



# Guru Nanak Dev Engineering College, Bidar

## Course File

Course Code Course Name

Credit: 03

Hours:40

## CONTENTS

**Course Learning Objectives:** This course will enable students to

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

**Pre-requisites:** Basic Understanding of Computer Networks

**Linkages with other Courses:** Computer Networks, Cloud Computing, Artificial Intelligence.

### Course Policies and Procedures:

(Expectations from students, Rules for Student Assignments, Assignment Grading System, In-Class Quiz Sessions, Sessional and Semester End Examinations.)

### Evaluation Policy:

Level of Question	Approximate % of Question
Understanding	20
Apply	35
Analyze / Solve	35
Design	10

### Lesson Plan

Module wise distribution of Classes	Topics	Class Number	Teaching Methodology
-------------------------------------	--------	--------------	----------------------

	Overview of course, Course Outcome its linkages with other courses and practical applications, expectations from students, Evaluation Policy etc.		Interactive Discussion
	<b>Module – 1:</b>		--do--
1	<i>Genesis of IoT, IoT and Digitization,</i>	1	--do--
2	<i>Impact, Convergence of IT and IoT</i>	1	--do--
3	<i>IoT Challenges,</i>	1	--do--
4	<i>IoT Network Architecture and Design,</i>	1	--do--
5	<i>Drivers Behind New Network Architectures,</i>	1	--do--
6	<i>Comparing IoT Architectures,</i>	1	--do--
7	<i>A Simplified IoT Architecture</i>	1	--do--
8	<i>The Core IoT Functional Stack</i>	1	--do--
9	<i>IoT Data Management and Compute Stack</i>	1	--do--
10	Revision of Topics Covered in Module	1	Revision / Quiz
11	<b>Module – 2:</b>	1	
12	<i>Smart Objects: The “Things” in IoT, Sensors</i>	1	--do--
13	<i>Actuators, and Smart Objects, Sensor</i>	1	--do--
14	<i>Actuators, and Smart Objects,</i>	1	--do--
15	<i>Sensor Networks</i>	1	--do--
16	<i>Connecting Smart Objects</i>	1	--do--
17	<i>Connecting Smart Objects</i>	1	--do--
18	<i>Communications Criteria,</i>	1	
19	<i>Communications Criteria,</i>	1	
20	<i>IoT Access Technologies.</i>	1	
21	<i>IoT Access Technologies.</i>	1	
22	Revision of Topics Covered in Module	1	Revision / Quiz
23	<b>Module – 3:</b>	1	
24	<i>IP as the IoT Network Layer</i>	1	
25	<i>The Business Case for IP</i>	1	
26	<i>The Business Case for IP</i>	1	
27	<i>The need for Optimization</i>	1	
28	<i>Optimizing IP for IoT</i>	1	
29	<i>Profiles and Compliances</i>	1	
30	<i>Application Protocols for IoT</i>	1	
31	<i>The Transport Layer</i>	1	
32	<i>IoT Application Transport Methods.</i>	1	
33	<i>IoT Application Transport Methods.</i>	1	
34	<b>Module – 4:</b>	1	
35	<i>Data and Analytics for IoT, An Introduction to Data Analytics for IoT</i>	1	
36	<i>Machine Learning</i>	1	
37	<i>Big Data Analytics Tools and Technology,</i>	1	
38	<i>Edge Streaming Analytics</i>	1	
39	<i>Network Analytics, Securing IoT</i>	1	
40	<i>A Brief History of OT Security, Common Challenges in OT Security</i>	1	
41	<i>How IT and OT Security Practices and Systems Vary</i>	1	
42	<i>Formal Risk Analysis Structures: OCTAVE and FAIR</i>	1	
43	<i>Formal Risk Analysis Structures: OCTAVE and FAIR</i>	1	

44	<i>The Phased Application of Security in an Operational Environment</i>	1	
45	<b>Module – 5:</b>	1	
46	<i>IoT Physical Devices and Endpoints</i>	1	
47	<i>Arduino UNO: Introduction to Arduino, Arduino UNO</i>	1	
48	<i>Installing the Software, Fundamentals of Arduino Programming</i>	1	
49	<i>IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi</i>	1	
50	<i>About the RaspberryPi Board: Hardware Layout</i>	1	Revision / Quiz
51	<i>Operating Systems on RaspberryPi</i>	1	
52	<i>Configuring RaspberryPi, Programming RaspberryPi with Python</i>	1	
53	<i>Wireless Temperature Monitoring System Using Pi,</i>	1	
54	<i>DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH</i>	1	
55	<i>Accessing Temperature from DS18B20 sensors</i>	1	
56	<i>Remote access to RaspberryPi, Smart and Connected Cities</i>	1	

#### Course Teaching Materials:

##### Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN:978-9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017

##### Reference Books:

1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).

