WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus
For
Final Year B.Tech. in Electronics and Telecommunication Engineering

W.E.F. 2024-25

Electronics and Telecommunication Engineering Department

Department Vision

To be a distinguished center for nurturing the holistic development of competent young engineers in the electronics and allied field.

Department Mission

1. To inculcate and stimulate Electronics & allied Engineering proficiency amongst students through quality education and innovative educational practices.
2. To create engineering professionals with social consciousness.
3. To foster technical skills of students through creativity and critical thinking.
4. To enhance soft skill set of students which is crucial for career success through effectual training.

Electronics and Telecommunication Engineering
Under Graduate Program
Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in Electronics and Telecommunication Engineering and allied fields.
2. Graduates will manifest technological progression, hardware & software skills to fabricate sustainable, energy efficient and futuristic solutions to pursue successful professional careers in multidisciplinary fields.
3. Graduates will demonstrate professional ethics, effective communication, teamwork, leadership qualities and ability to relate engineering issues to broader social context along with lifelong learning.

Program Outcomes (POs)

The program outcomes of B.Tech. E&TC Engineering Program are summarized as following:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and cultural, societal and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities, relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

1. Graduates will be able to attain a solid foundation in Electronics and Telecommunication Engineering with an ability to function in multidisciplinary environment.
2. Graduates will be able to use techniques and skills to design, analyze, synthesize, and simulate Electronics and Telecommunication Engineering components and systems.
3. Graduate will be capable of developing programs in Assembly, High level and HDL languages using contemporary tools for software development.

Legends used–

L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanity and Social Science
NPTEL	National Programme on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Course Code Format:

2	1	E	T	U/P	2	C	C	1	T / L
Batch Entry Year		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Course Type		Course Serial No. 1-9	T-Theory, L-Lab session A-Tutorial P-Programming/ Design / Drawing / Tools

Program Code	
ET	Electronics and Telecommunication Engineering
Course Type	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Core Compulsory Course
SN*	Self-Learning **N*** *indicates the serial number of electives offered in the respective category*
EN*	Core Elective **N*** *indicates the serial number of electives offered in the respective category*
SK	Skill Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship

Sample Course Code:

21ETU7CC1T	Networking and Security

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Structure of Final Year B. Tech. Electronics and Telecommunication Engineering, (W.E.F. 2024-2025)

Semester – VII

Course Code	Name of Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE		ISE	ICA	
21ETU7CC1T	Networking and Security	3		-	3	60		40		100
21ETU7CC1A	Networking and Security		1		1				25	25
21ETU7EN*****2T	Core Elective-II	3		-	3	60		40		100
21ETU7EN*****2A	Core Elective-II		1	-	1				25	25
21ETU7EN*3T	Core Elective -III	3	-	-	3	60		40	-	100
21ETU7CC4T	CMOS Technology	3	-	-	3	60		40	-	100
	Sub Total	**12**	**2**		**14**	**240**		**160**	**50**	**450**
	Laboratory					**POE**	**OE**			
21ETU7EN*3L	Core Elective-III	-	-	2	1	-			25	25
21ETU7CC4L	CMOS Technology	-	-	2	1	25			25	50
21ETU7PR5L	Project Phase I	-	-	8	4	50			100	150
21ETU7IN6L	Internship II	_	_	_	2				50	50
	Sub Total	**-**		**12**	**8**	**75**		**-**	**200**	**275**
	Grand Total	**12**	**2**	**12**	**22**	**315**		**160**	**250**	**725**

- **N*** *indicates the serial number of electives offered in the respective category*

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Structure of Final Year B. Tech. Electronics and Telecommunication Engineering, (W.E.F. 2024-2025)

Semester– VIII

Course Code	Name of Course	Engagement Hours			Credits	FA	SA		Total
		L	T	P		ESE	ISE	ICA	
21ETU8PR1L	Project Phase II			4*	2	50		50	100
21ETU8IN2L	Internship III / On Job Training (OJT)	--	--	20*	10	100		100	200
	Grand Total	**0**	**-**	**24**	**12**	**150**	**--**	**150**	**300**

Note:

1. Internship II - Four weeks of the internship can be completed by students from after the completion of Semester V up to the end of Semester VII, the report of which will be assessed at Semester VII. Students can complete two separate internships of two weeks each or one internship of four weeks. Internship can be done in the form of an Industrial Internship / Vocational Training/ MOOC course / Industry Certification course / Workshop/ any other relevant activity as specified by the department.

2. Core Elective - II at Final year B. Tech. E&TC Engineering, Part-I, Semester VII

21ETU7EN*2T Core Elective – II List

List of Core Electives – II offered to students pursuing Honors in the Internet of Things	
Course Code	**Course title**
21ETU7E12T	Programmable ICs and ASIC
21ETU7E22T	Mobile and Satellite Communication

List of Core Electives – II offered to all other students	
Course Code	**Course title**
21ETU7E12T	Programmable ICs and ASIC
21ETU7E22T	Mobile and Satellite Communication
21ETU7E32T	Internet of Things

3. Core Elective -III at Final year B. Tech. E&TC Engineering, Part-I, Semester VII

21ETU7EN*3T Core Elective – III List

List of Core Electives – III offered to students pursuing Honors in the Internet of Things	
Course Code	**Course title**
21ETU7E13T	Business Intelligence
21ETU7E23T	Microwave Engineering

List of Core Electives – III offered to all other students	
Course Code	**Course title**
21ETU7E13T	Business Intelligence
21ETU7E23T	Microwave Engineering
21ETU7E33T	Cloud Technology

OR

The list of approved NPTEL/Online courses/Industry MOOC of a minimum twelve weeks duration for Core Elective-III' shall be announced by the BOS chairman at the commencement of Semester VII. Students shall register and complete one of the courses from approved lists successfully and submit the passing certificate to the department.

