

# **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  
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE  
ESE Duration : 03 Hrs.

Credits : 03  
Total Marks : 100

### 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

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

### **Reference Book**

1. Financial Accounting for Management, Paresh Shah, 3<sup>rd</sup> Edition, Oxford University Press, 2019
2. Financial Management Text, Problems and Cases, Khan and Jain, 8<sup>th</sup> Edition, Tata McGraw Hill, 2018
3. Financial Management, Ravi Kishore, 8<sup>th</sup> 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.

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### **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, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2008
2. Computer Network, A. S. Tanenbaum and D. J. Wetherall, 5<sup>th</sup> Edition, Pearson, 2011
3. Data and Computer Communications, W. Stallings, 8<sup>th</sup> Edition, Pearson, Prentice Hall of India, 2007

### **Reference Books**

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

## ET402UA MOBILE COMMUNICATION

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

**Credits** : 03  
**Total Marks** : 100

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### **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, 3<sup>rd</sup> Edition, 2010
2. Mobile Communications, J. Schiller, 2<sup>nd</sup> Edition, Pearson Education, 2001

### **Reference Books**

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



## ET402UB MIXED SIGNAL DESIGN

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

**Credits** : 03  
**Total Marks** : 100

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### 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, 2<sup>nd</sup> Edition, Oxford University Press, 2010
3. Design of analog CMOS integrated circuits, Behzad Razavi , 2<sup>nd</sup> 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, 1<sup>st</sup> 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

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### 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, 1<sup>st</sup> Edition, Prentice Hall, 1978
2. Speech and Audio Signal Processing, B. Gold and N. Morgan, 1<sup>st</sup> Edition, Wiley, 2011
3. Artificial Neural Network, B. Yegnanarayana, 1<sup>st</sup> Edition, Prentice Hall of India, 2005

### **Reference Books**

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

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

# ET402UD VERY LARGE SCALE INTEGRATION DESIGN

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

Credits : 03  
Total Marks : 100

## 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, 4<sup>th</sup> Edition, Pearson Publication, 2011

### **Reference Books**

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

# ET403UA INTERNET OF THINGS

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

**Credits** : 03  
**Total Marks** : 100

## 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, 1<sup>st</sup> Edition, Academic Press, 2014
2. Internet of Things: A Hands-On Approach, V. K. Madisetti and A. Bahga, 1<sup>st</sup> Edition, Publisher VPT, 2014

### **Reference Books**

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, F. daCosta, 1<sup>st</sup> 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.

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### **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, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2017
2. Satellite Communications, T. Prattt, 3<sup>rd</sup> Edition, Wiley India, 2003

### **Reference Books**

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

## ET403UC ADAPTIVE SIGNAL PROCESSING

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

**Credits** : 03  
**Total Marks** : 100

### 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. Stearns, Pearson Education India, 2005
2. Adaptive Filter Theory, S. Haykin, 4<sup>th</sup> 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  
 Evaluation Scheme : 10 ISA+30MSE +60ESE  
 ESE Duration : 03 Hrs

Credits : 03  
 Total Marks : 100

## 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, 2<sup>nd</sup> Edition, Pearson Education Inc., 2006
2. Microsystem Design, S. D. Senturia, 1<sup>st</sup> Edition, Springer Publication, 2000
3. MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering, T. R. Hsu, 6<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2002

### **Reference Books**

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

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

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### **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  
**Evaluation Scheme** : 10 ISA +30 MSE +60 ESE  
**Duration of ESE** : 03 Hrs

**Credits** : 03  
**Total Marks** : 100

## 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, 7<sup>th</sup> Edition (13<sup>th</sup> reprint), TMH, 2012
2. Modern Digital Electronics, R. P. Jain, 4<sup>th</sup> Edition, TMH New Delhi, 2010

### **Reference Books**

1. Electronic Devices and Circuit Theory, R. L. Boylestad and Louis Nashelsky, 7<sup>th</sup> Edition, 1998
2. Op-amps and Linear Integrated Circuits, R. A. Gayakwad, 4<sup>th</sup> Edition, PHI, 2008
3. Electronics Principles and Applications, C. A. Schuler, 9<sup>th</sup> 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  
**Evaluation Scheme** : 10 ISA + 30MSE + 60 ESE  
**ESE Duration** : 03 Hrs

**Credits** : 03  
**Total Marks** : 100

## 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, 2<sup>nd</sup> Edition, Pearson Education, 2010
2. Wireless Communications and Networking, V. Garg, 1<sup>st</sup> Edition, Morgan Kaufmann Publishers, 2007

### **Reference Books**

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

## ET405U COMPUTER COMMUNICATION LAB

Teaching Scheme : 02P Total: 02  
Evaluation Scheme : 25 ICA + 25 ESE

Credits : 01  
Total Marks : 50

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### 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

CO	PO												PSO		
	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 ET402U. 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  
**Evaluation Scheme** : 25 ICA + 25 ESE  
**ESE Duration** : 03Hrs

**Credits** : 01  
**Total Marks** : 50

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### 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.
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# ET406UC SPEECH AND AUDIO SIGNAL PROCESSING LAB

Teaching Scheme : 02P, Total: 02  
Evaluation Scheme : 25 ICA +25 ESE  
ESE Duration : 03 Hrs.

