

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

NEP 2020 Compliant Curriculum Syllabus

ELECTRONICS & TELECOMMUNICATIONENGINEERING

Name of the Course: Final Year B. Tech (Sem.– VII & VIII)

(Syllabus to be implemented from w.e.f. AY-2026-27)



**PUNYASHLOK AHILYADEVII HOLKARSOLAPUR
UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY**

Electronics & Telecommunication Engineering

Programme Educational Objectives and Outcomes

A. Program Educational Objectives

1. To make students competent for professional career in Electronics & allied fields.
2. To build strong fundamental knowledge amongst student to pursue higher education and continue professional development in Electronics & other fields
3. To imbibe professional ethics, develop team spirit and effective communication skills to be successful leaders and managers with a holistic approach.
4. To nurture students to be sensitive to ethical, societal & environmental issues while conducting their professional work.

B. Program Outcomes

Electronics & Telecommunication Engineering Graduate will be able to –

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 the 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 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 life-long learning in the broadest context of technological change.

C. Program Specific Outcomes

1. **Solid foundation :** Graduates will be able to attain a **solid foundation** in Electronics and Tele-Communication Engineering with an ability to function in multidisciplinary environment.
2. **Techniques and Skills:** Graduates will be able to use **techniques and skills** to design, analyze, synthesize, and simulate Electronics and Communication Engineering components and systems.
3. **Developing Programs:** Graduate will be capable of **developing programs** in Assembly, Highlevel and HDL languages using contemporary tools for software development.



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Final Year B. Tech (Electronics & Telecommunication Engineering)

NEP 2020 Compliant Curriculum With effect from 2026-2027

Semester –VII

Distribution	Course Code	Name of the Course	Engagement Hours			Credits	FA	SA			Total
			L	T	P		ESE	ISE	ICA	OE/ POE	
PCC	ENTPCC-13	Microwave Engineering	3	-	-	03	70	30	-	-	100
PCC	ENTPCC-14	Data Communication	2	-	2	03	70	30	25	-	125
PEC	ENTPEC-04	Programme Elective-IV or MOOCS #	4	-	-	04	100	-	-	-	100
Project	ENTProject	Capstone Project	-	-	8*	04	-	-	100	100	200
RM	RM	Research Methodology and IPR	3	-	2	04	70	30	25	-	125
MDM	ENTMDM-05	MD Minor-V	2	-	-	02	70	30	-	-	100
		Total	14	-	12	20	380	120	150	100	750

Students should attend MOOCS in that 4 hrs

PCC- Programme Core Course, PEC: Programme Elective Courses,

RM-Research Methodology, MDM-Multidisciplinary Minor

*Load based on the project groups

Research Methodology course syllabus is common for all branches.

MDM – Multidisciplinary Minor: It should be selected from other UG engineering minor program.

List of MOOCs courses related to ENTPEC04 will be provided by BOS time to time



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Final Year B. Tech (Electronics & Telecommunication Engineering)

NEP 2020 Compliant Curriculum With effect from 2026-2027

Semester –VIII

<i>Distribution</i>	<i>Course Code</i>	<i>Name of the Course</i>	<i>Engagement Hours</i>			<i>Credits</i>	<i>FA</i>		<i>SA</i>		<i>Total</i>
			<i>L</i>	<i>T</i>	<i>P</i>		<i>ESE</i>	<i>ISE</i>	<i>ICA</i>	<i>OE/POE</i>	
PCC	ENTPCC-15	Wireless Sensor Network	4#	-	-	04	100	-	-	-	100
PEC	ENTPEC-05	Programme Elective-V or MOOCS	4#	-	-	04	100	-	-	-	100
OJT	ENTOJT	On-Job Training	-	-	24	12		-	200	100	300
		Total	8	-	24	20	200	-	200	100	500

PCC- Programme Core Course, PEC: Programme Elective Courses, OJT-On job Training

#ENTPCC-15-Students will practice or attend in Self-Learning mode

#ENTPEC-05: - Students will practice or attend in Self-Learning mode or MOOCS.

List of MOOC courses related to ENTPEC05 will be provided by BOS time to time

Basket of Program Elective Course (PEC)

PEC/Sem	Course code and name
ENTPEC - 01/ V	ENTPEC – 01A: Digital Logic Design ENTPEC – 01B: Fundamentals of Image Processing
ENTPEC - 02/ VI	ENTPEC – 02A: VLSI Design ENTPEC – 02B: Digital Image Processing
ENTPEC - 03/ VI	ENTPEC – 03A: Embedded Systems ENTPEC – 03B Pattern Recognition
ENTPEC - 04/ VII OR	ENTPEC – 04A: CMOS VLSI ENTPEC – 04B: Computer Vision
ENTPEC - 04/ VII	MOOC Courses offered by NPTEL/SWAYAM ENTPEC – 04C : <As per the list provided by BoS>
ENTPEC - 05/ VIII OR	ENTPEC – 05A: Advanced Embedded System ENTPEC – 05B: Image Processing Applications
ENTPEC - 05/ VIII	MOOC Courses offered by NPTEL/SWAYAM ENTPEC – 05C: <As per the list provided by BoS>