4. Internship III / On Job Training (OJT) :

i. Students may complete an internship / On Job Training (OJT) of a minimum of two months duration at the industry during Final Year Sem VIII.

ii. The Industry shall appoint a Supervisor to assess the performance of the student and share the same with the departmental supervisor for the fulfillment of ICA marks

iii. The student shall prepare a report of the work completed at the Industry duly endorsed by the industry Supervisor and submit the same as an Internship report.

iv. The ESE for Internship III / On Job Training (OJT) shall be conducted by the Departmental Supervisor in the presence of an external industry or academic expert.

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Final Year B. Tech. (Electronics & Telecommunication Engineering) Semester-VII

21ETU7CC1T: Networking and Security

Teaching Scheme:
Lectures – 3 hrs/week, 3 Credits
Tutorial – 1 hr/week, 1 Credit

Examination Scheme:
ESE – 60 Marks
ISE – 40 Marks
ICA – 25 Marks

This course introduces TCP/IP and ISO OSI protocol layers and their functionality. Also, introduces various encryption technologies to secure data.

Course Prerequisite:

Basic understanding of analog and digital data and fundamentals of networking.

Course Objectives:

1. Gain a comprehensive understanding of data communication principles, network types, topologies, and the OSI and TCP/IP model
2. Develop proficiency in the concepts and protocols to implement efficient and reliable communication networks.
3. Explore fundamental concepts of computer security, classical encryption techniques, block ciphers, and encryption standards
4. Aware of classical and modern encryption techniques, for secure data transmission and ensure confidentiality, integrity, and authenticity in communication networks.

Course Outcomes:

At the end of the course, students will be able to

1. Demonstrate a comprehensive understanding of data communication principles, network architectures.
2. Define protocols enabling to analyze and evaluate different types of networks effectively.
3. Equipped with the knowledge necessary to assess and implement network security measures effectively.
4. Explain classical and modern encryption techniques, key management and distribution enabling to design and implement secure communication systems.

Unit 1- Data Communication and Network No of lectures - 07

Data Communication, Network- Need, Types (LAN, MAN, WAN), Topologies, Layer communication, OSI model, TCPIP Suite, Network Devices at each layer (RS232, MODEM, Repeaters, Switches, bridges, routers, gateway).

Unit 2- Physical and Data Link Layer No of lectures - 08

Physical Layer- Circuit Switched network, packet switching,

Data Link Layer- Introduction, Link layer addressing, Error detection and correction- Introduction, block coding, CRC, Checksum, Forward error correction

Unit 3- Network Layer & Transport Layer No of lectures –09

Network Layer – Network layer services, packet switching, IPv6 addresses, Forwarding of IP packets, Network layer protocols-IP, ICMPv6

Transport Layer- Introduction, Transport Layer protocols, UDP, TCP

Unit 4 – Security Fundamentals No of lectures - 07

Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography.

Substitution Techniques: Caesar Cipher, Mono alphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Rotor Machines, Steganography.

Unit 5 – Block Ciphers and the Data Encryption Standard No of lectures - 08

Traditional Block Cipher Structure: Stream Ciphers and Block Ciphers, Motivation for the Feistel Cipher Structure, Feistel Cipher.

Data Encryption Standard: DES Encryption, DES Decryption, The Strength of DES.

Public-Key Cryptography and RSA: Principles of Public Key Cryptosystem, RSA: Description of the Algorithm, Computational Aspects, Security of RSA.

Unit 6 – Key Management and Distribution No of lectures - 06

Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure.

Internal Continuous Assessment (ICA):

ICA consists of minimum eight assignment/tutorial based upon above curriculum.

Text Books:

1. Data communication and Networking 5E - B.A. Forouzan, 5th Edition Mc Graw Hill Education.
2. TCP/IP protocol suit- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
3. Computer networks- Andrew S. Tanenbaum.
4. Computer Security: Principles and Practices- Willaim Stallings, Pearson Publication
5. Cryptography and Network Security- Atul Kahate, TataMcGrawhill.
6. Network Security and Cryptography- Bernard Menezes, Cengage Learning

Reference Books:

1. Internetworking TCP/IP Principal, Protocol and Architecture -Douglas Comer- Wesley
2. TCP/IP Illustrated, The Protocols – W. Richard Slevens, G.Gabrani –PE pub.
3. Data and computer communication – William Stallings. - PE pub.
4. Cryptography and Network Security, Behrouz A Forouzan, , McGraw Hill Publications
5. Cyber Security Understanding Cyber crimes Computer Forensics and Legal Perspectives - Nina Godbole.

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

Core Elective II – 21ETU7E12T: Programmable ICs and ASIC

Teaching Scheme:	**Examination Scheme:**
Lectures– 3 Hours/week, 3 Credits	ESE – 60 Marks
Tutorial – 1 Hour/week, 1 Credit	ISE – 40 Marks
	ICA – 25 Marks

This course provides a deep understanding of programmable ASICs, FPGA-based systems, SoC design principles and Complex Programmable Logic Device (CPLD), equipping with valuable skills for advanced electronic engineering applications.

