

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

ACCREDITED BY NAAC WITH 'A++' GRADE

Ibrahimbagh, Hyderabad-31

Approved by A.I.C.T.E., New Delhi and

Affiliated to Osmania University, Hyderabad-07

Sponsored

by

VASAVI ACADEMY OF EDUCATION

Hyderabad



SCHEME OF INSTRUCTION AND SYLLABI UNDER CBCS FOR B.E. (ECE) VII and VIII Semesters

With effect from 2026-27

(For the batch admitted in 2023-24)

(R-23)



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Phones: +91-40-23146040, 23146041

Fax: +91-40-23146090

Institute Vision

Striving for a symbiosis of technological excellence and human values

Institute Mission

To arm young brains with competitive technology and nurture holistic development of the individuals for a better tomorrow

Department Vision

Striving for excellence in teaching, training and research in the areas of Electronics and Communication Engineering and fostering ethical values

Department Mission

To inculcate a spirit of scientific temper and analytical thinking and train the students in contemporary technologies in Electronics and Communication Engineering to meet the needs of the industry and society with ethical values

B.E (ECE) Program Educational Objectives (PEO's)	
PEO I	Graduates will be able to identify, analyze and solve engineering problems.
PEO II	Graduates will be able to succeed in their careers, higher education, and research.
PEO III	Graduates will be able to excel individually and in multidisciplinary teams to solve industry and societal problems.
PEO IV	Graduates will be able to exhibit leadership qualities and lifelong learning skills with ethical values.

B.E. (ECE) PROGRAM OUTCOMES (PO's)	
Engineering Graduates will be able to:	
PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
PO4	Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Lifelong learning: Recognize the need, and for have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

B.E (ECE) PROGRAM SPECIFIC OUTCOMES (PSO's)	
PSO I	ECE students will be able to analyze and offer circuit and system level solutions for complex electronics engineering problems, keeping in mind the latest technological trends.
PSO II	ECE students will be able to apply the acquired knowledge and skills in modeling and simulation of communication systems.
PSO III	ECE students will be able to implement signal and image processing techniques for real time applications.

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 DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
 SCHEME OF INSTRUCTION AND EXAMINATION (**R-23**) :: B.E. - ECE : SEVENTH SEMESTER (2026 - 27)

B.E (ECE) VII - Semester								
Course Code	Name of the Course	Scheme of Instruction			Scheme of Examination			Credits
		Hours per Week			Duration in Hrs	Maximum Marks		
		L	T	P		SEE	CIE	
THEORY								
U23PC710EC	Microwave Engineering	3	-	-	3	60	40	3
U23PC720EC	Data Communications and Computer Networks	3	-	-	3	60	40	3
U23PC730EC	Control Systems Engineering	3	-	-	3	60	40	3
U23PE7XXEC	Professional Elective – II	3	-	-	3	60	40	3
U23HS040EH	Economics and Finance for Engineers	2	-	-	3	60	40	2
PRACTICALS								
U23PC711EC	Microwave Engineering Lab	-	-	2	3	50	30	1
U23PC721EC	Data Communications and Computer Networks Lab	-	-	2	3	50	30	1
U23PE731EC	Control Systems Engineering Lab	-	-	2	3	50	30	1
U23PE7XXEC	Professional Elective – II Lab	-	-	2	3	50	30	1
U23PW719EC	Project Seminar	-	-	2	-	-	30	1
NPTEL Certification Course: 8 or 12 weeks duration		-	-	-	-	-	-	2
TOTAL		14	-	10	-	500	350	21
GRAND TOTAL		24				850		
Left over hours will be allocated for : Sports / Library / Mentor - Mentee Interaction / CC / RC / TC								

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Professional Elective (R-23) (Students can opt for all professional electives from single stream or several streams)								
Professional Elective Stream	Embedded Systems and VLSI Stream		Communication Engineering Stream		Signal Processing Stream		Networking Stream	
VII - Semester for the A.Y. 2026-27								
Professional Elective – II (Theory courses)	U23PE710EC	Advanced Embedded Systems	U23PE720EC	Wireless Communications	U23PE730EC	Digital Image and Video Processing	U23PE740EC	Cryptography and Network Security
Professional Elective – II (Lab courses)	U23PE711EC	Advanced Embedded Systems Lab	U23PE721EC	Wireless Communications Lab	U23PE731EC	Digital Image and Video Processing Lab	U23PE741EC	Cryptography and Network Security Lab

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Microwave Engineering

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PC710EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Analyze and design the field components of waveguides 2. Understand and analyze the working of circular waveguides, cavity resonators, and microstrip line structures. 3. Formulating the S parameters of Microwave components 4. Understanding the power output and efficiency characteristics of Microwave sources 5. Familiar with negative resistance and avalanche effect solid state devices	On completion of the course, students will be able to 1. Analyze the E and H field components of parallel and rectangular waveguides. 2. Describe the characteristics and applications of circular waveguides and cavity resonators. 3. Analyze the scattering parameters of microwave components. 4. Summarize the characteristics of Microwave sources. 5. Describe the characteristics of microwave solid-state devices.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2			2						2		3	
CO2	3	3	2			2						2		3	
CO3	3	3				2						2		3	
CO4	3	2				2	3					2		3	
CO5	2	2				2						2		3	

UNIT-I :

Introduction to Parallel plane waveguides, Wave Guides: TE and TM waves in rectangular waveguides, Wave Impedance, Characteristic Impedance, Attenuation in wave guides.

UNIT-II:

Introduction to Circular wave guides, Cavity resonators, resonant frequency, Applications of cavity resonators. Slotted wave guide structures, Elements of strip lines and micro strip lines. Design analysis of microstrip lines

UNIT-III:

Microwave Circuits and Components: Concept of Microwave circuit, Normalized voltage and currents, Introduction to scattering parameters and their properties, Reciprocal and Non-reciprocal components: E and H Plane Tees, Magic Tee Directional coupler, Attenuators, Phase Shifters, Isolators and circulators S parameters for and their properties. Estimation of waveguide parameters for different modes of operation using AI

UNIT-IV:

Microwave Tubes: High frequency limitations of conventional tubes, Bunching and velocity modulation, mathematical theory of bunching, principles and operation of two cavity, multi cavity, Reflex Klystron. Principle and operation of magnetrons, TWT.

UNIT-V:

Microwave Solid State Devices: Principles of operation, characteristics and applications of Varactor, PIN diode, GUNN diode and IMPATT diode

Learning Resources:

1. Samuel Y. Liao, Microwave Devices and Circuits, 3rd ed, Pearson, 2003.
2. Edward C. Jordon, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2015, Pearson, 2nd Edition.
3. R.E. Collins, "Foundations of Microwave Engineering", II edition, Wiley, 2001.
4. K.C. Gupta "Microwaves", John Wiley & Sons, 2012
5. Annapurna Das, Sisir K. Das, "Microwave Engineering" Tata McGraw-Hill Education, 2000
6. https://swayam.gov.in/nd1_noc19_ee57
7. https://swayam.gov.in/nd1_noc19_ee68

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Data Communications and Computer Networks

SYLLABUS FOR B.E. (ECE) VII – SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks : 60	Course Code: U23PC720EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- Develop foundation on network concepts - Provide concepts related to data link layer protocols - Implement network configurations and network protocols - Cover transport layer protocols - Train in network applications and usage of Artificial Intelligence	On completion of the course, students will be able to - Describe the network requirements for a given organization and select most appropriate network architecture - Design and analyze the performance of LAN for small and medium organizations. - Analyze the existing routing and congestion control algorithms. - Identify deficiencies in existing protocols and then formulate new and better protocols. - Implement applications of networks and machine learning.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												2	
CO2	2	2	3											3	
CO3	2	3												2	
CO4	2	3												3	
CO5	3	3	3		2							2		3	

UNIT - I :

Data communication, LAN, WAN, MAN, Network Topologies: Bus, Star, Mesh, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP, ATM.

Data Link Layer: Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols

UNIT - II :

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.11, 802.16 standards. Bluetooth, Bridges and

Routers. Circuit switching: Circuit Switching Principles and concepts.
Packet switching: Virtual circuit and Datagram subnets.

UNIT - III :

Network Layer: Network layer Services, Routing algorithms: Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing and Congestion Control Algorithms. Internet Working: The Network Layer in Internet, IPV4, IPV6 and Internet control protocols, Router Design.

UNIT - IV :

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols.

UNIT - V :

Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web.

k-Nearest Neighbor, Decision Trees, selection of features (Bandwidth, Delay, Congestion), Dynamic routing using Machine Learning (Decision Trees and KNN), Performance Assessment

Learning Resource:

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, "Data Communications and Networking," 5/e, TMH, 2008.
3. Tom Mitchell, "Machine Learning," Indian Edition, McGraw Hill, Indian Editin,2017.
4. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.
5. S. Keshav, "An Engineering Approach to Computer Networks," 2/e, PearsonEducation.
6. https://onlinecourses.nptel.ac.in/noc18_cs38/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|----------------------------------|-----------------------------------|-----------------------------------|
| 1. No. of Internal Tests | : <input type="text" value="2"/> | Max. Marks for each Internal Test | : <input type="text" value="30"/> |
| 2. No. of Assignments | : <input type="text" value="3"/> | Max. Marks for each Assignment | : <input type="text" value="5"/> |
| 3. No. of Quizzes | : <input type="text" value="3"/> | Max. Marks for each Quiz Test | : <input type="text" value="5"/> |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Control Systems Engineering

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PC730EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To develop the ability to model physical systems mathematically and derive their transfer functions. 2. To analyze the time-domain performance of control systems and evaluate system specifications and stability. 3. To understand and construct frequency response characteristics, including Bode and Nyquist plots for stability analysis. 4. To design suitable controllers and compensators to achieve desired system performance specifications. 5. To apply state-space techniques for the analysis and design of MIMO control systems.	On completion of the course, students will be able to 1. Develop the mathematical model of the physical systems and find its transfer function 2. Determine time domain specifications of a second order system and analyse its response. 3. Construct Bode plot, Nyquist plot for a given system and analyse its stability. 4. Design a compensator/ controller to meet desired specifications. 5. Analyse MIMO system using state variable approach

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1											3		
CO2	2	2		2									1		
CO3	1	3		3									1		
CO4	2	3	3									2	2		
CO5	2	3		2								2	2		

UNIT - I :

Control System fundamentals and Components: Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs.

UNIT - II :

Time response Analysis: Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time

domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability.

Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

UNIT - III :

Frequency response Analysis: Frequency domain specifications, bode plots, Gain margin and Phase Margin. Principle of argument, Nyquist plot and Nyquist criterion for stability.

UNIT - IV :

Compensators: Introduction to compensators, Lag compensator, Lead compensator, Lag- Lead compensator, Design of compensators.

Controllers: Introduction to controllers, P, I, D, PI, PD, PID controllers

UNIT - V :

State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability.

Learning Resources:

1. Nagrath, I.J., and Gopal, M., "Control System Engineering," New Age Publishers, 5/e, 2009.
2. Ogata, K., "Modern Control Engineering," 5/e, PHI, 2010.
3. Benjamin C. Kuo, "Automatic Control Systems," 7/e, PHI, 2010.
4. Nise, Norman S. Control Systems Engineering. 5th ed. New York, NY: John Wiley & Sons, 2007
5. Richard C. Dorf & Robert H. Bishop, "Modern Control Systems," 11/e, Pearson, 2008.
6. <http://www.nptelvideos.in/2012/11/control-engineeringprof-gopal.html>
7. <https://nptel.ac.in/courses/108101037/> 9. <https://nptel.ac.in/courses/108106098/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Advanced Embedded Systems

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code : U23PE710EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Define and classify embedded systems. 2. Justify the importance of ARM as CPU and write assembly programs. 3. Understand different serial protocols used for embedded networking. 4. Compare embedded software architectures. 5. Analyze debugging methods.	1. Define embedded system and describe the embedded system product design life cycle and challenges. 2. Describe ARM Core architecture along with its programming model. 3. Apply knowledge to design networked embedded systems using serial communication protocols. 4. Justify the importance of hardware software co-design and models involved. 5. Acquire the knowledge of embedded IDEs to design & specify debugging techniques.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3		1							3	3	2	
CO2	3	2	3		1							3	3	2	
CO3	3	2	3		1							3	3	2	
CO4	3	2	3		1							3	3	2	
CO5	3	2	3		2							3	3	2	

UNIT – I :

Embedded System Design: Introduction, Trends, Definition, Classifications; Embedded Product Development Life Cycle. CPU selection—hardware, software, memories, and I/O. Challenges in designing Embedded System; Design Metric of Embedded System.

UNIT - II:

ARM Processor Fundamentals: ARM Cortex-M based microcontroller architecture; ARM ISA, Memory Address Map, ARM Registers, ARM Cortex M4 Core Registers, ARM assembly programs: data transfer and branching

instructions; ARM addressing modes; AMBA System Bus and Bus Matrix, Memory and Peripherals, JTAG Debug System.

UNIT - III:

Embedded Networking: Embedded Networking design considerations; Embedded Networking through serial protocols: UART, I2C, SPI, CAN, IEEE1394 and USB; Porting of TCP/IP: Socket selection; HTTP client-server model.

UNIT - IV:

Hardware Software Codesign: Comparison of Co-Design Approaches; Formulation of the HW/SW scheduling, Optimization of Design Metric: Case study of Embedded Adaptive Cruise Control ECU Design.

Embedded Software Architectures: Round Robin, RR with interrupt driven, and Functional Queue architectures.

UNIT - V:

Embedded development tools: Host and Target machines, instruction packing: Endianness: Big-endian and little-endian ISA; application translation process for hardware executable: Intel and Motorola modes.

Debugging Methods: Testing on Host-Instruction set Simulators, native tools – IDEs, cross-compilers; ICE, JTAG, laboratory tools: Multi meter, CRO, Logic Analyzer & protocol sniffers.

