.	ECE835	Artificial Neural Network	3	1	0	4		
3.		Department Elective-4	3	0	0	3	NA	DSE
4.		Department Elective-5	3	0	0	3	NA	DSE
5.		Department Elective-6	3	0	0	3	NA	DSE
6.		Department Elective-7	-	0	0	3	NA	DSE
7.	RBL002	RBL -2	-	-	-	-	NA	AECC
Practical/Viva-Voce/Jury								
8.	CCU101	Community Connect	0	--	--	2	NA	SEC
9.		Department Elective-4 Lab	0	0	2	1		
10.		Department Elective-5 Lab	0	0	2	1		
						23		

[1] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Sharda School of Engineering & Technology
M.Tech in ECE
Batch: 2023-25
TERM: III

S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course[3]: 1. CC 2. AECC 3. SEC 4. DSE
			L	T	P			
Practical/Viva-Voce/Jury								
1.	ECE696	Seminar	0	0	4	2	NA	SEC
2.	ECE698	Dissertation-1	0	0	20	10	NA	SEC
TOTAL CREDITS						**12**		

[3] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Sharda School of Engineering & Technology
M.Tech in ECE
Batch: 2023-25
TERM: IV

S. No.	Course Code	Course	L	T	P	Credits	Pre-Requisite/Co Requisite	Type of Course[4]: 1. CC 2. AECC 3. SEC 4. DSE
Practical/Viva-Voce/Jury								
1.	ECE699	Dissertation- II	0	0	32	16	Dissertation-I	SEC
TOTAL CREDITS						**72**		

[4] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Course Module

2.1 Syllabus for courses

School: SSET		**Batch : 2023-2025**	
Programme: M.Tech			
Branch: ECE		**Semester: I**	
1	Course Code	ECE824	
2	Course Title	Sensors and Network	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Core	
5	Course Objective	1. Knowledge of mobile ad hoc networks, design and implementation issues, and available solutions. 2. Knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid. 3. Knowledge of clustering mechanisms and the different schemes that have been employed, e.g., hierarchical, flat, and leaderless. 4. Knowledge of the 802.11 Wireless LAN (WiFi) and Bluetooth standards. This includes their designs, operations, plus approaches to interoperability.	
6	Course Outcomes	After completion of this course student will able to: CO1: Identify emerging research areas in the field of sensor networks CO2: Identify the issues and challenges in WSN CO3: Make use of MAC protocols for communication in WSN CO4: Explore various dissemination protocols for WSN CO5: analyse the design principles of wireless sensor networks for a given application CO6: Design wireless sensor networks for a various application	
7	Course Description	A wireless sensor network (WSN) generally consists of compact low power sensors, which collect information and pass the information via wireless networks to achieve a high level of desired monitoring and control in coordinated manners. WSN applications can be found in areas such as environmental monitoring, smart energy systems, battle field surveillance, home automation, medical monitoring, mobile computing, etc. WSN has integrated network engineering, embedded system engineering and sensor technology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Sensor Networks**	

	A	Introduction to Sensor Networks, unique constraints and challenges			CO1, CO6
	B	Advantage of Sensor Networks, Applications of Sensor Networks			CO1, CO6
	C	Types of wireless sensor networks			CO1, CO6
	Unit 2	**Issues and challenges in wireless sensor networks**			
	A	Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks			CO2,CO6
	B	Enabling technologies for Wireless Sensor Networks			CO2,CO6
	C	Issues and challenges in wireless sensor networks			CO2,CO6
	Unit 3	**Routing protocols**			
	A	Routing protocols, MAC protocols: Classification of MAC Protocols,			CO3,CO6
	B	S-MAC Protocol, B-MAC protocol,			CO3,CO6
	C	IEEE 802.15.4 standard and Zig Bee			CO3,CO6
	Unit 4	**Dissemination protocol for large sensor network**			
	A	Dissemination protocol for large sensor network. Quality of a sensor network			CO4,CO6
	B	Data dissemination, data gathering, and data Fusion			CO4,CO6
	C	Real-time traffic support and security protocols.			CO4,CO6
	Unit 5	**Design Principles for WSNs**			
	A	Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication			CO5,CO6
	B	Single-node architecture, Hardware components & design constraints			CO5,CO6
	C	Operating systems and execution environments, introduction to TinyOS and nesC.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011			
	Other References	1. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009 2. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004 3. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science			

		4. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009	

School: SSET	**Batch : 2023-2025**
Programme : M.Tech.	

Branch: ECE		Semester: I
1	Course Code	ECE830
2	Course Title	Advanced Signal Processing
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	• The objective of DSP is usually to measure, filter and/or compress continuous real-world analog signals. • This course is the mathematical manipulation of an information signal to modify or improve it in some way. • This is characterized by the representation of discrete time, discrete frequency, or other discrete domain signals by a sequence of numbers or symbols.
6	Course Outcomes	After completing this course students will be able to CO1: Apply real time processing of audio and speech signal. CO2: Illustrate the sonar and radar signal processing, sensor array processing, spectral estimation, statistical signal processing. CO3: Apply the mathematics behind signal processing, for communications, control of systems, biomedical signal processing, seismic data processing, digital image processing etc. CO4: Use computing software package like MATLAB, and acquainted with digital processing tools available in MATLAB. CO5: Develop a signal processing system to analyze, predict and manipulate real data. CO6: Application of various systems to communication, vlsi and embedded system.
7	Course Description	Digital Signal Processing (DSP) is concerned with the representation, transformation and manipulation of signals on a computer. After half a century advances, DSP has become an important field, and has penetrated a wide range of application systems, such as consumer electronics, digital communications, medical imaging and so on. With the dramatic increase of the processing capability of signal processing microprocessors, it is the expectation that the importance and role of DSP is to accelerate and expand. Discrete-Time Signal Processing is a general term including DSP as a special case. This course will introduce the basic concepts and techniques for processing discrete-time signal on a computer. By the end of this course, the students should be able to understand the most important principles in DSP
8	Outline syllabus	CO Mapping

