Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination2021-22

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System(CBCS) Scheme

(Effectivefromtheacademicyear2021-22)

Programme: B.Tech: Electronics and Communication Engineering

VII SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	21EC71	Computer Networks	ECE	3			3	50	50	100	03
2	PCC	21EC72	Mobile Communication and Networks	ECE	3			3	50	50	100	03
3	PCC	21EC73	Digital Image Processing	ECE	3			3	50	50	100	03
4	PEC	21EC74X	Professional Elective Course-IV	ECE	3			3	50	50	100	03
5	OEC	21EC75X	Open Elective Course-III	ECE	4			3	50	50	100	04
6	PCC	21ECL76	Computer Networks Laboratory	ECE			2	3	50	50	100	01
7	PCC	21ECL77	Digital Image Processing Laboratory	ECE			2	3	50	50	100	01
8	PEC	21ECL78X	Professional Elective Course-IV Laboratory	ECE			2	3	50	50	100	01
9	PW	21PRJ79	Project-VII	ECE			2	3	50	50	100	01
10	HSS	21HSM710	Industrial Psychology and Organizational Behavior	ECE	1			3	50	50	100	01
Total					**17**	**0**	**8**	**30**	**500**	**500**	**1000**	**21**

Note: PCC-Professional Core Course, PEC-Professional Elective Course, OEC-Open Elective Course, PW-Project Work, HSS-Humanity and Social Science, AEC-Ability Enhancement Course.

Project (PRJ): A batch of 4 to 5 students (Same branch or different branches) with a guide, may undertake one project (1 hour of theory/tutorial or two hours of practice /activities.

Professional Elective Course-IV			
Course code under 21EC74X	**Course Title**	**Course code under 21ECL78X**	**Course Title**
21EC741	Power Electronics	21ECL781	Power Electronics Laboratory
21EC742	Low Power VLSI	21ECL782	Low Power VLSI Design Laboratory
21EC743	DSP Algorithm and Architecture	21ECL783	DSP Algorithm and Architecture Laboratory
Open Elective Course-III			
Course code under 21XX74X	**Course Title**		
21EC751	E-Waste Management		
21EC752	Wireless Sensor Network		
21EC753	Robotics		
AICTE Activity Points: In case students fail to earn the prescribed activity points, eighth semester Grade Card shall be issued only after earning the Required activity points. Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.			

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(Effectivefromtheacademicyear2021-22)

Programme: B.Tech: Electronics and Communication Engineering

VIII SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	Project	21PRJ81	Research Project / Field Project - VIII				16	3	50	50	100	08
2	Internship	21ECI82	Internship				12	3	50	50	100	06
Total							**28**	**06**	**100**	**100**	**200**	**14**

Note: PCC-Professional Core Course,PEC-ProfessionalElectiveCourse,OEC-OpenElectiveCourse,PW-ProjectWork,HSS-HumanityandSocialScience, AEC-Ability Enhancement Course. Internship-Tobecarried outduringthevacation/s ofVIand VIIsemesters orVIIandVIIIsemesters

Project(PRJ): A batch of 4 to 5 students (Same branch or different branches) with a guide, may undertake one project (1 hour of theory/tutorial or two hours of practice /activities.

Note: Project-8 Manufacturable and marketable project / Research project/Field Project.

COMPUTER NETWORKS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	21EC71	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40 Hours	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
- Understand the protocols associated with each layer.
- Learn the different networking architectures and their representations.
- Learn the various routing techniques and the transport layer services.

Modules	**Teaching Hours**
Module -1	
Introduction: Data Communications: Components, Representations, Data Flow. **Networks**: Physical Structures, Network Types: LAN, WAN, Switching, The Internet. **Network Models:** Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. Text 1: 1.1,1.2,1.3,2.1,2.2,2.3.	**08 Hours**
Module -2	
Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. **Data Link Control (DLC)**: services, Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. **Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing, Channelization. Text 1: 9.1,9.2,11.1,11.2,12.1,12.2,12.3.	**08 Hours**
Module -3	
Connecting Devices: Hubs, Switches, Routers. **Virtual LANs:** Membership, Configuration, Communication between Switches and Routers, Advantages. **Network Layer:** Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. Text 1: 17.1, 17.2,18.1,18.2,18.4,18.5	**08 Hours**
Module -4	
Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging tools, ICMP checksum. Mobile IP: Addressing, Agents, Three Phases,	**08 Hours**