Learning Resource:

- 1 Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, and Shujen Chen. 2016. "ARM Assembly Language Programming & Architecture (Volume 1)"
- 2 Raj Kamal. "Embedded Systems" 4th Edition 2020, McGraw Hill Education (India) Private Limited.
- 3 Wayne Wolf. 2008. Computers as Components, Second Edition: Principles of Embedded Computing System Design (2nd. ed.). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.
- 4 https://onlinecourses.nptel.ac.in/noc20_cs15/preview

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Advanced Embedded Systems Lab

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 0:0:2	SEE Marks : 50	Course Code: U23PE711EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- Write ARM assembly programs. - Implement Cortex M4Fxx embedded C programs. - Configure GPIOs of STM32F4xx for interfacing I/O devices - Use cross compiler tools for writing C or ARM ASM drivers. - Demonstrate a course-based project using STM32F4 MCU.	On completion of the course, students will be able to - Implement ARM assembly data processing instructions for Cortex M4. - Construct programs & Validate designs using cross assembler & compiler. - Develop embedded C drivers for on-chip peripherals of STM32F411RE. - Design system level solutions with off-chip components in Proteus - Implement a working prototype as a course based project.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3		3							3	3	2	1
CO2	1	2	3		3							3	3	2	1
CO3	1	2	3		3			2				3	3	2	1
CO4	1	2	3		3			2	3			3	3	2	1
CO5	1	2	3		3			3	3	3	3	3	3	2	1

Cycle – 1

- Assembly language programs to perform arithmetic operations
- ARM assembly to do different logical operations; CPSR flags.
- Load & Store instructions: LDR, LDRH, LDRB, STR, STRH, STRB
- ARM Addressing: Immediate, register & register indirect modes
- Branching instructions of ARM: BCS, BCC, BNE, BLS, BHI
- Unconditional Call instructions for ARM: B, BL, BX

Cycle – 2

7. GPIO programming in embedded C for STM32F's CortexM4MCU
8. Seven segment LED display interfacing with STM32F MCU
9. Interfacing a switch to STM32F and controlling the LED
10. Interfacing LCD (2x16) and development of driver for ARM
11. Keypad interface driver implementation in embedded C
12. Integration of LCD and Keypad for User Interface options in C

New Experiments:

1. To create GUI based Database of data sheets and application Notes used in MPMC, Advanced Embedded Systems, IoT & Applications Labs
2. Students must go through the related data sheets/ Application Notes before conducting each experiment
3. I/O port programming with CortexM4 ARM Assembly
4. Calling C functions from ARM Assembly and Vice Versa
5. Predict CPU and memory utilization in embedded systems using machine learning.

Cross Compiler	Keil µVision5 IDE	Targets	STM32F401RE (Simulation) STM32F411RE (Board); STM32F446RE (Board)
Simulation Software	Proteus 8.12 IDE	Debugger	JTAG SWI STM32

Guidelines for course based projects:

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from the faculty members offering the course.
- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

The break-up of CIE:

1. No. of Internal Test	:	1
2. Marks earmarked for Course-based Project	:	05
3. Marks earmarked for day-to-day lab class assessment	:	13
4. Marks earmarked for lab internal test	:	12

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Wireless Communications

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE720EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To introduce the fundamental concepts of wireless communication systems - To analyze radio wave propagation and channel modelling. - To understand cellular system design concept. - To explore the architecture and functioning of modern wireless systems. - To analyze and evaluate the performance of wireless systems under various channel conditions	On completion of the course, students will be able to - Summarize the progression of from 1G to 5G and analyse the 2G systems. - Apply mobile radio wave propagation models to evaluate channel characteristics. - Analyze 3G communication technologies and evaluate Bit Error Rate performance for various wireless system configurations. - Analyse 4G systems using OFDM, MIMO techniques and Massive MIMO and beamforming in 5G networks. - Model wireless communication system and Implement course based project

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		3										3	
CO2	2	3		3			3							3	3
CO3	3	3		2										3	
CO4	2	2		3								3		3	3
CO5	2	2	2	2	3	3		3	3	3	3			3	

UNIT - I : Introduction to wireless communication

Evolution of Wireless Communication Systems: A Brief History from 1G to 5G, classification of wireless communication systems

2G systems:

Fundamental architecture of cellular system, its operation, frequency reuse, channel assignment strategies, Handoff process, GSM architecture, GSM Channels, Channel access mechanisms (FDD, TDD),

UNIT - II: Mobile Radio Wave propagation

Large scale propagation models- Free space propagation model, three basic propagation mechanisms, practical link budget design using path loss models, Impulse response of the wireless channel, small scale fading and multipath propagation, Mathematical modelling of fading channel coefficient, Parameters of mobile multipath channels, types of small-scale fading.

UNIT - III: 3G systems

3G Technologies Overview, 3G Network Architecture, 3G Data services-3G W-CDMA(UMTS), 3G CDMA, 3G TD-SCDMA

Multi antenna systems: BER Analysis

BER analysis of wired communication system, SISO wireless system, Diversity, BER analysis of multiple antenna system: Maximal ratio combining, Diversity order, BER analysis of MISO wireless system

UNIT - IV: 4G systems

Introduction to OFDM, Multicarrier transmission, cyclic prefix in OFDM, Schematic representation of OFDM transmitter and receiver, BER analysis of OFDM system, LTE

Introduction to MIMO wireless communication systems, MIMO system model, MIMO ZF receiver, MIMO MMSE receiver

UNIT-V: 5G systems

5G Network Architecture, 5G Radio Access Technologies, Massive MIMO and Beamforming

Learning Resources:

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010
2. Aditya K. Jagannatham, "Principles of Modern Wireless Communication Systems Theory and Practice", McGraw Hill Education (India) Private Limited, 2017.
3. Principles of modern CDMA/MIMO/OFDM Wireless Communications – by Prof. Aditya. K. Jagannatham, IIT Kanpur. (NPTEL Course)
4. Introduction to cellular and wireless communications - by Dr. David. Koil pillai, IITM. <https://nptel.ac.in/courses/106106167/>
5. <https://www.coursera.org/learn/wireless-communications>
6. <https://www.udemy.com/introduction-to-wireless-communications>

Guidelines for course based projects:

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from

the faculty members offering the course.

- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

Assessment and Evaluation of Course Based Project:

The total marks should be a maximum of five (05) earmarked for Course-based project. The marks secured by the students in the respective Course-based project should be considered in lieu of one assignment i.e., for five marks. However, the total marks towards assignment marks for that course should be the average of marks secured in the other two assignments and marks secured in the Course-based project.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 2	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Wireless Communications Lab

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII – SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks : 50	Course Code: U23PE721EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To enable students to model and simulate wireless communication systems and channel characteristics 2. To impart practical skills in analyzing system performance parameters under varying wireless conditions. 3. To demonstrate equalization and noise mitigation techniques for improving communication reliability. 4. To introduce students to software tools such as GNU Radio and SystemVue 5. To provide hands-on experience with advanced wireless technologies using SDR and 5G simulation environments.	On completion of the course, students will be able to 1. Modeling of Wireless communication channel using MATLAB, Simulink. 2. Implement Wireless channel equalizers. 3. Testing and verification of channel parameters like SNR, BER using ATLA and 5G tool box 4. Establishing wireless connection using SDR 5. Demonstrating the effects of various types of noise on quality of reception

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1			3			2	1	2				3	
CO2	2	3			3			2	1	2				3	
CO3	3	3			2			2	2	3				3	
CO4	2	2			2	2		2	2	2				3	
CO5	2	1		2	3			2	2	3				3	

List of Experiments:

Cycle -1

1. Modelling and analysis of a Cellular Layout with Frequency Reuse Patterns in MATLAB
2. Modelling of two ray channel wireless communication systems using MATLAB
3. Modelling and simulation of Multipath fading channel using MATLAB

- 4 Analyse a wireless channel and evaluate the performance measurements such as BER, throughput, capacity, EVM using MATLAB
- 5 Wireless Channel equalization: Zero-Forcing Equalizer (ZFE), MMSE Equalizer (MMSEE) using MATLAB
- 6 Analysing the effects of phase noise, channel noise in higher order modulation using GNU radio.

Cycle -2

- 7 Wireless Path loss Computations - Study of Propagation Path loss Models: Indoor & Outdoor (Using MATLAB Programming)
- 8 Introduction to SystemVue – OFDM modulation and Demodulation
- 9 Noise Scaling for Frequency-Domain Channel Modelling and time domain channel modelling using 5G tool box
- 10 SNR Verification for Frequency-Domain Channel Modelling and time domain channel modelling using 5G tool box
- 11 Implementation of baseband modulation using System Vue
- 12 Implementation of RF simulation using System Vue

General Note:

1. At least 5 experiments from each part.
2. A total of not less than 10 experiments must be carried out during the semester.

New / Additional experiments planned:

- 1 Establishing wireless communication with 2X2 MIMO using SDR
- 2 Model 5G NR Communication Links using 5G tool box

Learning Resources / Tools:

1. Communication Systems Modeling and Simulation Using MATLAB and Simulink, K C Raveendranathan, Government Engineering College, Universities Press (India) Private Ltd, 2011. ISBN: 978-81-7371-722-2; Language: English.
2. Software-Defined Radio for Engineers By Alexander M. Wyglinski, Travis F. Collins, Robin Getz, Di Pu · 2018
3. Digital Communication Systems Using SystemVue (DaVinci Engineering) Hardcover

The break-up of CIE:

- | | | |
|---|---|----|
| 1. No. of Internal Test | : | 1 |
| 2. Max. Marks for internal test | : | 12 |
| 3. Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Digital Image and Video Processing

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE730EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Develop a solid foundation in Image Processing 2. Covering various Transform Techniques 3. Emphasize concepts on Spatial and frequency domains 4. Provide deep understanding on Compression and Segmentation 5. Train on Image and video processing with real-world applications	On completion of the course, students will be able to 1 Describe the basic concepts of Image and Video Processing 2 Apply the equations to transform images into different domains. 3 Apply spatial and transform domain techniques to process images. 4 Analyze quality of processed images using appropriate metrics 5 Design and implement various image and video processing techniques in a range of real-world applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													2
CO2	2	3			2										3
CO3	2	3			2										3
CO4	2	3		2	2										3
CO5	2	3	3	3	2	2						3			3

UNIT - I:

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures.

UNIT - II:

Fourier transform, FFT, Discrete cosine transform, Hadamard transform, Slant transform and their properties.

Wavelet Transforms: Discrete Wavelet Transforms.

UNIT - III:

Spatial enhancement techniques: Basic Intensity Transformation functions, Histogram equalization, Histogram specification, Spatial Filtering Techniques.

Frequency domain techniques: Low pass, High pass and Homomorphic Filtering.

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter.

Quality assessment of enhanced images.

UNIT - IV:

Image Compression-Redundancy-inter-pixel and psycho-visual, Huffman Coding, Arithmetic coding, Lossless compression – predictive, Lossy compression-predictive and Transform coding techniques (JPEG and JPEG2000).

Image Segmentation - Point, Line and Edge Detection, thresholding - global, region-based segmentation.

Quality assessment of compressed / restored and segmented images.

UNIT - V:

Video formation, perception, and representation, two-dimensional motion estimation.

Fingerprint image enhancement, Compression of Satellite images using JPEG, Medical image segmentation, Object tracking in videos.

Learning Resources:

- 1 R.C. Gonzalez and R.E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018.
- 2 Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004.
- 3 Video Processing and Communications Yao Wang, Jorn stermann, and Ya-Qin Zhang Prentice Hall, 2002 (Published September 2001).
- 4 Murat Tekalp, Digital Video Processing" Prentice Hall, 2nd edition 2015.
- 5 <https://nptel.ac.in/courses/117/105/117105135/>
- 6 <https://nptel.ac.in/courses/117/105/117105079/>

The break-up of CIE: Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Digital Image and Video Processing Lab

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks : 50	Course Code: U23PE731EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Covering practical operations on images and videos 2. Expose on Transform Techniques on images and videos 3. Hands on exposure on segmentation 4. Provide insights to implement compression 5. Train on video processing	On completion of the course, students will be able to 1. Implement basic operations on Images and Videos. 2. Apply various transform techniques on images. 3. Implement Segmentation technique on images. 4. Design and implement compression methods on images. 5. Detect moving objects in videos.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3			2		2					3
CO2	3	2			3			2		2					3
CO3	3	2			3			2		2					3
CO4	3	2	3		3	2		2		2		3			3
CO5	3	2		2	3	2		2		2		3			3

List of Experiments

(Conduct any Twelve experiments from given list)

Cycle-I

1. Reading images
2. Reading videos
3. Pixel based operations
4. Application of DCT on Images
5. Application of HT on Images
6. Application of DWT on Images

Cycle-II

1. Image enhancement using spatial domain technique
2. Image enhancement using transform domain technique
3. Lossless Image Compression
4. Image Compression using JPEG
5. Image Segmentation using region growing
6. Object Detection in Video Signal

New/ Additional experiments planned:

1. Medical Image segmentation
2. Satellite Image Compression

Learning Resources/Tools

1. MATLAB 2023a.
2. R.C. Gonzalez ,R.E. Woods and Steven L Eddins, Digital Image Processing using MATLAB, third Edition, Gatesmark Publishing, 2020.
3. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
4. Video Processing and Communications Yao Wang, Jorn stermann, and Ya-Qin Zhang Prentice Hall, 2002 (Published September 2001).

The break-up of CIE:

1. No. of Internal Test	:	1
2. Max. Marks for internal test	:	12
3. Marks for day-to-day laboratory class work	:	18

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Cryptography and Network Security

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE740EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1 To introduce the foundational concepts of network security, including types of attacks, services, and mechanisms, as well as classical and modern encryption techniques. 2 To equip students with the knowledge of symmetric and asymmetric encryption algorithms for securing data communication. 3 To enable learners to understand authentication methods and integrity mechanisms. 4 To familiarize students with network and web security architectures, including IPsec, SSL/TLS, SET, and firewall design. 5 To explore real-world threats and AI-driven security solutions, such as malware (viruses, worms), intrusion detection, and advanced authentication systems for robust cybersecurity in modern networks.	On completion of the course, students will be able to 1. Identify and analyse different types of security threats, attacks, and mechanisms in network systems. 2. Apply symmetric and asymmetric cryptographic algorithms to ensure confidentiality and secure key exchange. 3. Evaluate and implement authentication mechanisms using hash functions, digital signatures, and secure email protocols. 4. Analyze the architecture and functioning of IP and web security protocols. 5. Design and assess secure network systems using firewalls, intrusion detection, and AI-driven security tools for threat detection and prevention.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												3	
CO2	3	2												3	
CO3	3	2												3	
CO4	2	2		3										3	
CO5	3	2	3									3		3	

UNIT - I:

Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption

Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

UNIT-II:

Encryption: Triple DES, International Data Encryption algorithm, Characteristics of Advanced Symmetric block ciphers. Conventional Encryption Placement of Encryption function

UNIT-III:

Public Key Cryptography Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange , Number Theory in brief.

