Curriculum Structure for Multi-Disciplinary Minor (MDM) Degree in

Internet of Things

(In light of NEP 2020)

(NEP_Version II)

Offered By

Department of Electronics & Telecommunication Engineering

For students admitted in 2023-24 onwards

Government College of Engineering, Amravati

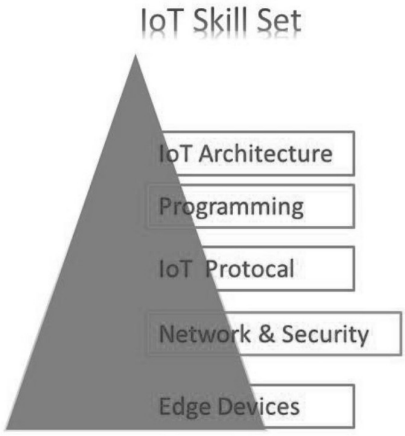
(An Autonomous Institute of Government of Maharashtra)
Near Kathora Naka, Amravati, Maharashtra
PIN 444604
www.gcoea.ac.in

A. **Preamble:**

IoT is a potential remedy for making the life of people better. Data exchange between the machines not only makes information more accessible, but it also has the potential to improve safety, health, education, and other elements of daily life. The smart watch, which keeps a connection to the cloud while monitoring health, is an example of this. Communication between the embedded systems offer the potential to boost efficiency, develop fresh manufacturing approaches, and get a deeper understanding of the market in sectors and businesses that deal directly with the end consumer. In the current technology scenario, IoT is gaining importance due to the features such as:

Better Decision Making
Real-time Tracking and Monitoring
Automation
Security and Privacy

B. **IoT skill set**



C. **Program-Specific Outcomes For Minor In Internet Of Things**

On completion of a Minor in Internet of Things, a student will be able to

PSO1: Design and develop secured IoT based embedded applications.

PSO2: Apply modern software and hardware tools to develop sustainable IoT applications to engage in lifelong learning and adapt in multi-disciplinary environment

PS03: Acquire IoT Application for environmental awareness

D. **Intake: Minimum 15**

E. **Eligibility criteria:** Students enrolled in Computer Science & Engg, Information Technology, Civil Engg, Mechanical Engg, Electrical Engg, Instrumentation Engg are eligible. The allotment of minor degree programme will be as per the policy of the Institute.

F. **Structure of the MDM course:**

E&Tc Department offer Mutidisplinary Minor Basket , Track-1 (Internet of Things)														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	TU	PR	Total	CT1	**CT2**	TA	ESE	ICA	ESE		
MM1	ET1315	Introduction to Internet of Things	3			3	15	15	10	60			100	3
MM2	ET1415	IoT Architecture & Protocols	3			3	15	15	10	60			100	3
MM3	ET1515	Programming with Arduino and Raspberry-Pi	3			3	15	15	10	60			100	3
MM4	ET1615	Industrial Internet of Things	3			3	15	15	10	60			100	3
MM5	ET1715	Project			4	4					25	25	50	2
Total			**12**	**0**	**4**	**16**	**60**	**60**	**40**	**240**	**25**	**25**	**450**	**14**

G. **Detailed syllabus:**

Course Code	**ET1315**							**Course category**			**MM1**
Course Name	**INTRODUCTION TO INTERNET OF THINGS**										
Teaching Scheme				**Examination Scheme**							**Credits**
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2.30 Hrs.	--	--	100	03

Course Objectives:

1. Describe what IoT is and how it works today
2. Recognize the factors that contributed to the emergence of IoT
3. Describe IoT Protocol
4. Recognize IoT cloud service providers
5. Define the infrastructure for supporting IoT deployments

Course Content:

Introduction to IoT: Architectural overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology, Fundamentals-Devices and gateways, Data management, Business processes in IoT, Role of cloud in IoT

Elements of IoT: Hardware components computing (Arduino, Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components- Programming APIs (Using python/Arduino) for communication protocols-MQTT, Zigbee, Bluetooth, CoAP, UDP, TCP.