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4. Text 1: 19.1,19.2,19.3, 20.1,20.2,20.3	
Module-5	
Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, **Transport Layer Protocols:** Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol, **User Datagram Protocol**: User Datagram, UDP Services, UDP Applications, **Transmission Control Protocol:** TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. Text 1: 23.1, 23.2,24.1, 24.2, 24.3	**08 Hours**
Course Outcomes: At the end of the course, the students will be able to: CO1- Demonstrate the fundamental principles of computer networking and the significance of layered network architecture in facilitating communication. CO2- Identify and analyze the protocols and services associated with the Data Link layer in networking. CO3- Describe the protocols and functions of the Network layer and their impact on data transmission and routing. CO4- Analyze and design routing protocols, and evaluate the packet routing process using various routing algorithms. CO5- Recognize the protocols and services of the Transport layer, and explain their role in supporting communication processes across the network.	
Text Books: 1. Data Communications and Networking ,Forouzan, 5th Edition, McGraw Hill, 2016 ISBN: 1-25-906475-3	
Reference Books: 1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4 2. Introduction to Data Communication and Networking, WayarlesTomasi, Pearson Education, 2007, ISBN:0130138282	

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

MOBILE COMMUNICATION AND NETWORKS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

Subject Code	21EC72	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40 Hours	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the wireless fundamentals.
- Understand the various generations of cellular technologies.
- Understand the concepts of modulation techniques and multiple access schemes.
- Understand the multicarrier modulation.
- Understand the concepts of multiple antenna transmission and reception.

Module -1	**Teaching Hours**
Wireless Fundamentals: Communication system building blocks, The broadband wireless channel: Path loss and shadowing, Cellular systems, The broadband wireless channel: Fading, Modelling of broadband fading channels, Mitigation of narrowband fading, Mitigation of broadband fading. (**Text1: 2.1-2.4, 2.5.1-2.5.2, 2.6.2-2.6.5, 2.7.1-2.7.2**)	**08 Hours**
Module -2	
Evolution of cellular technologies: Introduction, Evolution of mobile broadband, The case for LTE/SAE, Key enabling technologies and features of LTE, LTE network architecture, Spectrum options and migration plans for LTE, Future of mobile broadband-Beyond LTE. (**Text1: 1.1-1.8)**	**08 Hours**
Module -3	
Modulation and multiple access schemes: Binary phase shift keying (BPSK), Quadrature phase shift keying (QPSK), M-ary quadrature amplitude modulation (QAM), Multiple access techniques: Introduction, Frequency division multiple access (FDMA), Time division multiple access (TDMA), Spread spectrum multiple access, Space division multiple access (SDMA). (**Text2: 6.8.1, 6.8.3, 6.8.4, 6.10.2, 9.1-9.5)**	**08 Hours**
Module -4	
Multicarrier modulation: The Multicarrier concept, OFDM basics, OFDM in LTE, Timing and frequency synchronization, The peak-to-average ratio, Single-carrier frequency domain equalization (SC-FDE), The computational complexity advantage of OFDM and SC-FDE. (**Text1: 3.1-3.7)**	**08 Hours**
Module -5	
Multiple antenna transmission and reception: Spatial diversity overview, Receive diversity, Transmit diversity, Spatial multiplexing, How to choose between diversity, Interference suppression and spatial multiplexing, Channel estimation and feedback for MIMO and MIMO-OFDM. (**Text1: 5.1-5.3, 5.5-5.7**)	**08 Hours**

Course Outcomes: After studying this course, students will be able to:

CO1-Understand cellular concepts and signal propagation in mobile communication
CO2- Explain the evolution of cellular technologies.
CO3-Analyze the modulation and multiple access schemes.
CO4-Apply the multicarrier modulation techniques for advanced wireless communication systems design.
CO5-Analyze the multiple antenna transmission and reception techniques.

Text Books:

1. Arunabha Ghosh, Jun Zhang, Jeffrey G. Andrews, Rias Muhammed, "Fundamentals of LTE", Pearson Education, 2018.
2. T.S.Rappaport, "Wireless Communications Principles and Practice", PHI, 2nd Edition, 2010.

