GOVERNMENT COLLEGE OF ENGINEERING JALGAON [M.S]

(An Autonomous Institute of Government of Maharashtra)

"Globally Accepted Engineers with Human Skills"

Curriculum for

B. Tech. Electronics and Telecommunication

Progressively implemented from academic year 2018-19 (FY)

SH426U ACCOUNTS AND FINANCE FOR ENTREPRENEURS

Teaching Scheme : 03L + 00 T; Total: 03 **Credits** : 03
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 03 Hrs.

COURSE DESCRIPTION

This course introduces the fundamental concepts of financial management, the basic rules and principles of accounting, financial market, and sources of finance, financial accounting and statement preparation. Also the course offers leverage analysis as well as working capital management.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic accounting and finance

COURSE OBJECTIVES

The objectives of offering this course are to

1. impart the knowledge of financial accounting
2. know the preparation of financial statement
3. develop the ability to analyze various fundamentals of financial management problems
4. create awareness about budget and budgetary control
5. solve leverage analysis and working capital management

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. describe the basic concept of financial accounting
2. demonstrate the ability to prepare financial statement
3. implement the fundamental concepts of financial management problems
4. assess the budget and budgetary control
5. analyze and evaluate the leverage and working capital management

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	S	9	10	11	12	1	2	3
1						2			2	3		3			3
2						2			2	3		3			3
3						2			2	3		3			3
4						2			3	3		3			3
5						2		3	2	3		3			3

l- Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

CONTENT

Introduction to Financial Accounting

Introduction to accounting, meaning, evolution of accounting, importance of accounting, users of financial statements, financial, cost and management accounting, accounting concepts and conventions

Financial Statement Preparation

Meaning, classification of accounts, rules and principles governing double entry, book-keeping system, meaning, preparation of journal, ledger and trial balance, preparation of financial statement, profit and loss account, balance sheet

Budget and budgetary control

Introduction, definition of budget and budgetary control, objectives, essential requirements, advantages and disadvantages, types of budgets

Introduction to Financial Management

Finance and other discipline, nature and scope of financial management, functions of financial management, objectives of the firm, sources of finance, long term sources, short term sources, international sources

Leverage Analysis and Working Capital Management

Operating leverage, financial leverage, combined leverage, working capital management: operating cycle, determinants of working capital, types of working capital, importance of working capital, components of working capital, measuring working capital requirements, basic problems on working capital

Text books

1. Financial Accounting, V. Rajasekaran, 1st Edition, Pearson publications, 2011
2. Basic Financial Accounting, Karsten Wiborg, 1st Edition, academica publications, 2010
3. Financial Accounting, W. Albrecht, Earl Stice, James Stice, 11th Edition, South Western Cengage Learning, 2010
4. Financial Accounting, V.K. Goyal, 2nd Edition, Excel books Delhi, 2012

Reference Book

1. Financial Accounting for Management, Paresh Shah, 3rd Edition, Oxford University Press, 2019
2. Financial Management Text, Problems and Cases, Khan and Jain, 8th Edition, Tata McGraw Hill, 2018
3. Financial Management, Ravi Kishore, 8th Edition, Taxmann Publications Pvt. Ltd, 2020

ET401U COMPUTER COMMUNICATION

Teaching Scheme : 03L + 00 T; Total: 03 **Credits** : 03
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 03 Hrs.

COURSE DESCRIPTION

This course explores the basic concepts of computer communication, transmission modes, networks, interconnection of networks, network models, application of different layers and logical addressing. The course also covers the introduction to system and network security, security attacks, firewalls, intrusion detection systems and designed to lay the foundation for further studies in areas such as advanced communication systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic electronics engineering, analog and digital communication systems

COURSE OBJECTIVES

The objectives of offering this course are to

1. impart enriched knowledge and ability of analyzing and understanding various computer network and their topologies
2. create zeal of working with these structures as demanded in the widespread field of communications and networking
3. enhance passion for designing these structures with professional features
4. develop efficacy of building and handling different types of data/computer networks

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. illustrate the basic concepts of computer communication, OSI model, network and security.
2. solve the problems related to higher and complex computer networks
3. suggest and implement better solutions to the field practices of computer networks
4. summarize the sub netting and routing mechanisms.
5. design and develop modules for various computer network applications in fields

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	1	1	1	1							1		
2	3	3	3	3	3		1	2	1	1	2	1	3		2
3	3	3	3	3	3	2	2	2	1	1	1	1	3	2	2
4	3	3	3	3	3								1		
5	3	3	3	3	3	2	2	2	1	1	1	1	2	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Introduction to Computer Communication

Transmission modes: serial and parallel, asynchronous, synchronous, simplex, duplex communication: half, full; Switching: circuit and packet; Networks: network criteria, physical structures, network models, categories of networks; Interconnection of networks: internetwork; network models: layered tasks, Open Systems Interconnection (OSI) model, layers in OSI model, Transmission Control Protocol and Internet Protocol (TCP/IP) suite

Layers and its Applications

Physical layer: Guided and unguided transmission media (co-axial cable, Unshielded Twisted Pair (UTP), Shielded Twisted Pair (STP), fiber optic cable); Data Link Layer: Framing, flow control (stop and wait, sliding window flow control) error control, error detection(check sum, Cyclic Redundancy Check (CRC), bit stuffing, High-level Data Link Control (HDLC); Media access control: Ethernet (802.3), Carrier-Sense Multiple Access with Collision Detection (CSMA/CD), logical link control, Wireless Local Area network (LAN) (802.11), Carrier-Sense Multiple Access with Collision Avoidance (CSMA/CA)

Network Layer

Network layer logical addressing: Internet Protocol (IPv4 and IPv6); Address Resolution Protocols (ARP), Reverse Address Resolution Protocols (RARP); Subnetting, Classless Inter-Domain Routing (CIDR), Internet Control Message Protocol (ICMP), Internet Group Management Protocol (IGMP), Dynamic Host Configuration Protocol (DHCP); Virtual LAN, Networking devices (hubs, bridges and switches)

Routing Algorithm and Protocols

Routing: Routing and forwarding, static and dynamic routing; Routing algorithms: Distance vector, link state (Dijkstra's); Routing Protocols: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), Multi-Protocol Label Switching (MPLS)

Transport and Application Layer

User Datagram Protocol (UDP), TCP/IP-1; data traffic, congestion, congestion control, Quality of Services (QoS) and flow characteristics; Application Layer: Domain Name System (DNS), Remote logging (Telnet), Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP), World Wide Web (WWW), Hyper Text Transfer Protocol (HTTP), Post Office Protocol-3 (POP3), Multipurpose Internet Mail Extensions (MIME), Simple Network Management Protocol (SNMP)

Network Security System

Introduction to information system security, common attacks; Security at application layer, Electronic Mail (e-Mail), Pretty Good Privacy (PGP) and Secure/Multipurpose Internet Mail

Extensions (S/MIME)); Security at transport layer: Secure Sockets Layer (SSL) and Transport Layer Security (TLS); Security at network layer: Internet Protocol Security (IPSec); Defense and counter measures: Firewalls and their types; De-Militarized Zone (DMZ); Limitations of firewalls; Intrusion detection systems (IDS): Host based, network based and hybrid

Text Books

1. Data Communications and Networking, B. A. Forouzan, 4th Edition, Tata McGraw-Hill, 2008
2. Computer Network, A. S. Tanenbaum and D. J. Wetherall, 5th Edition, Pearson, 2011
3. Data and Computer Communications, W. Stallings, 8th Edition, Pearson, Prentice Hall of India, 2007

Reference Books

1. Cryptography and Network Security , B. A. Forouzan, 4th Edition, Tata McGraw-Hill, 2008
2. Computer Network - A System Approach, L. Peterson and B. S Davie, 4th Edition, Elsevier India, 2011
3. An Engineering Approach to Computer Networking, S. Keshav, 5th Edition, Pearson Education, 2010

ET402UA MOBILE COMMUNICATION

Teaching Scheme	**:** 03L+ 00 T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30 MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course will explore the basic concepts of mobile communication. It is designed to understand and learn various concepts of mobile termination, terminal equipment and mobile equipment. It emphasizes is given on analysis of performance of mobile communication systems. This course is designed to lay the foundation for further studies in areas such as advanced communication systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic mathematics and communication systems

COURSE OBJECTIVES

The objectives of offering this course are to

1. review of various architecture generations (2, 2.5 and 3)
2. demonstrate basic concept of mobile communication systems
3. develop a strong foundation on basic concepts of cellular system, wireless propagation and the techniques used to maximize the capacity of cellular network
4. construct architecture of Global Systems for Mobile (GSM) and Code Division Multiple Access (CDMA) system

COURSE OUTCOMES

On successful completion of this course; students will be able to

1. prepare the link budget of mobile communication system
2. analyze radio channel and cellular capacity
3. apply concepts of GSM and CDMA system
4. evaluate performance of a mobile communication system

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1		1		1	1				3	3	2
2	3	1	1	1	2	2		1	1	1			2	3	1
3	2	3	3	2	1		1	2		1	2		3	2	
4	3	2	2	3	3	2	1	2	2	2	2	2	1	3	3

1-Weakly correlated 2-Moderately correlated 3-Strongly correlated

COURSE CONTENT

Fundamentals of Mobile Communication

Introduction, mobile radio telephony, examples of wireless communication systems, related design problems, frequency reuse, channel assignment strategies, interface and system capacity, trunking and grade of service, improvement of coverage and capacity in cellular systems, Fading

Wireless Systems

Evolution of mobile radio communication, mobile radio systems around the world wireless communication system, trends in cellular radio and personal communications; second, third, fourth, fifth generation; wireless networks, Wireless Local Loop (WLL) and Wireless Local Area Network (WLAN)

Frequency Management and Channel Assignments

Frequency management, frequency spectrum utilization, set up channels, fix channel assignment schemes, non-fixed channel assignment schemes, delaying of handoff, forced and soft handoff, dropout calls

Second Generation Technology

Introduction to GSM, GPRS and EDGE architecture, radio specifications channels, IS-95: architecture of CDMA system, CDMA air interface, power control in CDMA system, handoff, rake receiver

Third Generation Technology

UMTS: Objectives, standardization, network architecture, air interface specifications, channels security procedure, W-CDMA air interface, attributes of W-CDMA system; CDMA-2000 cellular technologies: forward and reverse Channels, handoff and power control

Third GPP LTE Technology

Introduction, system overview, physical layer, logical and physical channels; Physical layer procedures: establishing a connections, retransmissions and reliability, power control and handover, introduction to fourth generation, future aspects of mobile communication and scope

Text Books

1. Wireless Communications, Principles and Practice, T. Rappaport, 3rd Edition, 2010
2. Mobile Communications, J. Schiller, 2nd Edition, Pearson Education, 2001

Reference Books

1. Mobile Cellular Telecommunication Systems, William C.Y. Lee, 2nd Edition, TMH, New Delhi, 2010
2. Wireless and Mobile Communications, Upena Dalal, 1st Edition, Oxford University Press, 2017
3. 4G, LTE advanced; E. Dahlman, 3rd Edition, Academic Press, 2016

ET402UB MIXED SIGNAL DESIGN

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs.		

COURSE DESCRIPTION

This course focuses on the concepts of mixed signal VLSI design. The course will give practical aspect of mixed signal VLSI blocks such as switched capacitor circuits, data converters, phase locked loop and oscillators

COURSE OBJECTIVES

The objectives of offering this course are to

1. demonstrate the concepts of switched capacitor circuits, comparator, data converter and PLL.
2. design product level blocks for VLSI applications.