	Unit 1	**Realisation of FIR Filters & IIR Filters**	
	A	Implementation of Discrete-Time Systems Digital Filter Structure: Block Diagram representation.	CO1, CO6
	B	Signal Flow Graph Representation, FIR Digital Filter Structure.	CO, CO6
	C	Direct-Form Structure, Cascade Form Structures.	CO1, CO6
	Unit 2	**Fundamentals of Multirate Digital Signal Procesing**	
	A	Basic Multirate operations- Decimation and Interpolation ,Sampling, Sampling Rate Conversion Digital Filter Banks,	CO2, CO6
	B	Two channel Quadrature Mirror Filter bank,	CO2, CO6
	C	Multilevel Filter Banks	CO2, CO6
	Unit 3	**Design of Digital Filters**	
	A	Design of Digital Filters Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear phase FIR Filter using Windows and Frequency sampling method	CO3, CO6
	B	Introduction to Chebyshev and Butterworth Filter, Gibbs phenomenon, Design of Optimum Equiripple Linear-phase FIR Filters	CO3, CO6
	C	Design of IIR Filters: Design by Approximation of Derivatives	CO3, CO6
	Unit 4	**The Discrete Fourier Transform & Efficient Computation of the DFT: FFT Algorithm**	
	A	Basic elements of Digital Signal Processing, Ideal Sampling reconstruction and concept of aliasing, Introduction to CTFT and DTFT , Discrete Fourier Transform .	CO4, CO6
	B	Properties of DFT: Periodicity, Linearity, Symmetry, Multiplication of two DFT, Circular Convolution, circular correlation, multiplication of two sequences, Parseval's theorem.	CO4, CO6
	C	Decimation-in-Time FFT algorithms & Decimation-in-frequency FFT algorithms	CO4, CO6
	Unit 5	**Adaptive Signal Processing and Applications.**	
	A	Adaptive systems - definitions and characteristics,	CO5, CO6
	B	Minimum Mean Square Error Critirean,The Window LMS Algorithm	CO5, CO6
	C	Introduction to filtering smoothing and prediction, Wiener – Hopf equation, Voice Processing, Application to Radar,DFT use in Spectral Estimation.	CO5, CO6
	Mode of	Theory	

	examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	*References-* *1. A. Y. Oppenhein and R. W. Schater, "Digital Signal Processing", PHI 1975* *2. A. Y. Oppenhein, R. W. Schater and J. R. Buck, "Discrete Time Signal Processing", PHI 1999.*			
	Other References	*1.G. Proakis and D.G. Manolakis, "Digital Signal Processing, Principals, Algorithms, and Applications", Pearson Education, 4th ed., 2007.* 2.S.Salivahanan, A. Vallavaraj "Digital Signal Processing"Tata McGraw-Hill Education ,2007			

School: SSET **Batch : 2023-25** **Programme: M.Tech** **Current Academic Year:** **Branch:ECE** **Semester:I**			
1	Course Code	ECE831	
2	Course Title	Advanced **Communication Technology**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	• To provide students an understanding of analog and digital communication. • To understand multiplexing and multiple access techniques. • To implement the block of OFDM	
6	Course Outcomes	The student will be able to CO1: Illustrate the knowledge foranalog and digital communication CO2: Compare multiplexing and multiple access techniques CO3: Illustratethe basic concepts of OFDM CO4: Analyze OFDM system CO5: Explain Long Term Evolution CO6: Apply the concept of communication to electronics devices	
7	Course Description	In this course, The fundamentals of communication system like analog and digital modulation are explored. The various multiple access techniques which are used in telephony and other communication field are discussed. Some new technology like OFDM and LTE advanced, which are the core technology for now a days 3G and 4G telephony are discussed in detail with their architecture and area of application. The course will also include the Case study on OFDM, in which student can implement the OFDM practically and can use it for real time applications.	
8	Outline syllabus		CO Mapping
	Unit A	**Basics of Communication System**	
	Unit A Topic 1	Pulse Code Modulation	CO1,CO6
	Unit A Topic 2	Differential Code Modulation, Delta Modulation, Adaptive Delta Modulation	CO1,CO6
	Unit A	Digital Modulation Techniques: ASK, FSK,PSK,	CO1,CO6

	Topic 3	QPSK, DPSK			
	Unit B	**Multiplexing and Multiple Access Techniques**			
	Unit B Topic 1	Time Division Multiplexing(TDM),Frequency Division Multiplexing(FDM)			CO2,CO6
	Unit B Topic 2	Multiple Access Techniques, TDMA, FDMA, SDMA, PDMA			CO2,CO6
	Unit B Topic 3	Spread Spectrum Technique, Use in CDMA			CO2,CO6
	Unit C	**Orthogonal Frequency Division Multiplexing**			
	Unit C Topic 1	Concept of MIMO, Importance of orthogonality, Comparision of FDM and OFDM,OFDM Transmitter, Orthogonality of Sub Carriers, Multipath Effect, Frequency Selective Fading, ISI, Cyclic Prefix			CO3,CO6
	Unit C Topic 2	Packet detection, Synchronization, Carrier Frequency Offset(CFO), Sampling Frequency Offset(SFO),Data Aided Phase Track			CO3,CO6
	Unit C Topic 3	Complete diagram of OFDM Transmitter and Receiver,			CO3,CO6
	Unit D	**Case Study on OFDM**			
	Unit D Topic 1	Analog OFDM System Implementation			CO4,CO6
	Unit D Topic 2	Simple OFDM implementation using FFT transforms			CO4,CO6
	Unit D Topic 3	802.11a OFDM Signal implementation			CO4,CO6
	Unit E	**Long Term Evolution**			
	Unit E Topic 1	Overview, Basic Parameters, Network Architecture, Roaming Architecture			CO5,CO6
	Unit E Topic 2	Numbering and Addressing, Radio Protocol Architecture, Protocol Stack Layers			CO5,CO6
	Unit E Topic 3	Layer Data Flow ,Communication channels, OFDM Technology			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book	1. Simon Haykin, "Digital Communication", Wiley Publication, 2nd Edition 2. Yong Su Chu, "OFDM Wireless Communication using MATLAB", Wiley Publication, 20101. 3. StefaniaSesia, "LTE-The UMTS Long Term Evolution: From Theory to Practice", Wiley Pub.,2nd Ed.	
	References	B.P.Lathi, Zhi Ding, Hari M. Gupta, Modern Digital and Analog Communication Systems, oxford publication, 1st Edition.	