Basket of Multidisciplinary Minor (MDM)

A) Multidisciplinary Minor in “Controllers and Applications”

Semester	Course Code	Course Title
III	ENTMDM-01A	Digital Techniques
IV	ENTMDM-02A	8051 Microcontroller
V	ENTMDM-03A	PIC Microcontroller
VI	ENTMDM-04A	Advanced Microcontrollers
VII	ENTMDM-05A	Programmable Logic Controller

B) Multidisciplinary Minor in “Internet of Things”

Semester	Course Code	Course Title
III	ENTMDM-01B	Sensor Technology
IV	ENTMDM-02B	Fundamentals of IoT
V	ENTMDM-03B	IoT Networks and Security
VI	ENTMDM-04B	Industrial IoT
VII	ENTMDM-05B	IoT Cloud Platform

Multidisciplinary Minors are for the students of Other Program

Semester VII



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)
Semester-VII

ENTPCC-13: Microwave Engineering

Teaching Scheme:

Lectures – 3 Hours/week

Examination Scheme:

ESE – 70 Marks

ISE – 30 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 learn about different ways of microwave generation and transmission using active and passive components.
3. To do analysis of microwave components performance using network analysis techniques
4. To acquaint students about measurement of various microwave parameters.

Course Outcomes:

After successful completion of this course student will able to:

1. Formulate the wave equations and waveguide parameters for wave guide
 2. Explain construction and working of different microwave components.
 3. Analysis of passive microwave components with given characteristics.
 4. Explain the working principles of microwave tubes.
 5. Explain the working principles of solid state devices.
 6. Choose a suitable microwave instrument and carry out the required measurements.
-

Section I

Unit 1–Microwave Waveguides

(07)

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands, Microwave Hazards, Applications of Microwave.

Introduction to Waveguide: Comparison between Transmission Line and Waveguide, Solution of wave equations in rectangular coordinates, TE modes, TM modes, Waveguide parameters- cut off frequency, cut off wavelength, phase velocity, group velocity and guided wavelength, Power transmission and losses

Unit 2–Microwave Components**(05)**

Construction and operation of E-plane, H-plane, Magic Tee, Directional couplers, Isolator, and Circulator.

Unit 3– Microwave Network Analysis**(10)**

The Transmission (ABCD) matrix: Introduction to Impedance and Admittance matrix, Relation to impedance matrix, Equivalent circuits for two-port networks.

Scattering Matrix: Significance, formulation, and properties. S-Matrix calculations - E plane, H-plane, Magic Tee, and Directional coupler

Section II**Unit 4- Microwave Tubes****(08)**

Limitations of conventional tubes, O and M type classification of microwave tubes, concept of reentrant cavity, velocity modulation.

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 magnetron, Hull cut off condition, PI mode operation, Applications.

Slow wave devices: Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

(Excluding mathematical derivations of Klystron, Magnetron and TWT, But numerical will included)

Unit 5-Microwave Solid State Devices**(08)**

Structural details, Principle of operation, specifications, and applications of Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, Gunn Diodes, IMPATT diode

Unit 6: Microwave Measurements**(06)**

Measurement of power, frequency, attenuation and VSWR,

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, Pearson Education
3. M L Sisodia & G S Raghuvanshi, “Basic Microwave Techniques and Laboratory Manual”, New Age International (P) Limited, Publishers



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)
Semester-VII

ENTPCC-14: Data Communication

Teaching Scheme:

Lectures – 2 Hrs/week, 2 credit
Practicals – 2 Hrs/week, 1 credit

Examination Scheme:

ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

Course Objectives:

1. To explain need of Data Communications System and network components.
2. To aware students about the layers of the OSI model and TCP/IP with function(s) of each layer.
3. To develop building skills of subnetting and understand routing mechanisms.
4. To introduce students with the different types of network topologies and standards.
5. To acquaint students with the basic protocols of computer networks and how they can be used to assist in network design and implementation.

Course Outcomes:

After completion of this course, student will be able to

1. Explain Data Communications System and its components.
 2. Develop building skills of subnetting and understand routing mechanisms.
 3. Enumerate the layers of the OSI model and TCP/IP and explain the function(s) of each layer.
 4. Identify the different types of network topologies and protocols.
 5. Acquaintance with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.
-

Section – I

Unit 1- Data Communication and Network

(05)

Introduction to Data Communication, Network- Types, Topologies, Layer communication, OSI model, TCP/IP Suite, Network Devices at each layer (RS232, MODEM, Repeaters, Switches, bridges, routers, gateway, Firewalls).

Unit 2- Data Link Layer**(05)**

Framing, Circuit Switching and Packet Switching, Error detection and error correction, Hamming code , Flow control methods- Stop and wait protocol, sliding window protocol, Piggybacking.

Unit 3- Network Layer**(05)**

Virtual circuit & datagram approach, Routing- Principle of optimality, routing protocols – shortest path, distance vector routing, link state, ICMP, ARP, RARP.