COURSE OUTCOMES

After successful completion of this course, students should be able to

1. demonstrate the understanding of practical situations where mixed signal analysis is required.
2. analyze the inter-conversion techniques between signals.
3. exhibit the knowledge of design considerations for systems involving mixed signals.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1			3	1	2								3	2	
2		3	2	2									3	2	
3		3	2	2	2										3

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Overview of Signal Processing

Analog and discrete-time signal processing, sampling theory; analog continuous-time filters: passive and active filters; Review of discrete-time filters and Z-transform

Switched-capacitor filters

Introduction, basic building blocks, operation and analysis, non-ideal effects in switched capacitor circuits, switched capacitor integrators, first order filters, switch sharing, bi-quad filters

Data Converters

DC and dynamic specifications, quantization noise, Nyquist rate analog-to-digital converters (ADC): successive approximation, flash, two-step, interpolating, folding, pipelined, time-interleaved; Nyquist rate digital-to-analog converters (DAC): decoder-based, binary-scaled, thermometer-code, hybrid

Oversampling Converters

Noise shaping modulators, decimating and interpolating filters, higher order modulators, delta-sigma modulators with multibit quantizers, delta-sigma DAC

Phase Locked Loop (PLL)

Introduction to frequency synthesizers and synchronization; PLL architecture; linearized small-signal analysis: second-order PLL model, limitations of the second-order small-signal model; PLL design example; Voltage Controlled Oscillators (VCO): Ring, LC; Phase noise and jitter considerations in PLL

Text Books

1. CMOS mixed-signal circuit design, R. Jacob Baker, Wiley India, IEEE press, Reprint 2008
2. CMOS Analog Circuit Design, P. E. Allen and D. R. Holberg, 2nd Edition, Oxford University Press, 2010
3. Design of analog CMOS integrated circuits, Behzad Razavi , 2nd Edition, McGraw-Hill, 2017

Reference Books

1. Electronic Filter Design Handbook, Arthur B. Williams, McGraw-Hill, 1981
2. CMOS Integrated Analog-to-Digital Converters and Digital-to-Analog Converters, V. D. Plassche and J. Rudy, Springer, Indian Edition, 2005
3. An introduction to mixed-signal IC test and measurement, M. Burns and G. Roberts, 1st Indian Edition, Oxford University Press, 2008

ET402UC SPEECH AND AUDIO SIGNAL PROCESSING

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course will explore the basic concepts and methodologies for the analysis, modeling, synthesis and coding of speech and music. It covers various concepts of audio and speech signal processing. In this course, more emphasis is given on analysis of performance of speech and audio signal processing. This course is designed to lay the foundation for further studies in areas such as advanced digital signal processing systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of signals and systems and digital signal processing

COURSE OBJECTIVES

The objectives of offering this course are to

1. understand the anatomy and physiology of acoustic production and perception model
2. analyze the speech in time domain and extract various parameters
3. study the concept of homomorphic system and analyze various audio coding techniques with applications

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. develop systems for various applications of speech processing
2. extract the LPC coefficients that can be used to synthesize or compress the speech
3. design a homomorphic vocoder for coding and decoding of speech
4. extract the features for automatic speaker recognition systems

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3		1	1			3			2		1		3
2			2			3	1		2		1	1		3	1
3				3				3		2	1	2	3	2	1
4				2	1						3		1	2	

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Fundamentals of Digital Speech Processing

Introduction, discrete time signals and system, transform representation of signals and systems, fundamentals of digital filters, sampling, the process of speech production, the acoustic theory of speech production-sound propagation, vocal tract transfer functions vowels, the effect of nasal coupling, digital models for speech signals, anatomy and physiology of speech organs

Time Domain Models for Speech Processing

Introduction, time dependent processing of speech, short time energy and average magnitude, short time average zero-crossing rate, speech vs. silence discrimination using energy and zero crossings, pitch period estimation using parallel processing approach

Homomorphic Speech Processing

Introduction, homomorphic systems for convolution- properties of the complex cepstrum, computational considerations, the complex cepstrum of speech, pitch detection, formant estimation, the homomorphic vocoder

Automatic Speech Recognition

Introduction, overview, component of automatic speech recognition, common feature vectors, dynamic features, strategies for robustness, auditory models, multichannel input

Audio Coding

Lossless audio coding, lossy audio coding, psychoacoustics, audio coding, parametric coding, MP3 formats (Different Audio formats), psychoacoustic fundamentals

Speech and Audio Applications using ANN

Biological neural network-features, comparison with computer, principles, terminology, models of neuron, learning methods

Text Books

1. Digital Processing of Speech Signals, L. Rabiner and R. Schafer, 1st Edition, Prentice Hall, 1978
2. Speech and Audio Signal Processing, B. Gold and N. Morgan, 1st Edition, Wiley, 2011
3. Artificial Neural Network, B. Yegnanarayana,1st Edition, Prentice Hall of India, 2005

Reference Books

1. Discrete Time Speech Signal Processing: Principles and Practice, T. Quateri, 1st Edition, Prentice Hall of India, 2002

2. Introduction to Digital Speech Processing, L. Rabinar and R. Schafer, 2nd Edition, Prentice Hall of India, 2007
3. Speech Communication: Human and Machine, D. O'Shaughnessy, 2nd Edition, Universities Press (India) Pvt Ltd, Reprint 2004

ET402UD VERY LARGE SCALE INTEGRATION DESIGN

Teaching Scheme	**:** 03L+ 00 T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs.		

COURSE DESCRIPTION

This course introduces the way digital circuits are designed in practice today. The emphasis is on modern design methodology using Computer Aided Design (CAD) to meet desired specifications. This course is extension to digital logic design. This course introduces the role of Hardware Description Language (HDL), Verilog Hardware Description Language (VHDL) and Verilog in conceptual structures, descriptions and processing in VLSI system design.

DESIRABLE AWARENESS/SKILLS

Knowledge of digital and analog electronics

COURSE OBJECTIVES

The objectives of offering this course are to

1. introduce architecture and design concepts underlying modern complex VLSI circuits and system-on-chips.
2. synthesize digital VLSI systems from register-transfer or higher level descriptions in hardware design languages.
3. design actual VLSI subsystems from high level specifications.
4. learn layout, stick diagrams, fabrication steps, static and switching characteristics of inverters.

COURSE OUTCOMES

On successful completion of this course; student shall be able to

1. analyze complex microelectronics circuits and systems.
2. design a system, component or process as per needs and specifications
3. model digital system using HDL

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	3	2	2	3		2	1	1	2	1	3	2	1
2	3	2	3	3	2	1	1			2		2	1	3	2
3	3	3	3	2	3	2	1		1		2		1	2	3

1-Weakly correlated 2-Moderately correlated 3-Strongly correlated

COURSE CONTENT

HDL Design

Structure of the Hardware Description (HDL) module, data types; operators: logical, relational, arithmetic, shift and rotational; styles (types) of description: behavioural, structural, switch level, data flow, mixed type, mixed language; simulation and synthesis

HDL Programming

Structure of various description styles: behavioural, structural, switch level, data flow, mixed type, mixed language; signal declaration and signal assignment statements, concurrent signal assignment statements, constant declaration and assignment statements, variable assignment statements; common programming errors: VHDL and Verilog programming errors

Digital CMOS Circuits

N-MOS, P-MOS and Complementary Metal Oxide Semiconductor (CMOS), MOSFET parasitic, technology scaling, channel length modulation, hot electron effect, velocity saturation, CMOS inverter, device sizing, CMOS combinational logic design, power dissipations, power delay product, body effect, rise and fall times, latch up effect, transmission gates

Digital Design and Issues

sequential synchronous machine design, Moore and Mealy machines, HDL code for machines, FIFO, metastability and solutions, noise margin, fan-out, skew, timing considerations, hazards, clock distribution, clock jitter, supply and ground bounce, power distribution techniques, power optimization, interconnect routing techniques; wire parasitic, signal integrity issues; design for testability

Programmable Logic Devices

Complex Programmable Logic Devices (CPLD) architecture, organization of Field Programmable Gate Arrays (FPGAs), FPGA programming technologies, programmable logic block architectures; programmable interconnects, programmable input output blocks in FPGAs, dedicated specialized components of FPGAs, and applications of FPGAs

Text Books

1. HDL Programming Fundamentals VHDL and Verilog, N. Botros, Thomson Learning Inc., 2005
2. CMOS VLSI Design: A Circuit and System Perspective, E. Weste, D. Harris, 4th Edition, Pearson Publication, 2011

Reference Books

1. Digital Systems Design using VHDL, C. Roth, PWS Publishing Company, 2007
2. Digital Design, M. Morris Mano, 3rd Edition, Pearson, 2017
3. Digital Design Principles and Practices, J. Wakerly, 4th Edition, Prentice Hall, 2008

ET403UA INTERNET OF THINGS

Teaching Scheme	**:** 03L+ 00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA+30MSE +60ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs.		

COURSE DESCRIPTION

This course focuses on various components of Internet of Things (IoT) such as sensors, internetworking and cyber space. It describes the market around the IoT, technology used to build these kinds of devices, communication, data storage, and distributed systems needed to support them. Finally techniques to design and implement IoT circuits and applications

DESIRABLE AWARENESS/SKILLS

Knowledge of fundamentals of computer network, network Security, internet technology

COURSE OBJECTIVES

The objectives of offering this course are to

1. assess smart objects and IoT architectures
2. build simple IoT using hardware platform
3. review data analytics and cloud in the context of IoT
4. develop IoT infrastructure for popular applications

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. summarize and demonstrate general concepts of IoT
2. recognize various devices, sensors and applications
3. categorize various M2M and IoT architectures
4. explore IoT solutions using sensors, actuators and devices

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2			3	2	1			1		1	1	
2	3	2	2	1	1	2	1	1					1	1	
3	3	3	3	2	2	2	1	2				1	1	1	
4	3	2	2	2	1	3	1	3		2	3	2	1	1	

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Internet of Things (IoT): Preliminaries

Introduction, sensing, actuation, networking basics, communication protocols, sensor networks, Machine-to-Machine (M2M) communications, IoT: definition, characteristics, functional blocks, physical design, logical design, communication models

M2M Evolution towards IoT

Introduction, M2M towards IoT: the global context, case example, differing characteristic, M2M value chains, IoT value chains, emerging industrial structure for IoT

Architectural Overview

Building architecture, main design principles and needed capabilities, IoT architecture outline, standards considerations, reference architecture and reference model of IoT

Getting familiar with protocol architecture, various architectural views of IoT: functional, information, operational, deployment, constraints affecting design in IoT world: introduction, technical design constraints

Domain Specific Applications

Home automation, industry applications, surveillance applications, hardware platform IoT applications: introduction, different tools, implementation of IoT, cloud computing, fog computing, connected vehicles, data aggregation for the IoT in Smart Cities, privacy and security issues in IoT

Text Books

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, J. Holler, V. Tsiatsis, C. Mulligan, S. Avesand, S. Karnouskos, D. Boyle, 1st Edition, Academic Press, 2014
2. Internet of Things: A Hands-On Approach, V. K. Madisetti and A. Bahga, 1st Edition, Publisher VPT, 2014

Reference Books

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, F. daCosta, 1st Edition, Apress Publications, 2013
2. Internet-of-Things (IoT) Systems Architectures, Algorithms, Methodologies, Dimitrios Serpanos, Marilyn Wolf, Springer International Publishing AG 2018
3. Building Blocks for IoT Analytics Internet-of-Things Analytics, John Soldatos, River Publishers, 2017
4. Getting Started with the Internet of Things, R. Media, Cuno Pfister, 2011, ISBN: 978-1-4493- 9357-1

ET403UB SATELLITE COMMUNICATION

Teaching Scheme	**:** 03L+ 00 T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA+30 MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs.		

COURSE DESCRIPTION

This course explores the basic concepts of satellite communication. It emphasizes on analysis of performance of satellite communication systems. It is designed to lay the foundation for further studies in areas such as advanced communication systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of analog and digital communication systems

COURSE OBJECTIVES

The objectives of offering this course are to

1. introduce various aspects in satellite communication systems.
2. define different concepts in geostationary orbit.
3. explain earth and space segment components.
4. demonstrate the various terminologies in space link and Very-Small-Aperture Terminal (VSAT) systems.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. describe satellite sub systems, orbital mechanics and launch methodologies.
2. demonstrate the basic concepts on space missions and national programs.
3. design the link budget of satellite communication system
4. Compare competitive satellite services.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	2	3	2								1	1	1
2	3	1	2	3	1		1	1	1	1	1	1	1	1	1
3	3	1	2	3	1	1	2	2	2	2	2	2	1	1	1
4	1	1	1	1	1								1	1	1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Satellite Systems

Introduction, frequency allocations for satellite systems; Orbits and launching methods: Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee, orbit perturbations, inclined orbits, local mean solar point and Sun-synchronous orbits, standard time

Geostationary Orbit

Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, Earth eclipse of satellite, Sun transit outage, launching orbits; Polarization: antenna polarization, polarization of satellite signals, cross polarization discrimination; Depolarization: ionospheric, rain, snow

Space Segment

Power supply, attitude control, station keeping, thermal control; Telemetry, Tracking and Command (TT&C) subsystem, transponders, antenna subsystem, earth segment; Television (TV) systems: receive-only home, master antenna, community antenna; transmit-receive earth station, Overview of Indian Space Research Organization (ISRO) missions

Space Link

Introduction, equivalent isotropic radiated power, transmission losses, the link power budget equation, system noise, Carrier-to-Noise Ratio (CNR), uplink and downlink budget, effects of rain, inter modulation noise, inter-satellite links, interference between satellite circuits

VSAT systems

Network architecture, access control protocols, basic techniques, Very-Small-Aperture Terminal (VSAT) earth station, calculation of link margins for a VSAT star network; Direct Broadcast Satellite Television (BDS) and radio: digital Direct Broadcast Satellite (DBS) TV; BDS TV system design and link budget, error control and installation, satellite radio broadcasting

Text Books

1. Satellite Communications, D. Roddy, 4th Edition, Tata McGraw-Hill, 2017
2. Satellite Communications, T. Prattt, 3rd Edition, Wiley India, 2003

Reference Books

1. Satellite Communications, R. M. Gagliardi, 1st Edition, CBS, 2007
2. Fundamentals of Satellite communications, R. Rao, 2nd Edition, PHI Learning, 2013

ET403UC ADAPTIVE SIGNAL PROCESSING

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

The primary aim of this course is to develop a theory of linear adaptive filters. Adaptation is accomplished by adjusting the free parameters of a filter according to the input data to achieve the desired output. Such adaptive algorithms are frequently encountered in many signal processing algorithms. The adaptive signal processing course provides a comprehensive treatment of signal processing algorithms for designing and analysing adaptive filters.

DESIRABLE AWARENESS/SKILLS

Knowledge of signal processing and probability theory

COURSE OBJECTIVES

The objectives of offering this course are to

1. introduce to the concept and need of adaptive filters and popular adaptive signal processing algorithms.
2. demonstrate the concepts of training and convergence and the trade-off between performance and complexity.
3. introduce to common linear estimation techniques.
4. demonstrate applications of adaptive systems to sample problems.