School: SSET **Batch : 2023-2025** **Programme : M.Tech.** **Current Academic Year:** **Branch:ECE** **Semester:I**		
1	Course Code	ECE834
2	Course Title	**Emerging Trends in Electronics**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	• To make students familiar with different solid state light emitters and detectors. • To define different Acoustic transduction and different acoustic transducers. • To explain Eye anatomy and eye optics, Color vision basics . • To illustrate concepts of LED, LCD, OLED. • To illustrate various MAC protocols like GSM, Spread spectrum, CDMA, TDMA & Basic electronics components. Handset Specific operating systems • To explain Working principle of mobile handset & Components used in mobile handsets . • To illustrate Comparison of the essential characteristics of Android and iOS.
6	Course Outcomes	After completing this course students will be able to CO1:Define functioning of various optoelectronic devices and underlying principles. CO2: Illustrate and differentiate among various acoustic systems. CO3: Explain working principles of various display devices. CO4: Compare diffrent Generations of mobile phones, CO5: Explain hardware components of mobile handset and OS used in mobiles. CO6: Apply latest technology to electronics communication devices
7	Course Description	In this course, the fundamentals of Optoelectronics like region of optical radiation, visible light and basic devices like LASER and LED etc. are described in detail. Basics of Acoustic engineering like vibration, acoustic, transmission and absorption are also explored .After that various display systems like LED, LCD and OLED are also described with their area of application. In subsequent chapter basic of generation of telephony like GSM, CDMA are discussed followed by the

		description of technology behind the Smart phone. At last the various operating systems used in smartphone's like Android and iOS are discussed in details. Comparative analysis of two OS is also done. Learning may be supplemented with periodic guest lectures by embedded systems engineers from industry.	
8	Outline syllabus		CO Mapping
	Unit A	**Optoelectronics**	
	Unit A Topic 1	The region of optical radiation and its properties, visible light emitting diodes, light emitting diodes, semiconductor diodes.	CO1,CO6
	Unit A Topic 2	Laser diodes, photo detection, photomultiplier, semiconductor photodiode.	CO1,CO6
	Unit A Topic 3	Schottky photodiode, CD records reader, laser printer, data transmission.	CO1,CO6
	Unit B	**Acoustics Engineering**	
	Unit B Topic 1	Fundamentals of vibration and acoustic wave equation.	CO2,CO6
	Unit B Topic 2	Transmission, absorption and attenuation of sound. Room and architectural acoustics.	CO2,CO6
	Unit B Topic 3	Acoustic transduction and different acoustic transducers.	CO2,CO6
	Unit C	**Display Technology**	
	Unit C Topic 1	How applications have been driving display developments? Evolution of display technology.	CO3,CO6
	Unit C Topic 2	Eye anatomy and eye optics, Color vision basics.	CO3,CO6
	Unit C Topic 3	Display system fundamentals and performance parameters-LED, LCD, OLED.	CO3,CO6
	Unit D	**Smartphone handset**	
	Unit D Topic 1	Introduction to mobile phones, Generations of mobile phones, FHSS networks.	CO4,CO6
	Unit D Topic 2	GSM, Spread spectrum, CDMA, TDMA & Basic electronics components. Handset Specific operating systems, Handset features & applications	CO4,CO6
	Unit D Topic 3	Working principle of mobile handset & Components used in mobile handsets.	CO4,CO6
	Unit E	**Smartphone OS**	
	Unit E Topic 1	Major features and functionalities of the Android and iOS OSs (Operating Systems) based on the Programming Language, Source model.	CO5,CO6
	Unit E Topic 2	Internet Browsing, Voice Commands, Video Chat, App Store, and Mobile Payments.	CO5,CO6
	Unit E Topic	Comparison of the essential characteristics of Android and	CO5,CO6

	3	iOS.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book	1.S.C.Gupta, Optoelectronics Devices and Systems, 3rd Edition, Prentice Hall India. 2. S.W. Rienstra& A. Hirschberg, "An Introduction to Acoustics". 3. Vinod Kumar Khanna,"Fundamentals of Solid-State Lighting", CRC Press.			
	References	*Joseph Annuzzi, Jr. Lauren Darcey Shane Conder, Introduction to Android Application Development, Fourth Edition, Addision Wesley.*			

School: SSET	**Batch : 2023-2025**		
Programme:M.Tech.			
Branch: ECE	**Semester: 2**		
1	**Course Code**	**ECE821**	
2	**Course Title**	**Embedded System Design**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	**The objectives of this subject are to:** 1. *Develop Programming and Design Skill with ARM processors.* 2. *Provide a platform for the students to deal with real time applications.* 3. *Provide an environment for the students for research works as well as some opportunity to hands on with ARM processors*	
6	Course Outcomes	**Upon successful completion of this subject, students should be able to:** CO1:Define Basic of RISC processor and ARM processor architecture. CO2:Explain Cortex – M4 architecture CO3:Illustrate advanced instructions supported in Cortex – M4 architecture CO4:Develop programming skills for Cortex – M4 CPU. CO5:Apply development skill for implementing algorithm CO6: Design a project based on ARM processor	
7	Course Description	Enhancement in the ARM processor architecture has resulted in to Cortex-M series architecture. This new architecture retains the best features from the 32-bit ARM architecture with the highly successful Thumb-2 instruction set design whilst adding several new capabilities such as low power consumption, Floating Point Unit, enhanced determinism and improved code density	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to ARM**	

	A	RISC Design Philosophy, ARM design Philosophy, embedded system hardware	CO1
	B	arm bus technology, embedded system software , registers, current program status register, pipeline , exception, interrupt and vector table	CO1
	C	core extension ,architecture revisions , ARM processor families.	CO1
	Unit 2	Fundamentals of Cortex-M4 architecture	
	A	Registers, Operating Modes, System Control Block, Systick Timer Reset Sequence,	CO2
	B	Nested Vectored Interrupt Controller (NVIC), Exception and Interrupts, Vector Tables, Memory Map,	
	C	Stack Memory Operation, Bus Interface, Memory Protection Unit, Debugging Support	
	Unit 3	Instruction Set	**CO3**
	A	Assembly language basics, Thumb-2 Technology, Pseudo instructions,	
	B	Instruction set with description for: Moving data, Processing data with Arithmetic and Logic operations, Branch operations, Stack Operations,	
	C	Instruction Barrier and Memory Barrier Instructions, Saturation Operations, IF-THEN (IT) instructions, Instructions for enhanced DSP operations, Saturated Math operations	
	Unit 4	CMSIS Standard and Cortex-M4 Programming	**CO4**
	A	Introduction to Cortex Microcontroller Software Interface standard (CMSIS),	
	B	Organization and Standardization of CMSIS Core, CMSIS Core Structure, usage and benefits,	
	C	CMSIS core register access, Intrinsic instruction, debug functions, Software development flow	
	Unit 5	Memory System	
	A	Memory System Features Overview, Memory Maps, Memory endianness, Memory Access Attributes	CO5
	B	Default Memory Access Permissions, Bit-Band Operations, Unaligned Transfers,	CO5