Reference Books:

1. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. HarriHolma and Antti Toskala, "LTE for UMTS Evolution to LTE-Advanced', John Wiley & Sons, 2nd Edition , 2011.
3. Vijay K. Garg, J.E.Wilkes, "Principle and Applications of GSM", Pearson Education, 2006.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-

DIGITAL IMAGE PROCESSING

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]
SEMESTER- VII

Course Code	21EC73	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam hours	03

CREDITS-03

Course Objectives: Students will be taught to:

- Understand the fundamentals of digital image processing
- Understand the image enhancement techniques in spatial domain used in digital image processing
- Understand the frequency domain enhancement techniques in digital image processing
- Understand the Color Image Processing in digital image processing.
- Understand the image restoration techniques and methods used in digital image processing

Module -1	**Teaching Hours**
Whatis Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition. **(Text: Chapter 1and Chapter 2: Sections 2.1to 2.2, 2.6.2)**	08 Hours
Module -2	
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters [Text 1: Chapter 3: Sections 3.2 to 3.6]	08 Hours
Module -3	
Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters. [Text 1: Chapter 4: Sections 4.7 to 4.9]	08 Hours
Module -4	
Color Image Processing: Color Fundamentals, Color Models, Pseudo-color Image Processing. [Text 1: Chapter 6: Sections 6.1 to 6.3] Error(Wiener) Filtering, Constrained Least Squares Filtering. (Text: Chapter 5: Sections 5.2, to 5.9)	08 Hours
Module -5	
Restoration: A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering. [Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8] Teaching Learning Process Chalk and talk method, PowerPoint P????	08 Hours

Course Outcomes: After studying this course, students will be able to:

CO1- Ability to define the fundamental concepts of digital image processing and to recognize different image processing applications.

CO2- Ability to apply image processing techniques in both the spatial domain.

CO3- Study and analysis of image enhancement in frequency domain.

CO4- Investigate the various noise models and image restoration techniques.

CO5- Ability to learn color image processing and morphological image processing.

Text Books:

1.Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Reference Books:

1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014.
2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-

POWER ELECTRONICS

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	21EC741	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives The objectives of the course is to enable students to:

- Understand the working of various power devices.
- Study and analysis of thyristor circuits with different triggering techniques.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Study of power electronics circuits under different load conditions.

Modules-1	**Teaching Hours**
Introduction & Power Transistors: Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics. (Text 1)	**08 Hours**
Module -2	
Thyristors : - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation . Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firingcircuit.(Text 2)	**08 Hours**
Module -3	
Controlled Rectifiers & AC Voltage Controllers : Controlled Rectifiers - Introduction, principle of phase controlled converter operation, Single phase full converters, Single phase dual converters. AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase control with resistive and inductive loads. (Text 1)	**08 Hours**
Module -4	
DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classifications. (Text 1)	**08 Hours**
Module-5	
Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter. (Text 1)	**08 Hours**

Course Outcomes: After studying this course, students will be able to:

CO1- Analyze the I-V characteristics of SCR, DIAC and TRIAC.
CO2- Analyze the characteristics of MOSFET, IGBT and UJT.
CO3- Construct and demonstrate the operation of AC voltage controller and differentiate its various configurations.

CO4- Design controllers for dc-dc converters in voltage and peak-current mode
CO5- Apply the different modulation techniques to pulse width modulated inverters and identify the harmonic reduction methods.

Text Books :

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- Graw Hill, 2009, ISBN: 0070583897.

Reference Books :

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	**3**	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	**3**	**3**	-	-	-	-	**2**	-	-	-	-	-	**3**	-	-
CO4	**3**	**3**	**3**	-	-	-	2	-	-	-	-	-	**3**	-	-
CO5	**3**	**3**	**3**	-	-	-	**2**	-	-	-	-	-	**3**	-	-

LOW POWER VLSI DESIGN

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	21EC742	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Know the basics and advanced techniques in low power design which is a hot topic in today's market where the power plays a major role.
- Describe the various power reduction and the power estimation methods.
- Explain power dissipation at all layers of design hierarchy from technology, circuit, logic, architecture and system.
- Apply State-of-the art approaches to power estimation and reduction.
- Practice the low power techniques using current generation design style and process technology

Modules	Teaching Hours
Module -1	
Introduction: Need for low power VLSI chips, charging and discharging capacitance, short circuit current in CMOS leakage current, static current, basic principles of low power design, low power figure of merits.	08 Hours
Module -2	
Simulation Power Analysis: SPICE circuit simulation, discrete transistor modeling and analysis, gate level logic simulation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.	08Hours
Module -3	
Probabilistic Power Analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.	08 Hours
Module -4	
Circuit: Transistor and gate sizing, equivalent pin ordering, network restructuring and reorganization, special latches and flip flops, low power digital cell library, adjustable device threshold voltage.	08 Hours
Module -5	
Logic: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic (Text 1). **Architecture and System :** Power and Performance Management,Switching Activity Reduction, Parallel Architecture with Voltage Reduction, Flow Graph Transformation.	08 Hours

Course outcomes After studying this course, students will be able to

CO1-Identify and analyze the various sources of power dissipation in CMOS circuits.