Course Prerequisite: Student shall have knowledge of Digital Devices, CMOS logic.

Course Objectives: Enable a student,

1. To learn concept of ASIC and its library cell design.
2. To analyze Programmable ASIC Logic and I/O Cells for design of various memory devices.
3. To understand FPFA organization and architecture for design of digital systems.
4. To learn concept of SoC and explore its applications.
5. To acquire knowledge of various architectures of CPLD's.

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

1. Explain different types of ASICs and its library cell design.
2. Describe the architecture of programmable ASIC Logic and I/O Cells.
3. Implement Boolean functions using different Programmable Logic Devices.
4. Comprehend the architecture of FPGA for implementation of digital design.
5. Explore the applications of SoC in specific domains.

UNIT-1: Introduction to ASIC: **No. of Lectures- 08**

Types of ASICs, ASIC Design flow, ASIC library cell design: Transistor and resistors, Transistor parasitic capacitance, Logical Effort, Library cell design, Library architecture, Gate array design, standard cell design.

UNIT-2: Programmable ASICs: **No. of Lectures- 08**

Antifuse, SRAM, EPROM, EEPROM based ASICs. Programmable ASIC logic cells and I/O cells. Programmable interconnects.

UNIT-3: Programmable Logic Devices: **No. of Lectures- 08**

ROM, PLA, PAL, PLD, PGA – Features, Implementation of Boolean functions using PLDs, CPLD architecture, Commercial CPLD Devices: Xilinx XC9500, Altera Max7000.

UNIT-4: FPGA based system: **No. of Lectures- 10**

Basic concept, Digital Design and FPGA, FPGA Fabrics: FPGA Organization and architecture and its description, Static RAM based FPGA, Permanent FPGA, Chip I/O, Circuit design of FPGA, Logic implementation of FPGA architecture, Commercial FPGA Devices: Altera Flex 10k, Actel ACT -Xilinx LCA.

UNIT-5: SoC Design: **No. of Lectures- 06**

Voice over IP SOC - Intellectual Property – SOC Design challenges- Methodology and design-FPGA to ASIC conversion – Design for integration-SOC verification-Set top box SOC.

Internal Continuous Assessment:

- Term work shall consist of minimum eight tutorials based on above syllabus.

Text Books:

1. Application Specific Integrated Circuits, by M. J. S. Smith, Pearson Education, 2008
2. FPGA-Based System Design, by Wayne Wolf, Prentice Hall PTR, 2009
3. Digital Design Using Field Programmable Gate Array, P. K. Chan & S. Mourad, prentice Hall (Pte), 1994

Reference Books:

1. Digital Integrated Circuits, Rabey, Chandrakasan, Nikolic, Pearson Education
2. From ASICs to SOCs: A Practical Approach by Farzad Nekoogar and Faranak Nekoogar, Prentice Hall PTR, 2003.
3.Principles of CMOS VLSI Design, Neil Weste, Kamran Eshraghian, Addison Wesley/Pearson Education
4. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, Prentice Hall,1998, Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition

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Final Year B.Tech. (Electronics & Telecommunication Engineering)Semester-VII

Core Elective II- 21ETU7E22T:
Mobile and Satellite Communication

Teaching Scheme:	**Examination Scheme:**
Lecture**:** 3hrs/week, 3 credits	ESE: 60 Marks
Tutorial:1 hr/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks

Course Prerequisite:

Basic knowledge of telecommunications and networking concepts along with an understanding of digital signal processing and RF engineering fundamentals is required to grasp the complexities of mobile and satellite communication systems.

Course Objectives:

1. To gain comprehensive understanding of mobile communication, cellular concepts and practical applications in modern systems.
2. To acquire deep knowledge of GSM, CDMA, GPRS, 4G LTE, and 5G technologies, understanding the evolution towards faster, more efficient networks
3. To achieve proficiency in satellite communication principles, encompassing satellite subsystems and orbital mechanics.
4. To apply knowledge to design and optimize mobile and satellite communication systems for diverse applications.

Course Outcomes:

At the end of the course, student will be able to

1. Gain comprehensive understanding of mobile communication, cellular concepts and practical applications in the modern systems
2. Acquire deep knowledge of GSM, CDMA, GPRS, 4G LTE, and 5G technologies, understanding the evolution towards faster, more efficient networks.
3. Achieve proficiency in satellite communication principles, encompassing satellite subsystems and orbital mechanics.
4. Apply knowledge to design and optimize mobile and satellite communication systems for diverse applications.

Unit 1: Introduction to Mobile Communication and Cellular Concepts

No of lectures – 8

Block Diagram, Data Technologies, Mobile and wireless devices, cellular concept, frequency reuse, channel assignment, hand-off and multiple access technologies.

Unit 2: Digital Cellular Mobile Systems No of lectures – 7

GSM-Services and features of GSM, Radio Subsystems, channel type, frame structure, CDMA-(IS-95) frequency and channel specification, forward and reverse CDMA channels, GPRS**.**

Unit 3: 4G (LTE) & 5G Next Generation Technology No of lectures – 7

Introduction to 4G, LTE Architecture, Elements of LTE- EPS, LTE Radio / air interface Modulation and features, LTE Channels, Introduction to 5G, 5G CN Architecture, Radio/air interface, features.