		Exclusive Accesses 6 Exceptions and Interrupts: Exception Types, Interrupt Management, Priorities, Exception sequence,			
	C	NVIC and SCB registers for exception control, Interrupt Masking .Low Power and System Control Features: Low Power Designs, Low power features, Instructions for low power operations			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Definitive Guide to ARM Cortex-M3 and Cortex M4 Processor by Joseph Yiu, Newness Publication, 3rd Edition 2. The Designer's Guide to the Cortex-M Processor Family, A Tutorial Approach by Trevor Martin, Newness Publication, 1st Edition			

School: SSET	**Batch : 2023-25**		
Programme: M.Tech.			
Branch: ECE	**Semester:I**		
1	**Course Code**	**ECE827**	
2	**Course Title**	**Advanced VLSI Using Verilog**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objectives of this subject are 1. To make the student understand advanced digital system design. 2. To understand HDL based IC design. 3. To understand Verilog programming. 4. To understand high level synthesis. 5. To understand verification using Verilog HDL.	
6	Course Outcomes	Upon successful completion of this subject, students should be able to: CO1: Write efficient Verilog programme CO2: Design advanced digital system using Verilog HDL. CO3: Design FSM based system. CO4: Understand STA and high-level synthesis. CO5: Understand static timing analysis CO6: VLSI project using EDA software.	
7	Course Description	This course covers the systematic design of advanced digital systems using field-programmable gate arrays (FPGAs). The emphasis is on top-down design starting with a software application, and translating it to high-level models using a hardware description language (such as VHDL or Verilog). The course will focus on design for high-performance computing applications using streaming architectures.	
8	Outline		CO

	syllabus		Mapping
	Unit 1		
	A	**VLSI Design** VLSI Design flow: Full Custom, ASIC and FPGA, VLSI CAD Tools: Applications of Simulation,SynthesisTools. Introduction to Hardware description languages (HDL)	CO1, CO6
	B	**Verilog HDL:**Abstraction levels, basic concepts, Verilog primitives, keywords, data types, nets and registers, Verilog MODULEs and ports; Lab Practice: Xilinx tool flow: simulation and synthesis	CO1, CO6
	C	**Verilog Operators :**Logical operators, Bitwise and reduction operators, Concatenation and conditional operators, Relational and arithmetic, Shift and equality operators, Operator execution order, Lab practice	CO1, CO6
	Unit 2		
	A	**Assignments:** Types of assignments, Continuous assignment,Proceduralassignments, Blocking and non-blocking assignments, Tasks and functions, Lab Practice	CO2, CO6
	B	**Verilog modeling**: gate type, design hierarchy, gate delay, propagation delay, logic simulation Dataflow-level modeling: assignments, Behavioralmodeling: Always block, FlowControl, If-else, case, case, while loop, for loop, repeat	CO2, CO6
	C	**Verilog for verification:**Design verification and testing,Testbenchwriting,Initialstatement, Verilog system tasks: $finish, $stop, $display, $monitor, $time, $realtime, $random, $save, $readmemh/$writememh, $fopen, $fclose, Compiler directives,ifdef, Array, multi-dimensional array. Memory modelling Lab practice	CO2, CO6
	Unit 3		
	A	**Combinational Logic Circuit Design:** Logic synthesis, RTL synthesis, high-level synthesis, synthesis design flow, Design and analysis of combinational circuits, Synthesis of combinational circuits, Arithmetic circuits, Initial design and optimization.	CO3, CO6
	B	Encoder, decoder, de-multiplexer circuits, multiplexer circuits and their implementation using Verilog,	CO3, CO6

		Design of a 4-bit comparator, Design of a 32-bit ALU and a simple processor using Verilog. Lab Practice	
	C	**Sequential Logic Circuit Design:** Synthesis of sequential circuits, Study of synchronous and asynchronous sequential circuits, Flip flops, ShiftRegisters,Counters and their design using Verilog. Lab practice	CO3, CO6
	Unit 4		
	A	**State Machine:** Basic Finite state machines (FSM) structures, Mealy and Moore type FSM, Mealy vs.Moore,Common FSM coding style,Serial adder design using FSM,	CO4, CO6
	B	FSM as an Arbiter circuit, FIFO, bus interfaces, Lab practice	CO4, CO6
	C	**High-level synthesis:** Basic concepts of high-level synthesis,Partitioning, scheduling,Allocation and binding, Technology mapping,	CO4, CO6
	Unit 5		
	A	**Static Timing Analysis:** Introduction to Static Timing Analysis, Timing path and constraints,Types of clock, Clock domain and variation, Clock distribution networks, How to fix timing failure?	CO5, CO6
	B	**Synthesis Coding Styles:** Registers in Verilog, Unwanted latches,RTL coding styles,Lab practice	CO5, CO6
	C	**Verilog Mini Projects:** Project specification analysis, Understanding the architecture, MODULE level implementation and verification, Building the top level MODULE,FPGA implementation of the design.	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA | MTE | ETE 25% | 25% | 50%	
	Text book/s*	1. Verilog HDL: A Guide to Digital Design and Synthesis; Samir Palnitkar; 2nd edition, Pearson Education, 2011. 2. Verilog Digital System Design; ZainalabedinNavabi; 2nd edition, TMH,2012. 3. Advanced Chip Design: Practical Examples in Verilog, Kishore Kumar Mishra, CreateSpace Independent Publishing Platform	
	Other	1. Verilog HDL Synthesis: A Practical Primer; J.	

	References	Bhasker, BSP Publishers, 2008. 2. FPGA-Based System Design, Wayne Wolf, 1st edition, Pearson. 3. Advanced Digital Design with the Verilog HDL; Michael D. Ciletti; 2009,1st edition, PHI,2010	

School: SSET		**Batch : 2023-25**	
Programme: M.Tech			
Branch: ECE		**Semester: 1**	
1	Course Code	**ECE**	Course Name: Research Based Learning -1
2	Course Title	Research Based Learning -1	
3	Credits	0	
4	Contact Hours (L-T-P)	0-0-0	
	Course Status	Compulsory	
5	Course Objective	1.To align student's skill and interests with a realistic problem or project 2.To understand the significance of problem and its scope 3.Students will make decisions within a framework	
6	Course Outcomes	After completion of this course student will be able to CO1: Define Literature Survey in Identified stream. CO2:Identifying the research gaps. CO3:Apply appropriate simulation software / experimental set up. CO4: Comparative Study of all possibilities. CO5: Draft a review article. CO6: Designing for research report and article.	
7	Course Description	In RBL-1, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	
8	Outline syllabus		CO Mapping
	Unit 1	Studyresearch papers.	CO1, CO2
	Unit 2	Identify the research area.	CO2,CO3
	Unit 3	Learn the simulation software.	CO3
	Unit 4	Comparative study related to identified research area.	CO3, CO4
	Unit 5	Prepare a write up based on comparative study and communicate the article.	CO4, CO5, CO6