UNIT-IV:

Message Authentication and Hash Functions Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications Kerberos, Electronic Mail Security: Pretty Good Privacy, S/MIME

UNIT-V:

IP Security Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted systems. Case studies and tools for AI-driven security solutions in web applications, including secure authentication and fraud detection.

Learning Resources:

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
3. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
<https://nptel.ac.in/courses/106105031/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
| 2. No. of Assignments | : 3 | Max. Marks for each Assignment | : 5 |
| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Cryptography and Network Security Lab

(Professional Elective-II)

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 0:0:2	SEE Marks : 50	Course Code: U23PE741EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To introduce classical encryption and decryption techniques, including substitution and transposition ciphers, for secure message transmission. - To enable students to implement and evaluate modern cryptographic algorithms, such as DES, AES, RSA, MD5, and SHA-1, through programming exercises. - To develop practical skills in key exchange protocols and digital signature schemes, facilitating secure communication and authentication. - To expose students to open-source tools and platforms for configuring firewalls, conducting vulnerability assessments, and simulating network attacks. - To build hands-on experience in packet analysis and intrusion detection, using tools like Wireshark, KF Sensor, and network simulation environments.	On completion of the course, students will be able to - Develop code for classical Encryption Techniques to solve the problems. - Build cryptosystems by applying symmetric and public key encryption algorithms. - Construct code for authentication algorithms. - Develop a signature scheme using Digital signature standard. - Demonstrate the network security system using open-source tools

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3			2						3	
CO2	3	2			3			2						3	
CO3	3	2			3			2				3		3	
CO4	2	2	3		3			2						3	
CO5	3	2		2	3	3		2				3		3	

LIST OF EXPERIMENTS:

Cycle 1

- Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher iv) Vigenère cipher.

2. Perform encryption and decryption using following transposition techniques i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Connect remote machine using Secure Shell (SSH)
5. Apply AES algorithm for practical applications.
6. Implement RSA Algorithm

Cycle-2

1. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
2. Calculate the message digest of a text using the MD5 algorithm.
3. Basic firewall configuration in packet tracer.
4. Write the RC4 logic using cryptography. Encrypt the text 'Hello world' using blowfish.
5. Calculate the message digest of a text using the SHA-1 algorithm.
6. Working With KF Sensor Tool for Creating and Monitoring Honeypot.

New additional experiments

1. Hacking algorithms
2. Use network analysis tools and design simple intrusion detection rules.
3. Capture ICMPv4 packets generated by utility programs and tabulate all the captured parameters using Wireshark.
4. Understand protocol-level concepts for authentication and key exchange.

Learning Resources:

1. Build Your Own Security Lab, Michael Gregg, Wiley India

LIST OF EQUIPMENT :

SOFTWARE: C / C++ / Java/Python or equivalent compiler GnuPG, KF Sensor /Snort, N-Stalker or Equivalent HARDWARE: **Standalone desktops –**

The break-up of CIE:

1. No. of Internal Test	:	1
2. Max. Marks for internal test	:	12
3. Marks for day-to-day laboratory class work	:	18

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DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

Economics and Finance for Engineers

SYLLABUS FOR B.E VII - SEMESTER

L:T:P (Hrs./week) : 2:0:0	SEE Marks : 60	Course Code: U23HS040EH
Credits : 2	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the learners to: Understand the concepts and tools of economics, accounting and finance that will equip them for decision making.	At the end of the course the learner will be able to: 1. Gain a conceptual understanding of economics as a discipline. 2. Construct a cost sheet and classify costs and make use of Marginal cost analysis in decision making. 3. Understand the accounting process and analysis of financial statements. 4. Conceptual understanding of Financial Management and evaluate Long term investment decisions in business.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2						1		2	3	2			
CO2		3						1		2	3	2			
CO3		3						1		2	3	2			
CO4		3						1		2	3	2			

UNIT - I:

Concepts in Economics: Definition of Managerial Economics - Scope of Managerial Economics - Relevance of Economics for Engineers - Concept of Demand - Determinants of Demand - Law of Demand - assumptions and exceptions of Law of Demand - Price Elasticity of demand - Numerical problems on price elasticity of demand - Application-oriented approach of price Elasticity - Types of market structures.

UNIT - II:

Cost Analysis and Profit Planning: Concept of Cost - Classification of Costs - Cost sheet (simple problems) - Marginal Costing Analysis (simple numerical problems on Break Even Analysis only) - Application oriented approach (Make or buy, continue or shutdown decisions - Theory)

UNIT - III:

Conceptual Understanding of Accounting: Preparation of Income statement and Balance Sheet (with adjustment of closing stock only) - Ratio Analysis - Liquidity Ratios (Current ratio, Liquid Ratio), Profitability Ratios (Gross Profit Ratio, Net Profit Ratio, Operating Cost Ratio, Operating Profit Ratio), Activity ratios (Stock Turnover Ratio, Debtors Turnover Ratio, Creditors Turnover Ratio, Fixed assets Turnover Ratio) Solvency Ratios (Debt-Equity Ratio, Long Term Debt to Shareholders Net worth Ratio).

UNIT-IV:

Financial Management Decisions: Investment decisions - Long term - Capital budgeting - Traditional and DCF Techniques (Numericals on capital budgeting techniques namely PBP, ARR, NPV, and PI) - Short term - Introduction to working capital (gross and net working capital)

Learning Resources for students:

1. Mehta P.L., "Managerial Economics: Analysis, Numericals and Cases", Sultan Chand and Sons. Latest edition.
2. S.P. Jain and K.L Narang., "Financial Accounting", Kalyani Publishers –Latest edition.
3. S.P. Jain and K.L Narang., "Cost Accounting", Kalyani Publishers, Latest edition.
4. M.Y. Khan and P.K. Jain., "Financial Management - Text, Numericals and Cases", McGraw Hill Education Private Limited, New Delhi. Latest edition
5. M. Kasi Reddy & S araswathi, Managerial Economics and Financial Analysis, PHI New Delhi, Latest edition.

Reference books:

1. Narayanaswamy, "Financial Accounting: A Managerial Perspective", Prentice Hall India
2. M. L. Seth., "Micro Economics", Lakshmi Narain Agarwal. Latest edition
3. Dr. R.P. Rustagi., "Fundamentals of Financial Management" Taxmann Publications. Latest edition

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
| 2. No. of Assignments | : 2 | Max. Marks for each Assignment | : 5 |
| 3. No. of Quizzes | : 2 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Microwave Engineering Lab

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 0:0:2	SEE Marks : 50	Course Code: U23PC711EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand the basic characteristics of Microwave Vacuum tube sources 2. Understand the basic characteristics of Microwave solid state sources 3. Verify the characteristics of rectangular wave guide 4. Measurement of impedance of various loads at different frequencies 5. Understand the measurement of various parameters of microwave components	On completion of the course, students will be able to 1. Describe the characteristics of microwave sources 2. Estimate the guide wave length and free space wave length 3. Measure the VSWR and impedance of unknown load 4. Determination of the scattering matrix of microwave Components/Junctions and implement course based projects. 5. Demonstrate characteristics of ferrite devices

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2	3	2	2	1		2		3	
CO2	2	2	2		2	2		2	2	1		2		3	
CO3	3	3			2	2		2	2	1		2		3	
CO4	3	3		3	3	2		2	2	3	3	2		3	
CO5	3	3				2		2	2	1		2		3	

Experiments:

1. Characteristics of Reflex Klystron oscillator
2. Characteristics of Gunn diode oscillator
3. Measurement of frequency and Guide wavelength
4. Measurement of VSWR of a given load
5. Measurement of impedance
6. Scattering matrix of a Directional coupler.
7. Scattering matrix of Waveguide Tees: E plane, H plane

8. Scattering matrix of Magic Tee.
9. Characteristics of Isolator and its scattering matrix
10. Characteristics of Circulator and its scattering matrix
11. Calibration of attenuator at a given frequency
12. Calibration of frequency meter at a given frequency

New / Additional experiments planned:

1. Gain and Radiation Pattern analysis and measurement of user defined Antenna.
2. Measurement of S-parameters using vector network analyzer.

Learning Resources:

1. Advanced Design Software(ADS)

Guidelines for course based projects:

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from the faculty members offering the course.
- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

The break-up of CIE:

1. No. of Internal Test	:	1
2. Marks earmarked for Course-based Project	:	05
3. Marks earmarked for day-to-day lab class assessment	:	13
4. Marks earmarked for lab internal test	:	12

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Data Communications and Computer Networks Lab

SYLLABUS FOR B.E. (ECE) VII – SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks : 50	Course Code: U23PC721EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To understand the basic concepts of computer networks, networking devices, and communication tools. - To implement IP addressing schemes and subnetting for different network scenarios. - To configure basic networking devices such as routers and switches. - To design, build, test, and troubleshoot LAN, WLAN, and WAN network topologies. - To implement and verify routing protocols, VLANs, inter-VLAN routing, and access control mechanisms.	On completion of the course, students will be able to - Implement IP addressing schemes and different sub netting scenarios. - Perform basic configurations of networking devices like switches and routers - Build and implement simple networking topologies and troubleshooting the networks. - Implement and troubleshoot virtual LANs and inter-VLAN routing. - Implement and test routing protocols like RIPv1, RIPv2, single-area and multi-area OSPF.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2		2				2	1	3	
CO2	3	3	2	3	2	2		2				2	1	3	
CO3	3	3	2	3	2	2		2				2	1	3	
CO4	3	3	2	2	2	2		2				2	1	3	
CO5	3	2	2	2	2	2		2				2	1	3	

CYCLE - I Experiments

- Getting started with Packet Tracer tool and Internetworking OperatingSystem.
- Implementation of different sub netting scenarios and IP addressingschemes
- Basic configuration of networking devices
- Building and troubleshooting different networking topologies
- Building and testing Wired Local Area Networks

6. Building and testing Wireless Local Area Networks
7. Implementation and understanding of different servers like HTTP,TFTP, TFTP and DNS

CYCLE - II Experiments

8. Creating and testing Wide Area Networks
9. Implementation of routing protocols
10. Implementation of Virtual Local Area Networks (VLAN) and inter VLANrouting
11. Testing and troubleshooting networks with Protocol Data Units
12. Implementation of access lists for traffic control in networking
13. Implementation of Gateway protocols (Boarder Gateway Protocols)
14. Experiments on DATA LINK LAYER

New / Additional experiments planned:

1. Implementation of FEC Codes
2. Implementation of CSMA Protocols
3. Google Remote Procedure Call (gRPC), gNMI (Network Management Interface) related experiments
4. Network cabling
5. Connections in LAN
6. Case Study: KNN, Decision tree for dynamic routing.

Learning Resources / Tools :

1. Packet tracer
2. CCNA module 1CCNA Routing and Switching: Introduction to Networks
3. CCNA module-2 CCNA Routing and Switching: Routing and Switching Essentials www.netacad.com

The break-up of CIE :

- | | | |
|---|---|----|
| 1. No. of Internal Test | : | 1 |
| 2. Max. Marks for internal test | : | 12 |
| 3. Marks for day-to-day laboratory class work | : | 18 |

Duration of Internal Tests: 3 Hours

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Control Systems Engineering Lab

SYLLABUS FOR B.E. (ECE) VII – SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks : 50	Course Code: U23PC731EC
Credits : 1	CIE Marks : 30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To develop the ability to model control systems using MATLAB/SIMULINK tools. 2. To analyze the time response characteristics and performance specifications of control systems. 3. To study and evaluate the stability of control systems using various analytical methods. 4. To understand and analyze MIMO systems using state variable techniques. 5. To design and evaluate controllers and compensators for achieving desired system performance	On completion of the course, students will be able to 1. Model any system using MATLAB/SIMULINK 2. Sketch the response of a system for a given input and determine the specifications of a system. 3. Perform stability analysis of a given system using various plots. 4. Analyze MIMO system using state variable approach. 5. Design a Compensator/Controller for given specifications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1			3								3		
CO2	2	3			3								2		1
CO3	3	3		2	2								2		1
CO4	2	2		3	2								2		
CO5	3	2	3	2	2								1		

List of Experiments:

Exp. No. Name of the Experiment

- 1
 - a) Modeling transfer function of a control system.
 - b) Transfer function for given closed loop system through block diagram representation.
- 2 Time domain specifications of a given control system.
- 3 Steady state errors of a given transfer function.
- 4 Stability analysis of a control system using root locus-effect of adding poles, zeros
- 5 Stability of a given system using bode plot.
- 6 Stability of a closed loop/open loop system using Nyquist plot.

- 7 ON/OFF temperature control system
- 8 Tuning of PID controller to meet required specifications
- 9 Speed control of servo motor, DC motor, stepper and BLDC motor using Quanser Mechatronics Actuator board.
- 10 Frequency response of compensating networks
- 11 Closed loop P, PD, PI, PID Controller on second order systems.
- 12 State space model for classical transfer function using MATLAB

New / Additional Experiments Planned

- 1 Implementing Zero order hold circuit for discrete time control system.
- 2 Measurement of frequency domain specifications
- 3 Develop an AI-based PID tuning mechanism for a DC motor control system.

Learning Resources / Tools:

Modeling, Analysis and Design of Control Systems in MATLAB and Simulink, Dingyü Xue, North eastern University China Yang Quan Chen, University of California, World Scientific Publishing Co., 2015.