Unit 4: Orbital Mechanics and Launchers No of lectures – 7

Orbital Mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and Launch Vehicles, Orbital effects in communication system performance.

Unit 5: Satellites No of lectures – 7

Satellite Subsystems, Attitude and control systems (AOCS), Telemetry, Tracking, Command and Monitoring, Power systems, Communication subsystems, Satellite antennas, Equipment reliability and space qualification.

Unit 6: Satellite Systems No of lectures – 8

Overview of VSAT Systems, Network Architecture Low Earth Orbit and Non-Geo-Stationary Satellite Systems**:** Orbit considerations, Coverage and frequency Consideration, Operational NGSO constellation design: Irridium, Teledesic Home Satellite TV, Digital DBS TV, Satellite Radio Broadcasting Radio and Satellite Navigation, GPS Position Location Principles, GPS Recivers and codes.

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum of six assignments/ tutorials/ practical tasks based on the above syllabus and one project-based assignment to perform analysis and generate reports using any tool for a given application.

Text Books:

1. Wireless Communications (principles and practices)-(2nd Edition)-Theodore S. Rappaport (Prentice Hall of India)
2. Satellite Communications – Timothy Pratt, Charles Bostian, Jeremy Allnutt John Wiley & Sons (II Edition)
3. Satellite Communications – Dennis Roody (McGraw Hill)
4. Satellite Communication- Monojit Mitra (PHI)

Reference Books:

1. Mobile Communications (2nd Edition)-Jochen Schiller (Pearson Education.)
2. Mobile and personal communication Systems and Services- Raj Pandya (Prentice Hall of India)
3. Wireless and Mobile Networks – Dr Sunilkumar S. Manv – Wiley India
4. 5G NR: The Next Generation Wireless Access Technology- By Erik Dahlman, Stefan Parkvall, Johan Skold

Note: Students, as a part of their term work, should visit satellite earth station and submit a report of visit

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

Core Elective II – 21ETU7E32T: Internet of Things

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Tutorial:1 hr/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks

The Internet of Things (IoT) is transforming industries and creating new opportunities for innovation. It integrates sensors, communication technologies, and data analytics to connect and manage devices in real-time. This course aims to equip final-year engineering graduates with the foundational knowledge and practical skills required to design, implement, and deploy IoT solutions. Understanding IoT is essential for leveraging its potential in smart cities, healthcare, manufacturing, and beyond.

Prerequisites:
Basic knowledge of electronics and communication principles, Familiarity with programming languages such as Python or C, Understanding of basic networking concepts.

Course Objectives

1. Provide a comprehensive understanding of the fundamental concepts and definitions of IoT.
2. Explain various industry standards and communication protocols used in IoT.
3. Teach sensor interfacing and the architecture of IoT systems, including security and data management.
4. Guide students in designing, implementing, and deploying IoT solutions using AWS IoT and Azure IoT.

Course Outcomes

At the end of the course, students will be able to:

1. Define and explain the basic concepts and characteristics of IoT.
2. Understand industry standards, IoT communication protocols, and IoT architecture.
3. Demonstrate knowledge of sensor interfacing, data management, and security in IoT.
4. Design, implement, and deploy IoT solutions using AWS IoT and Azure IoT.

Unit 1: Introduction to IoT and Industry Standards No of lectures – 10

Definition of IoT, Characteristics of IoT, Evolution of IoT, IoT Enabling Technologies, Overview of IoT Standards, IoT Reference Architecture, Communication Models, IoT Network Protocols.

Unit 2: Sensor Interfacing and IoT Architecture No of lectures – 10

Types of Sensors, Sensor Selection Criteria, Interfacing Sensors with Microcontrollers, Data Acquisition, IoT Architecture Layers, Edge, Fog, and Cloud Computing.

Unit 3: Security and Data Management in IoT No of lectures – 10

IoT Data Management, Security in IoT, Case Studies of IoT Applications, Future Trends in IoT.

Unit 4: Practical Implementation using AWS IoT and Azure IoT No of lectures – 15

Introduction to AWS IoT Core, Setting up AWS IoT, Device and Sensor Integration, Data Processing with AWS IoT Analytics, Introduction to Azure IoT Hub, Setting up Azure IoT, Device and Sensor Integration, Data Processing with Azure IoT Central.

Internal Continuous Assessment (ICA):

ICA shall consists of a minimum of 8 practicals based on above syllabus

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Text Books

1. Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti, 1st Edition, VPT.
2. Architecting the Internet of Things" by Dieter Uckelmann, Mark Harrison, Florian Michahelles, 1st Edition, Springer.

Reference Books

1. Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz, 1st Edition, Wiley.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Jerome Henry, Robert Barton, 1st Edition, Cisco Press.

Additional Online Resources

- AWS IoT Documentation
- Azure IoT Documentation
- Coursera - Introduction to the Internet of Things (IoT)
- edX - The Internet of Things (IoT)

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

Core Elective III – 21ETU7E13T: Business Intelligence

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical:2 hr/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks

This course introduces basic components of Business Intelligence environments, discuss business analytics, data mining, data visualization, data tools and infrastructure and describe various applications of BI.

Course Prerequisite:

Students shall have knowledge of basic types of data, data preprocessing methods, data cleaning and features extractions techniques.