Programme: M.Tech.			
Branch:ECE		**Semester: II**	
1	Course Code	ECE619	
2	Course Title	Internet of Things and Applications	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. Emphasize the application areas of IoT 2. Introduction to the building blocks of Internet of Things 3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks 4. Introduction to core technologies- Sensors,Communication and DataNetworks	
6	Course Outcomes	After completion of this course student will be able to CO1: illustrate key components of IoT and compare it with M2M CO2:.explain generic network model as well as EPA model CO3: analyze various IoT devices and their functionality CO4: justify use of IoT in Industry CO5:identify Key application areas CO6 justify role of Iot in providing solution to various problems	
7	Course Description	IoT has become a game changer in the new economy where the customers are looking for integrated value & the IoT perspective in thinking and building solutions	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics Internet of things**	
	A	Overview with application examples	CO1,CO6
	B	Design Principles for connected devices	CO1
	C	Physical &logical Design, M2M Communication	CO1
	Unit 2	**Basic Topologies & Network Toplogies**	
	A	LAN topologies;IIoT,physical networking	CO2
	B	OSI model: significance, scope, functions of all layers; IEC's four layers EPA model: significance, functions of all layers.	CO2

	C	Router internals, common router architecture			CO2
	Unit 3	**IoT Devices and Networks**			
	A	Protocol stack, Physical layer, data link layer (Frame Format and MAC)			CO3
	B	Cloud connectivity, User interface, web app versus mobile app			CO3
	C	IoT devices-EV26,AR01,FMB920,MCK01,MCK05			CO3
	Unit 4	**Industrial IIoT**			
	A	Zigbee: Special features, data rates, Comparison of Zigbee with Wi-Fi and Bluetooth			CO4
	B	Sensor technologies and sensor applications			CO4
	C	IIoT application examples,IIoT future trends			CO4,CO6
	Unit 5	**Illustrative application Scenarios & concepts**			
	A	Smart Waste management, Smart energy conservation			CO5,CO6
	B	Smart Urban planning, Sustainable urban Environment, Smart Medication &emergency handling			CO5,CO6
	C	Smart product management, Home automation			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. E-book-Designing of Internet of things by-Adrian McEwen, Hakim Cassimally, Wiley 2. *Internet of Things by-A Bahga &Vijay Madisetti,University Press* 3. *https://in.coursera.org/learn/industrial-internet-of-things*			

School: SSET **Batch : 2023-25** **Programme: M.Tech.** **Current Academic Year:** **Branch:ECE** **Semester:II**			
1	Course Code	ECE825	
2	Course Title	**Embedded Architecture and Programming**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	• Embedded Systems and design issues • Advanced Computer Architecture • Embedded System Installation/ Configuration using AVR microcontroller • Development of Embedded Firmware using AVR microcontroller • Troubleshooting and Maintenance of embedded system	
6	Course Outcomes	After completion of this course student will be able to CO1:Explain Embedded Systems and design issue CO2:Apply and illustrate advanced Computer architecture CO3:Apply Embedded System Installation/ Configuration using AVR microcontroller CO4:Development of Embedded Firmware using AVR microcontroller CO5:Troubleshooting and Maintenance of embedded system CO6: Apply Embedded tools in Real Time Applications	
7	Course Description	In this course, the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging will be discussed. The Intel 8051, a very popular microcontroller family, will be studied. The architecture and instruction set of the microcontroller will be discussed, and a wire wrapped microcontroller board will be built and debugged by each student. The course will culminate with a significant final project which will extend the concepts covered earlier in the course. Learning may be supplemented with periodic guest lectures by embedded systems engineers from industry	
8	Outline syllabus		CO Mapping
	Unit –A	**Embedded Systems**	

	Topic 1	Introduction of Embedded Systems, Embedded Design development life cycle	CO1,CO6
	Topic 2	Embedded Systems Design Issues, Introduction to Embedded Development tools	CO1,CO6
	Topic 3	Assemblers, Compilers, Linkers, Loaders, Debuggers, Embedded In-Circuit Emulators and JTAG	CO1,CO6
	Unit –B	**Advanced Computer Architecture**	
	Topic 1	RISC architecture, Pipelining, Principles of Pipelined computers	CO2,CO6
	Topic 2	Parallel Computing, Parallel Computer Model, Flynn's &Feng's Classification Performance Metrics and Measures	CO2,CO6
	Topic 3	Basic cache structure, Set associative caches, Evaluating Cache performances Determining Cache parameters, Replacement Policies, Implementing LRU	CO2,CO6
	Unit –C	**AVR Microcontoller**	
	Topic 1	Introduction to AVR, Series of AVR controllers	CO3, CO6
	Topic 2	Pin Configuration of AVR, Architecture of AVR,	CO3, CO6
	Topic 3	Registers of AVR, Different ports and DDR register	CO3, CO6
	Unit –D	**Programming of AVR**	
	Topic 1	The AVR Instruction Set	CO4, CO6
	Topic 2	Literal and control Operations, Watchdog timer, Interrupts, Timers/ counter	CO4, CO6
	Topic 5	Memory Paging, Addressing modes	CO4, CO6
	Unit –E	**CASE STUDY**	
	Topic 1	Use programming tools Aurdino IDE, Integrated design environments for HW-SW co-design	CO5, CO6
	Topic 2	Code firmware for Aurdino boards	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA | MTE | ETE	
		25% | 25% | 50%	
	Text book	1.Stallings, William, "Computer organization and architecture, designing for performance", Prentice Hall of India. 2. Gadre, Dhananjay V., 2001, Programming and Customizing the AVR Microcontroller, McGraw-Hill, ISBN: 0-07-134666-X	
	References	1.Morton, John, 2002, AVR: An Introductory Course, 1st Edition, Elsevier ISBN-10: 0-7506-5635-2 (ISBN-13: 978-0-7506-5635-2) 2. Barnett, R., O'Cull, L., Cox, S., 2007, Embedded C Programming for the Atmel AVR, Thompson-Delmar	