COURSE OUTCOMES

After successful completion of this course, students should be able to

1. demonstrate the knowledge of filtering solutions for optimising the cost function and the need for adaptation in design.
2. evaluate the performance of various methods for designing adaptive filters.
3. analyze convergence and stability issues associated with adaptive filter design and attempting for optimum solutions.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1			3	2	1								3	2	
2		2	2	3										1	
3		3	2		2										1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Introduction to Adaptive Systems

Definitions, characteristics, applications, example of an adaptive system, adaptive linear combiner; desired response performance function: gradient and Mean Square Error (MSE); stochastic processes and models: characterization; Mean ergodic theorem; correlation matrix

Wiener Filters

Introduction to filters, linear optimum filtering, principle of orthogonality: Minimum Mean Square Error (MMSE), Wiener-Hopf equations, error-performance surface, multiple linear regression model, linearly constrained minimum variance filter

Gradient search and Steepest Descent Algorithms

Introduction**,** searching the performance surface, gradient searching algorithm and its solution: stability and rate of convergence, learning curves, gradient search by Newton's method, the steepest descent algorithm applied to Wiener filter, stability and rate of convergence, virtue and limitations of steepest descent algorithm

Least Mean Square (LMS) Algorithm and Applications

Overview: LMS adaptation algorithm, stability and performance analysis, LMS gradient and stochastic algorithms, convergence of LMS algorithm; Applications: adaptive Binary Frequency Shift Keying (BFSK), Binary Phase Shift Keying (BPSK), Amplitude Shift Keying (ASK) demodulators and delay estimation, adaptive beam forming

Text books

1. Adaptive Signal Processing, B. Widrow, S. D. Strearns, Pearson Education India, 2005
2. Adaptive Filter Theory, S. Haykin, 4th Edition, Pearson Education India, 2002

Reference books

1. Adaptive Signal Processing-Theory and Applications - S.T. Alexander, Springer, 1986,
2. Digital Signal Processing: A Practitioner's Approach, K.V. Rangarao, R. K. Mallik, John Wiley publication (UK), November 2006

ET403UD INTRODUCTION TO MICRO ELECTRO MECHANICAL SYSTEMS

Teaching Scheme : 03L+ 00T; Total: 03 **Credits** : 03
Evaluation Scheme : 10 ISA+30MSE +60ESE **Total Marks** : 100
ESE Duration : 03 Hrs

COURSE DESCRIPTION

The course explores knowledge of Micro Electro Mechanical Systems (MEMS) by emphasizing the state-of-the-art science and technology in fabrication and materials of MEMS.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic micro systems and sensors, actuators fundamentals

COURSE OBJECTIVES

The objectives of offering this course are to

1. visualize knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
2. demonstrate the rudiments of micro fabrication techniques.
3. review various sensors and actuators.
4. categorize different materials used for MEMS.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. exhibit the knowledge of basic approaches for microsystem design.
2. acquire the knowledge of state-of-the-art lithography techniques for Microsystems.
3. explore new materials for MEMS.
4. illustrate state-of-the-art micromachining and packaging technologies.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	2			2	2	1			1		1	1	
2	3	1	2	1	1	2			1				1	1	
3	3	2	1	2	2	1						1	1	1	
4	3	2	2	2	1	1	1	1		2	2	2	1	1	

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

MicroElectroMechanical Systems (MEMS)

Introduction, intrinsic characteristics of MEMS, devices sensors and actuators: energy domains and transducers, sensor considerations, introduction to micro fabrication: silicon based MEMS processes, new materials and fabrication processes, review of electrical and mechanical concepts in MEMS: conductivity of semiconductors, stress and strain analysis, flexural beam bending, and torsional deflections

Sensors and Actuators-I

Electrostatic sensors: parallel plate capacitors and their applications, interdigitated finger capacitor, comb drive devices, micro grippers , micro motors , thermal sensing and actuation: thermal expansion, thermal couples, thermal resistors, thermal bimorph, applications, magnetic actuators: micromagnetic components, case studies of MEMS, actuation using shape memory alloys

Sensors and Actuators-II

Piezoresistive sensors: materials, stress analysis of mechanical elements, applications: inertia, pressure, tactile, flow sensors, piezoelectric sensors and actuators: mathematical description of piezoelectric effect, piezoelectric materials, applications: inertia, acoustic, tactile, flow sensors

Micromachining

Silicon anisotropic etching: wet etching, dry etching of silicon, plasma etching, deep reaction ion etching (DRIE), isotropic wet etching, gas phase etchants, case studies, basic surface micromachining processes, structural and sacrificial materials, acceleration of sacrificial etch, striction and antistriction methods, process synthesis

Polymer and Optical MEMS

Polymers in MEMS: polyimide, photoresist:SU-8, Liquid Crystal Polymer (LCP), Poly Di-Methyl Siloxane (PDMS), PolyMethyl MethAcrylate (PMMA), parylene, fluorocarbon, representation applications: acceleration, pressure, flow, tactile sensors, optical MEMS: lenses and mirrors, actuators for active optical MEMS

Text Books

1. Foundations of MEMS, Chang Liu, 2nd Edition, Pearson Education Inc., 2006
2. Microsystem Design, S. D. Senturia, 1st Edition, Springer Publication, 2000
3. MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering, T**.** R**.** Hsu, 6th Edition, Tata McGraw Hill, New Delhi, 2002

Reference Books

1. Micro Electro Mechanical System Design, J. J. Allen, 6th Edition, CRC Press Publisher, 2010

2. Microsensors MEMS and Smart Devices, J. W. Gardner, V. K. Varadan, O. O. Awadelkarim, 1st Edition, John Wiley and Son Ltd, 2002
3. Introduction MEMS, Fabrication and Application, T M. Adams and R. A. Layton, 5th Edition, Springer, 2012

ET403UE ONLINE COURSE

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs.		

COURSE GUIDELINE

Students have to select one online course available on digital learning sources (such as NPTEL) at that time. The online course should be selected such that its course content are relevant to the discipline of Electronics and Telecommunication Engineering and are not covered in the entire eight semesters of the program. It is required to select the online course as per the above guidelines before the start of the semester and to seek the approval from chairman Board of Studies (i. e. Head of Program). The selected course should be of 12 weeks for 3 credits.

Course coordinator will consider internal evaluation proportionately for NPTEL course in lieu of ISA and MSE, however institute will conduct ESE for the online course.

ET404UX ANALOG AND DIGITAL INTEGRATED CIRCUITS

Teaching Scheme : 03L+ 00 T; Total: 03 **Credits** : 03
Evaluation Scheme : 10 ISA +30 MSE +60 ESE **Total Marks** : 100
Duration of ESE : 03 Hrs

COURSE DESCRIPTION

This course imparts the knowledge about basic analog electronics devices to familiarize with characteristics of operational amplifiers and its applications such as summing, differentiator, integrator, voltage follower, instrumentation amplifier, filters as well as timer and oscillators. It also introduces fundamentals of digital logic circuits, combinational and sequential circuits.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic electrical and electronics engineering

COURSE OBJECTIVES

The objectives of offering this course are to

1. impart knowledge of working principles of op-amp and its applications.
2. introduce the fundamental concepts and applications of oscillators and timers.
3. interpret the knowledge of digital logic, combinational and sequential circuits.

COURSE OUTCOMES

Upon successful completion of this course the students shall be able to

1. demonstrate the knowledge working principle, characteristics of op-amp based circuits.
2. paraphrase the concept of oscillators and timer circuit and its applications.
3. apply and design digital logic circuits.
4. recognize, formulate and solve a problem of electrical and electronic systems.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2			1	1		1		1	1	1	1	
2	3	3	2	1		1	1		1				1	1	
3	3	3	2	1	1			1	1	1			1	1	
4	3	3	2	1	1			1	1	1			1	1	

1-Weakly correlated 2-Moderately correlated 3- Strongly correlated

COURSE CONTENT

Operational Amplifier

Introduction to op-amp, symbol, block diagram, parameters, ideal op-amp, inverting, non-inverting and differential configuration using ideal op-amp; applications: adder, subtractor, differentiator, integrator, voltage follower, instrumentation amplifier; Filters: ideal and practical responses of low-pass, high-pass, band-pass, band-stop, and all-pass

Oscillators and Multivibrator

Theory of sinusoidal oscillation, passive oscillators : Wien-bridge, phase-shift, Colpitts, Hartley, Clapp, crystal; op-amp based timer (555) - astable operation, monostable, Voltage-Controlled Oscillator (VCO); Timer application - start and reset, sirens and alarms, Pulse-Width Modulation (PWM), Pulse-Position Modulation (PPM), ramp generation, Phase-Locked Loop (PLL)

Digital Fundamentals

Introduction, digital logic gates, codes, error detecting and correcting codes, bipolar logic family-characteristics of digital ICs, Transistor-Transistor Logic (TTL), operation of TTL NAND gate

Combinational and Sequential Logic Design

Introduction to adder, subtractor, multiplexer, demultiplexers, encoder, decoder, standard representation for logic functions, K-Map - representation, simplification of logic functions. Flip-flops: 1 bit memory cell, S-R, D, J-K, and T; Introduction to registers, synchronous and asynchronous counters

Text Books

1. Electronic Principles, Albert Malvino, D. J. Bates, 7th Edition (13th reprint), TMH, 2012
2. Modern Digital Electronics, R. P. Jain, 4th Edition, TMH New Delhi, 2010

Reference Books

1. Electronic Devices and Circuit Theory, R. L. Boylestad and Louis Nashelsky, 7th Edition, 1998
2. Op-amps and Linear Integrated Circuits, R. A. Gayakwad, 4th Edition, PHI, 2008
3. Electronics Principles and Applications, C. A. Schuler, 9th Edition, McGraw-Hill Education, 2019
4. Digital Logic and Computer Design, M. M. Mano, Pearson, 2016

ET404UY WIRELESS COMMUNICATION TECHNOLOGIES

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course will explore the basic concepts of wireless communication. It will impart the basic concepts of digital communication. In the course, various concepts of communication systems and information theory are explained. In this course, more emphasis is given on analysis of performance of wireless communication systems. This course is designed to lay the foundation for further studies in areas such as advanced communication systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of analog and digital communication systems and mobile communication

COURSE OBJECTIVES

The objectives of offering this course are to

1. design various wireless networks and perform mini project in recent technologies.
2. gain basic concepts of cellular system, wireless propagation and the techniques used to maximize the capacity of cellular network.
3. understand architecture of Global Systems for Mobile (GSM) and Code Division Multiple Access (CDMA) system.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. analyze radio channel and cellular capacity.
2. gain knowledge of concepts of GSM and CDMA system.
3. evaluate performance of a mobile communication system.
4. demonstrate the understanding of propagation characteristics of wireless channels, attenuation.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1						3	2					2	3		1
2		3	2		3					1	1		1	2	3
3							2	3				3	1		2
4	1							3	3	3	3		3	1	2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Overview of Wireless Systems

Introduction, first (1G) and second(2G) generation cellular systems, cellular communication from 1G to 3G,wireless 4G systems, future wireless network, Wireless Local Loop (WLL)

Radio Propagation Characteristics

Models for path loss, shadowing and multipath fading (delay spread, coherence band width, coherence time, Doppler spread), jakes channel model, digital modulation for mobile radio, analysis under fading channels, radio wave propagation

Propagation Characteristics of Mobile Channel

Free-space attenuation, attenuation over reflecting surface, effect of earth's curvature, radio wave propagation, characteristics of wireless channel, multipath delay spread, coherence bandwidth, and coherence time, signal fading statistics, level crossing rate and average fade duration, propagation path-loss models, indoor loss models, fade margin, link margin

Wireless Networks

Wireless Local Area Networks (WLAN), bluetooth, Orthogonal Frequency Division Multiplexing (OFDM), cellular concept: frequency reuse, the basic theory of hexagonal cell layout, spectrum efficiency, Frequency Division Multiplexing (FDM) / Time Division Multiplexing (TDM) cellular systems: channel allocation schemes, handover analysis, Erlang capacity comparison of FDM / TDM systems and cellular Code Division Multiple Access (CDMA)

Universal Mobile Telecommunications System (UMTS)

System features, wireless core network architecture, reference architecture, channel structure, spreading and scrambling, bearer service, quality of service, beyond 3G

Text Books

1. Wireless Communications Principles and Practice, T. Rappaport, 2nd Edition, Pearson Education, 2010
2. Wireless Communications and Networking, V. Garg, 1st Edition, Morgan Kaufmann Publishers, 2007

Reference Books

1. Mobile Cellular Telecommunication Systems, William C.Y. Lee, 2nd Edition, McGraw-Hill, 1995
2. Wireless Communications and Networking, W. Stallings, 2nd Edition, Prentice Hall of India, 2006
3. Wireless Communication Technology, R. Blake and L. Chartrand, 1st edition, McGraw-Hill, 2000

ET405U COMPUTER COMMUNICATION LAB

Teaching Scheme : 02P Total: 02 **Credits** : 01
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks** : 50

COURSE DESCRIPTION

This course provides hands on network components and troubleshooting of networks. The laboratory exercises are designed to give ability of configuring various network commands and using different protocols.