Course Objectives:

1. To explain the basic components that makes up a business intelligence environment.
2. To discuss the structure of the decision-making process
3. To describe the mathematical model for business intelligence analyses
4. To discuss different visualization tools and techniques for data representation and report preparation.
5. To illustrate various applications of Business Intelligence

Course Outcomes:

After completing this course, student shall be able to –

1. Describe the basic components of the BI environment.
2. Use ETL and BI tools for the decision support system
3. Apply data mining techniques for data analysis
4. Apply different visualization tools for report generation and explicate components of business performance measurement systems
5. Illustrate various applications of Business Intelligence.

Unit 1: Introduction to Business Intelligence No of lectures – 08

Effective and timely decisions, role of mathematical models, BI architectures, ethics on BI. Introduction to data warehouse, architecture, OLAP

Unit 2: **Decision Support System** No of lectures – 07

Representation of decision-making system, evolution of information system, definition and development of decision support system, mathematical models for decision-making.

Unit 3: Data Warehousing and Data Mining No of lectures – 07

Definition and architecture of Data warehouse, Cubes and multidimensional analysis, Definition and applications of data mining, data mining process, analysis methodologies.

Unit 4: Business Reporting, Visual Analytics and Business Performance Management No of lectures – 08

Business reporting definitions and concepts, data and information visualization, different types of charts and graphs, data visualization and visual analytics, performance dashboards, business performance management, performance measurement, balanced scorecards, Six Sigma as a performance measurement system.

Unit 5: BI applications: Marketing Models **N**o of lectures – 07

Relational marketing, Salesforce management, Marketing models case studies.

Unit 6: BI applications: Logistic and Production Models No of lectures – 07

Supply chain optimization, optimization models for logistics planning, revenue management system, Logistics business case studies.

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum of six assignments/ tutorials/ practical tasks based on the above syllabus and one project-based assignment to perform analysis and generate reports using any tool for a given application.

Text Book:

1. Business Intelligence Data mining and optimization for Decision making by Carlo Vercellis, ISBN:978-81-265-4188-1, Wiley Publication
2. Business Intelligence and Analytics: Systems for Decision Support by Efraim Turban, Ramesh Sharda, Dursun Delen by Pearson Education, Ltd.
3. Data Mining and Business Intelligence by S.K. Shinde and Uddagiri Chandrashekhar
4. Data Mining for Business Intelligence by Galit Shmueli, Nitin Patel, Peter Bruce, Wiley Publications.

Reference Books:

1. Data Warehousing in the Real World – Anahory & Murray, Pearson Edt.
2. Data Warehousing Fundamentals – Ponniah [Wiley Publication]

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

Core Elective III – 21ETU7E23T: Microwave Engineering

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical:2 hr/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks

This course introduces importance of microwave engineering as emerging technology to be used for communication applications. It constitutes generation, transmission, and measurement of various parameters dealing with microwave frequency. The performance analysis is carried out using Microwave network analysis.

Course Prerequisite:
Student shall have knowledge of Electromagnetic Field Theory

Course Objectives:

1. To make students aware about Microwave communication and its importance.
2. To do analysis of microwave components performance using network analysis techniques.
3. To learn about different ways of microwave generation and transmission using active and passivecomponents.
4. To acquaint students about measurement of various microwave parameters.

Course Outcomes:

After successfully completing the course student will able to

1. Calculate the parameters, properties of transmission lines and explain the significance of microwaves.
2. Formulate the wave equation in wave guide for analysis.
3. Analyze different parameters of microwave components in microwave applications.
4. Explain the working principles of all the microwave tubes and solid state devices.
5. Choose a suitable microwave measurement instruments and carry out the required measurements.

Unit 1-Transmission lines No of lectures – 8

Transmission line sections as circuit elements, Transmission line equations using field theory and circuit theory, transmission line primary constants (R,L,C,G) and secondary constants (Z0, γ), Transmission line parameters (VSWR, Reflection coefficient, transmission coefficient), Smith Chart and solution of transmission line problems using Smith Chart, Microwave frequency band, Characteristics & applications, Microwave hazards of microwaves.

Unit 2–Rectangular waveguide No of lectures – 8

Comparison between Transmission Line and Waveguide, Wave equations in Rectangular co-ordinates, TE/TM mode analysis, Waveguide parameters (fc, □c, □g, Vp, Vg) Relation between Vp and Vg, Power transmission in Rectangular Waveguide

Unit 3–Microwave Components No of lectures – 8

Introduction to S parameters, **Multi port junctions -** Construction and operation of E-plane, H-plane, Magic Tee and Directional Coupler, S matrix for E-Plane Tee, H-Plane Tee, Magic Tee and Directional Coupler. **Non reciprocal devices** – Faraday's rotation - Construction and operation of Isolator and Circulator

Unit 4–Microwave Solid State Devices No of lectures – 6

Limitations of conventional semiconductor devices, Principle of operation, specifications and applications of - Varactor diode, PIN diode, Tunnel diode, Gunn Diode, IMPATT, TRAPATT diode

Unit 5- Microwave Tubes No of lectures –10

Limitations of conventional tubes **O-type tubes**: **Two cavity Klystron**: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. **Reflex Klystron**: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram. **M-type tubes**: Magnetron: Construction and Principle of operation of 8 cavity cylindrical magnetron, zero and PI mode operation **Slow wave devices**: Types of slow wave structure, Helix TWT: Construction and principle of operation.