Sensing and Actuation: Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT

IoT Application Development: Solution frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices

Text Book:

Vijay Midisetti, Arshdeep Bahgha " Internet of Things : Hands on approach", University Press

Reference Books:

Raj Kamal ," Internet of things: Architecture Design", Tata McGraw-Hill.

Useful Links:

Introduction to IoT and Embedded Systems Course web link: https://www.coursera.org/learn/iot

Sensors and Actuators Course web link: https://nptel.ac.in/courses/108/108/108108147
Course Outcomes:

ET1315.1: Understand predecessor of IoT technology and emergence of Internet of Things.
ET1315.2: Understand the architecture for Internet of Things.
ET1315.3: Learn about computing elements in IoT devices.
ET1315.4: Develop IoT end devices with sensors, actuators, and microcontrollers
ET1315.5: Understand IoT cloud process

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1315.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EE1315.2	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
EE1315.3	1	1	1	0	0	0	1	0	0	0	0	0	3	2	1
EE1315.4	0	1	1	0	0	0	0	0	2	0	0	0	2	2	0
EE1315.5	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	ET1415							Course category			MM2
Course Name	IOT ARCHITECTURE & PROTOCOLS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2.30 Hrs.	--	--	100	03

Course Objectives:

1. Assess the genesis and impact of IoT applications, architectures in real world.
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT.
4. Infer the role of Security in IoT.
5. Understand the role of IoT in various domains of Industry

Course Content:

IoT-An Architectural Overview: Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology

IoT Architecture-State of the Art Introduction, State of the art, Reference Model and Architecture, IoT reference Model - IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Real-World Design: Constraints- Introduction, Technical Design constraints Data management, Business processes in IoT,Bluetooth Low Energy, Zigbee Smart Energy, Wireless HART

Transport & Session Layer Protocols: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) Session Layer-HTTP.

Service Layer Protocols & Security: Service Layer -oneM2M, ETSI M2M, OMA, BBF Security in IoT Protocols MAC 802.15.4

Text Books:

Jan Holler, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence

Reference Books:

Peter Waher "Learning of Internet of Things " Packt Publications,2006.

Useful Links:

Design of Internet of Things, Course web link: https://onlinecourses.nptel.ac.in/noc21_ee85/

Course Outcomes:

ET1415.1: Understand Basics of IoT Architectures.
ET1415.2: Understand IoT Protocols
ET1415.3: Understand Programming the IoT applications using Microcontrollers.
ET1415.4: Interpret IoT Technologies in real world design.
ET1415.5: Analyse IoT security layer protocols and security

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1415.1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EE1415.2	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
EE1415.3	1	1	1	0	0	0	1	0	0	0	0	0	3	2	0
EE1415.4	0	1	1	0	0	0	0	0	2	0	0	0	2	2	1
EE1415.5	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	ET1515							Course category			MM
Course Name	PROGRAMMING WITH ARDUINO AND RASPBERRY PI										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs. 30 min.	00	00	100	03

Course Objectives: Students undergoing this course are expected to

I. Learn basic of Arduino Hardware
II. Learn Basic of Raspberry Pi
III. Learn Interfacing of Ardunio and Raspberry Pi with sensors, Actuators
IV. Study Installation, Testing and Verification Process

Course Content:

Basics of Arduino: Introduction to Arduino, Arduino Uno, Arduino Mega, Arduino Nano, Arduino IDE, Steps to install Arduino IDE, Basic commands for Arduino, LCD commands, Serial communication commands, Program with LED and Arduino and sketch.

Basics of Raspberry Pi: Introduction to Raspberry Pi, Raspberry Pi components, Installation of NOOBS and Raspbian on SD card , Terminal commands, Installation of Libraries on Raspberry Pi, Getting the static IP address of Raspberry Pi , Run a program on Raspberry Pi, Installing the Remote Desktop Server, Pi camera, Testing of the camera, Raspberry Pi camera as a USB video device, Face recognition using Raspberry Pi, Installation of I2C driver on Raspberry Pi, Serial Peripheral Interface with Raspberry Pi , Program with LED and Raspberry Pi, Program for read digital input and digital output.

