JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTHAPURAMU
COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA

Course Code	**:**	15ACS06			
Year & Semester		IV year & I semester			
Course Title	**:**	Internet of Things			
Course Structure	**:**	Lectures	Tutorials	Practicals	Credits
		4	0	0	4
Course Coordinator	**:**	K.Chandrasekhar			
Team of Instructors	**:**	G.Murali(HOD)			

I. Course Overview

IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics.

IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes.

IoT − Key Features

The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. A brief review of these features is given below −

- **AI** − IoT essentially makes virtually anything "smart", meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. This can mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low, and to then place an order with your preferred grocer.
- **Connectivity** − New enabling technologies for networking, and specifically IoT networking, mean networks are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale while still being practical. IoT creates these small networks between its system devices.

- **Sensors** − IoT loses its distinction without sensors. They act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real-world integration.
- **Active Engagement** − Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product, or service engagement.
- **Small Devices** − Devices, as predicted, have become smaller, cheaper, and more powerful over time. IoT exploits purpose-built small devices to deliver its precision, scalability, and versatility.

IoT − Advantages

The advantages of IoT span across every area of lifestyle and business. Here is a list of some of the advantages that IoT has to offer −

- **Improved Customer Engagement** − Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audiences.
- **Technology Optimization** − The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional and field data.
- **Reduced Waste** − IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.
- **Enhanced Data Collection** − Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

IoT − Disadvantages

Though IoT delivers an impressive set of benefits, it also presents a significant set of challenges. Here is a list of some its major issues −

- **Security** − IoT creates an ecosystem of constantly connected devices communicating over networks. The system offers little control despite any security measures. This leaves users exposed to various kinds of attackers.

- **Privacy** − The sophistication of IoT provides substantial personal data in extreme detail without the user's active participation.
- **Complexity** − Some find IoT systems complicated in terms of design, deployment, and maintenance given their use of multiple technologies and a large set of new enabling technologies.
- **Flexibility** − Many are concerned about the flexibility of an IoT system to integrate easily with another. They worry about finding themselves with several conflicting or locked systems.
- **Compliance** − IoT, like any other technology in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging when many consider standard software compliance a battle.

II. Prerequisite(s):

Level	Credits	Periods / Week	Prerequisites
UG	4	4	C language for Arduino Kit Python language for Raspberry Pi Hardware & Wireless Networks

III. Assessment:

FORMATIVE ASSESMENT	
Mid Semester Test I for 20 Marks in first 2(1/2) units is conducted at20/08/2019 the end of 7th week. Mid Semester Test II for 20 Marks in last 2(1/2) units is conducted at 28/10/2019 end of the course work. Average of two tests is taken as final	20 Marks
Multiple Choice Test in all Units is conducted along with Mid Semester Test IAND Test II for 10Marks	10 Marks
Total (Formative)	30 Marks
SUMMATIVE ASSESMENT	
End Semester Examination in all units is conducted for 70 Marks	70 marks
Grand Total	100 Marks

IV. Course objectives:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario..

V. Course Outcomes:

Upon completion of this course, students will acquire knowledge about:

- Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
- Develop web services to access/control IoT devices.
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario.

VI. Program outcomes:

Program Outcomes

A An ability to apply knowledge of computing, mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems to real-world problems (fundamental engineering analysis skills)

B An ability to design and conduct experiments, as well as to analyze and interpret data (information retrieval skills)

C An ability to design , implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability, and sustainability (Creative Skills)

D An ability to function effectively on multi-disciplinary teams (team work)

E An ability to analyze a problem, identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution (engineering problem solving skills)

F An understanding of professional, ethical, legal, security and social issues and responsibilities (professional integrity)

G An ability to communicate effectively both in writing and orally (speaking / writing skills)

H The broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society (engineering impact assessment skills)

I Recognition of the need for, and an ability to engage in continuing professional development and life-long learning (continuing education awareness)

J A Knowledge of contemporary issues (social awareness)

K An ability to use current techniques, skills, and tools necessary for computing and engineering practice (practical engineering analysis skills)

L An ability to apply design and development principles in the construction of software and hardware systems of varying complexity (software hardware interface)

M An ability to recognize the importance of professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers in computing (successful career and immediate employment).

VII. Syllabus:

UNIT I :Fundamentals of IoT

Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.

UNIT II: IOT and M2M

M2M, IoT vs M2M, SDN and NFV for IoT, IOT system Management with NETCONF-YANG.

UNIT III: IoTDesign Methodology

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

UNIT IV: Data Analytics for IoT

Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis.

UNIT V :Tools for IoT

Chef, Puppet, IOT code generator Case studies: Chef. Puppet – Multi-tier Deployment, NETCONF-YANG, Raspberry Pi.

TEXT BOOKS:

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A Hands-on Approach”, Universities Press, 2015.

REFERENCES:

1. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
2. Marco Schwartz, “Internet of Things with the Arduino Yun”, Pack Publishing, 2014.
3. *Simon Monk, “Programming the Raspberry Pi*: *Getting Started with Python”,* McGraw-Hill, *2013.*
4. CharalamposDoukas,”Building Internet of Things With the Arduino”, Second Edition, 2012.
5. Dr.John Bates, “Thingalytics: Smart Big Data Analytics for the Internet of Things”, Software AG Publisher, 2015.

IX. Course Plan:

The course plan is meant as a guideline. There may probably be changes.