DESIRABLE AWARENESS/SKILLS

Concepts and theory of the course ET401U Computer Communication

COURSE OBJECTIVES

The objectives of offering this course are to

1. explain various network components and its applications.
2. illustrate different protocols for network.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. differentiate among different network components and use it accordingly.
2. configure hardware components with PC used in networking.
3. troubleshoot the network connection using different tools.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2									3	1	1
2	3	2	2	1	1		1	1	1	1	1	1	3	1	2
3	3	2	1	1	1	1	2	2	2	2	2	2	3	1	1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire curriculum of course ET401U. The list given below is just a guideline.

List of Experiments

- Various network components
- Various Network cables
- Configuration of LAN card (Ethernet)

- Establishment of PC-LAN
- Trouble shooting of networks
- Installation of network device drivers
- Use/installation of proxy server
- IP address assignment and troubleshooting
- Various routing algorithms
- Various protocols using NS2
- Network address conflict and resolution
- Network management and security (A case study)
- Data center networking (A case study)

Note

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in oral examination.

ET406UA MOBILE COMMUNICATION LAB

Teaching Scheme	**:** 02P	**Credits**	**:** 01
Evaluation Scheme	**:** 25 ICA + 25 ESE	**Total Marks**	**:** 50

COURSE DESCRIPTION

This course deals with practice performance on concept like GSM architecture, CDMA and various emerging technologies. The laboratory exercises are designed to give ability of 2G, 3G and basic communication concept.

DESIRABLE AWARENESS/SKILLS

Concept and theory of the course mobile communication

COURSE OBJECTIVES

The objectives of offering this course are to

1. build foundation of basic mobile communication systems
2. provide knowledge of GSM and CDMA concepts

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. describe principle of mobile and networks
2. demonstrate telephony
3. perform CDMA and GSM architecture

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

	PO												**PSO**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	3	2			2		1	1	2	3		1
2	3	3	2	3	2			2		1	1	2	3		1
3	3	3	2	3	2			2		1	1	2	3		1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum 10 experiments from list shall be performed to cover entire curriculum of course ET402UA. The list given below is just a guideline.

- Mobile transmitter and receiver
- GSM architecture
- Cordless telephone system
- CDMA
- Voice over Internet Protocol (VoIP)
- J2ME
- Implementation of routing protocols

- DSSS using analog signal input and microphone
- DTMF tones

Note

- **ICA** – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format

- **ESE** – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET406UB MIXED SIGNAL DESIGN LAB

Teaching Scheme	**:** 02P Total: 02	**Credits**	**:** 01
Evaluation Scheme	**:** 25 ICA + 25 ESE	**Total Marks**	**:** 50
ESE Duration	**:** 03Hrs		

COURSE DESCRIPTION

In this course, the student will acquire hands-on experience of designing circuits that handle mixed signals, with a suitable software tool. The course covers experiments on simulation of differential amplifier, PLL, combinational and sequential design and post layout simulation of these circuits.

DESIRABLE AWARENESS/SKILLS

VLSI design tools (front end and back end)

COURSE OBJECTIVES

The objectives of offering this course are to

1. build strong foundation of mixed signal design.
2. strengthen the ability of students to design various circuits using CMOS.
3. familiarize students with layout design process of different circuits.

COURSE OUTCOMES

On the successful completion of this course; the student shall be able to

1. design various amplifier and complex circuits using CMOS logic.
2. implement various amplifier and complex circuits different logic styles.
3. demonstrate the knowledge of design layout process for different logic circuits.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		2	3		3								3	2	1
2			2	2	3								3	2	2
3		2	2		3										2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover the entire curriculum of the course ET402UB. The list given below is just a guideline.

List of Experiments

- Differential amplifier using switched capacitor
- Phase locked loop
- Two-stage operational amplifier and comparator
- Data converters
- Continuous time filtering
- Combinational circuit
- Flip-Flops and latches using CMOS
- Post simulation layout of amplifier, combinational and sequential circuits

Note

- **ICA** – It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format.

- **ESE** – It shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET406UC SPEECH AND AUDIO SIGNAL PROCESSING LAB

Teaching Scheme : 02P, Total: 02 **Credits** : 01
Evaluation Scheme : 25 ICA +25 ESE **Total Marks** : 50
ESE Duration : 03 Hrs.

COURSE DESCRIPTION

This course covers experiments on speech production, audio signal processing, audio compression, spectral analysis of speech signal to validate the theory behind speech and audio signal processing

DESIRABLE AWARENESS/SKILLS

Fundamentals of the course speech and audio signal processing

COURSE OBJECTIVES

The objectives of offering this course are to

1. formulate strong foundation of speech production.
2. implement fundamentals of audio systems and basics acoustics.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. describe the attributes of acoustics, sound engineering.
2. analyze speech signal.
3. record and reproduce multiple sounds.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2		3		2		1		3	3			3	1	1
2		1	1				3		1	3	3		3	2	
3							3			3		3		3	1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire curriculum of course ET402UC. The list given below is just a guideline

List of Experiments

- Speech production mechanism
- Plotting spectrogram of given audio signal
- Audio signal processing

- Audio compression
- Speech acoustics
- Auditory system as filter bank
- Spectral analysis of speech signal
- Voiced/unvoiced silence detection and silence removal
- Waveform coding of speech
- Sound synthesis using amplitude modulation
- Flipping an audio signal
- Play multiple sounds
- Linear Predictive Coding
- Vocoder
- Audio standards

Note

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET406UD VERY LARGE SCALE INTEGRATION DESIGN LAB

Teaching Scheme : 02P, Total: 02 **Credits** : 01
Evaluation Scheme : 25 ICA +25 ESE **Total Marks** : 50
ESE Duration : 03 Hrs.

COURSE DESCRIPTION

This course will impart the knowledge about implementation of various digital circuits on FPGA. In this lab course, emphasis is given on realization of frontend VLSI circuits. The course also introduces the preparation of layout of simple digital circuits. The course is designed to lay the foundation for further studies in VLSI Domain.

DESIRABLE AWARENESS/SKILLS

Knowledge of Digital Electronics and VLSI Design

COURSE OBJECTIVES

The objectives of offering this course are to

1. impart the knowledge of lab work based on principles of HDL description of combinational and sequential circuits.
2. develop the ability to implement basic digital circuit on FPGA.
3. enable the students to prepare layout of basic electronics circuits and learn fabrication process.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. describe the digital circuits in Hardware Description Language.
2. implement the digital circuits on FPGA.
3. prepare the layout of basic digital circuits.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	3	3	3	3		1	3	1	1	3	3	2	3	2
2	1	1	2	2	1		1	3	1	1	3	3	2	3	1
3	3	1	1	3	1		1	3	3	1	3	3	2	1	1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum 10 experiments from list shall be performed to cover entire curriculum of course ET402UD. Perform experiments using software and verify them on FPGA/CPLD board. The list given below is just a guideline.

List of Experiments

- Logic Gates
- Binary to gray converter/ BCD to seven segment decoder
- Multiplexer
- Decoder
- Full adder circuit Realization flip-flops
- 4 bit binary up down counter with Asynchronous reset
- 4 bit BCD counter with Synchronous reset
- Arithmetic and Logical Unit
- CMOS Inverter and basic gates
- Half/Full Adder
- 2:1 multiplexer using logic gates and transmission gates

Note

• **ICA –**Internal Continuous Assessment (ICA) shall support for regular performance of practical and its regular assessment. In addition, it shall be based on knowledge/skill acquired and record submitted by the student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10)**.**

• **ESE –** End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET407U SEMINAR

Teaching Scheme : 01 L Total: 01 **Credit** : 01
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks** : 50

COURSE DESCRIPTION

The seminar topic is to be selected such that it establishes a direct link between curriculum, state-of-the-art topics, and needs of the societal development. This course is designed to explore the knowledge of design, implementation, data analysis and comparative study of recent trends and expected research/development in the field of electronics and telecommunication engineering. The course aims at developing presentation skills and lifelong learning attitude.

DESIRABLE AWARENESS/SKILLS

Knowledge of engineering courses studied earlier, comprehension, drafting and presentation skills

COURSE OBJECTIVES

The objectives of offering this course are to

1. develop ability to link between curriculum, state-of-the-art topics, and needs of the society and research / development expected in near future
2. explore the ability of comparative study of recent trends and developments in the domain
3. inculcate capability to select from different methodologies of analysis.
4. enrich communication and presentation skills.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. correlate between curriculum, state-of-the-art topics, and needs of the society and research / development expected in near future.
2. compare different methodologies of analysis and suggest suitablesolution.
3. demonstrate communication and presentation skills.
4. exhibit lifelong learning abilities.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1		3						2		2	3	1	
2	2	1		3						2		2	3	2	
3	3	2		2						3		3	3	3	3
4	2	2		3						3	3	3	2		2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

- It includes detailed study of any one topic apart from curriculum in the field of Electronics, Communication or in the allied field of student's own choice approved by the department; presentation based on topic studied in the presence of other students followed by question and answer session.
- It is expected to submit the seminar report on the selected topic in the format as approved by the program coordinator and available on its website which shall include literature survey, concept, functional and technical detail, present status, future scope, application, comparison with similar technique and references etc.
- **Seminar deliverables:** A power point presentation on the topic and seminar report in the specified format which is available on institute's website. In addition, a record of continuous progress (Log Book) has to be maintained duly signed by guide and present as the seminar deliverable along with the report.

Format for Log Book

Sr. No.	Date and time	Work done (discussion with guide) during the session	Guide's remark	Sign of Guide

EVALUATION SYSTEM

It includes Internal Continuous Assessment (ICA) and End Semester Examination (ESE).Guidelines for ICA and ESE are mentioned below:

Internal Continuous Assessment (ICA)

- The ICA is to be evaluated by departmental committee consisting of two faculty members of (one of which shall be guide) the department appointed by the HoD.
- The candidate has to present the seminar topic followed by discussion and to be assessed on the basis of presentation / communication skill, depth of understanding, selection of seminar topic, literature survey, seminar report etc.

End Semester Examination (ESE)

- The End Semester Exam for this course is to be based on presentation followed by discussion session and seminar report. It is to be evaluated by two examiners out of which one examiner shall be out of institute and other shall be guide.

ET408U PROJECT PHASE-I

Teaching Scheme	**:** 03P; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 75 ICA + 75 ESE	**Total Marks**	**:** 150

COURSE DESCRIPTION

The project topic should be selected to ensure the satisfaction of the need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. It should include relevance to needs of society, relevance to value addition to existing facilities in the institute, relevance to industry need, problems of national importance, research and development in various domains. This course is designed to explore the knowledge of design, implementation, experimentation and data analysis. The course develops the ability to work in team as a member and leader.

DESIRABLE AWARENESS/SKILLS

Knowledge of engineering courses studied earlier and skills achieved through laboratory courses

COURSE OBJECTIVES

The objectives of offering this course are to

1. develop ability to synthesize knowledge and skills previously gained and applied to an in-depth.
2. suggest, design and execute the technical work in a group.
3. make students capable to select from different methodologies, methods and forms of analysis to produce a suitable design, and justify their design.
4. inculcate ability to present the findings of their technical solution in a written report.
5. inculcate leadership attitude and team spirit.

COURSE OUTCOMES

On successful completion of this course student shall be able to -

1. demonstrate ability to synthesize knowledge and skills previously gained.
2. suggest, design and implement the technical work using suitable methodology.
3. prepare and present technical report in appropriate format.
4. exhibit leadership attitude and team spirit.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	3	3	2	3		2						3	2	
2	3	2	2	3	3	2	2						3	2	
3		3	2	2					3				3	3	
4			2	2						3	3	3	2		3

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

- The project is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I in odd semester and Phase – II in even semester. The project work may be an extension of the Development Engineering Project leading to the prototype or final development.
- The project work shall be carried out in the group of 2 – 4 students and shall be carried out in- house i.e. in the department's laboratories and centers **OR** in the industry/organization allotted through department's T & P/project coordinator.
- The project outline (a brief or condensed information giving a general view) on the selected topic should be submitted to the Program Head for approval within two weeks from the commencement of academic year.
- The topic and guide shall be approved in the departmental meeting and informed to student within one week after the submission of outline to enable students to start the topic based work.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define project objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis, Computing and Processing (Hardware and Software) or any other related domain. In case of Industry sponsored project, (co-guide) the relevant application notes, white papers, product catalogues should be referred and reported.
- Each group is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation of the project and phase wise work distribution, and submit the proposal to guide within a month from the date of commencement of classes.
- Around 30–40 % work of the total quantum (i.e. literature survey, system schematic and its design and/or flowchart along with some software development, PCB layout etc.) should be completed by the end of 7^{th} semester.

Project Phase – I deliverables

A document report comprising of outline, introduction,literature survey, detailed objectives, project specifications, manual and/or computer aided design, work completed and work to be completed in Project Phase - II, references. In addition, student shall maintain a record of continuous progress (Log Book in the format given below) duly signed by guide and present as the Project Phase – I deliverable alongwith report.

Format for Log Book

Sr. No.	Date and Time; Roll numbers ofpresent Candidates	Work done (discussion with guide)during the session	Guide's Remark	Dated sign of Guide

EVALUATION SYSTEM

It includes Internal Continuous Assessment (ICA) and End Semester Examination (ESE).Guidelines for ICA and ESE are given bellow.

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by departmental committee consisting of two - three faculty members of the department (one of which shall be guide) appointed by the HoD following the principle of continuous evaluation i.e. project reviews as per academic calendar.
- Examiners shall judge the student on the basis of presentation, deliverables of Project Phase-I described earlier. In case of unsatisfactory performance, committee may recommend repeating the Project Phase – I work and such group shall reregister for this course in next semester.