Unit 6-Microwave Measurements No of lectures – 5

Measurement of Power, frequency, attenuation, phase shift, VSWR

Internal Continuous Assessment (ICA):
ICA consists of minimum eight practical shall be performed using Klystron and Gunn diode basedmicrowave bench based upon above curriculum.

List of Practicals:

1. Study Microwave Components and Instruments
2. Measurement of frequency and wavelength of microwave signal
3. Determination of Voltage Standing Wave-Ratio and Reflection Coefficient of a given load
4. Measurement of unknown impedance using Smith Chart
5. Verification of function of E plane TEE and H Plane TEE
6. Application of magic Tee as a mixer
7. Determination of parameters of Directional coupler by measuring following parameters

a) Main line and Auxiliary line SWR
b) Coupling Factor and Directivity

8. Measurement of different parameters of circulator
9. Verify the working of Isolator
10. Measurement of Phase shift
11. Verification of practical and theoretical aspects of V-I characteristics of Gunn Diode
12. Study the substitution method for attenuation measurement and determine the attenuation due toa component under test
13. Study reflectometer principle for measuring VSWR of a load under test

Text Books:

1. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson
2. David M. Pozar, “Microwave Engineering", Fourth edition, Wiley publications.
3. M. Kulkarni, “Microwave and Radar engineering”, 3rd edition, Umesh Publications

Reference Books:

1. Foundations for Microwave Engineering by Robert Collin, Wiley publications
2. Microwave Engineering (Passive Circuit) by Peter Rizzi, Pearon Eucation
3. M L Sisodia& G S Raghuvanshi, “Basic Microwave Techniques and Laboratory Manual”, New Age International (P) Limited, Publishers

Walchand Institute of Technology, Solapur

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

Core Elective III – 21ETU7E33T: Cloud Technology

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical:2 hr/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks

Cloud technology revolutionizes how businesses and individuals manage data, applications, and services. This course introduces final-year engineering students to the foundational concepts and technologies of cloud computing. It aims to provide a comprehensive understanding of cloud service models, deployment models, virtualization, security, and emerging trends. Mastery of cloud technology is essential for leveraging its potential in modern engineering solutions.

Course Prerequisites:

Students shall have basic understanding of computer networks and operating systems, familiarity with programming concepts and data management

Course Objectives:

1. Provide a comprehensive overview of cloud computing, including its history, characteristics, and service models.
2. Explain various cloud deployment models and the considerations for selecting them.
3. Teach the concepts of virtualization and containerization and their importance in cloud environments.
4. Introduce cloud security, cloud storage, networking fundamentals, and emerging trends in cloud technology.

Course Outcomes:

At the end of the course, students will be able to:

1. Comprehend the fundamentals of cloud computing, including service models and key industry players (Unit 1).
2. Understand various cloud deployment models and analyze real-world case studies (Unit 2).
3. Explain and utilize virtualization and containerization technologies in cloud environments (Unit 3).
4. Understand cloud security, cloud storage, networking, and emerging trends, and apply best practices for ensuring cloud security (Unit 4).

Unit 1: Introduction to Cloud Computing No of lectures – 10

Overview of cloud computing, historical context and evolution, characteristics and advantages of cloud computing, cloud service models (IaaS, PaaS, SaaS), key players in the cloud computing industry.

Unit 2: Cloud Deployment Models No of lectures – 10

Public cloud, private cloud, hybrid cloud, community cloud and multi-cloud strategies, considerations for selecting deployment models, case studies of real-world deployments.

Unit 3: Virtualization and Containerization No of lectures – 10

Concepts of virtualization and containerization, virtual machines vs. containers, benefits and challenges of virtualization and containerization in cloud environments, tools and platforms for managing virtualized and containerized environments.

Unit 4: Cloud Security, Storage, and Emerging Trends No of lectures –15

Importance of security in cloud computing, threats and vulnerabilities in cloud environments, identity and access management (IAM), data encryption and privacy, compliance and regulatory considerations, best practices for ensuring cloud security; Overview of cloud storage services, object storage vs. block storage, content delivery networks (CDNs), networking fundamentals in cloud environments, software-defined networking (SDN), scalability and elasticity in cloud networking; Emerging trends: edge computing, fog computing, serverless computing, AI and ML in the cloud, blockchain technology in cloud computing, green computing and sustainability in cloud infrastructure

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Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practicals based on above syllabus.

Text Books

1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Prentice Hall.
2. "Cloud Computing: Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Wiley.

Reference Books

1. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis, Wiley.
2. "Mastering Cloud Computing: Foundations and Applications Programming" by Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Morgan Kaufmann.

Additional Online Resources:

- Amazon Web Services (AWS) Documentation
- Microsoft Azure Documentation
- Google Cloud Platform (GCP) Documentation
- Coursera - Cloud Computing Courses
- Udemy - Cloud Computing Courses

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

21ETU7CC4T: CMOS Technology

Teaching Scheme:	**Examination Scheme:**
Lectures– 3 Hours/week, 3 Credits	**ESE – 60 Marks**
Practical – 2 Hours/week, 1 Credit	**ISE – 40 Marks**
POE - 25 Marks	**ICA – 25 Marks**

This course introduces how to design, simulate and test logic circuits using different CMOS Logic Design. It also describes the design of sequential logic circuits and timing issues present in the implementation of the logic circuits applications.