Section-II**Unit 4- Transport Layer****(05)**

TCP & IP header format, encapsulation, IPv4 addressing, IPv6 addressing subnetting & masking, user datagram protocol (UDP) – transmission control protocol (TCP) - three way handshake – congestion & its control

Unit 5- Application Protocols**(05)**

FTP, DNS, TELNET, HTTP, SMTP, E-mail, DHCP,

Unit 6- MAC Protocols & Case study**(05)**

MAC protocols: ALOHA, CSMA, CSMA/CD, CSMA/CA, HDLC, STP Protocol.

Cisco DNA-Center Controller, IBM Virtual Router Appliance (VRA).

Internal Continuous Assessment (ICA):

ICA shall consist of 8-10 experiments based on the above curriculum. Sample list is provided below.

1. Network Ethernet LAN driver installation and working.
2. Network topologies using CISCO packet tracer.
3. RS 232/switch/router based lab sessions-
 - a. Character transfer using half duplex and Full duplex mode of operation.
 - b. File transfer using serial port.
4. Flow control and error control mechanism using CISCO packet tracer.
5. Implementation of Scrambler and descrambler.
6. IP subnetting and masking in Intranet using CISCO Packet tracer.
7. All network protocol tree model setup in command prompt.

8. Internet application protocol-FTP and DNS.
 9. Network analyzer (Protocol analyzer)-wire shark.
 10. Study of OSI vs TCP/IP models using case studies
 11. Mapping of protocols to OSI & TCP/IP layers
 12. Packet flow analysis across layers using Wireshark
 13. Identify headers of Ethernet, IP, TCP, UDP, HTTP packets
 14. Trace route & ping analysis (Network layer behavior)
 15. Study of TCP 3-way handshake & termination using Wireshark
 16. Implementation of simple HTTP client-server
 17. Simulation of IP addressing & subnetting
 18. Configure static and dynamic IP (DHCP)
-

Text books:

1. Data communication- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
2. TCP/IP protocol suit- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
3. Computer networks- Andrew S. Tanenbaum.

Reference Books:

1. Internetworking TCP/IP Principal, Protocol and Architecture -Douglas Comer- Wesley
2. TCP/IP Illustrated, The Protocols – W. Richard Stevens, G.Gabrani –PE pub.
3. Data and computer communication – William Stallings. - PE pub.
4. Cisco-The complete reference-Brian Hills.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VII

ENTPEC-04A: CMOS VLSI

Teaching Scheme:

Lectures – 4 Hrs/week, 4 credit

Examination Scheme:

ESE – 100 Marks

Course Objectives:

After completing this course, students will be able to:

1. To introduce students to the IC fabrication process and CMOS process technologies used in modern VLSI circuits.
2. To enable students to understand VLSI layout concepts.
3. To study the electrical behavior of CMOS inverter circuits.
4. To familiarize students with the design and operation of CMOS sequential circuits.
5. To understand timing constraints and synchronization issues in digital circuits.
6. To introduce the design of CMOS arithmetic and memory circuits.

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain CMOS fabrication processes and technology scaling concepts.
 2. Apply design rules and stick diagrams for CMOS layout development.
 3. Analyze CMOS inverter characteristics and delay models.
 4. Design sequential CMOS circuits such as latches and flip-flops.
 5. Evaluate timing issues in digital circuits and clock distribution.
 6. Design arithmetic and memory building blocks using CMOS.
-

Section- I

Unit 1: CMOS Fabrication and Process Technology

(08Hrs)

Overview of IC fabrication process, wafer preparation and crystal growth, oxidation, lithography, diffusion and ion implantation, epitaxy, metallization and planarization (CMP).

CMOS process flow: n-well, p-well and twin-well processes.

Unit 2: Circuit Design Processes

(06Hrs)

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

Unit 3: CMOS Inverter and Delay Analysis**(10Hrs)**

CMOS inverter structure and operation. DC characteristics and voltage transfer characteristics (VTC). Noise margins and switching threshold. Transient response: rise time and fall time.

Propagation delay modeling. Power dissipation: static power, dynamic power and short-circuit power. Energy-delay product and power-delay trade-off.

Section II**Unit 4- Sequential Logic Designs in CMOS****(08Hrs)**

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**(08Hrs)**

Timing classification: synchronous interconnect, mesochronous interconnect, plesiochronous interconnect, asynchronous interconnect, 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**(08Hrs)**

Designing fast adders, designing fast multipliers, designing other arithmetic building blocks, designing ROMs, DRAMs & SRAMs

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. Modern VLSI Design, Wayne Wolf, 2nd Edition, Prentice Hall, 1998
4. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, PHI, EEE, 2005 Edition.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)
Semester-VII
ENTPEC-04B: Computer Vision

Teaching Scheme:
Lectures – 4 Hrs/week, 4 credit

Examination Scheme:
ESE – 100 Marks

This course introduces practical image processing techniques and their application in biometrics, medical diagnosis, industrial inspection, digital forensics, and human-computer interaction. Emphasis is placed on understanding domain-specific processing pipelines and applying core algorithms to real-world problems.

Course Prerequisite:

Student shall have knowledge of Image Processing, Probability.