End Semester Examination (ESE)

The End Semester Exam for this course shall be based on presentation and demonstration of Project Phase – I deliverables followed by oral examination. It shall be evaluated by two examinersout of which one examiner shall be out of institute and other shall be guide.

ET409U INDUSTRIAL LECTURES

Teaching Scheme : 01 L; Total: 01 **Credits** : 01
Evaluation Scheme : 50 ICA **Total Marks** : 50

COURSE DESCRIPTION

This course reflects on the importance of acquaintanceships and the interchange of needed information between practicing engineers in industry and students in educational institutions. There is a criticism, especially from practicing engineers, that existing engineering education is too theoretical and numerical with less orientation toward practical aspects. This course is designed to overcome this criticism. This course is intended to generate such interaction directly, through expert lectures by outstanding practicing engineers. This course will prove helpful to denote and understand the relations among the employers, employees, and other organizations.

DESIRABLE AWARENESS / SKILLS

Listening, understanding and analyzing ability along with the knowledge of concepts, principles and techniques studied earlier.

COURSE OBJECTIVES

The objectives of offering this course are to

1. make students familiar with industrial environment i.e. to provide appropriate exposure toworld of work.
2. demonstrate the knowledge and understanding of the industrial experience, attitudes, needs, and viewpoints of industrial expert to students.
3. denote and understand the role of various parties' viz., employers, employees, and statein maintaining industrial relations.
4. improve industry institute interaction.

COURSE OUTCOMES

On the successful completion of this course; students shall be able to

1. demonstrate the ability to face industrial environment/ world of work.
2. fulfill expectations of industry with respect to expertise, attitude and viewpoint.
3. exhibit the good interpersonal relations.
4. work in industrial environment either as employee or self-employed (entrepreneur) withcomfort.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1					3			3	3				3	1	3
2	2	2	3										3	2	
3										2	3	3	3	3	
4				2	3	3	2			2	2	3	2		2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

- There shall be minimum 5 lectures of 60-90 minutes duration.
- The lecture shall include presentation, informal discussions with students and faculty, and laboratory tours (if required).
- Topics of Industrial Lectures shall be technical in nature and should not be the specific or extended part of the curriculum.
- Typically lectures should be arranged about:
  - Speaker's own career following (and sometimes including university).
  - Interesting jobs/projects they have had worked on.
  - The areas of work they are currently involved in.
  - The type of work engineering graduates can expect.
  - Current job opportunities that may be available for engineering graduates ingeneral and electronics and telecommunication engineering graduates in particular.
  - Suggestions relating to explore job opportunities and soft skill development
  - Latest technology used in the industry which is not the part of curriculum or routine training programs.
  - Any other suitable topic/information which provides industrial exposure and improves entrepreneurship quality/ employability of the students.
- Course coordinator shall discuss with students on the content of lecture and may conduct oral or written assignments to judge their understanding.
- The report shall be submitted based on minimum five lectures providing summary of the lecture delivered.
- The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in the format provided by institute/department.

COURSE DELIVERABLES

An industrial lecture report as per the prescribed format and assignments given by course coordinator (if any)

(**Note:** List of renowned experts/Officials from Industries/Government Organizations/Private Sectors/Public Sectors/R&D Labs etc shall be prepared by the committee appointed by HoD and shall be approved by principal. After approval from the principal, minimum six Industrial Lectures shall be arranged, which shall be delivered by experts to cover the various aspects ofcourse content)

EVALUATION SYSTEM

It includes Internal Continuous Assessment (ICA). Guidelines for ICA are given below:

- The ICA is to be evaluated by course coordinator.

- Course coordinator shall judge the students on the principle of continuous evaluation andcontribution of individual student.
- It shall be evaluated on the basis of deliverables of industrial lecture and depth of understanding (oral conducted by course coordinator).
- Course coordinator shall maintain the record of continuous evaluation.

ET451U MICROWAVE COMMUNICATION

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course is designed to study microwaves and its applications areas. It explores the basic concepts of microwave devices. Fundamentals of microwave engineering will be premeditated. It offers concept of properties of transmission lines, reflection and transmission coefficient, propagation of microwave signal through a waveguide, etc. in this course, more emphasis is provided on understanding basics, visualizing the system as well as to study behaviour of signal through waveguides.

DESIRABLE AWARENESS/SKILLS

Knowledge of electromagnetic and communication engineering

COURSE OBJECTIVES

The objectives of offering this course are to

1. familiarize with microwave communication principles.
2. strengthen the ability of visualizing a system in three dimensions and develop a problem solving attitude.
3. conceptualize the applications of microwave engineering.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. exhibit the knowledge of properties of transmission lines.
2. implement the method of attenuation and noise measurement.
3. demonstrate the knowledge of the basics of microwave communication.
4. acquire the skill of understanding hidden messages in any mathematical equation.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2				2		2			3	1	1	3	2
2	1	3	3						3	3					
3		1	1					3	3		2	1	3	2	1
4	2			3			3			1		3	3		

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Transmission Lines

Basic principles, structures and properties of transmission lines, lossless wave guides, scattering parameters and circuit analysis, reflection coefficient and transmission coefficient, using coaxial connectors in measurement; standing wave and standing wave ratio, line impedance and admittance, impedance matching, microwave coaxial connectors

Microwave Waveguides

Rectangular waveguides, solutions of wave equations in rectangular coordinates, Transverse Electric (TE) modes in rectangular and circular waveguides, Transverse Magnetic (TM) modes in rectangular and circular waveguides, Transverse Electric and Magnetic (TEM) modes in rectangular and circular waveguides

Microwave Components

Directional couplers, circulators and isolators, Klystron tube, Reflex klystron, Travelling Wave Tube (TWT), solid state microwave devices: Varactor, PIN, Gunn and microwave tunnel diodes: principles of operation, microwave characteristics; microwave bipolar transistors: physical structure, configuration, principles of operation

Microwave Measurements

Description of microwave bench: different blocks and their features, precautions, microwave power measurement: bolometer method, measurement of attenuation, frequency, Voltage Standing Wave Ratio (VSWR), impedance measurements

Microwave Systems

System aspects of antennas, wireless communication systems, the radar equation, pulse radar, theory and applications of radiometry, total power radiometer; microwave propagation: atmospheric effects, ground effects, plasma effects

Text Books

1. Microwave Devices and Circuits, S. Liao, 3rd Edition, Prentice Hall of India Private Limited, 2003
2. Microwave Engineering, D. Pozar, 4th Edition, John Wiley and Sons, 2003

Reference Books

1. Microwave Measurements, R. Collier and D. Skinner, 3rd Edition, Institution of Engineering and Technology(IET), 2007
2. Microwave Measurements, E. L. Ginzton,1st Edition, McGraw Hill, 2005
3. Microwave Theory and Applications, S. Adam and H. Packard, 1st Edition, Hewlett-Packard Company, 2000

ET452U AUDIO VIDEO ENGINEERING

Teaching Scheme	**:** 03L+ 00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30 MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course is designed to explore fundamental principles and practical aspects of audio and video engineering. The course covers basic concept of sound recording and reproduction, monochrome and color television. It provides comprehensive coverage of advanced Television (TV) system, different advanced broadcasting systems and connectivity in telecommunication networks by using switching systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic concepts of analog and digital communication

COURSE OBJECTIVES

The objectives of offering this course are to

1. provide strong understanding of the fundamental principles and practical applications of audio and video engineering with latest updates.
2. learn and understand the working of real life video system and the different elements of video system with encoding/decoding techniques.
3. implement fundamentals of audio systems and basic acoustics.
4. learn switching in telephony.

COURSE OUTCOMES

On the successful completion of this course; student shall be able

1. understand the concept of basic television signal processing and telecommunication switching systems.
2. identify globally accepted color TV standards.
3. demonstrate the need of audio and video compression techniques in real life.
4. acquire knowledge of latest digital TV systems and applications.
5. describe the attributes of acoustics, sound engineering and storage media.
6. use the latest techniques, skills, and modern tools necessary for engineering practices.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2										3	1	
2	2	2	3	2	3								3	2	
3	3		3	2									3	3	
4	2			3	2								2		2
5	3		3	2									3	3	
6	2			3	2								2		2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Methods of Sound Recording and Reproduction

Introduction to disc recording, magnetic recording, optical recording: CD and DVD, monophony, stereophony, High Fidelity (Hi-Fi) system; Public Addressing (PA) system: Basics of acoustics, block diagram, requirement, characteristics, its planning for various uses; Introduction to blue ray disc format

Basic Concept of Television

Scanning methods, horizontal and vertical synchronization, introduction to camera tubes, aspect ratio, Kell factor, horizontal and vertical resolution, video bandwidth, positive and negative modulation, composite video signal, television transmission: VSB transmission, TV channels, standard, channels bands, basic block diagram of monochrome TV receiver

Color Television Receiver

Color fundamental, compatibility, frequency interleaving, color mixing, color camera tube, color purity, concept of color picture tubes-static and dynamic convergence, encoder, decoder and color different signals comparison, different system concepts: Phase Altering Line (PAL), Sequential Color and Memory (SECAM), National Television Systems Committee (NTSC) system, color TV transmitter and receiver block diagram

Advanced TV Systems and Techniques

Introduction to digital compression techniques, JPEG, MPEG techniques, block diagram of digital TV-transmitter and receiver, advanced displays: plasma, LCD, LED, organic LED, introduction to High-Definition TV (HDTV) transmitter and receiver

Advanced Broadcasting Systems

Introduction to digital cable TV, Conditional Access System (CAS), Direct to Home (DTH) system, video on demand, introduction to 3D Digital Terrestrial TV (DTV) system, study of Closed Circuit TV (CCTV) and DTV, introduction to Internet Protocol (IPTV) and mobile TV

Telephony

Introduction to fax, videophone, satphone, video conferencing, electronic space division switching-stored program control, centralized SPC, distributed SPC

Text Books

1. TV and video Engineering, A. M. Dhake, 2nd Edition, McGraw Hill, 2007
2. Modern Television Practice, R. R. Gulati, 2nd Edition, McGraw Hill, 2002
3. Audio and Video Systems, R. G .Gupta, 2nd Edition, McGraw Hill, 2010
4. Telecommunication Switching Systems and Networks, Thiagarajan Viswanathan, 36th printing, PHI Learning Private Limited, 2012

Reference Books

1. Television Engineering and Video Systems, R. G. Gupta, 2nd Edition, McGraw Hill, 2012
2. Television and video Engineering, A. M. Dhake, McGraw Hill, 2nd Edition, 2007
3. Basics Television and Video Systems, Bernard Grob, 5th Edition, McGraw Hill,1998

ET453UA WIRELESS SENSOR NETWORKS

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03Hrs		

COURSE DESCRIPTION

This course provides a wide idea of Wireless Sensor Networks (WSN), sensor node hardware architecture, network protocols as well as the applications of wireless sensor networks.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic concepts in digital communication and computer networking

COURSE OBJECTIVES

The objectives of offering this course are to

1. provide students with a firm grasp of the operating principles of wireless sensor networks.
2. understand the concepts of network architecture, protocols, data storage and manipulation.
3. introduce students with applications of wireless sensor networks.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. demonstrate the basic concepts of wireless sensor networks.
2. learn the design constraints and principles of network architecture.
3. compare different network and routing protocols.
4. identify different data manipulation techniques and applications of wireless sensor networks.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2		3										3	1	
2	2	2	3	2	2								3	2	
3		2	3		2							2	3	2	1
4	2		2	2	2							2	2		1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Fundamentals

Introduction to sensor networks, unique constraints and challenges, advantages and applications of sensor networks, performance metrics, design factors, mobile ad-hoc networks (MANETs) and wireless sensor networks, enabling technologies for wireless sensor networks

Sensor Node Hardware and Network Architecture

Single-node architecture, hardware components and design constraints, operating systems and execution environments, introduction to TinyOS and nesC, network architecture, optimization goals and figures of merit, design principles for WSNs, service interfaces of WSNs, gateway concepts

Deployment, Configuration and Network Protocols

Localization and positioning, coverage and connectivity, single-hop and multi-hop localization, self-configuring localization systems, sensor management; Issues in designing Media Access Control (MAC) protocol for WSNs, classification of MAC protocols, S-MAC protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

Routing Protocols

Issues in designing routing protocols, classification of routing protocols, energy-efficient routing, unicast, broadcast and multicast, geographic routing

Data Storage and Manipulation

Data centric and content-based routing, storage and retrieval in network, compression technologies for WSN, data aggregation technique

Applications

Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring, Building automation, industrial automation, medical applications

Text Books

1. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley and Sons, India, 2012
2. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, Springer Verlag, 1st Indian reprint, 2010
3. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann Publishers, 1st Indian reprint, 2013

Reference Books

1. Wireless sensor Network and Applications, Yingshu Li, MyT. Thai, Weili Wu, Springer

series on signals and communication technology, 2008
2. Wireless sensor Network: Technology, Protocols and Application, Kazem, Sohraby, Daniel Minoli, TaiebZanti, 1st edition, John Wiley and Sons, 2007

ET453UB ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS

Teaching Scheme	**:** 03L+ 00T Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30 MSE +60ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course introduces the fundamentals of Artificial Intelligence (AI) and Neural Networks (NN) as a multidisciplinary field that requires a range of skills in statistics, mathematics, analysis and their applications in engineering.