Interfacing with Raspberry Pi and Arduino: Programing with sensors, PIR Sensor, Analog sensors, interfacing diagram/sketch, Programming with Actuators, DC motors, Servo motors, Interfacing diagram/sketch.

Python and Arduino with Pyfirmata (Python Library): Reading an Arduino digital input with Pyfirmata, Reading an analog input with Pyfirmata, Reading the Temperature Sensor values with Pyfirmata.

Connecting to the Cloud: DHT11 Data Logger with Thing Speak Server, Installation of DHT11 Library, Steps to create a channel in Thing Speak and Program, Blynk Application with Raspberry Pi.

Text Books:

1. Internet of things with Raspberry Pi and Arduino, Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, and Mahindra Swain 2019, CRC Press.

Reference books:

1. Learn Programming with Raspberry Pi with Python, Wolffram Donat, Apress.
2. Arduino and Raspberry Pi Sensor Projects - Robert Chin, Robert Chin
3. Guide To Raspberry Pi 3 And Android Development Programming Raspberry Pi 3 Getting Started with Android-up skill learning

Web Resources:

NPTEL course on Introduction to internet of things, by Prof. Sudip Misra, IIT Kharagpur
https://nptel.ac.in/courses/106105166

Course Outcome:

On completion of the course, students will be able to

ET1515.1 Realize Design Flow

ET1515.2 Analyze Arduino & Raspberry Pi Hardware

ET1515.3 Implementation Different Basic Applications

ET1515.4 Analyze cloud connecting application

ET1515.5 Analyze testing, Verification.

CO-PO-PSO Mapping as per NBA Jan-2016 Format

CO	PO/PSO											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
ET1515.1	3	0	0	0	0	0	0	0	0	0	0	0
ET1515.2	0	2	0	0	0	0	0	0	0	0	0	0
ET1515.3	0	0	3	0	0	2	0	0	0	0	0	0
ET1515.4	0	0	0	2	0	0	2	0	0	0	2	0
ET1515.5	0	0	0	0	3	0	0	0	0	0	0	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

CO-PO-PSO Mapping as per NBA 1-Jan-2025 Format

CO	PO/PSO										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
ET1515.1	3	0	0	0	0	0	0	0	0	0	0
ET1515.2	0	2	0	0	0	0	0	0	0	0	0
ET1515.3	0	0	3	0	0	2	0	0	0	0	0
ET1515.4	0	0	0	2	0	0	2	0	0	0	2
ET1515.5	0	0	0	0	3	0	0	0	0	0	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	ET1615								Course category			MM
Course Name	INDUSTRIAL INTERNET OF THINGS											
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives: Students undergoing this course are expected

I. To provide Knowledge and Evaluation of IIoT
II. To provide students with good depth of knowledge of Implementation systems for IioT.
III. To provide knowledge of Designing Industrial IOT Systems for various application.
IV. Understand and address security challenges in IIoT implementations.

Course Contents:

Introduction to Industrial IoT (IIoT) Systems: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.

Implementation systems for IIoT: Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.

IIoT Data Monitoring & Control: IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

Cyber Physical Systems: Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management

Case Studies of IIoT Systems: IIoT application development with Embedded PC based development boards, Development of mini Project on new version of Operating systems and Edge development board. That project should also address to the current societal needs.

Text Book:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist, Publications: Apress

Reference Book:

1. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics, Bartodziej, Christoph Jan, Springer Publication
2. Embedded System: Architecture, Programming and Design, Rajkamal, TMH3.
3. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, , River Publishers

Web Resources:

https://onlinecourses.nptel.ac.in/noc20_cs69/preview
Introduction to Industry 4.0 and Industrial Internet of Things

Course Outcome:

On completion of the course, students will be able to

ET1615.1 Realize Design Flow
ET1615.2 Knowledge of theory and practice related to Industrial IoT Systems.
ET1615.3 Ability to identify, formulate and solve engineering problems by using Industrial IoT
ET1615.4 Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability
ET1615.5 Analyze various case studies.

