DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Scheme of Instruction, Evaluation
and
Syllabi of

B.E.MINOR
in
IOT AND EMBEDDED SYSTEMS

With effect from Academic Year 2024-25

UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, TS, INDIA

With effect from Academic Year 2024-25

SCHEME OF INSTRUCTION AND EXAMINATION

B.E. MINOR
in

IOT AND EMBEDDED SYSTEMS (MINOR)
FOR NON-ECE STUDENTS

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	MR501EC	Sensing techniques and sensors	3	-	-	**3**	3	40	60	3
2	MR601EC	Fundamentals of IoT	3	-	-	**3**	3	40	60	3
3	MR602EC	Fundamentals of Embedded Systems	3	-	-	3	3	40	60	3
4	MR701EC	IoT and Applications	3	-	-	**3**	3	40	60	3
5	MR702EC	Real Time Operating Systems	3	-	-	**3**	3	40	60	3
6	MR851EC	MR Project Work	-	-	6	**6**	-	-	100	3
		Total	**15**	**-**	**6**	**21**	**15**	**200**	**400**	**18**

Course Code	Course Title						Core//PE/OE
MR501EC	**SENSING TECHNIQUES AND SENSORS**						
Pre-requisites	**Contact Hours Per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
	3	-	-	-	40	60	3

Course objectives:

1. To expose the students to many varieties of transducers, measuring instruments, their Operating principles and construction.
2. To understand the principles of working of various sensors
3. Identify the details of instrumentation and devices intended for a particular application.
4. To provide an idea of strengths and weaknesses of the various types of sensors.
5. To know the suitable sensors for domain specific applications

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the fundamental and applications of several different types of sensors.
2. Evaluate and perform accurate measurements for any engineering system with clear idea of the potential errors.
3. Describe the working principles of various sensors.
4. Select an appropriate sensor for given application.
5. Understand various sensor materials and technologies used in designing sensors.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	-	-	-	-	-	1	2
CO2	3	3	2	1	1	-	-	-	-	-	1	2
CO3	3	3	2	1	1	-	-	-	-	-	1	2
CO4	3	3	2	1	1	-	-	-	-	-	1	2
CO5	3	3	2	1	1	-	-	-	-	-	1	2

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

Unit-I

Introduction: Difference between sensor and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band, Error - Absolute error, Relative error Limiting errors, Propagation of errors, Errors in measurement-gross, systematic and random errors, Loading effect, Statistical analysis of measurement data and probable error.

Unit-II

Sensors: Definition, classification of sensors.

Proximity Sensors: Principle, Inductive and Capacitive proximity sensors and its applications.
Velocity, motion, force sensors: Tachogenerator, Optical encoders, Strain Gauge as force Sensor.
Fluid pressure: Tactile sensors, **Flow Sensors**: Ultrasonic and laser, **Level Sensors:** Ultrasonic and Capacitive.
Light sensors: Photo Diodes and Applications of Photo Diodes.

Unit-III

Transducers: Definition, classification of Transducers.
Mechanical Transducers: Displacement-to-Pressure, Seismic Displacement Transducers.
Passive Electrical Transducers: LVDT, Resistor Moisture Transducer.
Active Electrical Transducers: Hall Effect Transducer, Piezoelectric transducer.

Unit-IV

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.

Unit-V

Applications: Microphone and its types, Temperature measurement-Thermistor, Thermometer - resistance wire thermometers, semiconductor thermometers and thermocouples, proximity sensor, Hygrometer.

Suggested Reading

1. D. Patranabis, “Sensors and Transducers”, Prentice Hall India Pvt., 2nd Ed, 2021.
2. Clarence W. De Silva, “Sensors and Actuators Engineering System Instrumentation”, Taylor & Francis Ltd, 2nd Ed, 2015.
3. Jacob Fraden, “Hand Book of Modern Sensors: Physics, Designs and Application” 4Ed, Springer, 2010.
4. 2. Jonathan Wolpaw and Elizabeth Winter Wolpaw, “Brain-Computer Interfaces: Principles and Practice”, Oxford University Press, 2012.
5. 3. D. V. S. Murty, “Transducers and Instrumentation”, Prentice Hall India Pvt., Limited, 2008.