		Learning, ISBN: 1-4180-3959-4	

School: SSET		**Batch: 2023-25**	
Programme : M. Tech		**Current Academic Year:**	
Branch: ECE		**Semester: II**	
1	Course Code	ECE 835	
2	Course Title	Artificial Neural Network	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	*Core*	
5	Course Objective	Fundamental techniques and principles of neural computation Investigation of some common models and their applications	
6	Course Outcomes	CO1: Analyse Organization of the Brain. CO2: Analyse Biological and Artificial Neuron Models. CO3: Single layer perceptron and designing of algorithms and learning of curve rate CO4: Multilayer perceptron and Back-propagation algorithm with improvisation algorithm CO5: Radial-basis function networks and strategies CO6: Designing of **Self-Organising Maps.**	
7	Course Description	Neural networks provide a model of computation drastically different from traditional computers. This course will provide learning and understanding of neural network architectures and algorithms, for applications in pattern recognition, image processing, and computer vision.	
8	Outline syllabus		CO Mapping
	Unit 1	**Neurons and Neural Networks**	
	A	Artificial and biological neural networks, Artificial intelligence and neural networks	CO1, CO6
	B	Biological neurons, Models of single neurons	CO1, CO6
	C	Different neural network models	CO1, CO6
	Unit 2	**Single Layer Perceptrons**	
	A	Least mean square algorithm	CO2, CO6
	B	Learning curve	CO2, CO6
	C	Learning rates, Perceptron	CO2, CO6
	Unit 3	**Multilayer Perceptrons**	
	A	Bayes Classifier, Bayes Classifier for Gaussian Distribution	CO3, CO6
	B	Back-propagation algorithm, Back Propagation Algorithm XOR Problem	CO3, CO6
	C	Heuristic for improving the back-propagation algorithm	CO3, CO6

	Unit 4	**Radial-Basis Function Networks**			
	A	Interpolation			CO4, CO6
	B	Regularisation			CO4, CO6
	C	Posed surface reconstruction			CO4, CO6
	Unit 5	**Self-Organising Maps**			
	A	Two Basic Feature Mapping Models, Self-Organization Map			CO5, CO6
	B	SOM Algorithm, Properties of Feature Map			CO5, CO6
	C	Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• **S. Haykin**, *Neural Networks: A Comprehensive Foundation* 2nd edition, (Prentice Hall, 1999) • **K. Mehrotra, C. Mohan, and S. Ranka**, *Elements of Artificial Neural Networks*, MIT Press, 1997.			
	Other References	1. The Essence of Neural Networks, R. Callan, Prentice Hall Europe, 1999. 2. Introduction to Neural Networks, R. Beale and T. Jackson, IOP Press, 1990 3. An Introduction to Neural Network, K Gurney, UCL Press, London, 1997			

School: SSET **Batch : 2023-25** **Programme: M.Tech.** **Current Academic Year:** **Branch: ECE** **Semester: II**			
1	Course Code	ECE815	
2	Course Title	**Method for Product Development for Electronics Subsystems**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	To understand the various processes and systems to address human needs by creating tangible Electronic Products. To pursue learners with emphasis on learning-by-doing and following a comprehensive process of design, engineering and producing products and systems	
6	Course Outcomes	CO1. Design electronic products using user centered design process CO2. Develop sketches, virtual and physical appearance models to communicate proposed designs CO3. Refine product design considering engineering design & manufacturing requirements and constraints. CO4. Make mock-up model and working prototype along with design documentation CO5. Understand Manufacturing Setup including Test Setup CO6: Application to manufacturing units	
7	Course Description	Product development and design processes and methods, including product specifications, concept development, engineering drawings, design for prototyping, and manufacturing	
8	Outline syllabus		CO Mapping
	Unit 1	**Concept: Product Development from Concept through Manufacturing**	
	A	The stage of idea for a new product, a variation on an existing product,	CO1, CO6
	B	The identification of a need for an undefined product causes	CO1, CO6
	C	Research to define a product, a market, and an approach for manufacturing this product.	CO1, CO6

	Unit 2	**Research & Circuit Design**: **Gated Product Development Process & Requirements and Conceptual Design**	
	A	Stage for product concept, identifying the technology, methods, and vendors involved in producing the product.	CO2, CO6
	B	The stage for detailed design specification: used to cost the design process, the estimated manufactured cost of the product.	CO2, CO6
	C	Stage for a schematic diagram (usually via computer drafting software) and a preliminary parts list for costing and prototyping the product.	CO2, CO6
	Unit 3	**Packaging and Printed Circuit Design**	
	A	Stage to design, suitable enclosure designed or selected. Selection, connectors, controls, and displays printed circuit layout commences. First step in designing printed circuits, the mechanical pattern or outline of the board assembly itself.	CO3, CO6
	B	The mechanical drawing ,drawing supplied by the manufacturer. Nomenclature and graphics of designed, labels, overlays, silk screens, or a combination.	CO3, CO6
	C	Processing of the printed circuit artwork, used by a manufacturer to etch printed circuit boards for the board assembler.	CO3, CO6
	Unit 4	**Prototyping or Trial Production & Design Review**	
	A	Schematic design. Electrical stimulation. PCB placement, routing, and BOM check.	CO4, CO6
	B	Firmware and software development, Mechanical design. Industrial design.	CO4, CO6
	C	Testing and analysis, Prototype ,Design verification/validation	CO4, CO6
	Unit 5	**Manufacturing Setup including Test Setup & Documentation &**Manufacturing and Supply Chain Management**:**	
	A	Component Procurement. Quick Turn Prototyping Design for Manufacturability (DFMA).Design for Testability (DFTA) Regulatory Compliance Testing, Analysis, and Certification	CO5, CO6
	B	Custom Enclosure Development Quality and Reliability Assurance Functional Test Fixture Requirements and Design	CO5, CO6
	C	Documentation, Agency Compliance Follow-up.	CO5, CO6
	Mode of	Theory	

	examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Cross N. “Engineering Design Methods: Strategies for Product Design”, Wiley.(2000) Otto K. and Wood K., “Product design: Techniques in Reverse Engineering and New Product development ”, Prentice Hall. (2001) Chakrabarty D., “Indian Anthropometric Dimensions for Ergonomic Design Practice”, NID, Ahmedabad(1999). . Norman D. A. , “The design of everyday things, Basic Books.”(2002			
	LINKS	https://www.industrologic.com/gtepdad.htm http://www.stilwellbaker.com/capabilities/electronic-product-development			