CO-PO-PSO Mapping as per NBA Jan -2016 Format

CO	PO / PSO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET1615.1	3	0	0	0	0	0	0	0	0	0	0	0
ET1615.2	0	2	0	0	0	0	0	0	0	0	0	0
ET1615.3	0	0	3	0	0	2	0	0	0	0	0	0
ET1615.4	0	0	0	2	0	0	2	0	0	0	2	0
ET1615.5	0	0	0	0	3	0	0	0	0	0	0	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

CO-PO-PSO Mapping as per NBA 1-Jan-2025 Format

CO	PO/PSO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ET1615.1	3	0	0	0	0	0	0	0	0	0	0
ET1615.2	0	2	0	0	0	0	0	0	0	0	0
ET1615.3	0	0	3	0	0	2	0	0	0	0	0
ET1615.4	0	0	0	2	0	0	2	0	0	0	2
ET1615.5	0	0	0	0	3	0	0	0	0	0	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Curriculum Structure for Multi-Disciplinary Minor (MDM) Degree in

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(In light of NEP 2020)

(NEP_Version II)

Offered By

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For students admitted in 2023-24 onwards

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A. Preamble:

This minor program covers the most current theories and practices used in Electronics and Communication Engineering. The program provides a valuable adjunct credential to engineering students pursuing their major degree in various fields. Engineering students from any branch may choose from a considerable variety of complementary courses under the categories of technical and complementary studies offered by Electronics and Communication Engineering Department. This minor program is rigorous enough to serve as a introductory credential for students subsequently electing to pursue advanced studies in Electronics and Communication Engineering.

B. Program-Specific Outcomes For Minor In Internet Of Things

On completion of a Minor in Internet of Things, a student will be able to

PSO1: Design and develop secured Digital circuit applications.

PSO2: Apply modern software and hardware tools to develop sustainable Electronics applications to engage in lifelong learning and adapt in multi-disciplinary environment

PS03: Acquire embedded system Application for environmental awareness

C. Intake: Minimum 15

D. Eligibility criteria:

Students enrolled in Computer Science & Engg, Information Technology, Civil Engg,, Mechanical Engg, Electrical Engg, Instrumentation Engg are eligible. The allotment of minor degree programme will be as per the policy of the Institute.

E. Structure of the MDM course:

E&Tc Department offer Mutidisplinary Minor Basket , Track-2 (Electronics & Telecommunication Engg)														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM1	ET1316	Digital Circuits	3			3	15	15	10	60			100	3
MM2	ET1416	Communication Engineering	3			3	15	15	10	60			100	3
MM3	ET1516	Microprocessor & Embedded System	3			3	15	15	10	60			100	3
MM4	ET1616	Wireless Communication	3			3	15	15	10	60			100	3
MM5	ET1716	Project			4	4					25	25	50	2
Total			**12**	**0**	**4**	**16**	**60**	**60**	**40**	**240**	**25**	**25**	**450**	**14**

F. Detailed Syllabus:

Course Code			ET1316						Course category			MM1
Course Name			DIGITAL CIRCUITS									
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2 hrs 30 min	--	--	--	03

Course Objectives:

1. To acquire the basic knowledge of digital logic circuit components
2. To implement minimization techniques and Boolean algebra for circuit minimization
3. To understand, analyze and design combinational logic circuits using gates and MSIs
4. To study various components and design sequential circuits and study semiconductor Memories

Number system and codes: Positional number system like binary, Decimal, Hexadecimal and Octal, conversions and arithmetic. Arithmetic using rth complements, Signed number representation and arithmetic, Codes: BCD, Gray, ASCII, etc and error detection codes.