CO2-Analysis of power for discrete, gate level and architecture level using SPICE simulation.

CO3- Analysis of probabilistic power techniques and power estimation using signal entropy.

CO4-Design and optimize circuit networks by applying restructuring and reorganization techniques to meet low-power objectives.

CO5-Apply strategies to minimize switching activity for improved energy efficiency and design gate reorganization techniques to boost circuit efficiency and lower power consumption.

Text Book:

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic, 1998.

Reference Books:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000
2. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, " Low power VLSI CMOS circuit design", Kluwer Academic,1995.
3. Jan M.Rabaey, MassoudPedram, "Low Power Design Methodologies" Kluwer Academic, 2010.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	-	-	-	-	2	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	2	-	-	-	-	-	3	-	-
CO3	2	3	2	-	-	-	2	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	2	-	-	-	-	-	3	-	-
CO5	2	3	3	-	-	-	2	-	-	-	-	-	3	-	-

DSP ALGORITHMS AND ARCHITECTURE

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

Subject Code	21EC743	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Figure out the knowledge and concepts of digital signal processing techniques.
- Understand the computational building blocks of DSP processors and its speed issues.
- Understand the various addressing modes, peripherals, interrupts and
- Pipelining structure of TMS320C54xx processor.
- Learn how to interface the external devices to TMS320C54xx processor in Various modes.

Modules	Teaching Hours
Module -1	
Architectures for Programmable Digital Signal – Processing Devices: Introduction, Basic Architectural Features, Classic DSP architecture characteristics, On-chip memories, DSP Computational Building Blocks, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing, Speed Issues.	**08 Hours**
Module -2	
TMS320C54xx Architecture: Introduction, Architectural overview ofTMS320C54xx DSP, Central Processing Unit, Internal Memory Organization, Program Control, Detail study of TMS320C54x& 54xx instructions and programming: Arithmetic operations, logical operations, program control operations, load and store operations.	**08 Hours**
Module -3	
Implementation of Basic DSP Algorithms: Introduction, Number representation in DSP, FIR filters, IIR filters, Interpolation and Decimation Filters (One example in each case) **Implementation of FFT Algorithms:** Introduction, DFT & IDFT, Requirement of FFT algorithms, Computation involved in Butterfly implementation, Algorithm for DIT-FFT implementation	**08 Hours**
Module -4	
Memory and Parallel I/O in TMS320C54xx-Description and Interfacing: Introduction, Memory Space, Program Memory, Dual access memory and the pipeline, single access memory and the pipeline, Data memory, External Bus, External memory Interfacing, External memory signal generated by 54xx, Memory Address decoding, Interfacing Parallel and I/O Devices.	**08 Hours**
Module-5	
Interfacing and Applications of DSP Processors: Introduction, DSP based measurement system, Heart rate monitor, Speech Processing System	**08 Hours**

Course Outcomes: At the end of this course, students would be able to

CO1- Outline and describe DSP fundamentals, DSP architecture, Address Generation Units (AGU), DSP computational blocks and on-chip memory.

CO2- Comprehend architecture of TMS320C54XX DSP, Instructions sets and Assembly language programming.

CO3- Analyze and design various filters, number representation and FFT algorithms.
CO4- Perceive the various memory devices and I/O interfacing.
CO5- Gain insight into DSP measurement and speech processing systems, and develop heart rate monitors.

Text Books:

1. "Digital Signal Processors" AndhePallavi and K.Uma Rao, Pearson-Education, 2012.

Reference Books:

1. "Digital Signal Processing: A practical approach", Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002.
2. "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, 2nd, 2010
3. "Architectures for Digital Signal Processing", Peter Pirsch John Weily, 2008
4. "Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

E-WASTE MANAGEMENT

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	21EC751	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- This course covers an extensive review of e-waste management in India.
- Focus on the evolution of legal frameworks in India and the world, it presents impacts and outcomes; challenges and opportunities; and management strategies and practices to deal with e-waste.
- Pan-India initiatives and trajectories of law-driven initiatives for effective E-waste management along with responses from industries and producers.
- Mitigate E-waste management issues, and helps to generate employment.
- Start E-waste recycling plants, with this the demand for employees with all levels of qualification and skills also increases.