Guidelines for course based projects:

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from the faculty members offering the course.
- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

The break-up of CIE:

1. No. of Internal Test	:	1
2. Marks earmarked for Course-based Project	:	05
3. Marks earmarked for day-to-day lab class assessment	:	13
4. Marks earmarked for lab internal test	:	12

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Project Seminar

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

L:T:P (Hrs./week) : 0:0:2	SEE Marks : -	Course Code: U23PW719EC
Credits : 1	CIE Marks : 30	Duration of SEE : -

COURSE OBJECTIVES	COURSE OUTCOMES
1. To guide students in identifying and formulating complex engineering problems through comprehensive literature review and analysis of current societal needs. 2. To familiarize students with modern engineering tools and technologies relevant to their chosen area of study or research. 3. To develop students skills in designing experiments, analyzing data, and interpreting results with scientific reasoning. 4. To enhance students technical communication abilities through structured report writing and oral presentations, while upholding academic and professional ethics. 5. To encourage collaborative learning and teamwork, fostering adaptability to emerging technologies and multidisciplinary approaches.	On completion of the course, students will be able 1. To select the complex engineering problems beneficial to the society after thorough literature survey 2. To identify the modern tools for solving the problems. 3. To analyze and comprehend the experimental results 4. To communicate effectively the experimental results with report and presentation following ethics 5. To work in teams and adapt for the advanced technological changes

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				2						3			
CO2		2			3							3			
CO3	2	2		3			3					3			
CO4								3	2	3					
CO5									3			3			

Note: CO1 & CO2 must be mapped with one of the relevant PSOs based on the domain of the project with 3

CO3: can be mapped to appropriate PSO with level 2

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her specialization.

Project seminar topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of seminar presentation.

- Selection of Topic & Literature Survey (5M)
- Solution & Clarity in Implementation (5M)
- Modern Tool usage & Implementation (5M)
- Results and Analysis (5)
- Team Work / Report writing & Presentation with ethics (10M)

Each student is required to:

1. Submit a one-page synopsis in the beginning of the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week of the semester to the last week of the semester and any change in schedule should be discouraged.

Students are required to submit a report on the project seminar.

- Batch size shall be 2 (or) 3 students per batch.
- Two reviews – One during 5th week and another during 10th week and final evaluation shall be conducted during 15th to 16th week.
- Students are required to give Presentations during the reviews.
- Students are required to submit project seminar report.

With effect from the academic year 2026-27

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS) :: IBRAHIMBAGH, HYDERABAD – 500 031.
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION **(R-23)** :: B.E. – ECE : EIGHTH SEMESTER (2026 - 27)

B.E (ECE) VIII - SEMESTER								
Course Code	Name of the Course	Scheme of Instruction			Scheme of Examination			Credits
		Hours per Week			Duration in Hrs	Maximum Marks		
		L	T	P		SEE	CIE	
THEORY								
U23PE8XXEC	Professional Elective – III	3	-	-	3	60	40	3
U23PE8XXEC	Professional Elective – IV	3	-	-	3	60	40	3
PRACTICALS								
U23PW819EC	Project / Internship	-	-	12	Viva-Voce	50	50	6
TOTAL		6	-	12		170	130	12
GRAND TOTAL		18				300		

With effect from the academic year 2026-27

Professional Elective (R-23)								
(Students can opt for all professional electives from single stream or several streams)								
Professional Elective Stream	Embedded Systems and VLSI Stream		Communication Engineering Stream		Signal Processing Stream		Networking Stream	
VIII - Semester for the A.Y. 2026-27								
Professional Elective – III	U23PE810EC	IoT Architectures and Protocols	U23PE820EC	Satellite Communication	U23PE830EC	Image and Video processing using Machine Learning	U23PE840EC	Wireless Sensor Networks
	U23PE811EC	Industrial IoT and Applications	U23PE821EC	Optical Fiber Communication	U23PE831EC	Speech and Audio Signal Processing	U23PE841EC	Optical Networks
	U23PE812EC	Low Power VLSI Design	U23PE822EC	Coding Theory and Techniques				
Professional Elective – IV	U23PE850EC	FPGA Architectures & Applications	U23PE860EC	Radar and Navigation Systems	U23PE870EC	Adaptive Signal Processing	U23PE880EC	Blockchain Technology and its Applications
	U23PE851EC	Electric and Hybrid Vehicle Systems: Design Approach and Applications	U23PE861EC	Global Positioning System	U23PE871EC	Biomedical Signal Processing	U23PE881EC	Network Management
			U23PE862EC	Quantum Communication Technologies and Applications	U23PE872EC	Language Models and Applications		

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

IoT Architectures and Protocols

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE810EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To introduce the fundamentals of IoT, including its evolution, characteristics, physical and logical design, and enabling technologies. - To understand IoT reference architectures, deployment views, edge system design, and real-world design constraints. - To explore IoT communication protocols across physical, network, transport, and application layers. - To study real-world IoT applications through case studies in smart systems and analyze IoT adoption in the Indian context and Industry 4.0. - To identify and address security requirements and threats in IoT systems, covering architecture, protocols, and device-level protections.	On completion of the course, students will be able to - Understand the Architectural Overview of IoT - Enumerate the need and the challenges in Real World Design Constraints - Choose the required protocol for a given application. - Explore IoT usage in various applications - Understand the Security requirements in IoT.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1												1	1
CO2	3	2	3				2					2	1	2	2
CO3	3	1												1	1
CO4	3	1		1		2	2		2			2		2	2
CO5	3	2		1		2						2		1	1

UNIT - I : IoT

Definition and Technologies that led to evolution of IOT, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment. M2M and IoT Technology Fundamentals- Devices and gateways, Introduction to cloud IOT platforms like MS Azure, AWS IOT, Google Cloud IOT, Thingworx, Business processes in IoT.

UNIT - II : IoT Reference Architecture

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. IoT edge system architecture.

Real-World Design Constraints: Technical Design constraints, Connectivity constraints, Data representation and visualization, Big Data Management.

UNIT - III : IoT communications

Data link and physical layer Protocols: PHY/MAC Layer (IEEE 802.11,

IEEE 802.15), Bluetooth Low Energy, Thread, introduction to Wi-SUN.

Network Layer Protocols: IPv6, 6LoWPAN;

Transport layer protocols: TCP, UDP;

Messaging protocols: Quality of services in MQTT, standards and security in MQTT, CoAP, AMQP.

UNIT - IV : Case Studies

Smart Cities, Smart Homes, Smart Transportation, Smart Healthcare, Precision Agriculture, Connected Vehicles.

IOT in Indian Scenario: i) IOT and Aadhaar ii) IOT for health services. iii) IOT for financial inclusion. iv) IOT for rural empowerment v) India Urban Data Exchange (IUDX).

Industry 4.0: Industrial Internet of Things (IIoT), Reference Architecture, Characteristics of Industry 4.0.

UNIT - V : Securing the Internet of Things

Security Requirements in IoT Architecture - Security in Enabling Technologies, Security Concerns in IoT Applications.

Security Architecture in the Internet of Things - Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT. Security and Vulnerabilities – Secrecy & Secret Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Secure Cloud/Web Interface, Secure Software/Firmware, Physical Layer Security.

Learning Resources:

- 1 Pethuru Raj and Anupama C. Raman, —The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st Edition, 2017, CRC Press.
- 2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henny "IoT Fundamentals: Networking technologies Protocols, and Use Cases for the internet of things", June, 2017, Cisco press.
- 3 Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, —From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, 2014, Academic Press.
- 4 Arshdeep Bahga, Vijay Madisetti, —Internet of Things: A Hands-on Approach, Universities Press, 2014.
- 5 Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren, Packt Publishing, 2016.
- 6 Securing the Internet of Things Elsevier Authors: Shancang Li Li Da Xu, Paperback ISBN: 9780128044582, Imprint: Syngress Published Date: 13th January 2017.
- 7 <https://nptel.ac.in/courses/106105166/5>
- 8 <https://nptel.ac.in/courses/108108098/4>

The break-up of CIE: Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Industrial IoT and Applications

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE811EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the evolution of Industry 4.0 and the foundational principles of IIoT systems. 2. To explore the role and architecture of Cyber-Physical Systems (CPS) and Next Generation Sensors in Industry 4.0 3. To analyze key enablers of IIoT such as processing topologies, supervisory control systems, and security frameworks. 4. To examine the integration of advanced technologies in IIoT. 5. To evaluate real-world IIoT implementations through industry-specific case studies	On completion of the course, students will be able to 1. Explain the basics of Industry 4.0 and the IIoT architecture with key communication protocols like Zigbee and Wireless HART. 2. Compare embedded systems and cyber-physical systems and describe the features and uses of next-generation sensors. 3. Identify the needs and challenges of IIoT processing and explain the importance of multi-level security in IIoT systems. 4. Describe the role of advanced technologies like SDN and Smart Factories in modern industrial applications. 5. Analyze real-world IIoT case studies and explain their architecture, challenges, and benefits in various industries.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1									1	1	3	
CO2	2	2	1									1	3		
CO3	2	2	1									1	1		
CO4	3	2	1	1								1	1	1	1
CO5	3	1	1	1		3						1	1	1	1

UNIT-I: Introduction to Industrial IoT (IIoT) Systems & IIoT Reference Architecture

The Industrial 4.0 Revolutions, Industrial Internet Architecture Framework (IIAF), Five Functional domains of IIAF, IIoT- Sensing and Actuation, IIoT connectivity with IEEE 802.15.4, Zigbee, 6LoWPAN, Wireless HART. Industry 4.0: Globalization and Emerging Issues, Sustainability assessment of Emerging issues, LEAN Production System in Industry 4.0. IIoT Vs Automation.

UNIT-II: Cyber physical systems and Next generation sensors in Industry 4.0

Features of Cyber physical systems, Difference between Embedded system and

cyber physical system, Cyber physical systems architecture for IIoT, Challenges for Cyber physical system development, Introduction to Next generation sensors, Comparison of smart sensors with next generation sensors, Architecture framework for Next generation sensors, Applications of next generation sensors, Design challenges for Next generation sensors in Industry 4.0 . Challenges for Industrial Processes in Industry 4.0.

UNIT-III: Key Enablers of Industrial IoT Processing & Security in IIoT

Necessity of IIoT processing, Challenges in IIoT processing, IIoT Supervisory control and Management, Ongoing research in IIoT processing - Processing topologies, Semantic rules in processing, Necessity of security in IIoT, Security Goals, Standards for IIoT security, Architecture framework for Operational technology (OT) ,Security at different levels- Network level, System level. Introduction to IIoT analytics.

UNIT-IV: Advanced Technologies in IIoT

Software defined Networking- Architecture, Design Aspects, Applications and Advantages. Smart Factory- Architecture, Features, Applications and Advantages, Health care- Architecture, Challenges, Advantages, Applications. IIoT in power Plants- Architectural framework, Design challenges, Applications and Advantages.

UNIT-V: IIoT Case Studies

Case Study analysis in Chemical & pharmaceutical industry, Case Study analysis in Unmanned Aerial Vehicles(UAV), Case study analysis in Energy management, Case study analysis in Industrial monitoring system, Case study analysis in Oil & Gas Industry.

Note: Every case study includes- Architecture Framework, Design challenges, Role of IIoT, advantages and applications.

Learning Resource:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: Apress 2018.
2. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. Availability: https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1
3. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. Availability: https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3
4. https://onlinecourses.nptel.ac.in/noc23_cs52- Introduction to Industry 4.0 and Industrial Internet of Things

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Low Power VLSI Design

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE812EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To understand the physical mechanisms of power dissipation in deep submicron CMOS technologies and their limitations. - To study CMOS device characteristics, fabrication technologies, and their influence on power and performance. - To explore dynamic power consumption components and analyze circuit-level techniques for dynamic power reduction. - To examine leakage current components and investigate advanced circuit techniques to minimize static power consumption. - To design and evaluate low-power arithmetic building blocks and understand trade-offs between power and performance.	On completion of the course, students will be able to - Understand the basics of VLSI technology. - Apply the physics of power dissipation. - Analyze the circuit techniques for dynamic power dissipation. - Apply the circuit techniques for leakage reduction. - Design low power arithmetic operators.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2								3		
CO2	2	2	3										3		
CO3	2	2	2		2								3		
CO4		2	3	3	2								3		
CO5		2	2		2	2						3	3		

UNIT - I :

Physics of power dissipation in CMOSFET devices: introduction, Submicron MOSFET, Power dissipation in CMOS, short circuit dissipation, dynamic dissipation, load capacitance, Body Effect, Short Channel Effects, MOS Capacitances, Hot Carrier Effects.

UNIT - II :

CMOS Technology and Devices: Evolution of CMOS Technology, BiCMOS Technology, SOI CMOS Technology, Threshold Voltage , Narrow Channel Effects, Mobility & Drain Current, Subthreshold Current, Electron Temperature, Velocity Overshoot.

UNIT - III :

Circuits Techniques for Dynamic Power Reduction: Dynamic Power Consumption Components, Circuit Parallelization, Memory Parallelization, Voltage Scaling-Based Circuit Techniques: Multiple Voltages Techniques, Low Voltage Swing, Precomputation, Retiming, Gated Clocks, Circuit Technology-Dependent Power Reduction, Path Balancing.

UNIT - IV :

Circuit Techniques for Leakage Reduction: Leakage Components, Subthreshold Leakage Gate Leakage, Source/Substrate and Drain/Substrate P-N Junction Leakage, Circuit Techniques to Reduce Leakage in Logic, Dual Threshold CMOS, Multiple Supply Voltage, Runtime Standby Leakage Reduction Techniques, Leakage Control Using Transistor Stacks (Self-Reverse Bias), Sleep Transistor, Dynamic Vdd Scaling (DVS)
• Dynamic Vth Scaling (DVTS).

UNIT - V :

Low-Power Arithmetic Operators : Introduction, Addition, 1-Bit Addition Cells, Sequential Adder, Propagate and Generate Mechanisms, Carry Select Adder, Carry Skip Adder, Logarithmic Number System, Logarithmic Adders, Power/Delay Comparison.