Course Prerequisite: Student shall have knowledge of Digital Devices, combinational and sequential logic circuit design and simulation.

Course Objectives:

1. To make student learn EDA Tools for CMOS Logic Design and simulation.
2. To enable student to design CMOS Logic based design modules for combinational logic circuits.
3. To enable student to design CMOS Logic based design modules for sequential logic circuits.
4. To acquaint students to timing issues, arithmetic and memory module design and testing.

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

1. Describe MOS transistor theory and behavior of E-MOSFET.
2. Apply design process rules for CMOS circuit layout design.
3. Analyze combinational circuits using CMOS Logic structures.
4. Analyze sequential circuits using CMOS Logic structures and Timing issues in digital circuits.
5. Design arithmetic and memory building blocks using CMOS technology.

Unit 1- MOS Transistor Theory: No of lectures –7

Physical structure of MOS transistor, accumulation, depletion & inversion modes, MOS device design equations, second order effects, Static and dynamic behavior of CMOS inverter, power and energy delay, Technology scaling, impact of technology scaling on inverter.

Unit 2- Circuit Design Processes: No of lectures – 4

MOS Layers, Stick Diagrams, Design Rules and Layouts – Lambda based design and other rules.

Unit 3- CMOS Logic Structures for Combinational Logic Design: No of lectures – 10

Static CMOS design- complementary CMOS, Implementation of Boolean Expressions using CMOS Logic, Ratioed logic and pass transistor logic; Dynamic CMOS design- dynamic logic basic principle, speed and power dissipation, issues in dynamic design, cascading dynamic gates, comparison of static and dynamic designs in CMOS.

Unit 4- CMOS Logic Structures for Sequential Logic Design: No of lectures –9
Static latches and registers- the bistability principle, multiplexer-based latches, Master-slave edge triggered register, low voltage static latches, static SR flip flops, dynamic latches and registers dynamic transmission-gate edge triggered registers, C2MOS- A clock- skew insensitive approach, true single-phase clocked register (TSPCR).

Unit 5- Timing Issues in Digital Circuits: No of lectures –6
Synchronous design- clock skew, jitter, clock distribution, latch-based clocking, synchronizers and arbiters, using PLL for clock synchronization.

Unit 6- Designing Arithmetic and Memory Building Blocks: No of lectures –6
Designing fast adders, designing fast multipliers, designing other arithmetic building blocks, designing ROMs, DRAMs & SRAMs.

Internal Continuous Assessment:
Term work shall consist of minimum eight experiments based on above syllabus using any EDA software tool suggested.

List of Practical: Design and Implementation of Following using CMOS / Ratioed Logic / Dynamic CMOS Logic.
1. Logic Gates
2. Universal Logic Gates
3. Boolean Expression
4. Half adder and full adder
5. Half subtractor and full subtractor
6. Multiplexer and DeMultiplexer
7. Latches
8. Flip flops

Text Books:
1. Digital Integrated Circuits, Rabey, Chandrakasan, Nikolic, Pearson Education
2. CMOS VLSI design, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson Education

Reference Books:
1. CMOS digital integrated circuits, Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, TATA McGRAW Hill
2. Principles of CMOS VLSI Design, Neil Weste, Kamran Eshraghian, Addison Wesley/Pearson Education
3. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, Prentice Hall,1998 4. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

21ETU7PR5L: Project Phase I

Teaching Scheme:
Practical:8 hr/week, 4 credit

Examination Scheme:
ICA : 100 Marks
POE : 50 Marks

Project-based learning is a well-established educational paradigm gaining increasing importance today. To align with this approach, a project course is integrated into the final year curriculum, spanning both semesters. In this course, students work in teams to undertake a project, allowing them to showcase their abilities and develop expertise in their chosen areas of interest. The projects can involve both hardware and software, with a strong emphasis on design and research aspects. Additionally, effective communication, both oral and written, is a crucial skill for engineering graduates in various contexts. This course aims to cultivate these essential communication skills as well.

Course Prerequisite:

A student must possess both technical competency and effective teamwork skills to successfully contribute to a project. This includes adept knowledge of hardware and software architecture, as well as associated programming skills. Additionally, the student should have strong technical report writing and presentation abilities, along with proficiency in office software for word processing and creating presentations.

Course Objectives:

1. To expose students to the electronics and software engineering industries, enabling them to identify problem areas and formulate problem statements.
2. To equip students with the ability to design electronic and software systems that address the identified problems.
3. To develop students' skills in designing the hardware and software architecture for their projects.
4. To train students in writing technical specifications and project documentation for their chosen problems.

Course Outcomes:

After completing this course, student shall be able to –

1. Conduct a comprehensive literature review to identify a project that addresses societal and environmental needs for sustainable development.
2. Develop a detailed project plan, including a timeline and an estimated budget.
3. Utilize engineering expertise to design the hardware and software architecture required for the project.
4. Exhibit teamwork and presentation skills by preparing thorough reports and delivering presentations, while adhering to professional ethical standards.

Guidelines:

1. The student will finalize the project after obtaining approval from their guide and submit a synopsis along with a presentation.
2. The student should prepare the project design.
3. The project synopsis should ideally include an abstract, literature survey, problem definition, and proposed system and design.
4. The student will need to present his/her work on the project design implemented and submit project phase -I report with details of implementation methodology, results and discussion.