Boolean algebra: Boolean algebra, Logic gates – basic (and, OR, NO), derived (Ex-OR,EX NOR) and universal (NAND, NOR), theorems and properties of Boolean algebra, DeMorgan's theorem, canonical and standard SOP and POS forms,

Logic functions Minimization: simplification and synthesis of Boolean functions using gates, Boolean theorems, K-Map, Don't care condition (up to four variables) and Implementation of Boolean expressions.

Combinational logic Circuit realization – realization of adders, Subtractor, BCD adder, ripple carry look ahead adders, comparator, parity generator, encoders, decoders, multiplexers, de-multiplexers, Realization of Boolean expressions- using decoders-and multiplexers.

Sequential circuits components – Introduction to sequential circuit. Latches, D, T, SR, JK flip flops, its triggering, inter-conversion, Shift registers: SISO, SIPO, PISO, PIPO, and Universal; Introduction to Counters.

Text Books:

1. Digital Principles & Logic Design by A. Saha N. Manna By Infinity Science Press LLC, 2007
2. Digital Design by Morris Mano, Pearson education, 2018

Reference Books:

1. T. L. Floyd "Digital Fundamentals", 11th ed., Pearson Education, 2018.
2. Wakerly J F, "Digital Design: Principles and Practices, Prentice-Hall", 5th Ed., 2018.
3. Roth C.H., "Fundamentals of Logic Design", Jaico Publishers. V Ed., 2009.

Course outcomes:

At the end of the course student will be able

ET1316.1 Optimize the digital circuits by applying the applying the Boolean algebra and other minimization techniques

ET1316.2 Examine and design the combinational circuits using gates and MSIs
ET1316.3 Realize the sequential circuits suing flip-flops counters and shift registers.
ET1316.4 Comparisons of logic families and implementation of gates using RTL, DTL and TTL
ET1316.5 Device logic circuits using SSIs and MSIs.

CO-PO-PSO Mapping

CO	PO / PSO														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
ET1316.1	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0
ET1316.2	2	1	0	0	0	0	0	0	0	0	0	0	3	2	0
ET1316.3	2	2	1	1	1	1	0	0	0	0	0	0	3	2	0
ET1316.4	1	2	1	2	2	2	0	0	0	0	0	0	3	1	0
ET1316.5	3	3	1	2	3	1	0	0	1	1	0	0	3	3	0

0- Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code			ET1416						Course category			MM2
Course Name			COMMUNICATION ENGINEERING									
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives:

To make the student able

1. To introduce students with basics of communication system and its elements.
2. To describe various types of noise in communication systems.
3. To understand, analyze and explain the analog modulation schemes.
4. To identify the atmospheric and terrestrial effects on radio wave propagation.

Course Contents:

Introduction to Communications Systems: Communication system – Information, Transmitter, Channel, Noise, Receive; Modulation - Need for modulation; Electromagnetic spectrum and typical applications.

Noise: External noise – Atmospheric noise, Extraterrestrial noise, Industrial noise; Internal Noise – Thermal agitation noise, Shot noise; Noise Figure, Noise Temperature.

Amplitude Modulation: Frequency Spectrum of the AM Wave, Representation of AM, Power Relation in the AM wave, Demodulation: Envelop Detector.

Frequency Modulation: Theory of Frequency and Phase Modulation: Description of systems, Mathematical Representation of FM, Frequency Spectrum of the FM Wave, Phase Modulation, Intersystem Comparisons, Demodulation: Foster-Seeley Discriminator, Ratio Detector.

Propagation of Waves: Ground Waves, Sky-wave Propagation, Space Waves, Tropospheric Scatter Propagation, Extraterrestrial Communications.

Text Books:

1. Electronic Communication Systems, George Kennedy, Bernard Davis, McGraw Hill Publication, 5th edition, 2011.

Reference Books:

1. Communication System, S. Haykin, 5th edition, John Wiley and sons, 2009.
2. Electronic communications, R. Dennis and J. Coolen, 4th edition, Prentice Hall
3. Communication Electronics Principles and Application, "Frenzel", Tata McGraw Hill, 3rd Edition

Course Outcomes:

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

ET1416.1 understand and identify the fundamental concepts and various components of Analog Communication Systems.

