Savitribai Phule Pune University Second Year of Artificial Intelligence and Data Science (2020 Course) 217529: Internet of Things		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Lecture: 03 Hours/Week	**03**	**Mid_Semester(TH): 30 Marks** **End_Semester(TH): 70 Marks**

Prerequisite Courses:	**110005: Programming and Problem Solving**
Companion Course:	**217531: Internet of Things Laboratory**

Course Objectives:
- Understand the Basic Digital Electronics and microprocessors.
- To introduce students with the architecture and operation of typical microprocessors and microcontrollers and its interfacing
- Understand the definition and significance of the Internet of Things.
- Interface and deploy analog and digital sensors.
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Outcomes:
On completion of the course, learner will be able to–
CO1: Have a thorough understanding of the structure, function and characteristics of computer systems and Understand the structure of various number systems and its application in digital design.
CO2: Develop the skill set to build IoT systems and sensor interfacing.
CO3: Explain the concept of Internet of Things and identify the technologies that make up the internet of things
CO4: Analyze trade-offs in interconnected wireless embedded device networks. Select Appropriate Protocols for IoT Solutions
CO5: Design a simple IoT system comprising sensors by analyzing the requirements of IoT Application
CO6: Identify the Application of IoT in automation of Commercial and Real World examples

Course Contents

Unit I	**Fundamentals of Computer Organization & Digital Electronics**	**(09 Hours)**

Basic Organization of Computers, Classification Micro, Mini, Mainframe and Super Computer. System Bus and Interconnection, PCI, Computer Function, I-Cycle, Interrupt and Class of Interrupts.
Number systems, Decimal Number system, Binary number system, Octal & Hexadecimal number system, 1's & 2's complement, Binary Fixed Point Representation.

#Exemplar/Case Studies	Various sensors and its internal operation
Mapping of Course Outcomes for Unit I	CO1

Unit II	**Communication Interface**	**(06 Hours)**

Basic Peripherals & their interfacing with 8086/8088, Semiconductor Memory Interfacing-Dynamic RAM Interfacing-Interfacing I/O ports-PIO-8255, Modes of operation-interfacing Analog-Digital Data converter-stepper motor interfacing.

#Exemplar/Case Studies	Arduino Uno 3
Mapping of Course Outcomes for Unit II	CO2

Unit III	**Introduction & IOT Technologies behind smart and intelligent devices**	**(09 Hours)**

IoT Concepts, Introduction to IOT Communications, Telemetry vs IOT, Applications of IOT Communications, People, Processes and Devices.
Automation, asset management, telemetry, transportation, telematics. Telemetry and Telemetric; Report

location, logistics, tracking and remote assistance; Next generation kiosks, self-service technology; Cellular IOT connectivity services.

#Exemplar/Case Studies	Big Data, Cloud Computing
Mapping of Course Outcomes for Unit III	CO3

Unit IV	IoT Systems, Network and Protocols	(07 Hours)

Study of RF Wireless Sensors; Wireless networks; Wireless Sensor Networking (WSN); Cellular Machine-to-Machine (M2M) application networks; Computer Connected to Internet; Network Devices; Device configuration and management; Exchange information in real time without human intervention; IoT Protocols.

#Exemplar/Case Studies	RFID, Industry 4.0- IOT
Mapping of Course Outcomes for Unit IV	CO4

Unit V	IOT Design and System Engineering	(06 Hours)

Discuss IOT Requirements; Hardware & Software; Study of IOT Sensors; Tagging and Tracking; Embedded Products; IOT Design; SIM Card Technology; IOT Connectivity and Management; IOT Security & IOT Communication.

#Exemplar/Case Studies	ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks -Focus on Wearable Electronics
Mapping of Course Outcomes for Unit V	CO5

Unit VI	IOT Applications	(07 Hours)

IOT Verticals; IOT Hosted Services; IOT Application development, IOT Connectivity; IOT Software providers; Review of various IoT application domains including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communication and wearable computing devices.

#Exemplar/Case Studies	Rural Development using IOT
Mapping of Course Outcomes for Unit VI	CO6

Learning Resources

Text Books:
1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things: Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0

Reference Books:
1. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
2. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345 3.
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN: 978-1-118-43063-7

e-Books: Internet of Things and Access Control: Sensing, Monitoring and Controlling Access in IoT-Enabled Healthcare Systems (Smart Sensors, Measurement and Instrumentation Book 37), 1st Edition, Kindle Edition

MOOC Courses: Introduction to IoT (NPTEL) by Prof. Sudip Mishra, IITKGP.

@The CO-PO mapping table

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	2
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	1	1	-	-	-	-	-	-	-	-	-	-