##### Virtual Laboratory: Youtube videos

<https://www.youtube.com/watch?v=QSIPNhOiMoE>

<https://www.youtube.com/watch?v=LlhmzVL5bm8&vl=en>

<https://www.youtube.com/watch?v=FRxRT0DjE7A>

<https://www.youtube.com/watch?v=8hGk66QA38>

##### Question Bank:

## **Module 1:**

1. Illustrate Internet of Things (IoT). Interpret the components required to design IoT Device with example.
2. Interpret the phases of Internet of Things (IoT) with example.
3. Give brief overview of IoT.
4. Discuss vision of IoT?
5. Demonstrate four Pillars of IoT and how they are inter-connected with each other?
6. Classify challenges of IoT?
7. Classify various components required for IoT device?
8. Illustrate Machine to Machine communication (M2M)?
9. Explain different Characteristics of IoT.
10. Appraise the effect of internet of things (IoT) on our daily lives? Explain with any one example of smart device.

## **Module 2:**

1. Discuss requirements of IoT device.
2. Elaborate on Actuators and smart objects.
3. Explain an emerging industrial structure for IoT.
4. Distinguish different business and research opportunities for IoT?
5. Analyze layered architecture of IoT.
6. Point out building block of IoT.
7. Categorize different networking and communication model in IoT.
8. Infer different wired and wireless connectivity used in IoT explain with example.
9. Explain wireless sensor network?
10. Correlate between WSN and IoT. Explain with example.

## **Module 3:**

1. Write note on : RFID, NFC, ZigBee.
2. Predict effects of internet of things (IoT) in healthcare? Illustrate with any one example of smart device.

3. Discuss ZigBee in detail?
4. Appraise IoT protocol stack.
5. List and explain different types of sensors.
6. Correlate Near Field Communication (NFC) and RFID.
7. Distinguish TCP/IP vs IoT protocol sack.
8. Summarize various requirement of IoT Protocol Standardization?
9. Illustrate with example MQTT Protocol. What is role of MQTT protocol in IoT?
10. Write a note on : CoAP, REST, XMPP.

#### **Module 4:**

1. Distinguish different IoT protocols?
2. Correlate the role of Cloud Computing and Big Data in Internet of Things?
3. Discuss IoT Analytics?
4. Infer Data visualization and its importance in IoT.
5. Point out various components and Communication media required for making smart building.
6. Distinguish between Web of Things versus Internet of Things.
7. Illustrate WoT with example.
8. Explain Two Pillars of the Web.
9. Select different Platform Middleware for WoT?
10. Infer WoT Portals and Business Intelligence?

#### **Module 5:**

1. Sketch Cloud of Things.
2. Assess need of IoT Security.
3. Analyze issues in IoT security.

4. Write a note on: 1) Trust for IoT 2) Security and Privacy for IoT 3) Physical IoT Security.
5. Assess on Devices Security and Privacy of IoT cloud.
6. Infer Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments?
7. Summarize IoT Application and Deployment Scenarios in different domains.
8. Discuss IoT Smart X Applications?
9. Write note on: Wearable - Smart Cities- Smart Home – Smart HealthCare- Agriculture - Smart Grid.
10. Explain with example: Wearable - Smart Cities- Smart Home – Smart HealthCare- Agriculture - Smart Grid.

#### **Text Books:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "**IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things**", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN:978-9386873743)
2. Srinivasa K G, "**Internet of Things**", CENGAGE Learning India, 2017

#### **Reference Books:**

1. Vijay Madiseti and Arshdeep Bahga, "**Internet of Things (A Hands-on-Approach)**", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "**Internet of Things: Architecture and Design Principles**", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).

#### **Journals:**

<https://www.journals.elsevier.com/internet-of-things>

#### **Web Resources:**

<https://www.upchain.com/blog/26-iot-resources/>

#### **Blogs:**

<https://www.upchain.com/blog/26-iot-resources/>

**NPTEL/MOOCs: Introduction to Internet of Things, By Prof. Sudip Misra | IIT Kharagpur**

[https://swayam.gov.in/nd1\\_noc19\\_cs65/preview](https://swayam.gov.in/nd1_noc19_cs65/preview)

#### **Software:**

**Research Organizations / Industries in the field:**

<https://dst.gov.in/internet-things-iot-research-initiative>

**Course Outcomes:**

**CO1** Interpret the impact and challenges posed by IoT networks leading to new architectural Models.

**CO2:** Contrast the deployment of smart objects and the technologies to connect them to network. Identify impact of IOT.

**CO3:** Appraise the role of IoT protocols for efficient network communication.

**CO4:** Elaborate the need for Data Analytics and Security in IoT.

**CO5:** Discuss different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**CO-PO Matrix:**

Sub. Name With code	po1	po2	po3	po4	po5	po6	po7	po8	po9	po1 0	po1 1	po1 2	ps0 1	ps0 2
C409.1	2											1		
C409.2	2	2										1		1
C409.3	3											1	2	
C409.4	2	2										1	2	
C409.5	1	1	3	2						2	2	1	2	
AVG	2	1.6	3	2						2	2	1	2	1