Course Code	Course Title						Core/PE/OE
MR601EC	**FUNDAMENTALS OF IOT**						**Core**
Prerequisite	**ContactHoursPerWeek**				CIE	SEE	Credits
-	L	T	D	P			
	3	-	-	-	40	60	**3**

Course Objectives

1. To study fundamental concepts of IoT
2. To describe the features and architecture of Embedded Development Boards.
3. To Learn different protocols used for IoT design
4. To understand the role of IoT in various domains of Industry..

Course Outcomes:

On completion of the course, student will be able to

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Apply the concepts of IoT to Embedded Development Board.
3. Understand and apply various protocols for design of IoT systems
4. Understand various applications of IoT
5. Understand APIs to connect IoT related technologies

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-
CO3	-	2	2	-	-	-	-	-	-	-	-	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	-	-	-	-

UNIT-I

Introduction and Concepts: Introduction to Internet of Things, Definitions and Characteristics of IoT, Physical Design of IoT: Things in IoT, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data, Communication Protocols, IoT Levels & Deployment Templates.

UNIT- II

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration,Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-III

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC,Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.Edge connectivity and protocols.

UNIT-IV

Arduino Simulation Environment: Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD. Interfacing of temperature, Humidity, Motion, Light and Gas Sensor with Arduino Interfacing of Actuators with Arduino.Interfacing of Relay Switch and Servo Motor with Arduino

UNIT-V

Basic Networking with ESP8266 WiFi module: Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration, posting sensor(s) data to web server, Study of IOT Cloud platforms, Thing Speak and MQTT API, Interfacing ESP8266 with Web services

Text Books:

1. Hakima Chaouchi, ― "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, ― "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, ― "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

Course Code	Course Title						Core/PE/OE
MR602EC	**FUNDAMENTALS OF EMBEDDED SYSTEMS**						**Core**
Prerequisite	**Contact Hours Per Week**				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	**3**

CourseObjectives:

1. Learn basics of Computer architecture, its working and types.
2. Learn basics of Embedded Systems and their applications.
3. Learn interfacing various components with Embedded Systems

CourseOutcomes

Aftercompletingthiscourse, thestudentwillbeable to:

1. Learn about the general principles of computer architecture
2. Understand the working of a simple embedded system and embedded system applications
3. Understand the hardware aspects of embedded systems
4. Understand the sensors, ADCs and actuators used in embedded systems
5. Understand the real world examples of embedded systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	1
CO3	2	-	-	-	-	-	-	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2

UNIT-I

Basics of computer architecture and the binary number system:

Basics of computer architecture, computer languages, RISC and CISC architectures, number systems, number format conversions, computer arithmetic, units of memory capacity.

UNIT-II

Introduction to embedded systems:

Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, figure of merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems, current trends

UNIT-III

Embedded systems-The hardware point of view:

Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems, low power design, pull up and pulldown resistors

UNIT-IV

Sensors, ADCs and Actuators:
Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators Displays, Motors, Opto couplers/Opto isolators, relays

UNIT-V

Examples of embedded systems:
Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks (WISENET), robotics, biomedical applications, brain machine interface

SUGGESTED READING

1. Lyla B Das, Embedded systems: An Integrated Approach, 1st Ed., Pearson, 2013
2. Raj Kamal, Embedded Systems – Architecture, Programming and Design, 2nd Edition, TMH, 2008
3. Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
4. Kanta Rao B, Embedded Systems, 1st Ed., PHI
5. Frank Vahid & Tony Givargis, Embedded System Design, 2nd Edition, John Wiley