DESIRABLE AWARENESS

Calculus, Linear Algebra, Statistics and Predominant Programming Language

COURSE OBJECTIVES

The objectives of offering this course are to

1. provide the most fundamental knowledge to the students so that they can understand AI and NN.
2. identify problems where AI and NN techniques are applicable.
3. understand and apply some general purpose search algorithms.
4. make aware the students about the feedforward and feedback neural networks with their applications.

COURSE OUTCOMES

On the successful completion of this course, student shall be able to

1. demonstrate the fundamental knowledge of artificial intelligence, architecture of expert systems and intelligent systems.
2. compare and apply suitable search techniques for solving AI problems.
3. analyze and apply some feedforward neural networks.
4. analyze and apply some feedback neural networks.
5. learn the applications of NN in the domain of Electronics and Telecommunication engineering.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1									2	1	
2	2	3	2	2	2								3	1	
3	3	2	2	1	3								2	2	1
4	3	2	1	1									2	1	

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Fundamentals

Definition, applications and examples of artificial intelligence (AI), terminology, AI issues: concerns and ethical considerations, expert systems: architecture, functions of various parts, mechanism and role of inference engine, types of expert systems, tuning of expert systems

Intelligent Agents

Agents and environments, good behavior, the nature of environment, the structure of agents-agent programs, simple reflex agents, model-based reflex agents, goal-based agents, utility-based agents, learning agents

Problem Solving and Search

Problem solving agents, well-defined problems and solutions, formulating problems, examples problems, uninformed search strategies : breadth first, depth first, bidirectional search, comparison of uninformed search strategies, informed search strategies : greedy best fit search, memory bounded heuristic search, local search algorithm and optimization problems-hill climbing search and genetic algorithm

Fundamentals of neural networks

Definition, introductory terminology and concepts, characteristics of problems suitable for NN, applications of ANN, basic models of NN: types based on connections, learning and activation functions, mcculloch-pitts neuron, learning rules: Hebbian, perceptron, delta: least mean square (LMS) rule, Hebb network: theory, training algorithm

Feedforward Neural Networks

Single layer perceptron classifiers: Classification model, discriminant functions, linear machine and minimum distance classification, training and classification using the discrete perceptron, single layer continuous perceptron networks for linearly separable classifications, multi-category single layer perceptron network

Multilayer Feedforward Networks: Linearly non-separable pattern classification, Delta learning rule for multi-perceptron layer, feedforward recall and error back-propagation training

Feedback Neural Networks

Introduction, discrete Hopfield network-architecture, training and application algorithm, analysis, continuous Hopfield network, Boltzman machine

Case Studies

Application of neural networks in image classification, image segmentation, neural network controller, spectrum allocation in cognitive radio

Text books

1. Artificial Intelligence A modern approach, Stuart Russel, Peter Norvig, 2nd Edition, 14th reprint, Pearson Education, 2013
2. Artificial Intelligence and Neural Networks, K. Uma Rao, Pearson Education, 2011
3. Introduction to Neural Networks Using MATLAB 6.0, S. N. Sivanandanam, S. Sumathi, S. N. Deepa, 1st Edition, McGraw Hill Education, 2017
4. Introduction to Artificial Neural Systems, Zurada Jacek M., 5th Edition, Jaico Publishing House, 2004

Reference books

1. Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson, 3rd Edition, Prentice Hall of International, 2000
2. Artificial Neural Networks, Robert J. Schalkoff, Tata McGraw Hill Edition, 2011
3. An Introduction to Genetic Algorithms, Melanie Mitchell, 2nd Edition, MIT Press, 1999

ET453UC BIO-MEDICAL ELECTRONICS

Teaching Scheme	**:** 03L+ 00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA +30MSE +60ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course provides necessary background to understand and appreciate the field of biomedical engineering. It includes introduction to the biomedical instruments and measurements.

DESIRABLE AWARENESS/ SKILLS

Knowledge of basic human anatomy and physiology, electronic instruments and measurement

COURSE OBJECTIVES

The objectives of offering this course are to

1. understand fundamental aspect of biomedical
2. converse about the use, service and application of biomedical instruments

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. demonstrate the knowledge of the modern health care system and role of biomedical engineers.
2. evaluate the sources of biomedical signals, basic medical equipment.
3. analyze man-instrument system and implement the problems encountered in attempting to obtain biological measurements.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	3	1	1	1	1						3		
2	2	3	2	1	1	3	2						3		
3	2	3	2	1	1	2	2	3	2	1	1	2	3		

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Introduction to Human Body and Related Measurement

Elementary ideas of cell structure, action potential, propagation, heart and circulatory system, central nervous system, muscle-skeletal system, respiratory system, and reproductive system, basics of biomedical instrumentation system, sources of biomedical signals, transducers and sensors: pressure transducers, transducer for temperature measurement, displacement, position

and motion transducers, photoelectric transducers, etc.

Biomedical Signals and Equipment

Bioelectric signals Electrocardiogram (ECG), Electromayogram (EMG), Electroencephalogram (EEG), Electrooculogram (EOG) and Electroretinogram (ERG) and their characteristics, electrodes: types, interface issues, diagnostic, therapeutic and clinical laboratory equipment; electric safety: micro and macro shocks, grounding and safety

Signal Recording and Patient Monitoring System

Physiological pre-amplifier and specialized amplifiers, electrode systems and machines: ECG, EMG, and EEG; measurements: heart rate, pulse rate, respiration rate, blood pressure, ECG and EEG analysis, computerized catheterization, audiometer and audiometric tests, electrocautery machine, shortwave and microwave diathermy, patient monitoring, artificial respirator, defibrillators and pacemakers

Scanning Techniques

Basic X-ray components and circuits, types of X-ray machines biological effects of X-rays and precautions, Computerized Axial Tomography (CAT), ultrasonic and Magnetic Resonance Imaging (MRI) techniques: fetus monitoring and other, introduction to T-rays

Text books

1. Biomedical Instrumentation and Measurements, L. Cromwell, F. J. Weibell, E. A. Pfeiffer, 2nd Edition, Prentice Hall of India, 1980
2. Biomedical Instrumentation and Measurement, J. J. Carr, J. M. Brown, 3rd Edition, Pearson Education, 1996
3. Biomedical Instruments, D. S. Chaudhari, 1999

Reference books

1. Biomedical Instrumentation, R. S. Khandpur, 2nd Edition, Tata McGraw Hill, 2012
2. Medical Instrumentation, J. G. Webster, 2nd Edition, John Wiley, 2006
3. Principles of Medical Electronics and Biomedical Instrumentation, C. S. R. Rao, S. K. Guha,1st Edition, Universities Press, 2001

ET453UD FIBER OPTIC COMMUNICATION

Teaching Scheme	**:** 03L+ 00T Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30 MSE + 60ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course is designed to lay the foundation for studies in fiber optic communication. It will explore the basic concepts of fiber optic communication and understand types of fibers, such as monomode and multimode fibers. This course emphasizes on understanding basics of fiber optic Communication.

DESIRABLE AWARENESS/SKILLS

Awareness of basic concepts of fiber optic communication and LED, LASER diode

COURSE OBJECTIVES

The objectives of offering this course are to

1. understand basic concepts of fiber optic communication.
2. know the Laser diode and detectors.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. solve numerical based on Acceptance angles and Numerical aperture.
2. illustrate basic concepts of wave theory of optical propagation.
3. apply the wave theory of optical propagation.
4. identify the light emitting diodes and a LASER diode.
5. demonstrate measurements of attenuation, dispersion and refractive index in optical fiber.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	2	3	2	3	3				3		
2	3	2	2	2	2								3		
3	3	2	2	2	2								3		
4	3	2	2	2	2								3		
5	1	3	2	2	2								3		

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Introduction to Optical Fiber Communication Systems

Basic optical fiber communication system, comparison of optical fiber communication with other communication systems, ray theory of transmission and concept of acceptance angle and numerical aperture, meridonial and skew propagation, wave theory of optical propagation: cut-off wavelength, group velocity and group delay, types of fibers

Light sources and Detectors Sources

Light Emitting Diode (LED) and types: Surface Emitter, Edge emitter LEDs, LED operating characteristics, radiation patterns of Surface and Edge emitters

Light Amplification by Stimulated Emission of Radiation (LASER) diode: Principles, semiconductor LASER diode, hetero junction, strip-geometry, operating characteristics, radiation patterns; Detectors**: c**haracteristics or factors for their Selection, P-N photodiode, P-I-N Photodiode, avalanche photodiode; detector parameters: quantum efficiency, responsivity, speed of response

Losses and Measurements in Optical System

Losses in fibers, absorption, scattering and bending losses, signal distortion in optical fiber, material, waveguide, and intermodal dispersion

Noise in optical fiber: thermal, shot, signal to noise (S/N) ratio, noise equivalent power

Optical Transmission and Reception

Optical transmitter and receiver circuit**,** LED modulation and circuits, analog and digital circuits

Advanced Systems and Techniques

Fiber optics system design, optical power budgeting, rise time budgeting, detection: coherent, heterodyne and homodyne, Optical Time Domain Reflectometer (OTDR), optical networks: Synchronous Optical Networking (SONET)

Text Books

1. Optical Fiber Communication (Principles and Practice), J. M. Senior, 3rd Edition, Pearson Education, 2014
2. Optical Fiber Communication , G. Keiser , McGraw Hill , 5th Edition,2009

Reference Books

1. Fiber Optic Communication System, G. P. Agrawal , Wiley Publication, 2010
2. Fiber Optics and Optoelectronics, R. P. Khare, Oxford, 2010
3. Fiber Optic Communication System and components, V. Mishra, S. P. Ugale, Wliey India, 2012

ET454UA WAVELET TRANSFORM

Teaching Scheme	**:** 03L+ 00 T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30 MSE+ 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs.		

COURSE DESCRIPTION

Transforms are useful that makes easier understanding of the problem in one domain than in another does. Wavelet has established itself as an important tool in modern signal processing. Students should know fundamental concepts of signal processing and its applications and have to understand theory and importance of wavelet transform. The objective of this course is to apply the wavelet transform theory in necessary applications.

DESIRABLE AWARENESS/SKILLS

Knowledge of signal processing and transforms

COURSE OBJECTIVES

The objectives of offering this course are to

1. understand basics of wavelet theory.
2. illustrate the use of wavelet for signal processing.
3. explore the knowledge about different types of wavelet transforms.

COURSE OUTCOME

On the successful completion of this course, student shall be able to

1. compare Short Time Fourier Transform (STFT) and Continuous Wavelet Transform (CWT).
2. demonstrate the understanding of CWT and Discrete Wavelet Transform (DWT).
3. analyze and reconstruct signals using filter banks.
4. apply wavelet-based algorithms for signal and image processing applications.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		2	2												
2		2	2										3		
3		3	2		1							1	3	2	
4				2	3							1			2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Introduction

Stationary and non-stationary signals, necessity of transformation, brief introduction to Fourier transform and Short Time Fourier Transform (STFT), the uncertainty principle and time frequency tiling, different wavelet families

Continuous Wavelet Transforms (CWT)

Introduction, definition, basic properties of wavelets used in CWT, constant Q factor filtering, interpretation of time-frequency resolution, CWT: operator, redundancy, zoom property, inverse

Discrete Wavelet Transform (DWT)

Continuous and discrete wavelet transform, Haar basis: scaling and wavelet function, nested spaces and multi-resolution analysis of square-integrable functions, orthogonality of scaling and wavelet functions, normalization of Haar bases at different scales, support of a wavelet system, Daubechies wavelets (Daub2)

Filter Banks

Signal decomposition and its relation with two-channel filter bank, frequency response, signal reconstruction from coarse scale to fine scale, perfect matching filters, generating scaling functions and wavelet functions from filter coefficients, M-channel filter bank

DWT and Applications

Two-dimensional wavelets, image decomposition and reconstruction using DWT, wavelet packets; Transform coding, wavelet transform for signal and image compression, detection of signal changes, analysis and classification of audio signals using DWT, wavelet-based signal de-noising, wavelets in adaptive filtering, Orthogonal Frequency Division Multiplexing (OFDM) system using wavelet transform

Text Books

1. Insight into Wavelets from Theory to Practice, K. P. Soman, K. I. Ramchandran, N. G. Resmi, 3rd Edition, Prentice Hall of India, 2011
2. Wavelet transforms: Introduction, Theory and applications, Raghuveer Rao and Ajit S. Bopardikar, Pearson Education Asia, 2000

Reference Books

1. A Wavelet Tour of Signal Processing, S. Mallat, 2nd Edition, Academic Press, 1999
2. Fundamentals of Wavelets: Theory, Algorithms, and Applications, J. C. Goswami and A. K. Chan, 2nd Edition, Wiley, 2011
3. Multiresolution and Multirate Signal Processing: Introduction, Principles and Applications, V. M. Gadre, A. S. Abhyankar, 1st Edition, McGraw Hill India, 2016

ET454UB ANALOG AND DIGITAL COMPLEMENTARY METAL OXIDE SEMICONDUCTOR DESIGN

Teaching Scheme	**:** 03L+ 00 T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30 MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course will direct design and analysis of analog and digital circuits, precisely, design concepts relevant to real world applications, with a prominence on CMOS. It deals with the design and analysis of CMOS single stage and differential amplifiers at low and high frequencies of operation. This course introduces the design of current mirror and CMOS op-amp circuits. It also describes the noise analysis of CMOS amplifiers. Circuit performance is predicted by intuition and simple hand calculations and is verified by computer simulations.