Learning Resources:

1. Low power CMOS circuits technology, logic design and cad tools by Chtristian piguet.
2. Low power CMOS VLSI circuit design by Koushik Roy & Sharath prasad.
3. Low-Voltage CMOS VLSI Circuits , James B. Kuo
4. <https://onlinecourses.nptel.ac.in/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
| 2. No. of Assignments | : 3 | Max. Marks for each Assignment | : 5 |
| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Satellite Communication

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE820EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1 To understand the working principles of various satellites and their importance in global communication 2 To acquire the knowledge on satellite sub systems and various factors affecting the function of communication satellite. 3 To design satellite uplink and down link with noise margin 4 To study the need of multiple access techniques and various protocols being used in satellite communications 5 To provide the details and applications of various Indian satellite systems	On completion of the course, students will be able to 1 Apply Kepler's law to find satellite orbital parameters. 2 Describe satellite subsystems like telemetry, tracking and command control. 3 Analyze Satellite link design 4 Describe the various multiple access techniques. 5 Understand the importance of special purpose communication satellite and their applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				2								3	
CO2	3	2				2								3	
CO3	3	2				2								3	
CO4	3	2		3		2								3	
CO5	3	2				2						3		3	

UNIT – I

Evolution and growth of communication satellites, synchronous satellites, frequency allocation, orbits, orbital mechanism and kepler's laws, effects of orbital inclination, azimuth and elevation, range and angle, eclipse, placements of a satellite in geo-stationary orbit.

UNIT – II

Space segment, stabilization, communication sub systems, Telemetry,

tracking and command, Attitude & orbital Control Systems, Power Systems, Earth segment, large and small Earth station antennas, Redundancy configuration, Thermal System.

UNIT - III

System noise temperature and G/T ratio, Basic RF link analysis, EIRP, C/N, Interference, attenuation due to rain, cross polarization, design of uplink and down link

UNIT - IV

Multiple access techniques, SCPC companding systems, TDMA frame structure, Frame efficiency, Super frame structure, frame acquisition and synchronization, types of demand assignments, SPADE.

UNIT - V

Special purpose communication satellites, INTELAST, Global Positioning System, Echo- Cancellation techniques, Protocols, Satellite applications, Introduction to NavIC system Indian activities in satellite communication. Indian Scientific satellites

Learning Resources:

1. Timothy Pratt and Charles W. Bostan, Satellite Communications, 2003.
2. Dr. D.C Agarwal, Satellite Communications 7th Edition, Khanna Publishers, 1996
3. Tri-T-ha, Digital Satellite Communications, 2nd Edition, McGraw Hill, 1990.

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | | | |
|--------------------------|---|--------------------------------|-----------------------------------|---|---------------------------------|
| 1. No. of Internal Tests | : | <input type="text" value="2"/> | Max. Marks for each Internal Test | : | <input type="text" value="30"/> |
| 2. No. of Assignments | : | <input type="text" value="3"/> | Max. Marks for each Assignment | : | <input type="text" value="5"/> |
| 3. No. of Quizzes | : | <input type="text" value="3"/> | Max. Marks for each Quiz Test | : | <input type="text" value="5"/> |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Optical Fiber Communication

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE821EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- Describe the principles fiber-optic communication, the components and the bandwidth advantages. - Apply the properties of the optical fibers and optical components. - Use optical sources and detectors for various applications. - Analyze system performance of optical communication systems. - Design optical networks and understand non-linear effects in optical fibers.	On completion of the course, students will be able to - Describe the principles fiber-optic communication, the components and the bandwidth advantages. - Apply the properties of the optical fibers and optical components. - Use optical sources and detectors for various applications. - Analyze system performance of optical communication systems. - Design optical networks and understand non-linear effects in optical fibers.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3											1	3	
CO2	2	2	3	2										3	
CO3	1	2											2	3	
CO4	2	3		3								3		3	
CO5	2	2				2						3		3	3

UNIT – I:

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

UNIT - II:

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

UNIT - III:

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

UNIT - IV:

Optical switches - coupled mode analysis of directional couplers, electro-optic switches. Optical amplifiers - EDFA, Raman amplifier. WDM and DWDM systems. Principles of WDM networks

UNIT - V:

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication.

Learning Resources:

- 1 J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
- 2 G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, 3rd Ed, 2002.
- 3 K.C. Gupta, Opto Electronic Devices and Systems, PHI Learning, 2005.
- 4 <https://nptel.ac.in/courses/117101054/>
- 5 <https://nptel.ac.in/courses/117104127/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
| 2. No. of Assignments | : 3 | Max. Marks for each Assignment | : 5 |
| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Coding Theory and Techniques

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE822EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students: 1 To study encoding and decoding of a message using source codes for data storage. 2 To differentiate different types of errors for linear block codes for data transmission. 3 To study convolutional codes for error control. 4 To understand different construction methods of LDPC codes. 5 To study Galois fields required for BCH and RS codes.	On completion of the course, students will be able to 1 Apply the probabilistic method to construct different types of source codes. 2 Identify different types of errors and to comprehend various linear block codes. 3 Construct convolution codes for error detection and correction. 4 Generate LDPC codes for encoding with different specifications 5 Construct Galois Fields and to apply them to generate BCH and RS codes

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2											3	
CO2	3	3	2											3	3
CO3	3	2	3											3	
CO4	3	2	3											3	
CO5	3	2	3											3	

UNIT - I:

Coding for Reliable Digital Transmission and Storage: Source coding: Entropy encoding algorithms: Arithmetic coding and Golomb coding, Dictionary codes: Lempel-Ziv codes, Run Length Encoding.

UNIT - II:

Linear Block codes: Block Codes, Hamming codes, Repetition codes, Reed-Muller codes, the (24,12) Golay codes, Interleaved codes.

UNIT - III:

Convolutional codes: Encoding, Structural properties, State diagram, Code tree diagram, soft decision and hard decision decoding, Viterbi algorithm.

UNIT - IV:

Low Density Parity Check codes: Introduction, Properties, Graphical Representation of LDPC Codes: Tanner graphs, Types of constructions, Regular and Irregular LDPC codes, methods of constructing LDPC codes: Gallager's method, Algebraic construction of H for regular codes, Random construction of H for irregular codes, Encoding and problems.

UNIT - V:

BCH and RS codes: Groups, Fields, Binary arithmetic, Construction of Galois Fields $GF(2^m)$, Basic properties of Galois Fields, Introduction to BCH and RS codes.

Learning Resource:

1. K. Deerga Rao, 'Channel Coding Techniques for Wireless Communications,' Second Edition, Springer 2019
2. Shu Lin and Daniel J. Costello, Jr. "Error Control Coding," 2/e, Pearson, 2011.
3. K Sam Shanmugum, "Digital and Analod Communication Systems," Wiley, 2010.
4. Simon Haykin, "Digital Communication," TMH, 2009.
5. <https://nptel.ac.in/courses/117106031/>

The break-up of CIE: Internal Tests + Assignments + Quizzes

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|--------------------------|---|--------------------------------|-----------------------------------|---|---------------------------------|
| 1. No. of Internal Tests | : | <input type="text" value="2"/> | Max. Marks for each Internal Test | : | <input type="text" value="30"/> |
| 2. No. of Assignments | : | <input type="text" value="3"/> | Max. Marks for each Assignment | : | <input type="text" value="5"/> |
| 3. No. of Quizzes | : | <input type="text" value="3"/> | Max. Marks for each Quiz Test | : | <input type="text" value="5"/> |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Image and Video Processing Using Machine Learning

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE830EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Develop a solid foundation in machine learning principles 2. Provide technical details on Decision Trees and Bayesian Networks 3. Emphasize concepts on Support Vector Machines and clustering techniques 4. Cover various deep learning techniques 5. Train with real-world applications	On completion of the course, students will be able to 1 Describe the basic concepts of Machine Learning 2 Apply Machine Learning techniques suitable for a given problem. 3 Apply Deep Learning techniques suitable for a given problem. 4 Analyze the performance of various models using appropriate metrics. 5 Design and implement various machine learning algorithms in a range of real-world applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													2
CO2	2	3			2										3
CO3	2	3			2										3
CO4	2	2		3	2										3
CO5	2	2	3	2	3	2						3			3

UNIT - I :

Introduction to Machine learning, Core concepts, Data inconsistencies, Practical Machine learning applications, Types of learning problems, Machine learning architecture, Machine learning algorithms.

Linear Regression, Cost Function, Gradient Descent and Logistic Regression.

UNIT - II :

Working with Decision trees: Basics of Decision trees, uses, Advantages, Limitations, different algorithm types - ID3, C4.5, CART

Bayesian Networks: Graph theory, probability theory, Bayes theorem, working of Bayesian Networks.

UNIT - III :

Support vector Machines: Definition of SVM, uses of SVM, Basic classification principles, How Support Vector Machines Approach classification.

Combining Classifiers using Boosting

Clustering: Definition of clustering, clustering types-K-means, Agglomerative hierarchical, DBSCAN.

UNIT - IV :

Deep learning: Background, Deep learning Taxonomy, Hebbian learning, Perceptron Learning, Back propagation, Convolutional Neural networks, Recurrent Neural Networks, Autoencoders.

UNIT - V :

Applications of Machine learning: Image retrieval, Face recognition, Video classification. Image Segmentation using K-means clustering, Satellite Image Classification using Decision Trees. Image/Video Classification using CNN, Performance analysis of various algorithms.

Segment tumors in MRI images using deep learning and compare with threshold-based methods.

Learning Resources:

- 1 Machine Learning, Tom M. Mitchell, 1st Edition, McGraw-Hill Education; 1st edition, 2017.
- 2 Introduction to Machine Learning, Ethem Alpaydin, third edition, PHI.
- 3 Machine Learning for Big Data: Hands on for developers and technical professionals wiley publications, 2018 by Jason Bell.
- 4 Practical Machine Learning. Sunila Gollapudi, Packt publishers, 2016.
- 5 <https://nptel.ac.in/courses/106/105/106105152/>
- 6 <https://nptel.ac.in/courses/106106139/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Speech and Audio Signal Processing

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE831EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1 To understand the mechanism of speech production. 2 To analyze various speech synthesizers. 3 To study various types of coders and decoders. 4 To design Automatic speech recognition system (ASR) by pattern matching method. 5 To analyze speaker identification and verification systems.	On completion of the course, students will be able to 1 Apply the knowledge of science to design an artificial model of speech production system. 2 Analyse the types of speech signals & convert the signals to digital. 3 Synthesize the speech signal using a text as input. 4 Design speech encoder and decoder. 5 Design an Automatic speech recognition system (ASR) by pattern matching method.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2			2					3	2			3
CO2	2	3	2	4							2	2			3
CO3	2	3	3			2					2	2			3
CO4	3	3	3								3	2			3
CO5	2	3	3			2				2	2	1			3

UNIT - I :

Applications of Digital Speech Processing, Phonetic Representation of Speech, Models for Speech Production-Schematic model of the vocal tract system, Source filter model for a speech signal production. Speech Quantization- Scalar quantization-uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization.

UNIT - II :

Short-Time Analysis of Speech-Short-Time Energy and Zero-Crossing Rate, Short-Time Autocorrelation Function (STACF), Short-Time Fourier

Transform (STFT), The Speech Spectrogram, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using a parallel processing approach, the Short time autocorrelation function, Average magnitude function, Pitch period estimation using the autocorrelation function. Linear Predictive Coding (LPC) Analysis. Homomorphic Speech Analysis.

UNIT - III :

Speech Synthesis Methods, Linear predictive synthesizer, phone use synthesis, Introduction to Text-to-Speech and Articulator speech synthesis.

UNIT - IV :

Lossless Audio Coding, Lossy Audio coding, Sub-band coding, Transforms coding, channel decoder, Formant decoder, Cepstral decoder, linear predictive decoder, vector quantizer coder.

UNIT - V :

Automatic Speech Recognition (ASR), The Problems and Challenges in Automatic Speech Recognition, Building a Speech Recognition System, The Decision Processes in ASR, Representative Recognition Performance, Automatic Speaker Recognition: Recognition techniques, Dynamic Time warping method of speech pattern recognition, Technology.

Learning Resources:

1. Lawrence R. Rabiner and Ronald W. Schafer, "Introduction to Digital Speech Processing", now, 2007.
2. Owens F.J., "Signal Processing of Speech", Macmillan, 2000.
3. Daniel Jurefskey & James H. Martin, "Speech and Language Processing", Pearson Education, 2003.
4. <https://nptel.ac.in/courses/117105145/>
5. https://onlinecourses.nptel.ac.in/noc22_ee117/preview
6. <https://www.udemy.com/course/digital-speech-processing/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

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|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
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| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Wireless Sensor Networks

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE840EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To introduce the fundamental concepts, characteristics, and challenges of Wireless Sensor Networks (WSNs). - To familiarize students with the single-node architecture including hardware components, energy consumption models, and the design trade-offs in sensor node development. - To explore networking aspects of WSNs, such as transceiver design, MAC protocols, routing algorithms, and their optimization goals. - To impart knowledge on infrastructure establishment, including topology control, clustering mechanisms, time synchronization, localization, and sensor tasking. - To provide hands-on insight into sensor network platforms and tools, covering simulation environments, node-level software, operating systems, and real-world engineering applications.	On completion of the course, students will be able to - Analyze Wireless Sensor Network Characteristics and its challenges; and, differentiate WSN with other ad-hoc networks. - Illustrate the architecture of Single WSN mote with Energy consumption mathematical models of a single mote both during the transmission and reception. - Apply Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks and their comparisons - Analyze different topology control and clustering schemes with localization concepts. - Describe some of the widely used WSN simulation tools and platforms with engineering case studies.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2											3	
CO2	3	3	2				3							3	3
CO3	3	3	2											3	
CO4	2	3	2	3										3	
CO5	3	3	2		3	2								3	

UNIT-I: OVERVIEW OF WIRELESS SENSOR NETWORKS

Challenges for Wireless Sensor Networks Characteristics requirements- required mechanisms, Difference between mobile ad-hoc and sensor

networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks

UNIT-II: ARCHITECTURES

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

UNIT-III: NETWORKING SENSORS

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, Zigbee: IEEE 802.15.4 MAC Layer, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT-IV: INFRASTRUCTURE ESTABLISHMENT

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

UNIT-V: SENSOR NETWORK PLATFORMS AND TOOLS

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware -Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Learning Resource:

1. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks," John Wiley, 2005.
2. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach," Elsevier, 2007.
3. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks- Technology, Protocols and Applications," John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs," John Wiley, 2003.
5. <https://nptel.ac.in/courses/106105160/21>

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Optical Networks

(Professional Elective-III)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE841EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand the fundamentals of SONET/SDH and the architecture of optical transport networks.	On completion of the course, students will be able to
2. Explore WDM network components including OLTs, OADM, and optical cross-connects.	1 Implement SONET for communication.
3. Learn control and management functions within optical layers for efficient network operation.	2 Contribute in the areas of optical network and WDM network design.
4. Analyze survivability strategies and protection mechanisms in optical and client layers.	3 Implement simple optical network and understand further technology developments for future enhanced network.
5. Design WDM and access networks using routing, wavelength assignment, and performance models.	4 Contribute in the area of network survivability.
	5 Design WDM Network

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3											1	3	
CO2	2	2	2	2										3	
CO3	1	2											2	3	
CO4	2	3										2		3	
CO5	2	2	3			2						2		3	3

UNIT - I:

SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol label switching.