Credits : 01  
Total Marks : 50

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## 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  
Evaluation Scheme : 25 ICA +25 ESE  
ESE Duration : 03 Hrs.

Credits : 01  
Total Marks : 50

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### 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.
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## ET409U INDUSTRIAL LECTURES

Teaching Scheme : 01 L; Total: 01  
 Evaluation Scheme : 50 ICA

Credits : 01  
 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 to world 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 state in 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) with comfort.

### **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 in general 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 of course 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 and contribution 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  
**Evaluation Scheme** : 10 ISA + 30MSE + 60 ESE  
**ESE Duration** : 03 Hrs

**Credits** : 03  
**Total Marks** : 100

## 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, 3<sup>rd</sup> Edition, Prentice Hall of India Private Limited, 2003
2. Microwave Engineering, D. Pozar, 4<sup>th</sup> Edition, John Wiley and Sons, 2003

### **Reference Books**

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

## ET455U MICROWAVE COMMUNICATION LAB

Teaching Scheme : 02P; Total: 02  
Evaluation Scheme : 25ICA + 25 ESE  
ESE Duration : 03 Hrs

Credits : 01  
Total Marks : 50

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### 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.

## ET454UA WAVELET TRANSFORM

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

**Credits** : 03  
**Total Marks** : 100

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



# ET454UB ANALOG AND DIGITAL COMPLEMENTARY METAL OXIDE SEMICONDUCTOR DESIGN

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

**Credits** : 03  
**Total Marks** : 100

## **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 cascode; 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, 4<sup>th</sup> Edition, Pearson, 2011
2. Design of Analog CMOS Integrated Circuits, B. Razavi, 2<sup>nd</sup> Edition, Tata McGraw Hill Edition, 2017

### **Reference Books**

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

3. CMOS Analog Circuit Design, P. E. Allen and D. R. Holberg, 2<sup>nd</sup> 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.

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### **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  
**Evaluation Scheme** : 10 ISA +30 MSE +60 ESE  
**ESE Duration** : 03 Hrs.

**Credits** : 03  
**Total Marks** : 100

### **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, 2<sup>nd</sup> Edition, McGraw Hill Education, 2018
2. Introduction to Programmable controller, Garry Dunning, 2<sup>nd</sup> Edition, Thomson Asia, Pvt Ltd, Singapore, 2002
3. Securing SCADA System, R. L. Krutz, 1<sup>st</sup> Edition, Wiley Publishing, 2007

## **Reference Books**

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

## ET407U SEMINAR

Teaching Scheme : 01 L Total: 01  
Evaluation Scheme : 25 ICA + 25 ESE

Credit : 01  
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 suitable solution.
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 examinee shall be out of institute and other shall be guide.

## ET459U PROFESSIONAL INTERNSHIP

Teaching Scheme : 00 L+ 00 T; Total 00  
Examination Scheme: 75 ICA

Credits : 02  
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  
**Examination Scheme:** 25 ICA

**Credits** : 02  
**Total Marks** : 25

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## **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 standards and 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 in exceptional 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 3-5 days 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/ computer hardware-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.

## ET461U PROJECT

**Teaching Scheme** : 04P; Total: 04  
**Evaluation Scheme** : 100 ICA + 100 ESE

**Credits** : 06  
**Total Marks** : 200

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### **COURSE DESCRIPTION**

The project for option-II curriculum structure shall be industry-based project.

(Project to be carried out in industry and shall be completed in one semester (VIII semester) only, unlike phase-I and phase-II in VII and VIII semester for option-I of curriculum structure.)

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 industry needs, 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
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	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 work shall be carried out either individually or in a group of 2-4 students and shall preferably be carried out 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 the semester.
- 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 industry-mentor, 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 individual student / 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.

### **PROJECT DELIVERABLES**

- A project report as per the specified format (available on the institute website), and a developed system in the form of hardware and/or software shall be the main deliverables of the Project. In addition, student shall maintain a record of continuous progress (Log Book) duly signed by guide and industry mentor and present as Project deliverable along with report. Also, the student / group of students have to submit a certificate of satisfactory completion of the project by the concerned industry / organization in which the project has been carried out by the student.

### **FORMAT FOR LOG BOOK**



Sr. No.	Date and Time; numbers of present candidates	and Roll of	Work done (discussion with guide / industry mentor) during the session	Guide's Remark / Industry mentor's remark	Dated sign of Guide / industry mentor

### **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.
- Examiners shall judge the student on the basis of presentation, deliverables of Project described earlier.

#### **End Semester Examination (ESE)**

The End Semester Examination for this course shall be based on presentation and demonstration of Project 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 the guide.