Course Objectives:

1. To introduce the basic mathematical tools essential for an Image analysis.
2. To learn different Features detection and tracking techniques.
3. To interpret the Segmentation techniques.
4. To understand High level vision.
5. To develop understanding of image processing techniques used in biometric identification systems and security systems.
6. To study some applications of computer vision algorithms.

Course Outcomes: After completion of syllabus students should be able to

1. Apply the basic mathematical tools essential for an Image analysis.
 2. Apply image processing techniques to detection of features and tracking techniques.
 3. Understand different Segmentation techniques.
 4. Understand High level vision 3D object recognition.
 5. Evaluate image synthesis.
 6. Learn different applications in Surveillance and In-vehicle vision system.
-

Section I

Unit 1: Essential mathematical tools: (08)

Least squares, Probabilistic inference, Robust optimization beyond RANSAC, Eigen-analysis, PCA, SVD, clustering, gradient-based optimization methods, Camera models, Epipolar geometry, Stratified reconstruction, Applications: large scale reconstruction

Unit 2: Features detection and tracking: (08)

Harris corner detector, KL tracking, SIFT, Overview of other contemporary descriptors. Learned feature descriptors, Deep feature matching.

Unit 3: Segmentation: (08)

Low-level segmentation, energy minimization and clustering based methods, semantic segmentation. Instance segmentation, panoptic segmentation, Vision Transformers for segmentation

Section II

Unit 4: High level vision: (08)

CNN overview, single image depth estimation, Flow-net, 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion

Unit 5: Synthesis: (06)

GAN overview, 3D shape synthesis, integrating viewpoint and texture, semantic image synthesis, Diffusion models, Text-to-image & multimodal generation, 3D generative models.

Unit 6: Applications: (10)

Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Text books:

D. Forsyth and J. Ponce, Computer vision – A modern approach, Second edition, Pearson, 2012.

References:

1. R. Hartley and A. Zisserman, Multiple view geometry in computer vision, Second edition, Cambridge univ. press, 2003
2. S. Prince, Computer vision – Models, learning and inference, Cambridge univ. press, 2012.
3. C. Bishop, Pattern Recognition and Machine learning, Springer, 2006.
4. Milan Sonka et al. – Image Processing, Analysis, and Machine Vision
5. Computer Vision: A Modern Approach (Second Edition) by David Forsyth and Jean Ponce



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VII

ENT Project: Capstone Project

Teaching Scheme:

Practical: 8 Hours /week, 4 credits

Examination Scheme:

ICA – 100 Marks

POE – 100 Marks

Course Pre-requisite:

Student shall have technical competency as well as behavioral facet to carry project as a part of a team. He/She shall have an adequate knowledge of hardware and software architecture and associated programming skills. He shall also possess necessary technical report writing skills, presentation skills and shall have proficiency in office software for word processing and presentation

Course Objectives:

1. To enable students to identify and analyze real-world engineering problems and formulate appropriate solutions.
2. To develop the ability to apply engineering knowledge, modern tools, and techniques in designing and implementing a project.
3. To enhance teamwork, leadership, and project management skills during project development.
4. To improve research ability, literature review, and problem-solving skills.
5. To encourage innovation, creativity, and ethical practices in engineering design.
6. To develop technical documentation, report writing, and presentation skills.

Course Outcomes:

After completion of the course, students will be able to:

1. Identify and define engineering problems and develop feasible solutions using appropriate methodologies.
2. Design and implement a prototype/system that meets specified requirements and constraints.
3. Apply modern engineering tools and techniques for analysis, simulation, and testing.
4. Work effectively in a team, demonstrating leadership and project management skills.
5. Prepare technical reports and present project results effectively to technical and non-technical audiences.
6. Demonstrate professional ethics, sustainability awareness, and societal impact in engineering solutions.

General Guidelines:

Here are **general guidelines for a Capstone Project** for undergraduate engineering students:

1. Project Selection

- Choose a **relevant and practical problem** related to your engineering branch.
- The topic should involve **innovation, research, or application of engineering concepts**.
- It should be **feasible within the available time and resources**.

2. Project Proposal

- Prepare a **project proposal** including:
 - Title of the project
 - Objectives
 - Problem statement
 - Methodology
 - Expected outcomes
- Get approval from the **project guide/supervisor and department**.

3. Literature Review

- Study **previous research papers, journals, and similar projects**.
- Understand existing methods and identify the **research gap**.

4. Project Planning

- Prepare a **project plan or schedule** (timeline).
- Divide work among team members if it is a **group project**.

5. Design and Methodology

- Develop **design, models, algorithms, or system architecture**.
- Select appropriate **tools, software, hardware, or experimental methods**.

6. Implementation

- Develop the **prototype, simulation, model, or experiment**.
- Follow engineering standards and safety procedures.

7. Testing and Analysis

- Perform **testing, validation, and performance evaluation**.

- Analyze results and compare them with expected outcomes.

8. Documentation

- Prepare a **detailed project report** including:
 - Abstract
 - Introduction
 - Literature Review
 - Methodology
 - Results and Discussion
 - Conclusion and Future Scope
 - References

9. Presentation and Demonstration

- Prepare a **PowerPoint presentation** explaining the project.
- Demonstrate the **working model or results** during evaluation.

10. Ethics and Originality

- Ensure the project work is **original and free from plagiarism**.
- Properly **cite references** used in the study.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VII

ENTMDM-05A: Programmable Logic Controller

Teaching Scheme:

Theory: 2 Hours /week, 2 credits

Examination Scheme:

ESE – 70 Marks

ISE – 30 Marks

Course Prerequisite: Student should have knowledge of Digital Electronics, Control Systems, and basic Microcontroller concepts. Familiarity with logic circuits, sensors, actuators, and industrial automation principles will be helpful for understanding PLC programming, control logic implementation, and industrial automation applications.

Course Objectives:

1. Understand PLC architecture, hardware, and I/O modules.
2. Develop skills in PLC programming using IEC 61131-3 standards.
3. Analyze and implement industrial control applications.
4. Introduce SCADA, Industrial Communication, and Industry 4.0 integration

Course Outcomes:

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

1. Explain PLC hardware, architecture and working principles
 2. Demonstrate digital/analog I/O, source/sink concepts, and PLC safety
 3. Develop PLC programs using Ladder Diagram
 4. Integrate PLC with SCADA and Industrial Networks
-

SECTION- I

Unit 1: Introduction to PLC

(08Hrs.)

Definition of PLC, History of PLC, The need of PLC, Types of PLC's, PLC advantages, Disadvantages and applications, Comparison of PLC with microcontroller & relay logic, PLC architecture: CPU, Power Supply, Memory, Input & Output modules, PLC scan cycle and execution, PLC selection criteria, Leading companies in PLC's.

Unit 2: PLC Hardware and I/O Modules**(07Hrs.)**

Power supply for PLC, Concept of source and sink, Digital and Analog I/O Modules for PLC, Safety and protection in PLC systems, Specifications of PLC.

SECTION- II**Unit 3: PLC Programming Fundamentals****(08Hrs.)**

PLC programming standards – IEC 61131-3, Programming languages overview, Ladder Diagram-LD Basics, Relay Logic, Timers, Counters, Comparators, Basic logic instructions, Arithmetic instructions, Data handling instructions, PLC addressing and data types.

Unit 4: Basics of Communication protocols and Advancements in PLC**(07Hrs.)**

Industrial communication protocols: Modbus, Profibus, Profinet, Ethernet/IP, Introduction to SCADA systems, PLC in Industry 4.0, Case Studies: Conveyor Belt Control System, Garage door control system, Elevator Control System.

Text Books:

1. John W. Webb & Ronald A. Reis – *Programmable Logic Controllers: Principles and Applications*, Prentice Hall, 2010
2. Frank D. Petruzella – *Programmable Logic Controllers: An Introduction*, McGraw-Hill Education, 2016
3. L.A. Bryan & E.A. Bryan – *Programmable Logic Controllers: Programming Methods and Applications*, Newnes / Elsevier, 2005
4. Gary Dunning – *Introduction to Programmable Logic Controllers (PLC)*, Cengage Learning, 2013

Reference Books:

1. Jon Stenerson – *Industrial Automation and Process Control*, Delmar Cengage Learning, 2009
2. Hugh Jack – *Automating Manufacturing Systems with PLCs*, Elsevier, 2012
3. Terry Bartelt – *Industrial Control Electronics*, Cengage Learning, 2010
4. Max Rabiee – *Programmable Logic Controllers: Hardware and Programming*, Pearson Education, 2008
5. Thomas A. Hughes – *SCADA and Industrial Automation Handbook*, CRC Press, 2011
6. R.K. Rajput – *PLC & SCADA: Theory and Practice*, S. Chand Publishing, 2015



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VII

ENTMDM-05B: IOT Cloud Platform

Teaching Scheme:
Theory: 2 Hours /week, 2 credits

Examination Scheme:
ESE – 70 Marks
ISE – 30 Marks

Course Prerequisite: Student shall have knowledge of basic understanding of Internet of Things (IoT), computer networks, operating systems, familiarity with programming concepts and data management.

Course Objectives:

1. To understand the fundamentals and role of cloud computing in IoT systems.
2. To study IoT cloud architectures, service models, and deployment models.
3. To learn IoT data management techniques, cloud storage mechanisms, and implement security and privacy measures in IoT cloud environments.
4. To explore IoT cloud for developing real-world IoT applications.

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the fundamentals of cloud computing and its integration with IoT.
 2. Explain IoT cloud architectures including Device-Gateway, Cloud models.
 3. Describe IoT data management techniques, cloud storage mechanisms, and security, privacy in IoT systems.
 4. Design end-to-end IoT solutions using IoT cloud platforms for real-world applications.
-

Section-I

Unit 1: Introduction to IoT Cloud Computing

(07 Hrs)

Overview of cloud computing: Concepts, characteristics and enabling technologies, Need of cloud computing for IoT, Role of cloud computing in IoT, M2M, IoT vs M2M, Comparison of Edge, Fog, and Cloud computing, Applications of Edge-Fog-Cloud computing with real-world examples (smart infrastructure, healthcare, transportation, and industrial IoT)

Unit 2: IoT Cloud Architecture & Device Integration**(08 Hrs)**

IoT cloud architecture, Cloud Computing Architecture, Cloud service models: IaaS, PaaS, SaaS, Cloud deployment models: Public, Private, Hybrid, Device–Gateway–Cloud architecture, Device identity, Device-to-Cloud (D2C) and Cloud-to-Device (C2D) communication models, Digital twins: concept, role, and applications.

Section-II**Unit 3: IoT Data Management, Security & Privacy****(07 Hrs)**

IoT data characteristics and IoT data lifecycle, Data collection and management, Data synchronisation techniques in IoT, Cloud storage Mechanism, Security Issues in IoT and Real-world Attacks, Security Challenges in IoT Systems, Security in the Future IoT Systems, Authentication, authorization, and access control, Data encryption and secure communication, Privacy fundamentals and ethical considerations in IoT deployments

Unit 4: Cloud Platforms & Case Studies**(08 Hrs)**

IoT data analytics fundamentals, AI and ML in IoT cloud, Data Analytics and Methods, Introduction of blockchain technology in cloud computing, Overview of popular IoT cloud platforms: AWS IoT, Google Cloud IoT, Azure IoT, Comparison of free and paid IoT cloud platforms (Blynk, Things Board, Node-RED), Case studies: Home Automation, Smart cities, Smart agriculture.

Text Books:

1. Internet of Things: A Hands-On Approach, Universities Press by Arshdeep Bahga, Vijay Madiseti.
2. IoT Security, Data Management and Cloud Integration – Dr. Balaji Venkateswaran, Dr. Dharmeshkumar B, Addition Publishing House.
3. Internet of Things, Connecting Future by Manish Soni

Reference Books:

1. Cloud Computing Concepts, Technology & Architecture by Thomas Erl, Printice Hall
2. Security and Privacy in Internet of Things (IoTs) by Fei Hu, CRC Press
3. An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications by Rahul Dubey, Cengage
4. *Mastering Cloud Computing*, McGraw-Hill Education By Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi.

5. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis, Wiley
6. Digital Twin Technology: Fundamentals and Applications by Manisha Vohra , Wiley

Resources:

1. IoT Security Challenges Solutions & Future Prospects by Mikhail Gloukhovtsev
 2. AWS IoT Documentation - <https://docs.aws.amazon.com/iot/index.html>
 3. Azure IoT Documentation - <https://learn.microsoft.com/en-us/azure/iot-hub/>
 4. Quickstart | Cloud IoT Core Documentation | Google Cloud <https://cloud.google.com>
 5. <https://sourceforge.net/software/compare/Blynk-vs-Node-RED-vs-Thingsboard/>
-

Semester VIII



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VIII

ENTPCC-15: Wireless Sensor Network

Teaching Scheme:

Theory: 4 Hours /week, 4 credits

Examination Scheme:

ESE– 100 Marks

Course Objectives:

1. To understand fundamental WSN concepts, key challenges (resource constraints, security), enabling technologies, and real-world applications, differentiating them from mobile ad-hoc networks.
2. To apply the knowledge of hardware (motes, sensors) and software (OS, execution) of individual nodes, analyze node energy consumption, and explain network scenarios, optimization goals (energy efficiency), and gateway functions.
3. To analyse network topology, clustering for efficiency, precise time synchronization, and manage sensor tasking and control.
4. To understand MAC protocols for low power (wake-up, duty cycles), understand connection-based vs. schedule-based protocols, and detail the IEEE 802.15.4 standard for WSN communication.
5. To interpret RFID physics, backscatter communication, antenna design, automation for tag/system design, and apply RFID for identification, healthcare, and emergency response.
6. To understand EMC principles, design considerations, and steps to ensure reliable WSN devices functionality without electromagnetic interference.

Course Outcomes:

At the end of the course, student's will be able to-

1. Explain WSN basics, challenges (energy, scalability, security), and compare with MANETs, identifying key enabling technologies and applications.
2. Apply the knowledge of hardware/software to single-node, energy models, and WSN network architectures, including optimization goals and gateway roles.
3. Categorize the WSN infrastructure using topology control, clustering, time synchronization, localization, and tasking methods.

4. Discuss MAC protocols (low duty cycle, scheduling, IEEE 802.15.4) and describe connection-based protocols for WSNs.
 5. Present RFID physics, backscatter communication, antenna design, automation, and outline its applications in data capture, healthcare, and emergencies.
 6. Discuss EMC principles, design considerations, and steps for ensuring Electromagnetic Compatibility in WSN designs.
-

Section- I

Unit 1: Introduction to Wireless Sensor Network

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, applications of WSN and Mobile adhoc networks and wireless sensor networks.

Unit 2: Architectures of WSN

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

Unit 3: Infrastructure Establishment

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

Section- II

UNIT 4: Protocols and Standards

MAC protocol- Low duty cycle and wake up concepts, Connection based protocols, Schedule based protocols and The IEEE 802.15.4 MAC protocol.