DESIRABLE AWARENESS/SKILLS

Knowledge of CMOS operation and analog circuit analysis

COURSE OBJECTIVES

The objectives of offering this course are to

1. create models of moderately sized CMOS circuits that realize specified digital functions to design and analyse the single stage and differential MOS amplifiers.
2. analyze the MOS amplifiers and to study the frequency response of it.
3. understand the concepts of combinational and sequential circuits.

COURSE OUTCOMES

On successful completion of this course; student shall be able to

1. demonstrate the fundamentals of CMOS technology in analog and digital domain.
2. design CMOS analog and digital circuits.
3. apply backend tools for designing layout of analog and digital circuits.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	3	1			1	1			1	3	1	1
2	3	3	3	2	1	2	1		2	2	3	2	3	2	1
3	3	3	3	2	1	1	1	2	1	2	1	1	2	3	3

1-Weakly correlated 2-Moderately correlated 3-Strongly correlated

COURSE CONTENT

MOS Transistor Theory

Metal Oxide Semiconductor Field Effect Transistor **(**MOSFET) as analog device, MOS device models, MOSFET structure and switch, MOS characteristics, I-V characteristics, C-V characteristics, DC transfer characteristics, Complementary Metal Oxide Semiconductor (CMOS) Logic, CMOS logic gates, compound gate, pass transistors, tristate buffers, multiplexers, CMOS fabrication process and layout, stick diagrams

MOS Amplifiers

Single stage amplifiers, common source stage, source follower stage, common gate stage, cascode stage, folded cascade; differential amplifier, single ended differential operation, basic differential pair, common mode response; current mirrors, cascode current mirror, active current mirror

Combinational and Sequential Circuit Design

Introduction to combinational logic design, circuit families, static CMOS, ratioed circuits, cascode voltage switch logic, dynamic circuits, pass-transistor circuits; circuit pitfalls, threshold drops, ratio failures, leakage, charge sharing, power supply noise, hot spots; introduction to sequential circuit design, sequencing static circuits, circuit design of latches and flip-flops

Power and Delay

Dynamic, static and short circuit power dissipation, energy delay optimization; introduction to delay, timing optimization, RC delay model, effective resistance, gate and diffusion capacitance, transient response, elmore delay, linear delay model, logical effort, parasitic delay, delay in logic gates

Testing, Debugging, and Verification

Introduction, testers, test fixtures and test programs; logic verification principles, manufacturing test principles, design for testability

Text Books

1. Principles of CMOS VLSI Design, N. Weste and Kamaran, 4th Edition, Pearson, 2011
2. Design of Analog CMOS Integrated Circuits, B. Razavi, 2nd Edition, Tata McGraw Hill Edition, 2017

Reference Books

1. Digital Integrated Circuits: A Design Perspective, J. M. Rabaey, A. Chandrakasan and B. Nikolic, 2nd Edition, Pearson, 2016
2. CMOS Digital Integrated Circuits: Analysis and Design, S-M. Kang and Y. Leblebici, 3rd Edition, Tata McGraw Hill, 2002

3. CMOS Analog Circuit Design, P. E. Allen and D. R. Holberg, 2nd Edition, Oxford University Press, 2016

ET454UC ONLINE COURSE

Teaching Scheme	**:** 03L+00T; Total: 03	**Credits**	**:** 03
Evaluation Scheme	**:** 10 ISA + 30MSE + 60 ESE	**Total Marks**	**:** 100
ESE Duration	**:** 03 Hrs**.**		

COURSE GUIDELINES

Students have to select one online course available on digital learning sources (such as NPTEL) at that time. The online course should be selected such that its course content are relevant to the discipline of Electronics and Telecommunication Engineering and are not covered in the entire eight semesters of the program. It is required to select the online course as per the above guidelines before the start of the semester and to seek the approval from chairman Board of Studies (i. e. Head of Program). The selected course should be of 12 weeks for 3 credits.

Course coordinator will conduct ISA, MSE and institute will conduct ESE for the online course.

ET454UD PROGRAMMABLE LOGIC CONTROLLER and SUPERVISORY CONTROL AND DATA ACQUISITION

Teaching Scheme : 03L+ 00 T; Total: 03 **Credits** : 03
Evaluation Scheme : 10 ISA +30 MSE +60 ESE **Total Marks** : 100
ESE Duration : 03 Hrs.

COURSE DESCRIPTION

The course focuses on automatic process control systems and controllers, Programmable Logic Controller (PLC) and industrial protocol. It covers Supervisory Control and Data Acquisition (SCADA), PLC systems in terms of architecture, interface to the process hardware, functionality and application development of the controls of machinery.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic electrical and electronics engineering, control systems

COURSE OBJECTIVES

The objectives of offering this course are

1. define the role of industrial automation for various processes.
2. illustrate the application of PLC and SCADA based systems in process control.
3. discuss the basics of industrial communication protocol.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. apply the knowledge of automation in machine control.
2. design and conduct practical setup applicable in manufacturing, testing and maintenance.
3. build the automation system for fast and value added quality products for economic growth through technological development.
4. judge and solve engineering solutions for the fast growing industrial sector with a reliable atomized system using PLC and SCADA system.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2			2	2	2	2	2	1	1	1	1	
2	3	2	2	2	2	1	1						1	1	
3	3	3	2	**1**	1				1	1			1	1	
4	3	2	2	1	1				1	1			1	1	

1-Weakly correlated 2-Moderately correlated 3- Strongly correlated

COURSE CONTENT

Process Control Systems and Controllers

Introduction, process control, the elements in a control loop, process facility considerations, units and standards, instrument accuracy; Control modes actions: on/off, differential, proportional, derivative, integral, PID; Implementation of controllers in loop: on/off action pneumatic, on/off action electrical, PID action pneumatic, PID action control circuits, PID electronic

Introduction to Programmable Logic Controller (PLC)

Introduction, programmable controller, control operation, input modules - analog and discrete input, special function input; output modules: analog and digital, smart input and output modules; Ladder : diagrams, input and output symbols, layout, gate equivalent, applications, selection criteria for PLC

Industrial Protocol and Communications

Evolution of signal standard, overview of Open Systems Interconnection (OSI) model – functions, protocols; functions of Transmission Control Protocol / Internet Protocol (TCP/IP) layers, TCP/IP protocol, Distributed Network Protocol-3 (DNP3), International Electrotechnical Commission's IEC61850 layered architecture, Control and Information Protocol (CIP), DeviceNet, ControlNet, EtherNet/IP, Flexible Function Block process (FFB), Process Field bus (Profibus)

Supervisory Control and Data Acquisition (SCADA)

Overview of SCADA, concept of supervisory control, process measurement, data communication, logic, field devices actuators, reliability, communication, topology, architecture and new communication methods, common applications: scanning, monitoring, alarms, commands, data gathering, report generation, achieving. Industry specific applications: oil and gas production, pipelines, electric generation and transmission, irrigation. Newer industry applications: optimizing dead time, communication methods, security implications of the SCADA protocols, Introduction to Distributed Control System (DCS)

Text Books

1. Fundamentals of Industrial Instrumentation and Process Control, W. C. Dunn, 2nd Edition, McGraw Hill Education, 2018
2. Introduction to Programmable controller, Garry Dunning, 2nd Edition, Thomson Asia, Pvt Ltd, Singapore, 2002
3. Securing SCADA System, R. L. Krutz, 1st Edition, Wiley Publishing, 2007

Reference Books

1. Instruments Engineers Handbook Process Control, VoL-II, B. G. Liptak, 4th Edition, CRC Press, 2006
2. SCADA: Supervisory Control and Data Acquisition, S. A. Boyer, 4th Edition, ISA Publishing, 2010
3. Programmable Controllers, G. L. Batten, 2nd Edition, McGraw Hill Inc., 2004
4. Computer-Based Industrial Controls, Krishna Kant, 2nd Edition, PHI Learning Pvt Ltd, New Delhi 2010
5. Programmable Logic Controllers: Principles and Application, J. W. Webb, Ronald A. Reis, 5th Edition, McGraw Hill Inc., 2006
6. Programmable Logic Controllers Programming Methods and Applications, J. R. Hackworth, Frederick D., Hackworth Jr., 3rd Edition, Pearson Education, 2005

ET455U MICROWAVE COMMUNICATION LAB

Teaching Scheme : 02P; Total: 02 **Credits** : 01
Evaluation Scheme : 25ICA + 25 ESE **Total Marks** : 50
ESE Duration : 03 Hrs

COURSE DESCRIPTION

This course is designed to study microwaves and application areas of microwave energy. This course will explore the basic concepts of microwave devices. It offers knowledge of fundamentals of microwave engineering

DESIRABLE AWARENESS/SKILLS

Fundamentals of microwave engineering

COURSE OBJECTIVES

The objectives of offering this course are to

1. make strong foundation of microwave engineering.
2. familiarize with microwave communication principles.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. demonstrate the knowledge of the basics of microwave communication.
2. create and execute the properties of microwave components.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1			3	3		3				1	1	1	3		1
2						3	3	3				3	1		3

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire curriculum of course ET451U. The list given below is just a guideline.

List of Experiments

- Microwave bench
- Microwave components
- Klystron Tube
- Gunn diode
- Directional coupler

- Microwave connectors
- Reflex klystron
- Circulators
- Isolators
- Tunnel diodes
- LED and photo diode
- Propagation loss and bending loss
- VNA (Vector Network Analyzer)

Note

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET456U AUDIO VIDEO ENGINEERING LAB

Teaching Scheme : 02P Total: 02 **Credits** : 01
Evaluation Scheme : 25ICA + 25ESE **Total Marks** : 50

COURSE DESCRIPTION

This course is designed to explore fundamental principles and practical aspects of audio and video engineering. The course covers basic concept of sound recording and reproduction, monochrome and color television. It provides comprehensive coverage of advanced Television (TV) system, different advanced broadcasting systems and connectivity in telecommunication networks by using switching systems.

DESIRABLE AWARENESS/SKILLS

Knowledge of basic concepts of analog and digital communication

COURSE OBJECTIVES

The objectives of offering this course are to

1. provide students with a strong understanding of the fundamental principles and practical applications of audio and video engineering with latest updates.
2. learn and understand the working of real life video system and the different elements of video system with encoding/decoding techniques.
3. implement fundamentals of audio systems and basic acoustics.
4. learn switching in telephony.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. understand the concept of basic television signal processing and telecommunication switching systems.
2. identify globally accepted color TV standards.
3. demonstrate the need of audio and video compression techniques in real life.
4. acquire knowledge of latest digital TV systems and applications.
5. describe the attributes of acoustics, sound engineering and storage media, use the latest techniques, skills, and modern tools necessary for engineering practices.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2											3		1
2	2	3	3		2								1	3	
3	3		3	1		3	1						3		3
4	3	1	1	3	3			1					3	1	2
5	1	1	1		2	1		3					3		1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire curriculum of course ET452U. The list given below is just a guideline.

List of Experiments

- Color TV receiver
- Voltage and waveform analysis for color TV
- Alignment and fault finding of color TV using pattern generator
- HDTV
- Digital TV
- Visit to TV transmitter/Studio
- DTH and set top box
- CD/DVD players
- PA system with cordless microphone
- FAX
- Visit to telephone exchange

Note

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

ET457UA WIRELESS SENSOR NETWORKS LAB

Teaching Scheme : 02P; Total: 02 **Credits** : 01
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks** : 100
ESE Duration : 03Hrs

COURSE DESCRIPTION

This course is designed to acquire hands-on experience of wireless sensor network with any simulation tool. It helps to understand and validate the theory behind wireless sensor networks and covers experiments on installation of network simulator, simulation of sensor nodes, communication between mobile nodes, and different routing protocols.

DESIRABLE AWARENESS/SKILLS

Fundamentals of the course wireless sensor networks and computer networking

COURSE OBJECTIVES

The objectives of offering this course are to

1. provide students with a firm grasp of the operating principles of wireless sensor networks.
2. understand and implement the concepts of network architecture, protocols, data storage and manipulation.
3. introduce applications of wireless sensor networks.

COURSE OUTCOMES

On the successful completion of this course; students shall be able to

1. install wireless sensor networks in a simulator.
2. demonstrate the understanding of design constraints and principles of network architecture.
3. simulate and compare different network and routing protocols.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2		3										3	1	
2	2	2	3	2	2								3	2	
3		2	3		2							2	3	2	1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire curriculum of course ET453UA using simulation software. The list given below is just a guideline.

List of Experiments

- Introduction of wireless sensor network applications and its simulation
- Network Simulator installation of wireless sensor network
- TCL script for transmission between mobile nodes
- TCL script for sensor nodes with different parameters
- TCL script for UDP/ CBR traffic in WSN nodes
- TCL script for TCP / CBR traffic in WSN nodes
- Routing protocol in NS2 for AODV protocol
- Routing protocol in NS2 for DSR protocol
- Routing protocol in NS2 for TORA protocol
- Study other wireless sensor network simulators

Note

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S10).