UNIT - II:

WDM network elements: optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

UNIT - III :

Control and management: network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety.

UNIT - IV :

Network Survivability: protection in SONET/SDH & client layer, optical layer protection Schemes.

UNIT - V :

WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models. Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

Learning Resources:

- 1 Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3rd edition, 2010.
- 2 C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001

The break-up of CIE : Internal Tests + Assignments + Quizzes

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|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
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| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FPGA Architectures and Applications

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE850EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- Understand the fundamentals of memory types, PLDs, and programmable architectures including ROM, RAM, PLA, PAL. - Explore various types of Sequential PLDs and their use in designing finite state machines. - Examine the architecture and internal components of Field Programmable Gate Arrays (FPGAs). - Analyze FPGA placement and routing techniques to optimize logic implementation. - Apply digital design flow, verification, and testing methodologies for FPGA-based systems.	On completion of the course, students will be able to - Identify and differentiate various types of programmable logic devices (PLDs) and memory types. - Design digital systems using PLAs, PALs, and sequential PLDs. - Analyze FPGA architectures and evaluate their components and performance characteristics. - Apply placement and routing algorithms for efficient logic synthesis in FPGAs. - Demonstrate FPGA design flow, testing techniques, and verification procedures.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1									3	3		
CO2	3	3	2									3	3		
CO3	3	2	2									3	3		
CO4	2	3	3									3	3		
CO5	2	2	2									3	3	1	1

UNIT-I: Introduction to PLD's and PGA'S

Memory- Read-only memory, read/write memory - SRAM and DRAM. Programmable Logic Devices-PLAs, PALs and their applications; Sequential PLDs and their applications; State- machine design with sequential PLDs; Programmable gate arrays (pgas), Introduction to field programmable gate arrays (FPGAs), design flow using FPGA, programming technologies.

UNIT-II: FPGA Architectural Aspects

Organization of FPGAs, Programmable Logic Block Architectures,

Programmable Interconnect, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs. XILINX XC4000 Architecture, Routing Structure, Actel FPGA's Architecture, AMD FPGA architecture, Altera FPGA Architecture. Comparison of Architectural features of Commercial FPGAs

UNIT-III: Placement, Routing Algorithms and Static Timing analysis in FPGA Architectures

Placement: objectives, placement algorithms: Mincut-Based placement, iterative improvement placement, simulated annealing. Routing: objectives, segmented channel routing, Maze routing, Routability estimation, Net delays, computing signal delay in RC tree networks. Timing analysis in combinational circuits, timing analysis in sequential circuits.

UNIT-IV: Testing methods in FPGA Architectures and Logic Optimization

Stuck at faults, ATPG methods, LFSR, Scan path design, BIST Architecture, programmability failures, Fault coverage, System/Network-on-chip testing- Modular testing. Logic block functionality versus area-efficiency, Logic block area and routing model, Impact of logic block functionality on FPGA performance

UNIT-V: FPGA Application Domains

Comparison of ASIC and FPGA, Advantages of FPGAs.

Case study: Machine Learning application using FPGAs, Artificial Intelligence in FPGAs, Hardware Accelerators in FPGA Design, Generative AI using FPGAs, FPGAs in High level synthesis flow, FPGA based task scheduler for Real time systems.

Learning Resources:

1. S. Brown, R. Francis, J. Rose, Z.Vransic, "Field Programmable Gate array", BSP, 2007.
2. P.K. Chan & S. Mourad, "Digital Design Using Field Programmable Gate Array", Pearson Education 2009.
3. Spartan-3A/3AN FPGA Starter Kit Board User Guide, 2010.
4. S. Trimberger, Edr., "Field Programmable Gate Array Technology", Kluwer Academic Publications, 2004.
5. [https://nptel.ac.in/syllabus/117108040/prof.Kuruvillea Varghese IISC Bangalore](https://nptel.ac.in/syllabus/117108040/prof.Kuruvillea%20Varghese%20IISC%20Bangalore).

The break-up of CIE : Internal Tests + Assignments + Quizzes

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|--------------------------|---|--------------------------------|-----------------------------------|---|---------------------------------|
| 1. No. of Internal Tests | : | <input type="text" value="2"/> | Max. Marks for each Internal Test | : | <input type="text" value="30"/> |
| 2. No. of Assignments | : | <input type="text" value="3"/> | Max. Marks for each Assignment | : | <input type="text" value="5"/> |
| 3. No. of Quizzes | : | <input type="text" value="3"/> | Max. Marks for each Quiz Test | : | <input type="text" value="5"/> |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

**Electric and Hybrid Vehicle Systems:
Design Approach and Applications**

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE851EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To understand the history, evolution, and types of electric vehicles (EVs) and their comparison with internal combustion engine (ICE) vehicles. - To explore hybrid electric vehicles (HEVs), their architectures, and the role of driving cycles in fuel economy. - To study hybrid energy storage systems, their topologies, and advanced storage methods for EV applications. - To analyze plug-in hybrid electric vehicles (PHEVs), their working principles, architectures, and market strategies. - To discuss future trends and emerging EV technologies, including advancements in battery management, machine learning, and mass production strategies.	On completion of the course, students will be able to - Differentiate between EVs and ICE vehicles and understand the role of regenerative braking in energy efficiency. - Analyze various HEV architectures and compare series, parallel, and series-parallel hybrid systems. - Evaluate different hybrid energy storage systems and select appropriate topologies for specific applications. - Design and compare PHEV architectures and assess their challenges and benefits in modern transportation. - Discuss future trends in EV technology and understand how software updates, machine learning, and new battery technologies impact EV adoption.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1										1		
CO2	2	2	1										1		
CO3	2	2	1										1		
CO4	3	2	1	1									1	1	1
CO5	3	1	1	1									1	1	1

UNIT - I: Introduction to Electric Vehicles and Braking system in EVs:

History and Evolution of EVs, Comparison of EVs with Internal Combustion Engine (ICE), Vehicles, Types of EVs[Battery Electric Vehicles (BEV), Hybrid Electric Vehicles (HEV), Plug-in Hybrid EVs (PHEV), Fuel Cell EVs (FCEV)]

Fundamentals of Regenerative Braking: Breaking energy consumption, Breaking energy Vs Vehicle speed, Breaking energy Vs Breaking Power, Parallel Hybrid brake system, Fully controllable Hybrid brake system.

UNIT - II: Hybrid Electric Vehicles:

Introduction to Hybrid Electric vehicles, Comparison between conventional and

hybrid EVs, Concept of Hybrid Electric vehicles, Architecture of Hybrid Electric vehicles, Driving Cycles and Road Conditions on Fuel Economy, HEV Technologies: (Micro Hybrids, Mild Hybrids, Full Hybrids) Series hybrid electric vehicles, Parallel hybrid electric vehicles, Series-Parallel hybrid electric vehicles, Case study analysis on series Vs Parallel Hybrid vehicles.

UNIT - III: Hybrid Energy storage Systems in Electric Vehicles:

Combined battery and UC(Ultra capacitor) Topologies: Passive parallel connection topology, cascaded converters topology, Multiple parallel- connected converter topology, Dual-active-bridge converter topology, Multiple-Input Converter topology, Switched Capacitor Converter topology.

Energy storage systems: Compressed air-pumped hydraulic CS-based Storage System, Super Conducting magnetic energy storage system, Fly wheel energy storage system

UNIT - IV: Plug-In Hybrid Electric Vehicles (PHEV):

Introduction, Functions and Benefits of PHEV, Components of PHEVs, Operating PRINCIPLES OF PLUG-IN HYBRID VEHICLE: Charge-depleting mode, Charge - sustaining mode

PLUG-IN HYBRID VEHICULAR ARCHITECTURE: PHEV series hybrids, PHEV parallel hybrids, PHEV compound hybrids, PHEV related technologies and challenges, PHEV Market strategies.

UNIT - V: Future Trends and Emerging Technologies in Electric vehicles:

Environmental Impact, Importance of Different Transportation Development Strategies to Future Oil Supply Emerging Technologies: Early challenges with thermal management (air-cooled batteries), Impact of software updates and over-the-air (OTA) improvements using machine learning, Blade Battery Technology, Quad-motor all-wheel drive (AWD) system, Mass Production Strategy – MEB (Modular Electric Drive Matrix) platform.

Learning Resources:

1. Advanced Electric Drive Vehicles- Ali Emadi, CRS Press, 2019,CRC Press
<https://www.aston-recruitment.co.uk/wp-content/uploads/2022/12/Advanced-Electric-Drive-Vehicles-Energy-Power-Electronics-and-Machines-PDFDrive-.pdf>
2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2018. <https://dlib.hust.edu.vn/bitstream/HUST/20371/1/OER000001366.pdf>
3. Hybrid and Electric vehicles,CRC Press
https://www.routledge.com/rsc/downloads/CRC_Hybrid_Vehicles_Freebook.pdf?srsltid=AfmBOoogsVpk6AkRlr1qAx_NxzsAxi18HP1IqdyW5M_KLVhyZ1hVH-AB

The break-up of CIE: Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
| 2. No. of Assignments | : 3 | Max. Marks for each Assignment | : 5 |
| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Radar and Navigation Systems

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE860EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1 Derive and understand the Radar range equation and the parameters	On completion of the course, students will be able to
2 Analyze the working of pulse, continuous wave and Moving target indicating radars	1 Derive and evaluate Radar range equation and nature of detection
3 Understand the different Navigational methods	2 Describe the continuous and moving target indicator radars.
4 Understand the direction of arrival techniques	3 Interpret techniques and functionalities of various tracking radar systems.
5 Explore the different hyperbolic Navigation systems	4 Explain principles of navigation including the operation of approach and landing aids.
	5 Describe and assess the features and applications of satellite-based navigation systems.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2		3						2		3	
CO2	3	3		2		3						2		3	
CO3	3	3		2		3						2		3	
CO4	3	2		2		3						2		3	
CO5	3	2		2		3	3					2		3	

UNIT - I :

Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

UNIT - II :

Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, blind speeds, delay line cancellers, staggered PRF, limitations to the performance of MTI radar.

UNIT - III :

Tracking radars: Sequential lobing, Conical scan, Monopulse: amplitude comparison and phase comparison methods, Radar antennas. Radar displays. Duplexer.

UNIT - IV :

Direction Finding - Four methods of Navigation, Loop Antenna as direction finding, An Aural Null Direction Finder, Adcock Direction Finders, Direction Finding at Very High Frequencies: The LF/MF Four course Radio Range, VHF Omni Directional Range(VOR), Errors in Direction Finding.

UNIT - V :

Hyperbolic Navigation Systems: Principle of Hyperbolic Navigation Systems: Loran and Decca and Omega System, GPS principle and operation, Position location determination and applications.

Learning Resource:

1. Merrill I. Skolnik, "Introduction to Radar Systems", 2nd Edition Tata Mc Graw-Hill 2017.
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.
3. Peyton Z. Peebles, "Radar Principles", John Wiley, 2004 2. J.C Toomay, "Principles of Radar", 2nd Edition –PHI, 2004.
4. Radar Systems and Radio Aids to Navigation, Sen & Bhattacharya, Khanna publishers
5. NPTEL Links: <https://nptel.ac.in/courses/101108056/3>

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Global Positioning System

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE861EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To study basics of mathematics and science related to GNSS constellations - To understand the different coordinates for representation user position. - To study the different errors of GPSs - To acquire the knowledge of augmentation systems. - To understand the GPS data formats for use of different application - To study basics of mathematics and science related to GNSS constellations	On completion of the course, students will be able to - Apply the knowledge of basic mathematics and science to understand the different GNSS constellations - Utilize different coordinate systems for accurate user position estimation. - Identify and categorize the sources of errors in GPS-based navigation systems. - Interpret and analyze GPS data for diverse real-time applications. - Apply knowledge of augmentation techniques to assess their suitability in specific GNSS-based applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		2		3						2		3	
CO2	3	2				3						2		3	
CO3	3	2				3	3					2		3	
CO4	3	2				3						2		3	
CO5	3	2				3						2		3	

UNIT - I :

GPS Fundamentals: GPS Applications , GPS Constellation, Principle of operation, GPS Orbits, Orbital mechanics and satellite position determination, Time references, Geometric Dilution of Precision: Geometrical dilution of Precision, Vertical dilution of precision, Position dilution of precision.

UNIT - II :

Coordinate Systems and errors: Geometry of ellipsoid, geodetic reference system. Geoid, Ellipsoid, Global and Regional datum, World

geodetic system- 84, Different coordinate systems, Various error sources in GPS: Satellite and receiver clock errors, Ephemeris error, Atmospheric errors, Receiver measurement noise and User Equivalent Range Error.

UNIT - III :

GPS measurements: GPS signal structure, C/A and P-codes, Code and carrier phase measurements, position estimation with pseudo range measurements, Spoofing and anti spoofing, GPS navigation and observation data formats.

UNIT - IV :

GPS Augmentation systems: Code-based and carrier based Differential GPS(DGPS) Techniques, DGPS errors, Wide area augmentation system-architecture, GAGAN, Local area augmentation system concept.