ET1416.2 comprehend the effect of noise in communication systems.

ET1416.3 discuss the working principle of various analog modulation techniques.

ET1416.4 develop the ability to compare and contrast the strength and weaknesses of various analog modulation systems.

ET1416.5 identify the atmospheric and terrestrial effects on radio wave propagation.

CO – PO – PSO Mapping:

	PO / PSO														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
ET1416.1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
ET1416.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ET1416.3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ET1416.4	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
ET1416.5	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	ET1516								Course category			MM
Course Name	MICROPROCESSOR AND EMBEDDED SYSTEM											
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives: Students undergoing this course are expected to

I. To learn the fundamentals Microcomputer System
II. To know microprocessors 8085, its architecture and working
III. To understand the concepts of Assembly Language Programming
IV. To learn and develop ALP programming using 8085
V. To know about 8051 and embedded System

Course Contents:

Introduction to Microprocessor: Microcomputer system, and Assembly language memory, Microprocessor Architecture and Microcomputing system, Microprocessor architecture and its operations, memory, input output (I/O) device, example of Microcomputer system

8085 Microprocessor Architecture and Memory interfacing the 8085 MPU: block diagram of 8085, Example of an 8085 based Microcomputer, memory interfacing, Illustrative examples, Programming model of 8085 Concept of Interrupts, 8085 interrupts, serial I/O basics.

8085 Instruction Set: types of instructions, Data Transfer, Arithmetic, Logical, Branch control, machine control instructions, Addressing modes: register, immediate, register indirect, implicit etc of instructions, Timing diagram of instructions

Assembly Language Programming: Assembly language Programming; programming using 8085 instructions simple programs, programs using conditions, using loops. Program to transfer data, array sorting, simple subroutines

Introduction to embedded System: role of Microcontroller, architecture of Microcontroller, components of Microcontroller and embedded system, 8051 microcontroller architecture, memory organization, Comparison of Microprocessors and Microcontrollers.

Text Books:

1. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar,5th edition, Penram International Publication,2004.
2. The 8051 microcontroller, Kenneth Ayala,3rd edition, Delmar Cengage Learning,2005.

Reference Books:

1. 0000 to 8085 – Introduction to Microprocessor for Engineers and Scientists, P. R. Sridharand P. K. Ghosh, 2nd edition, Prentice Hall India Ltd,2005.
2. Introduction to Microprocessor, Aditya P. Mathur,3rd edition, Tata McGraw-Hill,2004.
3. Advanced microprocessors and Peripherals, A. K. Ray and K. M. Bhurchandi, 2nd edition, Tata Mc Graw Hill, 2008
4. 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi, 2ndedition, Prentice Hall,2000

Web Resources:

1. NPTEL course on Electrical Engineering - NOC:Microprocessors And Microcontrollers
   https://archive.nptel.ac.in/courses/108/105/108105102/#
   Prof. Santanu Chattopadhyay, Department of Electronics and Electrical Communication Engineering I IT Kharagpur week 1-6

Course Outcomes: On completion of the course, students will be able to

ET1516.1 Understand need of Microprocessor, Know various components of Microprocessor base system

ET1516.2 Realize working of various components of Microprocessor 8085

ET1516.3 Recognize the power of 8085 instruction set for programming

ET1516.4 Verify your logic with 8085 programs

ET1516.5 Understand basics of embedded systems

CO-PO-PSO Mapping as per NBA Jan-2016 Format

CO	PO / PSO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET1516.1	0	0	1	0	0	0	0	0	0	0	0	0
ET1516.2	1	1	1	0	0	0	0	0	0	0	0	0
ET1516.3	1	1	1	1	1	0	2	0	0	0	0	0
ET1516.4	1	2	2	2	2	0	2	0	0	0	0	0
ET1516.5	3	2	2	1	3	0	3	0	0	0	0	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