UNIT 5: Applications of RFID in WSN

Physics and Geometry of RFID, Backscatter Communication, Antenna Directivity and Gain, Design Automation for RFID Tags and Systems, RFID Physical Layer Design Automation, RFID Controller Design Automation, Applications of RFID: Identification and data capture, Health care and Massive incidents.

UNIT 6: Electromagnetic Compatibility

Aspects of EMC, Principle of EMC, Design steps EMC

Reference: -

1. FUNDAMENTALS OF WIRELESS SENSOR NETWORKS- WalteneagusDargie, Christian Poellabauer-A John Wiley and Sons, Ltd., Publication
2. PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS- Holger Karl Andreas Willig - John Wiley & Sons Ltd., Publication
3. BASICS OF WIRELESS SENSORS NETWORKS (WSN) - Kutubuddin Sayyad Liyakat Kazi, Lap- Lampert Publication. (ISBN- 978-620-7-64048-5)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VIII

ENTPEC-5A: Advanced Embedded System

Teaching Scheme:

Theory: 4 Hours /week, 4 credits

Examination Scheme:

ESE– 100 Marks

Prerequisites:

Students should have knowledge of:

1. Fundamentals of Microprocessors and Microcontrollers (basic architecture and programming concepts).
2. C programming (variables, loops, functions, bitwise operations).
3. Knowledge of embedded systems concepts.

Course Objectives:

The objectives of this course are to:

1. Understand the architecture and features of the MSP430 mixed-signal microcontroller.
2. Learn MSP430 programming techniques, instruction set, and addressing modes.
3. Develop skills in digital and analog interfacing using MSP430.
4. Understand clock systems, reset mechanisms, interrupts, and low-power operation in MSP430.
5. Analyze and implement timer-based applications, PWM generation, and ADC operations.
6. Gain practical knowledge of serial communication protocols using MSP430 peripherals.

Course Outcomes:

After successful completion of this course, students will be able to:

1. Explain the architecture of the MSP430 microcontroller.
2. Write and debug MSP430 programs
3. Interface digital input and output devices with MSP430.
4. Configure and utilize the clock system, reset sources of MSP430.
5. Design applications using MSP430 timer modules
6. Implement serial communication using the USCI module of MSP430.

Section-I

Unit 1: Introduction to MSP430 Microcontroller

Mixed Signal Microcontroller: MSP430 series, MSP430 CPU Architecture, low power features, family variants (e.g., MSP430x5x).

Unit 2: Programming the MSP430

Addressing Modes. Constant Generator and Emulated Instructions. Introduction to Lunchbox Platform. Using the MSP430 Launch Pad, Instruction Set.

Unit 3: Fundamentals of Physical Interfacing

Connecting Input Devices: Switches, Keyboard and Output devices: LEDs, Seven Segment Displays (SSD). Interfacing LEDs and Switches with MSP430 using Digital Input and Output.

Section-II

Unit 4: MSP430 Clock and Reset System

MSP430 Clock sources and distribution. Types of Reset sources. Handling Interrupts in MSP430. Low Power Modes in MSP430. ADC operation in MSP430.

Unit 5: MSP430 Timer Module & Communication Protocols

Timer Capture Modes. Generating Pulse Width Modulation (PWM) using Timer Capture Mode. Serial Peripheral Interface, Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication.

Unit 6: Applications of MSP430

Design of soil monitoring system for agriculture. Home automation system. Environment monitoring system. Data Logging system and in medical devices like health monitors.

Text Books:

1. MSP430 Microcontroller Basics. John H. Davies. Elsevier. ISBN-10: 9789380501857.
2. Introduction to Embedded Systems: Using Microcontrollers and the MSP430, by Manuel Jiménez , Rogelio Palomera, Isidoro Couvertier 2014th Edition, ISBN-13: 978-1461431428, Springer Publication
3. MSP430™ MCUs Development Guide Book, Texas Instruments

Reference Books:

1. Embedded System Design: A Unified Hardware / Software Introduction. Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X
2. Programming Embedded Systems in C and C++. Micheal Barr. Shroff Publishers and Distributors. ISBN-10: 817366076X
3. Designing Embedded Hardware, John Catsoulis. 2nd edition. Shroff Publishers and Distributors. ISBN-10: 9788184042597



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VIII

ENTPEC-5B: Image Processing Applications

Teaching Scheme:

Theory: 4 Hours /week, 4 credits

Examination Scheme:

ESE– 100 Marks

Course Prerequisite:

Student shall have knowledge of Digital Signal Processing

Course Objectives:

1. To introduce the fundamental building blocks of image processing across diverse application domains.
2. To explain the role of image processing in computer-aided medical diagnosis.
3. To interpret the satellite image processing techniques.
4. To develop understanding of image processing techniques used in biometric identification systems and security systems.
5. To analyze industrial defect detection problems using image-based methods.
6. To analyze image processing using Machine learning and AI techniques.