UNIT - V :

GPS Modernization and other satellite navigation systems: Future GPS satellites, New signals and their benefits, Hardware and Software improvements, GPS integration – GPS/Geo Information System, GPS/Inertial Navigation System, GPS/pseudolite, GPS/cellular, GLONASS, Galileo System.

Learning Resources:

- 1 Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance," Ganga- Jamuna Press, 2/e, Massachusetts, 2010.
- 2 G.S.Rao, Global Navigation Satellite Systems, Tata Mc Graw-Hill, 2010.
- 3 Satheesh Gopi, "Global positioning system: Principles and Application", TMH, 2005.
- 4 B. Hofmann-Wellenhof, H. Lichtenegger, and J. Collins, "GPS Theory and Practice," Springer Verlag, 2008.
- 5 Bradford W. Parkinson and James J. Spilker, "Global Positioning System: Theory and Application," Vol. II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.
- 6 <https://nptel.ac.in/syllabus/105107062/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Quantum Communication Technologies and Applications

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE862EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- Understand the fundamental concepts of quantum mechanics required for communication applications. - Explain the representation and manipulation of quantum information using qubits and quantum gates. - Analyse quantum communication protocols and quantum cryptographic techniques. - Understand the architecture and components of practical quantum communication systems. - Explore emerging applications and future trends in quantum communication networks.	On completion of the course, students will be able to - Explain the basic principles of quantum mechanics and represent quantum states using qubits. - Apply quantum gates and quantum circuits for simple quantum information processing tasks. - Analyse quantum communication protocols such as teleportation and superdense coding. - Explain quantum cryptography protocols and evaluate their security aspects. - Describe practical quantum communication systems and emerging quantum networking technologies.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2							2		2	
CO2	3	3		2	3							2		2	
CO3	3	3		2	2							3		2	
CO4	2	3		2	2							2		2	
CO5	2	2		2	2							3		2	

UNIT-I: Fundamentals of Quantum Mechanics for Communication:

Introduction to quantum technologies and communication – Limitations of classical communication – Wave-particle duality – Quantum states and state vectors – Bra-Ket notation – Superposition principle – Qubits and Bloch sphere representation – Quantum measurement postulates – Uncertainty principle.

UNIT-II: Quantum Information Fundamentals

Classical bits versus qubits – Multiple qubit systems – Tensor products – Quantum entanglement – Bell states – Density matrices and mixed states – No-cloning theorem – Quantum gates: Pauli gates, Hadamard gate, Phase gate and CNOT gate – Quantum circuits.

UNIT-III: Quantum Communication Protocols

Quantum teleportation – Superdense coding – Quantum channels – Optical realization of qubits using photons – Single-photon sources and detectors – Quantum noise and decoherence.

UNIT-IV: Quantum Cryptography

Introduction to quantum cryptography – Security principles – BB84 protocol – B92 protocol – E91 protocol – Quantum Key Distribution (QKD) systems – Eavesdropping strategies and security analysis.

UNIT V: Advanced Quantum Communication Systems

Quantum repeaters – Quantum memories – Satellite-based quantum communication – Quantum Internet concepts – Fiber and free-space quantum communication – Applications in secure communications, IoT and 6G.

Learning Resources:

1. An Introduction to Quantum Communication Networks: Or, How Shall We Communicate in the Quantum Era?, Springer, 2021.
2. Quantum Communications and Cryptography, CRC Press, 2005.
3. Quantum Computation and Quantum Information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press, 10th Anniversary Edition, 2010.
4. Introduction to Quantum Mechanics, Pearson Education, 3rd Edition, 2018.
5. Quantum Computing for Computer Scientists, Cambridge University Press, 2008.

The break-up of CIE : Internal Tests + Assignments + Quizzes

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2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Adaptive Signal Processing

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE870EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1 To introduce some practical aspects of signal processing, and in particular adaptive systems 2 The basic principles of adaptation which cover various adaptive signal processing algorithms (e.g., the LMS algorithm, RLS algorithm) 3 To understand applications, such as adaptive noise cancellation, interference cancelling, system identification. 4 To Estimate the innovation process for Kalman filtering problem. 5 To understand vector Kalman filters for target tracking	On completion of the course, students will be able to 1 Design and apply optimal minimum mean square estimators and in particular linear estimators. 2 Implement and analyze Wiener filters and evaluate their performance. 3 Implement and apply LMS, RLS, and Kalman filters for given applications. 4 Estimate the innovation process for Kalman filtering problem. 5 Analyze vector Kalman filters for target tracking

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2			3					3	2			3
CO2	2	3	2								2	2			3
CO3	2	3	3			3					2	2			3
CO4	3	3	3								3	2			3
CO5	2	3	3							2	2	1			3

UNIT - I :

Approaches to the development of adaptive filter theory. Introduction to filtering, smoothing and prediction. Wiener filter theory, introduction; Error performance surface; Normal equation; Principle of orthogonality; Minimum mean squared error;

UNIT - II :

Gradient algorithms; Learning curves; LMS gradient algorithm; LMS stochastic gradient algorithms; convergence of LMS algorithms.

UNIT - III :

Applications of adaptive filter to adaptive noise cancelling, Echo cancellation in telephone circuits and adaptive beam forming

UNIT - IV :

Kalman Filter theory; Introduction; recursive minimum mean square estimation for scalar random variables; statement of the Kalman filtering problem: the innovations process; Estimation of state using the innovations process; Filtering examples

UNIT - V :

Vector Kalman filter formulation. Examples. Applications of Kalman filter to target tracking.

Learning Resource:

- 1 Simon Haykins, "Adaptive signal processing", PHI, 1986. 3rd EDITION
- 2 Sophoclas, J. Orphanidies, "Optimum signal processing an introduction", McMillan, 1985.
- 3 Bernard Widrow, "Adaptive signal processing", PHI, 1986
- 4 Bozic. SM., Digital and kalman Filtering
- 5 <https://nptel.ac.in/syllabus/117105026/>

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
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Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Biomedical Signal Processing

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE871EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To introduce the fundamentals of probability theory and random processes with biomedical signals applications. - To equip students with the fundamental tools that are used to describe, analyze and process biomedical signals. - To acquire the knowledge on fundamental principles in the analysis and design of filters, power spectral density estimation and non-stationary signal processing techniques with cardiological and neurological signals. - To develop competency in implementing data compression techniques for biomedical signals, particularly ECG, using both time-domain and transform-domain methods. - To enable students to apply adaptive filtering and pattern recognition techniques for advanced biomedical applications such as ECG and EEG signal interpretation, arrhythmia detection, and sleep stage classification.	On completion of the course, students will be able to 1 Apply the probability theory and random processes techniques in analyzing biological signals. 2 Determine to best class of compression techniques to use for a particular bio medical signal to compress. 3 Possess the basic mathematical, scientific and computational skills necessary to analyze and process cardiological signals as per the requirement. 4 Ability to formulate and solve basic problems in biomedical signal analysis. 5 Possess the basic mathematical, scientific and computational skills necessary to analyze and process neurological signals as per the requirement.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										3			3
CO2	3	2										3			3
CO3	3	2		2		3						3			3
CO4	3	2			2							3			3
CO5	3	2			2		3					3			3

UNIT – I

Discrete and continuous Random variables: Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables.

Stationary random process, Ergodicity, Power spectral density and

autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

UNIT – II

Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantisation, DCT and the K L transform.

UNIT – III

Cardiological Signal Processing: Pre-processing. QRS Detection Methods. Rhythm analysis. Arrhythmia Detection Algorithms. Automated ECG Analysis. ECG Pattern Recognition. Heart rate variability analysis.

Adaptive Noise Cancelling: Principles of Adaptive Noise Cancelling. Adaptive Noise Cancelling with the LMS Adaptation Algorithm. Noise Cancelling Method to Enhance ECG Monitoring. Fetal ECG Monitoring.

UNIT – IV

Signal Averaging, polishing – mean and trend removal, Prony's method, Prony's Method based on the Least Squares Estimate, Linear prediction. Yule – walker (Y – W) equations, Analysis of Evoked Potentials.

UNIT-V

Neurological Signal Processing: Modelling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modelling of seizure EEG. Sleep Stage analysis. Inverse Filtering. Least squares and polynomial modelling.

Learning Resources:

1. Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, 4th ed., 2009, TMH.
2. Biomedical Signal Processing- Principles and Techniques – D.C.Reddy, 2005, TMH.
3. Digital Bio signal Processing – Weitekunat R, 1991, Elsevier.
4. Biomedical Signal Processing – Akay M, IEEE Press.
5. Biomedical Signal Processing –Vol. I Time & Frequency Analysis – Cohen.A, 1986, CRC Press.
6. Biomedical digital Signal Processing: C-Language Experiments and Laboratory Experiments, Willis J.Tompkins, PHI.
7. <https://nptel.ac.in/courses/108105101/> Biomedical Signal Processing – by Prof.Sudipta Mukhopadhyay. IITKGP
8. <http://www.ecdept.iitkgp.ac.in/index.php/home/faculty/smukho>

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Language Models and Applications

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE872EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
- To provide a strong foundation in Natural Language Processing (NLP), including text preprocessing, regular expressions, and statistical language modeling techniques. - To enable students to analyze linguistic structures using N-gram models, Part-of-Speech tagging, and vector semantics. - To develop understanding of neural network-based NLP models such as Feedforward Networks, RNNs, and attention mechanisms. - To familiarize students with transformer architectures, transfer learning, and fine-tuning of models like BERT and GPT. - To introduce Large Language Models (LLMs), prompt engineering, and emerging paradigms like Agentic AI for real-world applications.	- Apply NLP preprocessing techniques, regular expressions, and N-gram models for text analysis and language modeling. - Analyze and implement linguistic models such as POS tagging, vector semantics, and similarity measures for NLP tasks. - Design and implement neural network-based models (Feedforward, RNNs, Encoder-Decoder with Attention) for language processing tasks. - Apply transformer-based models and perform fine-tuning using BERT/GPT for downstream NLP applications. - Evaluate and utilize Large Language Models, prompt engineering, and Agentic AI concepts for real-world problem-solving.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													2
CO2	3	3													3
CO3	3	3													3
CO4	3	2													3
CO5	3	2			3	3									3

UNIT-I:

Introduction: Introduction – NLP.

Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, words, corpora, Text Normalization, Minimum Edit Distance. N-gram Language Models: N-Grams. Part-of-Speech Tagging: HMM Part-of-Speech

Tagging. Vector Semantics and embeddings: Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Word2vec.

UNIT-II:

Neural Networks and Neural language Models: Feed forward Neural Networks, Feed forward Networks for NLP Classification and language modeling.

RNNs: Recurrent Neural Networks, RNNs as language models, RNNs for other NLP tasks, Encoder-Decoder models with RNNs, Attention.

UNITIII:

Transformers: Self Attention Networks - Transformers, Transformers as language models.

Fine-Tuning and Masked Language Models: Bidirectional Transformer Encoders (BERT), Training Bidirectional Encoders, Transfer Learning through Fine-Tuning.

UNIT-IV:

Overview of large language Models: What are Large language Models?, Definition of LLMs, Key Characteristics of LLMs, How LLMs work, Popular LLMs, GPT-3 and ChatGPT, Domain Specific LLMs.

Introduction to Agentic AI: Introduction to Prompt Engineering, Traditional AI Vs Agentic AI and Generative AI, Capabilities of Agentic AI, Benefits and Agentic AI Use cases, Agentic AI tools and frameworks: langchain and langgraph, Applications of Agentic AI.

UNIT-V:

Applications of LLMs: Classical NLP tasks, Free-Text Generation, Information Retrieval/Neural Semantic Search, Demonstration of BioGPT for health care applications, Defense applications.

Demonstration using hugging face models:

1)Microsoft/biogpt 2) Microsoft/VibeVoice-1.5B 3) openai/whisper-large-v3.

Learning Resources:

1. Daniel Jurasky & JamesH .Martin, "Speech and Language Processing", 3rd edition, Pearson Education. (<https://web.stanford.edu/~jurafsky/slp3/RevisedJanuary,2023>)
2. James Allan, Natural Language Understanding, 2nd edition (1995), Pearson Education.
3. Sinan Ozdemir, Quick Start Guide to Large Language Models: Strategies and Best Practices for Using ChatGPT and Other LLMs (Addison-Wesley Data & Analytics Series),2023.
4. Charnaick, Eugene, Statistical Language Learning, MIT Press,1993
5. Christopher D. Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing,(1999),The MIT Press.

6. Tanveer Siddiqui, USTiway, Natural Language Processing and Iretrieval, (2008), Oxford University Press.
7. Building Agentic AI Systems: Create intelligent, autonomous AI agents that can reason, plan, and adapt by Anjanava Biswas, Wrick
8. Talukdar, Matthew R Scott, Packt Publication, April 2025.
9. <https://python.langchain.com/docs/tutorials/rag/>
10. <https://www.udemy.com/course/the-complete-agentic-ai-engineering-course/?srsltid=AfmBOooNSYbinopPhhXaVkBuKqP0ngm-ZkWIA5b2sBLMvIhLHPgzlmi1&couponCode=ST16MT230625G1>

The break-up of CIE : Internal Tests + Assignments + Quizzes

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|--------------------------|---|--------------------------------|-----------------------------------|---|---------------------------------|
| 1. No. of Internal Tests | : | <input type="text" value="2"/> | Max. Marks for each Internal Test | : | <input type="text" value="30"/> |
| 2. No. of Assignments | : | <input type="text" value="3"/> | Max. Marks for each Assignment | : | <input type="text" value="5"/> |
| 3. No. of Quizzes | : | <input type="text" value="3"/> | Max. Marks for each Quiz Test | : | <input type="text" value="5"/> |

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Blockchain Technology and Applications

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE880EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Introduce the foundational concepts and evolution of Blockchain technology, types, architecture, and decentralization. 2. Explain the operational principles of cryptocurrencies, particularly Bitcoin and its underlying components such as transactions, mining, and keys. 3. Explore consensus mechanisms like Proof of Work (PoW), Proof of Stake (PoS), and other alternatives, along with scripting and functional challenges. 4. Examine major blockchain platforms like Ethereum, Hyperledger, and IOTA, and the design of decentralized applications. 5. Analyze privacy, security issues, and AI integration in Blockchain with relevant case studies across sectors like healthcare, finance, and retail.	On completion of the course, students will be able to 1. Illustrate the key principles, types, and benefits of Blockchain technology, including decentralization and cryptographic fundamentals. 2. Apply knowledge of Bitcoin operations, including digital keys, transactions, mining, and analyse its limitations and alternatives. 3. Compare and evaluate consensus protocols like PoW, PoS, and understand scripting features in Bitcoin networks. 4. Differentiate between blockchain platforms and design simple decentralized applications for real-world scenarios. 5. Assess privacy, security issues, and AI-driven applications in blockchain through use cases in healthcare, finance, and supply chain.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										3		3	
CO2	3	2										3		3	
CO3	3	2										3		3	
CO4	3	2				3						3		3	
CO5	3	2										3		3	

UNIT-I:

Introduction: Introduction to Blockchain, Properties of blockchain technology, Distributed systems, History of blockchain and Bitcoin, Types of blockchain. Hash functions.