CO-PO-PSO Mapping as per NBA 1-Jan-2025 Format

CO	PO/PSO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ET1516.1	0	0	1	0	0	0	0	0	0	0	0
ET1516.2	1	1	1	0	0	0	0	0	0	0	0
ET1516.3	1	1	1	1	1	0	2	0	0	0	0
ET1516.4	1	2	2	2	2	0	2	0	0	0	0
ET1516.5	3	2	2	1	3	0	3	0	0	0	0

0-Not Correlated 1-Weakly Correlated 2- Moderately Correlated 3- Strongly

Course Code	ET1616							Course category			MM
Course Name	WIRELESS COMMUNICATION										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2.30 Hrs.	00	00	100	03

Course Objectives: Students undergoing this course are expected

I. To get introduced to the wireless communication systems
II. To study the multiple access techniques used in wireless communication
III. To study the various system standards used in wireless communication
IV. To study the cordless system and other wireless systems

Course Contents:

Introduction: Evolution of Wireless Communication, advantages and disadvantages, Different types of Wireless Systems, Evolution to Next-Generation Wireless Networks, and Applications.

Multiple Access Technique: Frequency division multiple access (FDMA), time division multiple access (TDMA), frequency hop multiple access (FHMA), space division multiple access (SDMA).

Wireless Systems and Standards: Global system for mobile (GSM), system architecture, radio subsystem, channel types, frame structure, signal processing in GSM, code division multiple access CDMA (IS-95), frequency and channel specifications, forward and reverse CDMA channel.

Cordless Systems and WLL: Introduction to cordless systems, cordless telephony standard (CT2) and digital enhanced cordless telecommunication (DECT): standards, architecture, frame format and radio link, operation; IEEE802.16, role of wireless local loop (WLL), propagation considerations for WLL, local multipoint distribution services (LMDS) and multichannel multipoint distribution services (MMDS).

Wireless LAN: Overview, technologies; types: infrared, spread-spectrum, narrow band microwave LAN, mobile data networks, cellular digital packet data (CDPD), global packet for radio service (GPRS), wireless application protocol (WAP), introduction to Bluetooth technology

Text Books:

1. Wireless Communications Principles and Practice, T. S. Rappaport, 2nd edition, Pearson Education, 2010
2. Wireless Communications, T. L. Singhal, 4th reprint, Tata McGraw Hill, 2012

Reference Books:

1. Mobile Cellular Telecommunications, W. C.Y. Lee, 2nd edition, MGH, 2006
2. Wireless Communications and Networks, W. Stallings, 2nd edition, Pearson Education, 2009
3. Mobile Cellular Communication, G. S. Rao, 1st edition, Pearson Education, 2013

Course Outcomes:

On completion of the course, students will be able to

ET1616.1 Understand the functioning of wireless communication systems, and their evolution

ET1616.2 Demonstrate ability to explain various multiple access techniques for Wireless communication

ET1616.3 Compare the various wireless system standards

ET1616.4 Understand cordless and wireless local loop concepts

ET1616.5 Understand the concept of different wireless networks and Bluetooth technology

CO-PO-PSO Mapping as per NBA Jan -2016 Format

CO	PO / PSO											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
ET1616.1	2	1	1	1	2	0	0	0	0	1	0	2
ET1616.2	2	2	3	2	2	0	0	0	0	1	0	1
ET1616.3	3	3	2	3	2	0	0	0	0	1	0	1
ET1616.4	3	3	2	3	2	0	0	0	0	0	0	0
ET1616.5	3	3	2	3	2	0	0	0	0	0	0	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

CO-PO-PSO Mapping as per NBA 1-Jan-2025 Format

CO	PO/PSO										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
ET1616.1	2	1	1	1	2	0	0	0	1	2	0
ET1616.2	2	2	3	2	2	0	0	0	1	1	0
ET1616.3	3	3	2	3	2	0	0	0	1	1	0
ET1616.4	3	3	2	3	2	0	0	0	0	0	0
ET1616.5	3	3	2	3	2	0	0	0	0	1	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated