FRANCIS XAVIER ENGINEERING COLLEGE
AN AUTONOMOUS INSTITUTION
Accredited BY NBA | AICTE Sponsored Margdarshan Mentor Institution
DST-FIST Supported Institution | ISO 9001:2015 Certified
Recognized under Section 2(f) & 12(B) of the UGC Act, 1950
/fxengg /fxengg /fx_ec /fxengg
/francisxavierengineeringcollege

Curriculum and Syllabi- Minor Course (IoT)

CHOICE BASED CREDIT SYSTEM AND OBE

B.E – Electronics and Communication Engineering

Department Vision

To develop Electronics and Communication Engineers by permeating with proficient morals, to be recognized as an adroit engineer worldwide and to strive endlessly for excellence to meet the confronts of our modern society by equipping them with changing technologies, professionalism, creativity research, employability, analytical, practical skills and to excel as a successful

Department Mission

1. To provide excellence through effective and qualitative teaching-learning process that equips the students with adequate knowledge and to transform the students' lives by nurturing the human values to serve as a precious resource for Electronics and Communication Engineering and nation.
2. To enhance the problem solving and lifelong learning skills that will enable by edifying the students to pursue higher studies and career in research.
3. To create students with effective communication skills, the abilities to lead ethical values in order to fulfill the social needs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 **Acquiring Quality Education:** To acquire adequate and quality education on all aspects of Engineering and inculcate a spirit of lifelong learning which would spark an interest for Higher studies and Cutting-Edge research.

PEO 2 **Developing Multi-skills & Professionalism:** To develop dynamic Leadership skills, powerful Discerning & Decision making and communication skills with amicable team spirit and ethical responsibility.

PEO 3 **Contemporary learning:** To get equipped with skills in trending technologies in industries, which delivers excellent job prospects and kindles the spirit of entrepreneurship.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO_1 Design, Implement and Test Embedded and VLSI systems using state of the art components and software tools

PSO_2 Design and develop the signal processing and communication systems for the real time application.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO_a **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO_b **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.

PO_c **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.

PO_d **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.

PO_e **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.

PO_f **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.

PO_g **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.

PO_h **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO_i **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO_j **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.

PO_k **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO_l **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.

Mapping with PO's Vs PEO's, PSO's

PO	PEO1	PEO2	PEO3	PSO1	PSO2
1	3		2	3	1
2	1	2	2	2	1
3	1	2	2	2	2
4	2	2	2	3	2
5	1		2		3
6		2	2		
7	1	2	2		1
8		2			
9		3	2		2
10		3	2		1
11	2	3	2	1	1
12	2	2	2	2	2

B.E ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

SUMMARY OF CREDIT DISTRIBUTION

S. No	Category	Credits Per Semester								Total Credit	Credits in %
		I	II	III	IV	V	VI	VII	VIII		
1	**HSSM**	3	2			7	1			**11**	**7.74%**
2	**BS**	12	4	4						**20**	**11.90%**
3	**ES**	9	8	5						**22**	**13.10%**
4	**PC**		5	13	18	12	9	10		**67**	**39.88%**
5	**PE**					3	6	9		**18**	**10.71%**
6	**OE**					3	6	3		**12**	**7.14%**
7	**EEC**			1	1	1	3		10	**16**	**9.52%**
Total		**24**	**19**	**23**	**19**	**26**	**25**	**22**	**10**	**168**	**100%**

HSSM – Humanities and Social Sciences including Management
BS – Basic Sciences
ES – Engineering Sciences
PC – Professional Core
PE – Professional Elective
OE – Open Elective/ Programme Specific Elective for Expandable Scope
EEC – Employability Enhancement Courses

Minor Course on Internet of Things

FOURTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
21EC4S01	Introduction to Internet of Things	MC	3	0	0	3	3
FIFTH SEMESTER							
21EC5S01	Sensors and Actuators	MC	3	0	0	3	3
SIXTH SEMESTER THEORY CUM PRACTICAL							
21EC6S01	Embedded Systems for IoT	MC	3	0	2	4	5
SEVENTH SEMESTER THEORY CUM PRACTICAL							
21EC7S01	IoT with Arduino, ESP, and Raspberry Pi	MC	3	0	2	4	5
EIGHTH SEMESTER							
21EC8S01	Project Work	MC	0	0	8	4	8

21EC4S01	INTRODUCTION TO INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Prerequisites for the course

- **Basic Computer Knowledge & Computer Architecture**

Preamble

This course is about the architecture of internet of things and strategic research and its network infrastructure. It clearly explains about the various reference models which is suitable for IoT applications and discusses about the various case studies to appreciate the applications of the Internet of things.

Objectives

1. To make students know the IoT ecosystem
2. To appreciate the different aspects of IoT Architectures
3. To understand the IoT Reference Models
4. To develop IoT infrastructure for popular applications
5. To understand various security issues in IoT

UNIT I	Introduction to IoT	9

IoT & Web Technology: The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication.

UNIT II	IoT Architecture	9

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies.

UNIT III	IoT Reference Models	9

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

UNIT IV	IoT Applications	9

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT V	IoT Security	9

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT.

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	Formative Assessment Test (10 Marks)	End Semester Exams (60 Marks)

1. Description Questions 2. Formative Multiple Choice Questions	1.Assignment 2. Online Quizzes 3.Problem-Solving Activities	1. Description Questions 2. Formative Multiple Choice Questions

Outcomes

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

CO 1	Identify and design the new models for market strategic interaction
CO 2	Design business intelligence and information security for WoB
CO 3	Analyze various reference models for IoT
CO 4	Analyze applications of IoT in real time scenario
CO 5	Identify the different security issues in IoT

Text Books

1. Dr. Jeeva Jose, Internet of Things, Khanna Publishing House.
2. Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher.
3. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons.
4. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons
5. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media

Reference Books

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
2. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

Web Resources

1. **https://www.coursera.org/specializations/internet-of-things**

CO Vs PO Mapping and CO Vs PSO Mapping

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

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:

1. Sketch the structure of the IoT Ecosystem.
2. List various IoT Applications in city environment.

COURSE OUTCOME 2:

1. Justify the statement "M2M and IoT solutions will increase dramatically"
2. What types of networks can be used to provide remote connectivity between the M2M device and the application-side servers.

COURSE OUTCOME 3:

1. Discus the Resource-Level Services of IoT
2. Point out the purpose of the Communication Layer in the IoT Architecture

COURSE OUTCOME 4:

1. Tabulate the Various layers of the sensor nodes
2. What are Challenges faced by IoT industry applications

COURSE OUTCOME 5:

1. Justify the need of CapBAC
2. List out the 7 flows of supply chain information

21EC5S01	SENSORS AND ACTUATORS	L	T	P	C
		3	0	0	3

Prerequisites for the course

- **Basic Physics**

Preamble

This course deals with the basics of various sensors and actuators which can be used for the monitoring various environmental parameters and controlling any electronic appliances. This course clearly differentiates the various types of analog and digital sensors available in recent dates that can be based on contact type or non-contact type and about various mechanical actuators.

Objectives

1. To introduce the fundamentals of displacement measurement
2. To expose the fundamentals of Proximity, force and pressure
3. To discuss on velocity, force and pressure sensors
4. To familiarize the smart sensors for designing smart products
5. To teach the fundamentals of ACTUATORS

UNIT I	INTRODUCTION AND DISPLACEMENT MEASUREMENT	9

Sensors - Basic requirements of a sensors- Classification of sensors- Static and Dynamic characteristics of sensors- Displacement Sensors- Linear and Rotary displacement sensors- Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder, Photoelectric sensor, Hall Effect Sensor.

UNIT II	MEASUREMENT OF PROXIMITY, FORCE AND PRESSURE	9

Eddy current proximity sensor- Inductive Proximity sensor- Capacitive Proximity sensor - Pneumatic Proximity sensors- Proximity Switches- Contact and Noncontact type – Strain Gauge – Diaphragm Pressure Sensor- Capsule Pressure sensors- Bellows Pressure Sensor- Bourdon tube pressure sensor- Piezoelectric Sensor- Tactile sensor..

UNIT III	MEASUREMENT OF VELOCITY, FLOW AND LEVEL	9

Tachogenerator - Pyroelectric sensors - Ultrasonic sensor – Resistive sensor- Pitot tube – Orificeplate - flow nozzle- Venturi tubes – Rotameter- Electromagnetic flow meter. Float level sensor- Pressure level sensor- Variable capacitance sensor.

UNIT IV	SMART SENSORS	9

Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface– The Automation.

UNIT V	ACTUATORS	9

Pneumatic and Hydraulic Actuation Systems- Actuation systems – Pneumatic and hydraulic systems - Directional Control valves – Pressure control valves – Cylinders - Servo and proportional control valves – Process control valves – Rotary actuators.

Total Periods	**45**

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	**Formative Assessment Test (10 Marks)**	**End Semester Exams (60 Marks)**
1. Description Questions 2. Formative Multiple Choice Questions	1.Assignment 2. Online Quizzes 3.Problem-Solving Activities	1. Description Questions 2. Formative Multiple Choice Questions

Outcomes

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

CO 1	To familiarize the Working principles of various sensors
CO 2	Able to differentiate between various thermal and magnetic sensor
CO 3	To work on sensors based on the principles of Radiation and Electromagnetics
CO 4	Implement smart sensors for developing a smart product
CO 5	Work on various actuators to develop smart solutions

Text Books

1. D. Patranabis – "Sensors and Transducers" –PHI Learning Private Limited
2. W. Bolton – "Mechatronics" –Pearson Education Limited.