School: SSET		**Batch : 2023-25**	
Programme: M.Tech			
Branch: ECE		**Semester:II**	
1	Course Code	**ECE686**	
2	Course Title	Microwave Communication	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	1. To understand microwave and millimetre wave vacuum tube and solid state devices 2. To understand various type of antennas and their applications 3. To understand the designing of radio link	
6	Course Outcomes	After completing this course, students will be able to: CO1: The concept of microwave generation CO2: Analyse impedance matching CO3: Design and use of various antennas CO4:Apply concepts microwave propagation CO5: Analyze the Effect of atmosphere on radio wave propagation CO6: Application to the latest communication technology	
7	Course Description	This course is intended to introduce to students: (i) various types of devices for generation of microwaves (ii) concepts of impedance matching networks (iii) Scattering parameters (iv) Development of the free space communication link equations (iv) Microwave propagation losses.	
8	Outline syllabus		CO Mapping
	Unit 1	**Microwave and millimetre wave devices**	
	A	Overview of microwave and millimetre wave vacuum tube devices, limitations of microwave vacuum tubes	CO1, CO6
	B	Microwave and millimetre wave solid state devices, Gunn devices,	CO1, CO6
	C	IMPATT devices, and microwave and mm wave performance of IMPATT.	CO1, CO6
	Unit 2	**Microwave and mm wave circuits**	
	A	Review of scattering matrix concept in the light of vector network analyser.	CO2, CO6
	B	Impedance matching network, couplers, power dividers, resonators and filters	CO2, CO6

	C	Detectors, mixers, attenuators, phase shifters, amplifier and oscillator.			CO2, CO6
	Unit 3	**Antennas**			
	A	Hertzian dipole, loop antenna, helical antenna, frequency independent antenna: log spiral and log periodic dipole antenna array.			CO3, CO6
	B	Babinet principle, waveguide slot antenna, micro-strip antenna, horn antenna, parabolic antenna.			CO3, CO6
	C	Antenna arrays and phased array antenna.			CO3, CO6
	Unit 4	**Microwave and mm wave propagation**			
	A	Basic radio wave propagation mechanisms, Friis transmission formula.			CO4, CO6
	B	Plane earth propagation model, Tropo-scatter systems, ionosphere propagation.			CO4, CO6
	C	Duct propagation, microwave radio link and calculation of link budget.			CO4, CO6
	Unit 5	**Effect of atmosphere on radio wave propagation**			
	A	Effect on radio wave propagation due to rain, fog.			CO5, CO6
	B	Effect on radio wave propagation due to snow, ice.			CO5, CO6
	C	Effect on radio wave propagation due to atmospheric gases, Earth's magnetic field.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	*P Bhartia & I J Bahl, Millimeter wave engineering and Applications, John Wiley & Sons*			
	Other References	*David M Pozar, Microwave Engineering, John Wiley & Sons*			
		R E Collin, Antenna & Radio wave Propagation, McGraw Hill Book Co.			

School: SSET		**Batch: 2023-25**	
Programme : M. Tech.			
Branch:ECE		**Semester: II**	
1	Course Code	ECE836	
2	Course Title	**Data Communication**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Departmental Elective	
5	Course Objective	This course will introduce knowledge of Fundamentals of Digital Communication, Baseband pulse shaping, error detection and correction codes, Synchronous and Asynchronous transmission	
6	Course Outcomes	After completion of syllabus student is able to: CO1: understand the basic concepts of networking thoroughly. CO2: understand the data link layer functionality CO3: analyse the performance of the network. CO4: Investigate Quality control mechanisms. CO5: Analyse the various switching technologies. CO6: Explain and identify performance issues in computer networking.	
7	Course Description	Students are expected to have a strong mathematical background and an understanding of probability theory, understanding the procedure of transmitting data over the network and how to resolve the conflicting issues arising in the course of transmission.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Computer Networks -Store-and-forward and circuit switching	CO1
	B	layered network architecture, the OSI network model	CO1
	C	TCP/IP reference model, Internet architecture	CO1
	Unit 2	**Data Link Layer**	
	A	Datalinklayerdesignissues,Flowcontrol,andErrorcontrol.	CO2
	B	Datalinklayerprotocols,stop-and-waitprotocol, Sliding windowprotocol,Go-back-Nprotocol,HDLC,PPP.	CO2
	C	Mediaaccesssublayer,MACprotocols-ALOHA,slotted ALOHA,Carriersensemultipleaccessprotocol.	CO2

	Unit 3	**NetworklayerandTransportlayer**			
	A	Router,InternetProtocol,Routingalgorithms,BroadcastandMulticastrouting			CO3
	B	Connectionless transport - User Datagram Protocol,Connection oriented transport Transmission ControlProtocol			CO3
	C	IP,sub-netting,subnetmask.			CO3
	Unit 4	**CongestionControlandResourceAllocation**			
	A	IssuesinResourceAllocation,QueuingDisciplines			CO4
	B	TCPcongestionControl,CongestionAvoidanceMechanisms			CO4
	C	QualityofService			CO4
	Unit 5	**Switchinginnetworks**			
	A	Classificationandrequirementsofswitches,agenericswitch,			CO5
	B	CircuitSwitching,Time-divisionswitching,Space-divisionswitching			CO5
	C	Packetswitching,Blockinginpacketswitches,Threegenerationsofpacketswitches			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	AndrewTanenbaum,"Computernetworks",PrenticeHall, 2011-ISBN:9780132553179			
	Other References	1. B.A.Forouzan,"DataCommunicationsandNetworking",TataMcGrawHill,4th Edition,2006-ISBN:9780073250328 2. T.Viswanathan,"TelecommunicationSwitchingSystemandNetworks",PrenticeHall-ISBN:9788131764640 3. S. Keshav, "An Engineering Approach to ComputerNetworking",PearsonEducation-ISBN:9788131711453			

School: SSET		**Batch : 2023-25**	
Programme: M.Tech			
Branch:VLSI		**Semester:II**	
1	Course Code	ECE840	
2	Course Title	Advanced Digital design using HDL	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Department Elective	
5	Course Objective	The aim of this course are to develop advanced digital design skills, introduce a design approach based on programmable logic, allow students to gain experience in tackling both control and data oriented problems and to show the power of VHDL as a tool for advanced digital design. Students will also learn synthesis tools for direct digital implementation.	
6	Course Outcomes	After completion of this course the student will be able to CO1: Explain the VHDL design flow and design entities. CO2: Analyze signal assignments with delay component declaration CO3: Describe the objects in VHDL and VHDL types CO4: Use effectively a modern hardware description language (VHDL) and computer aided design tools to implement designs in programmable chips. CO5: Use the Mentor Graphics Modelsim or Aldec for VHDL simulation CO6: Simulate for all the basic gate, multiplexor, encoder, decoder, half and full adder, subtractor.	
7	Course Description	Advanced techniques in the design of digital systems. Hardware description languages, combinational and sequential logic synthesis and optimization methods, partitioning, mapping to regular structures. Emphasis on reconfigurable logic as an implementation medium.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Hierarchy**	
	A	Origin of VHDL,VHDL basics, VHDL levels of abstraction, VHDL design flow, modeling hardware in VHDL	CO1,CO6
	B	Concurrent signal assignments, signal assignments with delay Component declaration	CO1,CO6
	C	Direct instantiation, Configuration specifications, entity binding, port modes, VHDL process	CO1,CO6
	Unit 2	**Data types and statements**	
	A	Objects in VHDL, Constants, variable & signals, VHDL	CO2,CO6

		types, scalar types, Arrays, Records, Custom types subtypes, Tristate and resolved types			
	B	std_ulogic and std_logic, unsigned and signed ,attributes. Concurrent statements, Sequential statements			CO2,CO6
	C	Generate statements, signal and variable assignments, synthesis of statements, latch inference, for loop.			CO2,CO6
	Unit 3	**Simulation and Synthesis**			
	A	How a VHDL simulator works, Event driven simulation, Delta delay, transport delay, inertial delay, reject			CO3,CO6
	B	Basic gates like and, nor, xor etc multiplexor, encoder, decoder, half and full adder, half and full subtractor.			CO3,CO6
	C	Flip flop, latches, synchronous and asynchronous Flip Flop, Synchronous and asynchronous counter, loadable up and down counter.			CO3,CO6
	Unit 4	**Finite State Machine(FSMs)**			
	A	Review of Moore and Melay state machine			CO4,CO6
	B	Finite state machines representation			CO4,CO6
	C	FSM example :Sequence detector for different sequence like 1101,1001 etc, FSM for counter,			CO4,CO6
	Unit 5	**Subprograms and Packages**			
	A	Subprograms, functions, procedures, Differences between functions and procedures			CO5,CO6
	B	Generic parameters, generic mapping			CO5,CO6
	C	Introduction to Xilinx ISE for synthesis & implementation			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	*1 J.Bhasker, " AVHDL Primer" Prentice Hall*			
	Other References	*1-Peter J. Ashenden, "Designers guide to VHDL", Morgan Kaufman Publishers.* *2-Charles H Roth Jr, "Digital System Design using VHDL", Thomson Learning, 2002*			

School: SSET		**Batch : 2023-25**	
Programme: M. Tech.		**Current Academic Year:**	
Branch: VLSI		**Semester: II**	
1	Course Code	**ECE838**	
2	Course Title	**Low Power VLSI Design**	
3	Credits	**3**	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Departmental Elective	
5	Course Objective	**To expose the students to the low voltage device modeling, low voltage, low power VLSI CMOS circuit and system design.**	
6	Course Outcomes	**After completion of this course the student will be able to** **CO1:** Explain the sources of power dissipation in CMOS **CO2:** Classify the special techniques to mitigate the power consumption in VLSI circuits **CO3:** Summarize the power optimization and trade-off techniques in digital circuits. **CO4:** Illustrate the power estimation at logic and circuit level **CO5:** Summarize the power optimization and trade-off techniques in semiconductor memories. **CO6:** Explain the software design for low power in various level	
7	Course Description	This is a course on the design and applications of low power integrated circuits. This course introduces various strategies and methodologies for designing low power circuit and systems. It describes the many issues facing designers at architectural, logic, circuit and device levels and presents some of the techniques that have been proposed to overcome these difficulties.	
8	Outline of the Syllabus		CO Mapping
	Unit 1		
	A	Fundamentals , Need for Low Power Circuit Design: CMOS and FinFET	CO1, CO6, CO4
	B	Sources of Power Dissipation–Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation	CO1, CO6, CO4
	C	Short Channel Effects–Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.	CO1, CO6, CO4
	Unit 2		
	A	Low-Power Design Approaches, Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits	CO2, CO6
	B	Architectural Level Approach–Pipelining and Parallel	CO2,

		Processing Approaches.	CO6
	C	Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures	CO2, CO6
	Unit 3		
	A	Low-Voltage Low-Power Adders, Introduction to CMOS Digital Circuits, Standard Adder Cells,	CO3, CO6
	B	Low Power Adders: CMOS Adder's Architectures ,Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders	CO3, CO6
	C	Low Voltage Low-Power Design Techniques–Trends of Technology and Power Supply Voltage, Low Voltage Low-Power Logic Styles	CO3, CO6
	Unit 4		
	A	Introduction to Low-Voltage Low-Power Multipliers, Overview of Multiplication	CO4, CO6
	B	Types of Multiplier Architectures: Braun Multiplier, Baugh-Wooley Multiplier , Introduction to Booth Multiplier	CO4, CO6
	C	Types of Multiplier Architectures:, Introduction to Wallace Tree Multiplier	CO4, CO6
	Unit 5		
	A	Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs	CO5, CO6
	B	Basics of SRAM, Memory Cell, Pre-charge and Equalization Circuit, Low Power SRAM Technologies	CO5, CO6
	C	Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.	CO5, CO6
	Mode of examination	Theory/Jury/Viva	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. J. B. Kuo & J. H. Lou, "Low-voltage CMOS VLSI Circuits", Wiley, 1999. 2. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011. ISBN **978-0-070-53077-5**. 3. Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering. ISBN **978-0-07-143786-8**.	
	Other References	1. Michael Keating et al. "Low Power Methodology Manual For System-on-Chip Design" Springer, 2008. E-Book **ISBN 978-0-387-71819-4,** Hardcover **ISBN 978-0-387-71818-7**. 2. A. Bellaouar & M. A. Elmasry," Low power Digital VLSI Design, Circuits and Systems", Kluwer, 1996. E-Book **ISBN**	

		978-1-4615-2355-0 Hardcover **ISBN 978-0-7923-9587-4**	

School: SSET		**Batch : 2023-25**	
Programme: M.Tech			
Branch: ECE		**Semester: 2nd**	
1	Course Code		Course Name: Research Based Learning -2
2	Course Title	Research Based Learning -2	
3	Credits	0	
4	Contact Hours (L-T-P)	0-0-0	
	Course Status	Compulsory	
5	Course Objective	1.To align student's skill and interests with a realistic problem or project 2.To understand the significance of problem and its scope 3.Students will make decisions within a framework	
6	Course Outcomes	After completion of this course student will be able to CO1: Define Literature Survey in Identified stream. CO2:Identifying the research gaps. CO3: Apply appropriate simulation software / experimental set up. CO4: Comparative Study of all possibilities. CO5: Draft a review article. CO6: Designing for research report and article.	
7	Course Description	In RBL-2, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	
8	Outline syllabus		CO Mapping
	Unit 1	Studyresearch papers.	CO1, CO2
	Unit 2	Formulate the research problem.	CO2,CO3
	Unit 3	Apply the simulation software to the identified research problem.	CO3
	Unit 4	Analysis of the results obtained from simulation.	CO3, CO4
	Unit 5	Prepare a write up based on identified research work and communicate the article.	CO4, CO5, CO6