Course Outcomes: After completion of syllabus students should be able to

1. Explain the role and importance of image processing applications.
2. Apply image processing techniques to medical imaging and computer-aided diagnosis applications.
3. Analyze remote sensing and satellite images using multispectral, hyperspectral, change detection, and image fusion techniques for environmental, agricultural, and defence applications.
4. Evaluate image processing techniques used in biometrics image-based authentication, and surveillance analytics with respect to accuracy, robustness, and security requirements.
5. Design application-oriented image processing solutions for industrial inspection, embedded vision, and real-time automation systems considering hardware and performance constraints.
6. Analyze image processing using Machine learning and AI techniques such as Computer Vision for Intelligent Systems.

Section I

Chapter 1: Introduction to Image Processing Applications

Introduction, Basic Building Blocks of Image Processing Across Applications, Image Processing Applications, Image Segmentation & Analysis for Applications,

Chapter 2: Applications of image processing in Medical field

Introduction, Medical imaging modalities (CT, MRI, Ultrasound – overview), Image analysis for diagnosis, Computer-aided detection (CAD) systems, Image-based measurement and visualization, Applications – Cancer detection and analysis, Organ segmentation, Telemedicine

Chapter 3: Applications of image processing in Remote Sensing & Satellite communication

Introduction, Satellite image interpretation, Multispectral and hyperspectral imaging, Change detection techniques, Image fusion for remote sensing, Applications- Weather monitoring, Agriculture and forestry, Urban planning and defence

Section II

Chapter 4: Applications of image processing in Biometrics & Security Applications

Introduction, Image Processing in Emotion Detection, Image Processing in Emotion Detection in Human-Computer Interaction, Face recognition systems, Fingerprint and iris recognition, Image-based authentication, Surveillance and security analytics

Chapter 5: Applications of image processing in Industrial & Embedded Systems

Introduction, Machine vision systems, Industrial inspection and automation, Embedded vision hardware overview, Real-time constraints and performance issues, Applications- PCB inspection, Quality control, Robotics and automation

Chapter 6: Applications of image processing in Machine Learning and AI:

Computer Vision for Intelligent Systems - Image-based object recognition, Motion analysis and tracking, Stereo vision basics, Scene understanding, Use of Machine learning algorithm for image processing.

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods: Digital Image Processing, Pearson Education.
2. Milan Sonka et al. – *Image Processing, Analysis, and Machine Vision*
3. Kutubuddin Sayyad Liyakat Kazi: Image Processing Applications, Lambert Publishing
4. Anil K. Jain, Arun Ross, and Salil Prabhakar: Introduction to Biometrics, Springer.

5. Atam P. Dhawan: *Medical Image Analysis*, Wiley-Interscience.
6. Al Bovik (Ed.) – *Handbook of Image and Video Processing*
7. Shan Du, Yong Tao, and Alejandro Martinez: *Handbook of Facial Expression Recognition*, Springer.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-VIII

ENTOJT: On Job Training

Teaching Scheme:

Practical: 24 Hours /week, 12 credits

Examination Scheme:

ICA– 200 Marks

OE–100 Marks

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Course Objectives:

- 1 To give exposure for technical students of industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry
2. To Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job
3. To Familiarize with various materials, processes, products, softwares and their applications along with relevant aspects of quality control
4. To expose students to the engineer's responsibilities and ethics
5. To Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
6. To understand the psychology of the workers and their habits, attitudes and approach to problem solving

Course Outcomes:

At the end of the course students will be able to

1. Develop professional competence through internship.
 2. Apply academic knowledge in a personal and professional environment.
 3. Build the professional network and expose students to future employees.
 4. Apply professional and societal ethics in their day to day life.
 5. Become a responsible professional having social, economic and administrative considerations
 6. Make own career goals and personal aspirations.
-

Guidelines for On Job Training (OJT):

Engineering OJT 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 OJT with Small/ Medium / Large scale industries to make themselves ready for the industry.
2. Students should be available in the industry for the period of 12 to 14 weeks of the semester.
3. The evaluation of OJT activities carried out shall be done by Program Head / Cell Incharge / Project Coordinator / Project Guide / Faculty mentor.
4. Every student shall send weekly report to their internal guide without fail. Students shall have at least fortnightly communication with the internal guide without fail.
5. Students shall maintain OJT Diary/Workbook. The students should record in the daily training diary account of the observations, impressions, information gathered and suggestions given, if any.
6. Student will give a seminar based on his training report every month, before an expert committee constituted by the concerned department as per norms of the institute.
7. The OJT report shall be presented covering following recommended fields but not limited to:
 - Title/Cover Page
 - OJT completion certificate.
 - OJT Place Details- Company background-organization and activities/Scope and object of the study / personal observation.
 - Index/Table of Contents
 - Introduction
 - Title/Problem statement/objectives
 - Motivation/Scope and rationale of the study
 - Methodological details
 - Results / Analysis /inferences and conclusion
 - Suggestions / Recommendations for improvement to industry, if any
 - Attendance Record
 - List of reference (Library books, magazines and other sources)
8. The report submitted by student will be accepted and considered for final evaluation only if student continuously reports their work to the project guide and periodically evaluated by the internal examiners at college level.

9. ICA shall consider maintain of Training diary/workbook, Training Report, Certificate from Industry and presentation before department committee.
-