Decentralization: Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized organizations and platforms for decentralization.

UNIT-II:

Blockchain: Architecture, Versions, Variants, Use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.

Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.

UNIT-III:

Bitcoin basics: Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

UNIT-IV:

Introduction to Blockchain Platforms: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc. Advantages and Disadvantages, Ethereum vs Bitcoin, Design a new blockchain, Potential for disruption, Design a distributed application, Blockchain applications.

UNIT-V:

Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains, Block chain case studies in Retail ,Banking and Financial services, Health care, Energy and utilities Integration of AI and blockchain for secure electronic health records, medical diagnostics, and drug traceability.AI-driven customer analytics, fraud detection, and supply chain optimization in retail using blockchain-based transparency and authenticatio

Learning Resources:

1. Mastering Block chain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017 Reference Books.
2. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.
3. Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan" "Blockchain Technology" ISBN: 9789389211634 | Year: 2020.
4. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
5. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases"[MOOC],
NPTEL: <https://nptel.ac.in/courses/106/105/106105184>

The break-up of CIE : Internal Tests + Assignments + Quizzes

- | | | | |
|--------------------------|-----|-----------------------------------|------|
| 1. No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : 30 |
| 2. No. of Assignments | : 3 | Max. Marks for each Assignment | : 5 |
| 3. No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Network Management

(Professional Elective-IV)

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week) : 3:0:0	SEE Marks : 60	Course Code: U23PE881EC
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Analyze the goals, organization, functions, and architecture of network management and the network topologies and transmission technologies. 2. Understand and evaluate various network management standards network monitoring. 3. Examine and implement TMN standards, architecture, and management service frameworks solutions. 4. Apply and analyze key network management functions, including configuration, fault, performance, security. 5. Configure and manage LAN access, SNMP and IP-based services using tools such as web browsers	On completion of the course, students will be able to 1. Explain network management perspectives 2. Apply various network management protocol 3. Identify and describe TMN standards 4. Analyze various management issues 5. Demonstrate how to correctly maintain LAN

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												3	
CO2	3	2												3	
CO3	3	2												3	
CO4	3	2		3										3	
CO5	3	2												3	

UNIT - I:

Overview of Data Communication and Network Management – Goals, Organization and Functions; Network Management – Architecture and Organization; Network Management Perspectives; Current Status and Future of Network Management. Network Topology, Network Node Components, Transmission Technology.

UNIT - II:

Network Management Standards, Network Management Models, Organizational Model, Information Model, Communication Model. **SNMPv1** –History of SNMP, Internet Organization and Standards, SNMP Model, Organizational Model, System Overview, Information Model. SNMP Communication Model, Functional Model. SNMPv2 and SNMPv3.

UNIT - III:

TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, TMN Integrated View, TMN Implementation.

UNIT - IV:

Configuration Management, Fault Management, Performance Management, Security Management, Service Level Management, Accounting Management, Report Management, Policy-Based Management.

UNIT - V:

Setting-UP LAN Access, SNMP configuration, Switched Port Analyzer, Web Browser / Web Server Communication. IP Network Management - Configuration, Management Information Base, Simple Network Management Protocol, IP-Based Service Implementation- Network Management Issues, OSS Architecture.

Learning Resources:

1. Mani Subramanian "Network Management - Principles and Practice", Addison-Wesley, 2000.
2. Salah Aaidarons, Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998.
3. Lakshmi. G, Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi
4. J. Richard Burke, "Network Management: Concepts and Practice, A Hands-on Approach", Pearson Education, 2008.

The break-up of CIE : Internal Tests + Assignments + Quizzes

1. No. of Internal Tests	: 2	Max. Marks for each Internal Test	: 30
2. No. of Assignments	: 3	Max. Marks for each Assignment	: 5
3. No. of Quizzes	: 3	Max. Marks for each Quiz Test	: 5

Duration of Internal Tests: 90 Minutes

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Project / Internship

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

L:T:P (Hrs./week): 0:0:12	SEE Marks : 50	Course Code: U23PW819EC
Credits : 6	CIE Marks : 50	Duration of SEE : Viva-Voce

COURSE OBJECTIVES	COURSE OUTCOMES
- To introduce students to the process of identifying and defining complex engineering problems with real-world relevance and societal impact. - To equip students with the skills necessary to design appropriate solutions using scientific principles, engineering knowledge, and consideration of sustainability and ethics. - To train students in the use of modern engineering tools and techniques for simulation, modelling, analysis, and interpretation of data. - To develop students abilities in technical communication, including the preparation of professional reports and presentations in accordance with ethical standards. - To foster teamwork, leadership, and project management skills, encouraging adaptability to technological advancements and resource optimization	On completion of the course, students will be able - To select the complex engineering problems beneficial to the society and develop solutions with appropriate considerations - To apply modern tools and analyze the results to provide valid conclusions. - To communicate effectively the solutions with report and presentation following ethics - To work in teams and adapt for the advanced technological changes - To apply management principles to complete the project economically

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3			2	3					3			
CO2				3	3							3			
CO3								3		3					
CO4									3			3			
CO5									2		3				

Note: Some of relevant COs must be mapped with the relevant PSOs based on the domain and application area of the project.

Oral presentation is an important aspect of engineering education. The objective of the project is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her

specialization.

Project topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of project work carried out.

Each student is required to:

1. Submit a one-page synopsis in the beginning of project work for display on the notice board.
2. Give a 20 minutes presentation through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the project work with list of references and slides used.

Project reviews are to be scheduled from the 3rd week of the semester to the last week of the semester and any change in schedule should be discouraged.

- Batch size shall be 2 (or) 3 students per batch.
- Project allocation by department.
- Two reviews – One during 5th week and another during 10th week and final evaluation shall be conducted during 15th to 16th week.
- Students are required to give Presentations during the reviews.
- Students are required to submit project report.

Continuous Internal Evaluation (CIE) – 50 marks:

Evaluation Criteria	Maximum Marks
Literature Survey	10
Problem Formulation	10
Design/ Methodology	10
Implementation & Results	10
Presentation & Documentation	10

Semester End Examination (SEE) – 50 marks:

Evaluation Criteria	Maximum Marks
Literature Survey	10
Problem Formulation	10
Design/ Methodology	10
Implementation & Results	10
Presentation & Documentation	10

Note: Rubrics are used for assessment and evaluation.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Activity Planner/Calendar for the Academic Year 2026-27

S.No.	Date	Activities planned
1	20-07-2026 to 29-07-2026	FDP on Artificial Intelligence and Its Applications in Electronics and Communication Engineering
2	01-08-2026	Inauguration of Vasavi ISNT Club
3	17-08-2026 to 21-08-2026	FDP on AI Tools for Teaching and Learning in association with NITTTR, Chandigarh.
4	19-08-2026	Guest lecture by industry expert - Dr. C. Sulakshana, IEEE, Hyd.
5	22-08-2026	Alumni Guest lecture – 1 on “Career Guidance” by Kalyan Vemuru, Director, Software Engineer at Optum.
6	29-08-2026	Awareness on Library Learning Resources, by Dr. Ravikumar, Librarian, VCE
7	05-09-2026	Online coding competition in the Hacker Rank platform in Association with IEEE CAS
8	08-09-2026	Industry Visit - INCOIS PRAGNA
9	11-09-2026	Guest Lecture on “PCB Layout design using Kicad” by Dr. M. Shyam Sundar, Associate Professor, ECE, OU.
10	11-09-2026	Guest lecture on “Satellite Communication” by P. Rangaswamy, former Director, DDH.
11	12.09.2026	Industry Visit to IRISSET
12	19-09-2026	Guest Lecture on “Introduction to Enterprise Agile Product Management” by Mr. G. Bhanu Chander, Vice President, M/s. Wells Fargo, Hyderabad.
13	23-09-2026	Workshop on EM Simulation tools – Swapnil Gaul, Tarang Software
14	26-09-2026	Alumni Guest lecture – 2 lecture on skills for career growth Manoj Kumar Infrastructure Engineer principal global services.
15	03-10-2026	Alumni Guest lecture – 3 on “Career Guidance” by Vinay Garu, Director, SRE Optum.
16	03-10-2026	Microwave Component & Antenna Design Competition
17	15-10-2026	Guest Lecture on “HAMRADIO using SDR platform” by Mr. R. Sharath, Mr. R. Anil, Hyderabad
18	17-10-2026	Code Clash – IEEE Day Celebrations 2027 IEEE in Association with IEEE
19	24-10-2026	Guest Lecture on “Financial Literacy” by Mr. Srinidhi Rao, Managing Director, Naviture Financial Services Pvt. Ltd., Hyderabad.

20	31-10-2026	Alumni Guest lecture – 4 on “Acoustic noise cancellation” by C. Vanitha, Research Scholar NIT-Warangal.
21	02-11-2026	AI Tools usage for RF Engineers
22	07-11-2026	Essay writing competition on usage of AI and professional ethics in association with IETE Students Forum (ISF)
23	07-11-2026	IEEE Project Expo
24	07.11.2026	Industry Visit to IRISSET
25	02-01-2027	Introduction and objectives of CCA activities, Introduction of Technical Proposal which mainly focuses on the development of technical skills in students through projects, workshops and technical talks in various domains
26	21-01-2027	Industry Visit to NRSC, Balanagar.
27	23-01-2027	Circuit IQ – Test Your Circuit Intelligence in Association with IEEE
28	30-01-2027	Alumni Guest lecture – 5 on “Latest Technologies in Core” by T. Pavan Kalyan Analog Design Engineer in MOSCHIP Technologies
29	06-02-2027	Guest lecture by industry expert by Dr. Srinivas Kuchipudi, ASL, Hyd.
30	06-02-2027	Industry Visit to IRISSET
31	12-02-2027	Industry Visit TO RGIA Hyd.
32	20-02-2027	Invited talk on Recent trends in industrial growth by Dr. K. Krishna Kishore, Director AI-Powered Business Expansion, Houses of Companies-T-hub, Hyd.
33	27-02-2027	Extempore Competition in association with IETE Students Forum (ISF)
34	10-03-2027	Hands on Workshop on “Antenna Design for HAMRADIO”
35	12-03-2027 13-03-2027	3rd Edition of International Conference on Advanced Technologies in Electronics, Communication Engineering and Signal Processing (ICATECS-2027)
36	20-03-2027	Alumni Guest lecture - 6 on “Career Guidance” by Mr. Neeraj, Alumni VCE.
37	27-03-2027	“Contest on Verilog Coding” in association with VLSI Club
38	31-03-2027	IEEE Project Expo
39	03-04-2027	Poster presentation on “AI in healthcare” in association with IETE Students Forum (ISF).
40	03-04-2027	Guest lecture by industry expert by Mr. Sandeep, Unistring Technologies
41	04-04-2027	Industry Visit to IRISSET

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Professional Elective (R-23)								
(Students can opt for all professional electives from single stream or several streams)								
Professional Elective Stream	Embedded Systems and VLSI Stream		Communication Engineering Stream		Signal Processing Stream		Networking Stream	
VI - Semester for the A.Y. 2025-26								
Professional Elective – I (Theory courses)	U23PE610EC	Real Time Operating Systems	U23PE630EC	Software Defined Radio and its Applications	U23PE640EC	Artificial Neural Networks	U23PE650EC	Voice and Data Networks
	U23PE620EC	Advanced CMOS Microfabrication						
Professional Elective – I (Lab courses)	U23PE611EC	Real Time Operating Systems Lab	U23PE631EC	Software Defined Radio and its Applications Lab	U23PE641EC	Artificial Neural Networks Lab	U23PE651EC	Voice and Data Networks Lab
	U23PE621EC	Advanced CMOS Microfabrication Lab						
VII - Semester for the A.Y. 2026-27								
Professional Elective – II (Theory courses)	U23PE710EC	Advanced Embedded Systems	U23PE720EC	Wireless Communications	U23PE730EC	Digital Image and Video Processing	U23PE740EC	Cryptography and Network Security
Professional Elective – II (Lab courses)	U23PE711EC	Advanced Embedded Systems Lab	U23PE721EC	Wireless Communications Lab	U23PE731EC	Digital Image and Video Processing Lab	U23PE741EC	Cryptography and Network Security Lab
VIII - Semester for the A.Y. 2026-27								
Professional Elective – III	U23PE810EC	IoT Architectures and Protocols	U23PE820EC	Satellite Communication	U23PE830EC	Image and Video processing using Machine Learning	U23PE840EC	Wireless Sensor Networks
	U23PE811EC	Industrial IoT and Applications	U23PE821EC	Optical Fiber Communication	U23PE831EC	Speech and Audio Signal Processing	U23PE841EC	Optical Networks
	U23PE812EC	Low Power VLSI Design	U23PE822EC	Coding Theory and Techniques				
Professional Elective – IV	U23PE850EC	FPGA Architectures and Applications	U23PE860EC	Radar and Navigation Systems	U23PE870EC	Adaptive Signal Processing	U23PE880EC	Blockchain Technology and its Applications
	U23PE851EC	Electric and Hybrid Vehicle Systems: Design Approach and Applications	U23PE861EC	Global Positioning System	U23PE871EC	Biomedical Signal Processing	U23PE881EC	Network Management
			U23PE862EC	Quantum Communication Technologies and Applications	U23PE872EC	Language Models and Applications		