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VII

21ETU7IN6L: Internship II

Teaching Scheme:	**Examination Scheme:**
Credits: 2 credits	ICA: 25 Marks

Course Objectives:

1. To familiarize with the industry landscape.
2. To gain comprehensive knowledge of software and hardware development tools and techniques for solving real-world problems.
3. To learn to demonstrate professional and ethical responsibilities.

Course Outcomes:

After completing this course, student shall be able to –

1. Utilize hardware and software development tools and methodologies to solve real-world problems.
2. Convey a vocational training report proficiently through written and oral presentations.
3. Demonstrate professional and ethical responsibilities.
4. Integrate knowledge, skills, and professional practices effectively

Guidelines:

1. Internship II - Four weeks of the internship can be completed by students from after the completion of Semester V up to the end of Semester VII, the report of which will be assessed at Semester VII. Students can complete two separate internships of two weeks each or one internship of four weeks. Internship can be done in the form of an Industrial Internship / Vocational Training/ MOOC course / Industry Certification course / Workshop/ any other relevant activity as specified by the department.
2. Training will be done individually.
3. The project, which will be based on the training, will be completed either in the industry or following the training at the institute.
4. Internship report should be submitted along with completion certificate to the institute

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VIII

21ETU8PR1L: Project Phase II

Teaching Scheme:
Practical – 4 Hours/week, 2 Credit

Examination Scheme:
ICA – 50 Marks
POE – 50 Marks

Course Objectives:

1. To make student apply design concept, prepare detailed planning to solve problem undertaken
2. To make student to evaluate and analyze performance of the proposed solution to the problem undertaken
3. To make student aware of his responsibilities working in a team to provide time bound solutions to the problem
4. To make student write technical specifications, project document over problem undertaken.
5. To make student demonstrate a sound technical presentation of their selected project topic.
6. To make student aware of different software tools and soft-skills required to practice at various stages of project execution

Course Outcomes:

At the end of the course students will be able to

1. Apply different design concepts to plan solution to the problem undertaken
2. Evaluate performance and detailed analysis of outcome of the proposed solution for problem undertaken
3. Work in project group following work ethics
4. Communicate with engineers and the community at large in written and oral forms
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.
6. Select and use proper programming solution, simulator and necessary soft skills to provide solution to problem undertaken.

Guidelines:

The objective of Project- II is to enable the student to extend further the investigative study taken up under Project-I, either fully practical or involving both theoretical and practical work, under the guidance of a supervisor from the department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment normally includes:

1. In depth study of the topic assigned in the light of the report prepared under project-I
2. Review and finalization of the approach to the problem relating to the assigned topic
3. Detailed analysis/modelling/simulation/design/problem solving/experiment as needed
4. Final development of product/process, testing, results, conclusions and future directions
5. Preparing a paper for conference presentation/publication in journals and for project competition, if possible.
6. Preparing a project document in the standard format for being evaluated by the department.
7. Final Oral presentation and demonstration of project before a departmental and evaluation committee

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Final Year B.Tech. (Electronics & Telecommunication Engineering) Semester-VIII

21ETU8IN2L: Internship III/ On Job Training (OJT)

Teaching Scheme:
Practical – 20 Hours/week, 10 Credit

Examination Scheme:
ESE: 100 Marks
ICA: 100 Marks

Internships / On Job Training serve as crucial educational and career development experiences, offering hands-on learning in specific fields or disciplines. They play a significant role in equipping individuals with essential industry skills, awareness of professional practices, and familiarity with organizational culture. Typically, structured and short-term, internships / On Job Training provide supervised training centered on particular tasks or projects, adhering to defined timelines.

Course Objectives:

1. To provide technical students with hands-on experience in industrial environments, essential for developing industry-ready professionals.
2. To equip students with real-time technical and managerial skills necessary for their future careers.
3. To familiarize students with various materials, processes, products, and software applications, emphasizing quality control principles.
4. To introduce students to engineering ethics and responsibilities in professional practice.
5. To explore the social, economic, and administrative factors that impact industrial organizations' working environments.

Course Outcomes:

At the end of course, students will be able to

1. Develop professional competence through an internship experience.
2. Apply academic knowledge effectively in both personal and professional environments.
3. Expand their professional network and gain exposure to potential future employers.
4. Demonstrate the application of professional and societal ethics in their daily lives.
5. Formulate their own career goals and align them with personal aspirations.

Guidelines:

Internship III / On Job Training (OJT):

Engineering internships are intended to provide students with an opportunity to apply theoretical knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Final Year Engineering curriculum.

1. Students may undergo internship with Small/ Medium / Large scale industries to make themselves ready for the industry
2. Students may complete an internship / On Job Training (OJT) of a minimum of two months duration at the industry during Final Year Sem VIII.
3. The industry shall appoint a Supervisor to assess the performance of the student and share the same with the departmental supervisor for the fulfilment of ICA marks
4. Every intern must submit a weekly report to their internal guide without exception. Interns are required to have bi-weekly communication with their internal guide without exception.
5. During the internship, the student will present a seminar in online /offline mode based on his training / Project before an expert committee established by the department in accordance with institute guidelines.
6. The student shall prepare a report of the work completed at the industry duly endorsed by the industry Supervisor and submit the same as an Internship report.
7. The ESE for Internship III / On Job Training (OJT) shall be conducted by the Departmental Supervisor in the presence of an external industry or academic expert.