Lecture No.	Dates	Course Learning Outcomes	Topics to be covered	Course Outcomes	Text books & References	No.of classes
Unit – I		**Fundamentals of IoT**				
1-2	2-7-18, 4-7-18.	Learning about Characteristics of IoT	Introduction-Characteristics-Physical Design	After completion of this unit they will get knowledge about how to design theIoT kit and Domain specific IoTs such as water monitoring, weather monitoring.	**T1:1**:1-1.1.1	**4**
3-4	9-7-18, 11-7-18.	Rules and Regulations while using the IoT	Protocols		**T1:1:1.2-1.2.2**	**4**
5-6	16-7-18, 18-7-18.	Designing of IoT in logical Perception	Logical Design		**T1:1:1.3-1.3.3**	**4**
7-8	23-718, 25-7-18.	Learn about Technologies	Enabling technologies		**T1:1**:1.4-1.4.5	**4**
9	30-7-18.	Levels of IoT	IoT Levels		**T1:1:1.5-1.5.6**	**2**
10	1-8-18.	Levels of IoT	Six Levels of IoT		**T1:1:1.5.1-1.5.6**	**2**
11	6-8-18.	Learning about specific domain in IoT	Domain Specific IoTs.		**T1:2:2.1-2.6**	**2**
Unit - II		**IOT and M2M**				
12	8-8-18.	Learn about Machine to Machine	M2M	After completion of this unit they know Machine to Machine Technology and IoT vs M2M and Management of IoT system with NETCONF-YANG	**T1:3:3.1-3.2**	**2**
13	13-8-18,	Understand the IoT vs M2M	IoT vs M2M		**T1:3:3.3**	**2**
14	27-8-18.	Learn about SDN and NFV for IoT	SDN and NFV for IoT		**T1:3:3.4-3.4.2**	**2**
15-16	29-8-18, 3-9-18.	Understand theIOT system Management with NETCONF-YANG	IOT system Management with NETCONF-YANG		**T1:4:4.1-4.6**	**4**
Unit -III		**IoTDesign Methodology**				
17	5-9-18.	Understand the	IoT Systems Management	completion of this unit	**T1:4**	**2**

	.	system management		they know how to design the IoT system	**:4.1**	
18	10-9-18.	Understand the Design Methodologies	IoT Design Methodology	by using design Methodologies and integrate the applications	**T1:5 :5.2-5.2.10**	**2**
19	12-9-18.	Understand how to integrate the applications into IoT	Specifications Integration and Application Development		**T1:5 :5.3**	**2**
Unit –IV		**Data Analytics for IoT**				
20	17-9-18.	Understand the Apache Hadoop to connect the data base	Apache Hadoop	After completion of this unit they know how to connect the data base by using Apache Hadoop and MapReduce techniques for Batch Data Analytics and different technologies	**T1:10:10.2-10.2.4**	**2**
21-22	19-9-18.	Understand MapReduce Techniques for Big Data Analytics.	Using Hadoop MapReduce for Batch Data Analysis.		**T1:10:**10.3	**4**
23	24-9-18.	Understand theApache Oozie	Apache Oozie		**T1:10**:10.4-10.4.2	**2**
24	26-9-18.	Understand theApache Spark	Apache Spark.		**T1:10:10.5**	**2**
25	1-10-18.	Understand the Apache Storm	Apache Storm		**T1:10:10.6**	**2**
26	3-10-18.	Understand the Using Apache Storm for Real-time Data Analysis	Using Apache Storm for Real-time Data Analysis		**T1:10:10.7-10.7.2**	**2**
Unit -V		**Tools for IoT**				
27	10-10-18.	Understand the Chef, Puppet	Chef, Puppet	After completion of this unit they know about the tools for IoT such as Chef , Puppet and also Raspberry Pi	**T1:11:11.2-11.4**	**2**
28	15-10-18.	Understand the IOT code generator Case studies	IOT code generator Case studies		**T1:11:11.7**	**2**
29	22-10-18.	LearnChef. Puppet –	Chef. Puppet – Multi-tier		**T1:11:11.**	**2**

	.	Multi-tier Deployment, NETCONF-YANG	Deployment, NETCONF-YANG		**6-11.6.3**	
30	24-10-18.	Understand the Raspberry Pi	Raspberry Pi		**T1:7:7.5-7.6.3**	**2**

X. Mapping course outcomes leading to the achievement of the program outcomes:

Course Outcomes	Program Outcomes												
	A	B	**C**	**D**	**E**	F	G	H	I	J	K	L	M
1	S	H											S
2			H	S									S
3		S		H									S
4					H	H	H						S

S = Supportive **H = Highly Related**

Justification of Course syllabus covering Course Outcomes:

By covering the syllabus a student can understand how to design the IoT kit using different types of Methodologies and also integrate to the different internet applications

Justification of CO's –PO's Mapping Table:

By mapping CO-1 to the PO's A, B&M which are related to the course CO1: The student is able to Design the IoT kit.

By mapping CO-2 to the PO's C, D&M, which are related to the course CO2: The student is able to design IoT and do the experments.

By mapping CO-3 to the PO's B,D&M which are related to the course CO3: The student is able to understand to analyze the local and global impact of computing.

By mapping CO-4 to the PO's E,F,G,M which are related to the course CO4: The student is ableto understand the Raspberry Pi.

HOD of CSE **Signature of Staff**