Reference Books

1. Sensors and Actuators – D. Patranabis – 2nd Ed., PHI, 2013.

Web Resources

1. **https://www.coursera.org/learn/internet-of-things-sensing-actuation?**

CO Vs PO Mapping and CO Vs PSO Mapping

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

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:

1. State the working principle of Sensors
2. Classify the Sensors based on the application

COURSE OUTCOME 2:

1. How to classify the sensors as active and passive sensors?
2. When do the sensors will exhibits saturation?

COURSE OUTCOME 3:

1. Categorize the various methods of sensing Force.
2. Differentiate between Mechanical and Electromechanical sensors

COURSE OUTCOME 4:

1. What is the significance of voltage to frequency converter in sensor data transmission?
2. Classify the data transmission methods used for sensor signal transmission.

COURSE OUTCOME 5:

1. List the advantages and dis-advantages of hydraulic drive.
2. Why servomotors are preferred with stepper motor in robot applications?

21EC6S01	EMBEDDED SYSTEMS FOR IOT	L	T	P	C
		3	0	2	4

Prerequisites for the course

- **Basic Computer Knowledge & Computer Architecture**

Preamble

This is a theory cum Lab course, which tells about how to design an embedded systems by interfacing various sensors and with the help of various I/O peripherals and by interfacing various communication modules how to transfer a data from the sender to the receiver and also discusses about storing the sensed data in the various cloud servers and visualize it in the cloud dashboards.

Objectives

1. To make students know the basic concept and architecture of embedded systems
2. Different design platforms used for an embedded system for IoT applications.
3. To have knowledge about the IoT I/O Peripherals
4. To familiarize the IoT Communication Choice
5. To understand various IoT Cloud Offerings

UNIT I	Introduction to Embedded IoT	8

Purpose, requirement &specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices.

UNIT II	System Design using Sensors and Actuators	8

Design of Embedded Systems: Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture.

UNIT III	Input and Output peripherals	8

Inputs and Outputs: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, Bus In, Bus Out, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768).

UNIT IV	IoT Communication Module	8

IoT Enabling Technologies: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, ThingWorx.

UNIT V	IoT Cloud Offerings	8

Web of Things and Cloud of Things: Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers,Cloud Offerings and IoT Case Studies: Introduction to Cloud Storage Models, Communication API.

Total Periods			**45**
	LABORATORY		
S.NO	**NAME OF THE EXPERIMENTS**	**HOURS**	**CO**
1	Working with Microcontroller 89C51 Development Board	2 hours	**1**
2	Interfacing various Sensors With 89C51 Development Board	2 hours	**2**
3	Interfacing Actuators with 89C51 Development Board	2 hours	**2**
4	Introduction to Tinkercad Design Tool	2 hours	**2**
5	Simulating Arduino using Tinkercad Design Tool.	2 hours	**2**
6	Understand the layout of Arduino UNO board.	2 hours	**3**
7	Working with LEDs and Switches	2 hours	**3**
8	Working with Sensors and Actuators	2 hours	**2**
9	Study of LPC2148 ARM Development Board	2 hours	**1**
10	Interfacing LPC2148 with LEDs, Sensors and Actuators	2 hours	**3**
	Total Periods	**20**	

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	**Formative Assessment Test (10 Marks)**	**End Semester Exams (60 Marks)**
• Descriptive Answers- CAT-1, CAT-2	• Lab Experiment • Lab Model exam	• Descriptive Answers

Outcomes

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

CO 1	Develop and test embedded system using 89c51 Microcontroller.
CO 2	To apply hardware/software co-design techniques in IoT applications
CO 3	To design Embedded IoT Devices with Various I/O Peripherals
CO 4	Implement IoT Communication Module
CO 5	Working of various web/cloud based IoT applications

Text Books

1. Dr. Jeeva Jose, Internet of Things, Khanna Publishing House.
2. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
3. Klaus Elk, "Embedded Software for the IoT".

Reference Books

1. Perry Xiao, "Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed".
2. Elizabeth Gootman et. al, "Designing Connected Products", Shroff Publisher/O'Reilly Publisher.

Web Resources

1. https://www.coursera.org/learn/iot
2. https://www.udemy.com/course/8051-microcontroller/
3. https://www.youtube.com/watch?v=DlL6AS2PsuU

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

1	3	3	1		1	3	3	3	3	2		3	3	3
2	3	3	3	2	2	3	3	3	3	2		3	3	3
3	3	3	3	2	3	3	3	3	3			3	3	3
4	3	3	2		3	3	3	3	3			3	3	3
5	3	3	2		3	3	3	3	3	2	2	3	3	3

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:

1. Give the evolutionary phases of IoT.
2. Illustrate the IoT Reference model

COURSE OUTCOME 2:

1. Summarize the purpose of Sensors, Actuators and Smart Objects
2. Illustrate top down approach of embedded systems

COURSE OUTCOME 3:

1. Demonstrate the use of sensor nodes
2. Generalize the analog pins are used in Arduino UNO board.

COURSE OUTCOME 4:

1. Outline the features of 6LoWPAN
2. How does the data rate vary in LoRaWAN?.

COURSE OUTCOME 5:

1. Analyze in detail the key features of IOT cloud platform.
2. Generalize the Microsoft Azure IOT features.

21EC7S01	**IOT WITH ATMEGA328P, ESP8266, AND RASPBERRY PI**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Prerequisites for the course

- **Basic Knowledge in Microprocessor & Microcontrollers**

Preamble

This is a theory cum lab course, which clearly explains the functionality of various types of microcontrollers used for IoT Applications such as Arduino Atmega 328p microcontroller, ESP 8266 based WiFi on chip microcontrollers and pocket sized computer Raspberry Pi processor.

Objectives

1. To make students know the basic concept and architecture of embedded systems
2. Different design platforms used for an embedded system for IoT applications.
3. To have knowledge about the IoT I/O Peripherals
4. To familiarize the IoT Communication Choice
5. To understand various IoT Cloud Offerings

UNIT I	**IoTbuilding blocks**	**8**

IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).

UNIT II	**System Design using Arduino**	**8**

Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.

UNIT III	**System Design using ESP**	**8**

ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API- GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based HomeAutomation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).

UNIT IV	**System Design using Raspberry Pi**	**8**

Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.

UNIT V	**Raspberry Pi Cloud Interfaces**	**8**

Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Mobel B Comparison, LoRawan /LPWAN – Overview.

	Total Periods	**40**

LABORATORY

S.NO	**NAME OF THE EXPERIMENTS**	**HOURS**	**CO**
1	Interfacing Arduino UNO with ESP 8266 Wi-Fi Module	**2 hours**	**1**
2	Introduction to Automation using Arduino ESP8266	**2 hours**	**1**
3	Interfacing the Sensors with Arduino ESP8266	**2 hours**	**2**
4	Working with Node MCU & Sensors	**2 hours**	**2**
5	Introduction to various cloud offerings	**2 hours**	**3**
6	Controlling Actuators through Wi-Fi and Cloud applications	**2 hours**	**3**
7	Client Server Application using Node MCU	**2 hours**	**3**
8	Introduction to Raspberry Pi and its Installation Process	**2 hours**	**4**
9	Interfacing Sensors, Actuators with Raspberry Pi	**2 hours**	**4**
10	Working with open source cloud platforms for monitoring the sensor updates	**2 hours**	**5**
	Total Periods	**20**	

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	**Formative Assessment Test (10 Marks)**	**End Semester Exams (60 Marks)**
• Descriptive Answers- CAT-1, CAT-2	• Lab Experiment • Lab Model exam	• Descriptive Answers

Outcomes

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

CO 1	Provide solutions for complex embedded problems using Atmega328p
CO 2	To work on social relevant problems and provide solutions using ESP with critical protocols and its communication to cloud
CO 3	To install an operating system in Raspberry PI and build a system to work in cloud applications
CO 4	To apply commonly used IOT protocols such as REST API, MQTT through IOT based demonstration
CO 5	To Incorporate analog sensor and digital sensor with IOT devices.

Text Books

1. Dr. Jeeva Jose, Internet of Things, Khanna Publishing House.
2. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
3. Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.

Reference Books

1. Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd
2. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O'Reilly Publisher Media, Inc."

Web Resources

1. https://www.coursera.org/specializations/iot?
2. https://www.coursera.org/learn/raspberry-pi-platform?

CO Vs PO Mapping and CO Vs PSO Mapping

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

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:

1. Give the features of Arduino microcontroller.
2. Formulate how Raspberry Pi products is different from Arduino microcontroller.

COURSE OUTCOME 2:

1. Write a sketch to blink the on board LED on the Arduino UNO.
2. Compare LM35 and DHT11 temperature sensors.

COURSE OUTCOME 3:

1. Discuss about the pin configuration in the ESP8266
2. Demonstrate the publish and subscribe model of IoT

COURSE OUTCOME 4:

1. Differentiate Raspberry with Arduino
2. List the essential requirements for setting up Raspberry Pi.

COURSE OUTCOME 5:

1. Illustrate the cloud services used for IOT.
2. List the key features of IOT cloud platform.