Module -1	**Teaching Hours**
Introduction to Waste Management Waste – Definition, Different types of Waste – Biodegradable, non – biodegradable, plastic waste, biomedical waste, E- waste, Construction and demolition waste and Industrial waste, Scope of waste management audits, significance and benefits of conducting waste management audits.	10 Hours
Module -2	
Audit Procedure and preparation ,E-Waste management audit procedures and target areas of auditing, Benefits, phases and components of ewaste management audit, e-waste risk assessment, composition and impact of e-waste in environment, Role of education institution in e-waste generation, qualitative and quantitative measures to conduct audits, carbon emission due to e –waste, Report preparation.	10 Hours
Module -3	
Toxicity and Health hazards of E waste: Introduction, Burden of E waste, Health hazard, Electronic waste Managemnt, E waste Cycling Taking on circular economy, Impact of Spent Lithium -Ion Batteries Recycling on Economy and Environment: Introduction, Structure of Lithium-Ion Battery, Multiple ways for final disposal of Batteries, Phases of recycling process, Challenges in recycling of Lithium -Ion batteries, Recycling process Lithium -Ion batteries.	10 Hours
Module -4	
Disposal techniques and its impact,impact of E- Waste on Health and environment, Impact of Recycling E-Waste, Availability of more resources in recycling, Essentials for E-Waste Disposal audit, Essential disposal steps for these e-waste items, Steps for Mobile Device Disposal, Personalized Recommendations for EWaste Disposal, Action Plan and Suggestions for Waste Reduction in the Organization .	10 Hours

Module -5	
Laws and Legislation: Broad overview of e-waste management policies in the U.S, e-waste management rules in India, UNEP, GeSI – Global e-sustainability initiative, E-waste treatment system and Technology.	10 Hours

Course outcomes: After studying this course, students will be able to:

CO1- Comprehend e-waste management, global and Indian statistics, regulatory frameworks, and sustainability concepts such as SDGs, Circular Economy (CE), and Life Cycle Impact Assessment (LCIA).

CO2- Understand & explain Extended Producer Responsibility (EPR) as a regulatory framework for e-waste management, its implementation across different countries, and its impact on human health and the environment.

CO3- Evaluate themes related to resource use, sustainable development, urban mining, financial support for recycling infrastructure, and policy needs for resource utilization in India.

CO4- Identify and analyze pan-India initiatives, including research, legal frameworks, industrial interventions, and strategies for achieving the Agenda 2030 goals.

CO5- Assess the opportunities and challenges in four key domains: legal and judicial frameworks, economic aspects, recycling culture/society, and environmental concerns.

Reference Books:

1. VarshaBhagatGangulay, 'E-Waste Management', Taylor and Francis, 2022.
2. https://link.springer.com/book/10.1007/978-3-030-14184-4 3.
3. https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf
4. https://greene.gov.in/wp-content/uploads/2018/01/E-waste-Vol-II-E-waste-Management-
5. Manual.pdf •https://nptel.ac.in/courses/105105169

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	-	-	-	-	-	3	3	2	-	-	-	2	-	-	3
CO2	-	-	-	-	-	3	3	2	-	-	-	2	-	-	3
CO3	-	-	-	-	-	3	3	2	-	-	-	2	-	-	3
CO4	-	-	-	-	-	3	3	2	-	-	-	3	-	-	3
CO5	-	-	-	-	-	3	3	3	-	-	-	3	-	-	3

WIRELSESS SENSOR NETWORKS [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VII			
Subject Code	21EC752	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	48	Exam Hours	03
CREDITS-04			

Course Objectives: This course will enable students to:

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Applications of wireless sensor networks in commercial components.

Modules	Teaching Hours
Module -1	
Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. **RBT:L1, L2**	10 Hours
Module -2	
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies.**RBT:L1, L2**	10 Hours
Module -3	
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **RBT:L1, L2,L3**	10 Hours
Module -4	
Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. **RBT:L1, L2,L3**	08 Hours
Module -5	
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. **RBT:L1, L2**	10 Hours

Course outcomes: After studying this course, students will be able to:

CO1- Explore the technology and apply the principles of Wireless Sensor Networks across various domains.

CO2-Develop applications of wireless sensor actuator networks.

CO3-Analyze various routing protocols for wireless sensor networks.

CO4- Analyze various design issues in wireless sensor networks.

CO5-Apply the WSN in applications like, building automation, industrial automation, medical applications, military applications, etc.

Text Book:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:, WILEY , Second Edition (Indian) , 2014.
2. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
3. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books:

1. .K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
2. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-

ROBOTICS

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	21EC753	CIE Marks	50
Number of Lecture Hour/Week	4L	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- Demonstrate an ability to apply spatial transformation to obtain forward kinematics equation of robot manipulators.
- Demonstrate an ability to perform kinematics and inverse kinematics analysis of robot systems.
- Demonstrate knowledge of robot controllers.
- To develop the student's knowledge in various robot structures and their workspace.