- **ESE –** The end semester examination (ESE) for this laboratory course shall be based on oral examination to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET457UB ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS LAB

Teaching Scheme	**:** 02 PR; Total: 02	**Credits**	**:** 01
Evaluation Scheme	**:** 25 ICA + 25 ESE	**Total Marks**	**:** 50

COURSE DESCRIPTION

This course introduces the student to practical aspects of artificial intelligence (AI) and neural networks using a suitable simulation environment. The course covers experiments on standard problems in AI and neural networks.

DESIRABLE AWARENESS

Concepts of the course Artificial Intelligence and Neural Networks and knowledge of simulator environment

COURSE OBJECTIVES

The objectives of offering this course are to

1. provide students with a firm grasp of the operating principles of artificial intelligence and neural networks.
2. simulate the concepts of artificial intelligence to solve some standard AI problems.
3. simulate the concepts of neural networks.

COURSE OUTCOMES

On the successful completion of this course, students shall be able to

1. compare and apply suitable techniques for solving AI problems.
2. analyze and apply some feedforward neural networks.
3. analyze and apply some feedback neural networks.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2								2	1	1
2	1	3	2	2	2								2	1	1
3	1	3	2	2	2								2	1	1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire curriculum of course ET453UB. The list given below is just a guideline.

List of Experiments

- Introduction to Prologue
- Monkey Banana problem
- Four-Queens problem
- Traveling salesman problem
- Demonstration of genetic algorithm using standard module
- Learning rules and activation functions in neural network
- Multilayer perceptron and Hebb neuron model
- Demonstration of LMS learning rul.
- Supervised learning using neural network (NN) Toolbox
- Perceptron neural network algorithm
- Error back propagation algorithm using standard module
- Auto associative network using outer product rule

Note

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S10).

- **ESE –** The end semester examination (ESE) for this laboratory course shall be based on oral examination to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET457UC BIO-MEDICAL ELECTRONICS LAB

Teaching Scheme	**:** 02P Total: 02	**Credits**	**:** 02
Evaluation Scheme	**:** 25ICA + 25ESE	**Total Marks**	**:** 50
ESE Duration	**:** 03 Hrs		

COURSE DESCRIPTION

This course provides necessary background to understand and appreciate the field of biomedical engineering. It includes introduction to the biomedical instruments and measurements.

DESIRABLE AWARENESS/ SKILLS

Knowledge of basic human anatomy and physiology, electronic instruments and measurement

COURSE OBJECTIVES

The objectives of offering this course are to

1. understand fundamental aspect of course.
2. converse about the use, service and application of biomedical instruments.

COURSE OUTCOMES

On the successful completion of this course student shall be able to

1. demonstrate the knowledge of the modern health care system and role of biomedical engineers.
2. perform the experiments on biomedical signals, basic medical equipment express use of scanning techniques.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	3	1	1	1	1						3	2	1
2	2	3	1	2		3	2						1	3	2
3	2	3	2	1	1	2	2				1	2	2		1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum eight experiments shall be performed to cover entire curriculum of course ET453UC.The list given below is just a guideline.

List of Experiments

- Biomedical electrodes
- Blood pressure measurement
- ECG amplifier

- ECG waveforms
- EEG waveforms
- Pulse rate and temperature
- Shortwave / Microwave diathermy
- Audiometer
- Ultrasound technique
- X -ray, CAT scan
- MRI technique
- Grounding and safety
- Field visits to hospital/ medical college

Note

- **ICA –**It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

- **ESE** – It shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET457UD FIBER OPTIC COMMUNICATION LAB

Teaching Scheme	**:** 02P Total: 02	**Credits**	**:** 01
Evaluation Scheme	**:** 25 ICA+25 ESE	**Total Marks**	**:** 50
ESE Duration	**:** 03Hrs		

COURSE DESCRIPTION

This course is designed to lay the foundation for studies in areas such as fiber optic communication. It will explore the basic concepts of fiber optic communication and understand types of fibers, such as single mode fibers, monomode fibers and multimodal fibers are studied. This course emphasizes on understanding basics of fiber optic Communication.

COURSE OBJECTIVES

The objectives of offering this course are to

1. implement optical fiber circuits.
2. study LASER diode and LED.
3. study monomode fibers, multimode fibers and graded index fibers.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. implement electrical characteristics of Laser diode.
2. design analog and digital link for optical fibers.
3. realize set up for optical fiber communication.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2		3										3	1	
2		2	3		2							2	3	2	1
3	2		2	2	2							2	2		1

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

Minimum ten experiments shall be performed to cover entire theory content of the course 453UD. The list given below is just a guideline.

List of Experiments

- V-I Characteristics of LED
- Electrical Characteristics of Laser diode

- Photometric characteristics of LED of different wavelengths
- Numerical Aperture of single mode and multi mode graded index fiber
- Attenuation due to angular misalignment
- Attenuation due to longitudinal misalignment
- Propagation loss of given fiber
- Bending loss of given fiber
- Spectral characteristics of LED/LASER diode
- Set up analog link and measure various parameters like 3 db optical bandwidth, 3db electrical bandwidth
- Set up digital link and measure various parameters like 3 db optical bandwidth, 3db electrical bandwidth
- Fiber Optical Connectors
- OTDR

Note

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S10).**

- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET458U PROJECT PHASE-II

Teaching Scheme : 04 P; Total: 04 **Credits** : 03
Evaluation Scheme : 100 ICA+ 100 ESE **Total Marks** : 200

COURSE DESCRIPTION

The course Project Phase-II is the extension of the work completed in the course Project Phase-I. It is expected to exert on design, development and testing of the proposed work as per the schedule.

DESIRABLE AWARENESS/SKILLS

Knowledge of engineering courses studied earlier, skills achieved through laboratory courses and Project Phase-I

COURSE OBJECTIVES

The objectives of offering this course are to

1. develop ability to synthesize knowledge and skills previously gained and applied to an in-depth.
2. suggest, design and execute the technical work in a group.
3. make students capable to select from different methodologies, methods and forms of analysis to produce a suitable design, and justify their design.
4. enhance the ability to present the findings of their technical solution in a written report.
5. inculcate leadership attitude and team spirit.

COURSE OUTCOMES

On successful completion of this course, student shall be able to

1. demonstrate ability to synthesize knowledge and skills previously gained.
2. suggest, design and implement the technical work using suitable methodology.
3. prepare and present technical report in appropriate format.
4. exhibit leadership attitude and team spirit.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	3	2	3		2						3	2	
2	3	2	2	3	3	2	2						3	2	
3		3	2	2					3				3	3	
4			2	2						3	3	3	2		3

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

- The remaining work of Project Phase – I shall be undertaken and completed by the same group of students in this course as the project is a year-long activity.
- **Project Phase - II deliverables:** A project report as per the specified format (available on the institute website), developed system in the form of hardware and/or software. In addition, student shall maintain a record of continuous progress (Log Book) duly signed by guide and present as Project Phase - II deliverable along with report.

EVALUATION SYSTEM

It includes Internal Continuous Assessment (ICA) and End Semester Examination (ESE). Guidelines for ICA and ESE are given below:

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by departmental committee consisting of two - three faculty members of the department (one of which shall be guide) appointed by the HoD following the principle of continuous evaluation i.e. project reviews as per academic calendar.
- Examiners shall judge the student on the basis of presentation, deliverables of Project Phase II described earlier. In case of unsatisfactory performance, committee may recommend repeating the Project Phase – II work and such group shall re-register for this course in next semester.

End Semester Examination (ESE)

- The End Semester Exam for this course shall be based on presentation and demonstration of Project Phase – II deliverables followed by oral examination. It shall be evaluated by two examiners out of which one examiner shall be out of institute and other shall be guide. (If guide is absent at the time of examination, the other examiner shall be the committee member of ICA evaluation)

ET459U PROFESSIONAL INTERNSHIP

Teaching Scheme : 00 L+ 00 T; Total 00 **Credits** : 02
Examination Scheme: 75 ICA **Total Marks** : 75

COURSE DESCRIPTION

Internship can make a big difference in the overall career of a student. One of the issues for the fresher while searching for the job is work experience. In today's competitive world, every employer is looking for the best candidate with work experience. Getting a degree is not good enough for a student to secure a good job, they need industrial experience and here internship plays a crucial role for them. A professional internship is an opportunity for students when they are trained for the skills they are good at and it provides them a chance to apply their knowledge practically in industries.

DESIRABLE AWARENESS/SKILLS

Knowledge of engineering courses studied earlier and skills achieved through practical courses

COURSE OBJECTIVES

The objectives of the course are to

1. open the opportunities for students to apply their theoretical knowledge they have learnt in their classroom.
2. be familiar with the industrial environment and work culture.
3. provide the practical exposure of how to work with others in a team, collaboration with other members, time management, communication, punctuality and so many other aspects.

COURSE OUTCOMES

On successful completion of the course, student shall be able to

1. apply their theoretical knowledge in the classroom for solving real life engineering problems.
2. demonstrate the knowledge of real life industry experience and exposure.
3. connect with the professionals, that helps to the career of students in the future.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2	2			3				3	1	3
2	2		3	3	3	3	2		3		3	2	3	2	3
3								3	3	3		3	3	3	2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

Professional internship of six weeks (one training program of minimum two weeks) is required to be completed during the span of IV to VIII semester (preferably during vacation or weekends period). The course will be assessed in VIII semester.

The internship work shall be decided and / or approved by departmental T & P coordinator in consultation with head of program.

Individual or group of students shall undergo internship in any industry relevant to the engineering discipline (Electronics and Telecommunication Engineering) for minimum six weeks fulltime and / or training program/s (preferably of two weeks) providing practical / industrial / field exposure.

COURSE DELIVERABLES

Every student shall submit the satisfactory completion certificate of the Internship / Training program from the concerned industry / training organization / institute. Also, it is required to submit a report in the format prescribed by the department duly signed by course coordinator and Head of Program.

EVALUATION SYSTEM

It includes Internal Continuous Assessment (ICA). Guidelines for ICA are given below:

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by course coordinator appointed by the head of program.
- Course coordinator shall judge the student on the basis of presentation and deliverables of the course.

ET460U SPECIAL STUDY / ENTREPRENEURSHIP DEVELOPMENT PROGRAM

Teaching Scheme	**:** 00 L+ 00; Total 00	**Credits**	**:** 02
Examination Scheme:	25 ICA	**Total Marks**	**:** 25

COURSE DESCRIPTION

This multi-option course explores specialized study of state-of-the-art technology, the knowledge of industry / organization, new trends in manufacturing, maintenance and safety or provides actual work experience with exposure to industrial environment or boost entrepreneurial aspirations or analytical skills to solve real life problems as per student interest.

DESIRABLE AWARENESS/SKILLS

Knowledge of engineering courses studied earlier and skills achieved through laboratory courses, clarity of goal setting about career path ahead after completion of degree program

COURSE OBJECTIVES

The objectives of offering the course are to

1. introduce the basic industries and the process/product development cycle.
2. be familiar with the industrial environment and work culture.
3. learn the importance of entrepreneurial skills.
4. emphasize intuitive understanding and practical implementations of the theoretical concepts.

COURSE OUTCOMES

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

1. demonstrate the knowledge of organizational set up of an industry.
2. evaluate and analyze the manufacturing, material handling, maintenance, safety standardsand environmental considerations in industry.
3. explore entrepreneurial ways to understand the impact of engineering solutions in a global,economic, environmental and social context.
4. exhibit analytical skills to solve real life problem as per student interest.

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO-RELATION

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		3	3	3	2	2							3	1	3
2			3	3	3	3							3	2	3
3										3	3	3	3	3	2
4		2	2	3	3	3			3				2		2

1-Weakly correlated 2 - Moderately correlated 3 - Strongly correlated

COURSE CONTENT

This course shall be completed preferably during the summer vacation after sixth semester but inexceptional cases can be completed during the winter vacation after seventh semester or during the weekends of seventh semester. **Under any circumstances; this course shall be completed before the commencement of eighth semester.**
Scope of this course includes (Any two) the following:

Special Study: The students interested in higher studies in engineering/ management/ etc or to start own business can opt for special study. It shall include study of typical industrial / social / domestic / organizational real life problem as approved by the course coordinator to formulate problem and suggest remedies / alternative approaches to solve the problem or students can undergo any market or any other suitable statistical survey and obtain some result from the survey.

Entrepreneurship Development Program: Individual or group of students shall undergo Entrepreneurship Development Program (EDP) of 3-5days organized by professional / Government / public / private sector organization. Department can organize such EDP training to facilitate the students. The students interested to start own enterprise/business can opt for EDP.

Industrial Visits and Training Program: Industry visits for minimum four industries local or outstation shall be carried out by each student. Department shall arrange the industrial visits during the summer/winter vacations after sixth/seventh semester or in exceptional cases weekends during the seventh semester. Industries shall be related to solar energy/ power electronics/ telecom sector/ computerhardware-software/ manufacturing/ automobile automation/ bio-tech-agriculture sector/power station, TV-Radio Station/ sugar-chemical factory/ any other relevant industry approved by course coordinator.

COURSE DELIVERABLES

A report in the format provided by department/course coordinator duly signed by course coordinator and HoD, along with the appropriate (visit / training / attendance / visit for special study) certificate, has to be submitted by the students.

EVALUATION SYSTEM

It includes Internal Continuous Assessment (ICA). Guidelines for ICA are given below:

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by course coordinator appointed by the HoD.
- The course coordinator shall judge the student on the basis of presentation, deliverables of the course described earlier.