Modules	Teaching Hours
Module -1	
INTRODUCTION ROBOTICS: Robotics – Basic components – Classification – Performance characteristics – Actuators- Electric actuator- DC motor horse power calculation, magneto-astrictive hydraulic and pneumatic actuators. Sensors and vision systems: Different types of robot transducers and sensors – Tactile sensors – Proximity and range sensors - ultrasonic sensor-touch sensors-slip sensors-sensor calibration- vision systems – Image processing and analysis – image data reduction – segmentation feature extraction – Object recognition.	**10 Hours**
Module -2	
ROBOT CONTROL : Control of robot manipulators- state equations-constant solutions-linear feedback systems-single axis PID control- PD gravity control- computed torque control-variable structure control- Impedance control.	**10 Hours**
Module -3	
END EFFECTORS: End effectors and tools- types – Mechanical grippers – Vacuum cups – Magnetic grippers – Robot end effectors interface, work space analysis work envelope-workspace fixtures-pick and place operation- continuous path motion-interpolated motion-straight line motion.	**10Hours**
Module -4	
ROBOT MOTION ANALYSIS : Robot motion analysis and control: Manipulator kinematics -forward and inverse kinematics	**10 Hours**
Module-5	
ROBOT APPLICATIONS : Industrial and non industrialrobots, Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear plants.	**10 Hours**

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

CO1- Understand and apply the significance, social impact and future prospects of robotics and automation in various engineering applications.

CO2- Identify and describe the anatomy of robotic system and analyze robotic motions.

CO3- Summarize drives, end-effectors and identify DOF for different robot applications

CO4- Classify about sensors and various path planning techniques and design different robotic motions

CO5- Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types of robots based on the design and applications in real world scenarios.

Text Books:

1. Mikell P Grover et. al. "Industrial Robots: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 1980, ISBN 9781259006210.
2. Robert J. Schilling, "Fundamentals of Robotics-Analysis and Control", PHI Learning, 2009, ISBN 9788120310476

Reference Books:

1. K.S. Fu, Ralph Gonzalez, C.S.G. Lee, "Robotics: control, sensing, vision and Intelligence", 1st Edition, Tata Mcgraw-Hill, 2008, ISBN 9780070265103

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

COMPUTER NETWORKS LABORATORY

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

Subject Code	21ECL76	CIE Marks	50
Number Lab practice Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
- Design a suitable network and simulate using a Network simulator tool.
- Simulate the networking concepts and protocols using C/C++ programming.
- Model the networks for different configurations and analyze the results.

Laboratory Experiments

PART-A:
Implement the following in C/C++

1. Write a program for a HLDC frame to perform the Bit stuffing.
2. Write a program for a HLDC frame to perform the Character stuffing.
3. Write a program for Distance vector algorithm to find suitable path for transmission.
4. Implement Dijkstra's algorithm to compute the shortest routing path.
5. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
   a. Without error
   b. With error
6. Implementation of Stop and Wait Protocol.
7. Implementation of Sliding Window Protocol.
8. Write a program for congestion control using leaky bucket algorithm.

PART-B:
Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3.
3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
4. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
5. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
6. Implementation of Link state routing algorithm.

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3- Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Reference Book

1. Data Communications and Networking ,Forouzan, 5th Edition, McGraw Hill, 2016 ISBN: 1-25-906475-3.

2. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

DIGITAL IMAGE PROCESSING LABORATORY

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Course Code	21ECL77	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Number of Lecture Hours	24	Credits	03

CREDITS-01

Course Objectives: Students will be taught to:

- To introduce the concepts of image processing.
- To expose students to basic concepts such as distance and connectivity, image transformation, point operation, analysis of colour image processing.
- To introduce the concepts of Image Compression techniques.
- To expose students to basic edge detection techniques.

LIST OF EXPERIMENTS

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT,DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2- Utilize laboratory instruments/simulation tools to build and test experiments.
CO3- Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):
Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

POWER ELECTRONICS LABORATORY

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	21ECL781	CIE Marks	50
Number Lecture Hour/Week	02	SEE Marks	50
Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Any five experiments from the below list **must be** simulated using the **spice-simulator**.

Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:

- SCR, DIAC Static characteristics
- Static characteristicsof MOSFET and IGBT
- Controlled Rectifiers
- SCR Turn off &UJT firing circuit circuits.
- Voltage (Impulse) commutated choppers.
- AC voltage controllers & controlled rectifiers.
- Speed control of universal & stepper motor.

Experiments

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using
    a. LC circuit
    b. ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ trials using digital circuits/ microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of universal motor.
11. Speed control of stepper motor.

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3- Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Text Books :

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- Graw Hill, 2009, ISBN: 0070583897.

Reference Books :

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):
Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

LOW POWER VLSI DESIGN LABORATORY

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

Subject Code	21ECL782	CIE Marks	50
Number Lab practiceHour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Understand the different parameters which are going to effect on power.
- Understand the different types of power dissipations.
- Learn different types of low power VLSI designs techniques.
- Learn the use of different EDA tools.
- Understand the design and realization of CMOS Digital circuits.

Laboratory Experiments

Following Experiments to be done using Mentor Graphics/Cadence Tool/ Spice Tool

Design, simulate and estimate the power dissipation for following circuits using

a) Conventional CMOS techniques.

1. Inverter
2. NAND and NOR
3. XOR/ XNOR

b) MTCMOS techniques.

4. D-Latch
5. NAND and NOR
6. XOR/ XNOR

c) DTCMOS techniques.

7. Inverter

d) compare static NOR and dynamic NOR

e) Glitch free AND circuit.

f) D-latch using clock gating.

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3- Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Reference Book

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic, 1998.
2. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000
3. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, " Low power VLSI CMOS circuit design", Kluwer Academic,1995.
4. Jan M.Rabaey, MassoudPedram, "Low Power Design Methodologies" Kluwer Academic, 2010.
5. Sung-Mo Kang and Yusuf Leblebici "CMOS Digital Integrated Circuits"

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):
Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

DSP ALGORITHM AND ARCHITECTURE LABORATORY

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

Subject Code	21ECL783	CIE Marks	50
Number Lab practiceHour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Use of instruction set of TMS320C54xx DSP processor to develop ALP for DSP algorithms.
- Learn ALP programming for TMS320C54xx
- Learn the use of Code Composer Studio (CCS) IDE software.
- Understand the design and realization of Digital FIR and IIR filter
- Understand the design and realization of Decimation and Interpolation filters

Laboratory Experiments

Following Experiments to be done using Code Composer Studio (CCS) IDE and DSP Processor

1. Write a TMS320C54XX assembly language program to add set of 5 numbers stored in an array labeled 'num'
2. Write a TMS320C54XX assembly language program to compute the dot product of two vectors x1 and x2 and store the product in the location y.
3. Write a TMS320C54XX assembly language program to compute the output y=mx1+C. consider that x1 and C are stored in data memory and m in the program memory. The result y should be stored in data memory. Assume suitable values of m, x1 and C.
4. Write a TMS320C54xx assembly language program to read 100 words from input port address INPORT and store them in the data memory at address 'Buffer'.
5. Write a TMS320C54xx assembly language program to implement y(n)=h0 X x(n)+h1 X x (n-1)+h2 X x(n-2).
6. Write the assembly language program to multiply two Q15 numbers Num1 and Num2 and obtain the result N3.
7. Write an assembly language program to implement IIR filter
8. Write an assembly language program to implement FIR filter
9. Write an assembly language program to implement Decimation filter
10. Write an assembly language program to implement interpolation filter

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3- Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Reference Book

1. AndhePallavi, K.Uma Rao, Digital Signal Processor Architecture, Programming and Applications, Pearson Education ISBN-978-81-317-6666-8.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):
Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

PROJECT-VII [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VII			
Subject Code	21PRJ79	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

- Get exposure about the electronics hardware and various software tools.
- Design the working model of the open ended problem.
- Understand concepts of Packaging.
- Understand the latest technology trends in the PCB design.
- Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

Course outcomes: After studying this course, students will be able to:

CO1- Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2- Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3- Design and implement the system to solve the real time problem of the society.

CO4- Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5- Use the modern tool available like advanced hardware and software tools.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**3**	3	**-**	**3**	**-**	**3**	**-**
CO2	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**-**
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**-**	**3**	**3**	**2**	**3**	**-**	**3**	**-**
CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**
CO5	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**

INDUSTRIAL PSYCHOLOGY AND ORGANISATIONAL BEHAVIOUR

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

Subject Code	21HSM710	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Relating human psychology to science
- Understand the human psychology
- Understand the nature of organization and organization models
- Understand the human social communication
- Understand the leadership qualities

Modules	Teaching Hours
Module -1	
Introduction to I/O psychology: Major fields of I/O psychology, brief history of I/O psychology, employment of I/O psychology, ethics in I/O psychology. (Chapter-1)	**3 Hours**
Module -2	
Organisational communication: Types of organizational communication, interpersonal communication, improving employee communication skills. (Chapter-11)	**3 Hours**
Module -3	
Leadership : Introduction, personal characteristics associated with leadership, interaction between the leadership and the situation specific leader skills, leadership where we are today. (Chapter-12)	**5 Hours**
Module -4	
Group behaviour- teams and conflicts Group dynamics, factors affecting group performance, individual versus group performance, group conflicts. (Chapter-13)	**5 Hours**
Module-5	
Stress management: Dealing with the demands of life and work, stress defined, predisposition to stress, sources of stress, consequences of stress, stress reduction intervention related to life /work issues. (Chapter-15)	**4 Hours**

Course Outcomes: At the end of this course, students would be able to

CO1-Comprehend the knowledge and concepts of human psychology

CO2-know the importance of communication in organization.

CO3-have insight into individual, group behavior and leadership skills.

CO4-deal with people in better way by knowing their behavior.

CO5-Dealing with stressand work issues.

Text Book: Michael G.Aamodt, Industrial/Organizational Psychology: An Applied Approach, 6th Edition, Wadsworth Cengage Learning, ISBN: 978-0-495-60106-7.

Reference Books:

1. Blum M.L. Naylor J.C., Horper& Row, Industrial Psychology, CBS Publisher, 1968
2. Luthans, Organizational Behaviour, McGraw Hill, International, 1997
3. Morgan C.t.,KingR.A.,JohnRweisz&John Schoples, Introduction to Psychology, McHraw Hill, 1966
4. SchermerhornJ.R.Jr., Hunt J.G &Osborn R.N., Managing, Organizational Behaviour, John Willy

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):
Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	-	-	-	-	-	3	2	2	2	3	2	3	-	-	3
CO2	-	-	-	-	-	3	2	3	3	3	2	3	-	-	3
CO3	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3
CO4	-	-	-	-	-	3	2	3	3	3	3	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	-	-	3

RESEARCH PROJECT/FIELD PROJECT-VIII [As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VIII			
Subject Code	21PRJ81	CIE Marks	50
Total No. of implementation weeks	16P	SEE Marks	50
		Exam Hours	03
CREDITS-8			
Course Objectives: Students will be Guided to: ➢ Understanding about the Project and its components. ➢ Introduction of the project selected. ➢ Detailed literature survey of the project and understand concepts of problem identification. ➢ Design and development of Proposed Methodology. ➢ Implementation of the proposed methodology and thesis document preparation.			
STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM INDIVIDUALLY			
Course outcomes: After studying this course, students will be able to: CO1- Apply the knowledge of electronics hardware and software components to solve the real time problems of the society. CO2- Analyze the various existing solutions available to solve the real time problem and propose the best solution. CO3-Design and development of proposed methodology based on the societal needs, environmental friendly. CO4-Use the modern tool available like advanced hardware and software tools to implement the proposed methodology and make it use for society and prepare a document and submit. CO-5-Publish the proposed work in the peer reviewed Journal			

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	3	**-**	**3**	**-**	**3**	**-**
CO2	**3**	3	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	3	**-**	**3**	**-**
CO3	**3**	**3**	3	**-**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	3	**-**
CO4	**3**	3	3	**-**	**-**	**-**	**-**	**3**	**3**	**3**	3	3	**-**	**3**	**-**
CO5	**3**	**3**	**-**	**3**	**-**	**-**	**-**	3	**3**	**3**	**3**	**3**	**-**	3	**-**

INTERNSHIP

[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VIII

Subject Code	21ECI82	CIE Marks	50
Total No. of implementation/training weeks	12P	SEE Marks	50
		Exam Hours	03

CREDITS-06

Course Objectives: Students will be taught to:

- Learn to appreciate work and its function in the economy.
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the job interview process.
- Build a record of work experience.
- Acquire employment contacts leading directly to a full-time job following graduation from college.

Students has to carry out the internship OF 12 weeks in the industry.

Course outcomes: After studying this course, students will be able to:

CO1- Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2- Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3- Design and implement the system to solve the real time problem of the society.

CO4- Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5- Use the modern tool available like advanced hardware and software tools.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	-	-	-	3	3	2	-	-	-	-	3	-	3	-
CO2	2	3	2	2	-	2	2	-	-	-	-	3	-	3	-
CO3	2	2	3	2	-	2	2	-	-	-	-	3	-	3	-
CO4	-	-	-	-	-	-	-	2	3	3	2	3	-	3	-
CO5	-	-	-	-	3	-	-	2	-	-	-	3	-	3	-