Techno India NJR Institute of Technology

Course File

Session 2021-22

Internet of Things (7CS4-01)

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For Techno India NJR Institute of Technology
पंकज पोरवाल
Dr. Pankaj Kumar Porwal
(Principal)

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Scheme & Syllabus

IV Year- VII Semester: B. Tech. (Computer Science & Engineering)

7CS4-01: Internet of Things

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Introduction to IoT:** Definition and characteristics of IoT, Design of IOT: Physical design of IOT, Logical Design of IOT- Functional Blocks, communication models, communication APIs, IOT enabling Technologies- Wireless Sensor Networks, Cloud computing, big data analytics, embedded systems. IOT Levels and deployment templates.	08
3	**IoT Hardware and Software:** Sensor and actuator, Humidity sensors, Ultrasonic sensor, Temperature Sensor, Arduino, Raspberry Pi, LiteOS, RIoTOS, Contiki OS, Tiny OS.	07
4	**Architecture and Reference Model:** Introduction, Reference Model and architecture, Representational State Transfer (REST) architectural style, Uniform Resource Identifiers (URIs). Challenges in IoT- Design challenges, Development challenges, Security challenges, Other challenges.	08
5	**IOT and M2M:** M2M, Difference and similarities between IOT and M2M, Software defined networks, network function virtualization, difference between SDN and NFV for IoT.	08
6	**Case study of IoT Applications:** Domain specific IOTs- Home automation, Cities, environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyles.	08
	Total	40

Course Overview:

The explosive growth of the "Internet of Things" is changing our world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products at home. In this subject,student will learn the importance of IoT in society, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered. You will also learn how to make design trade-offs between hardware and software. We'll also cover key components of networking to ensure that students understand how to connect their device to the Internet.

Course Outcomes:

CO.NO.	Cognitive Level	Course Outcome
1	Comprehension	Describe the definition and usage of the term "Internet of Things" in different contexts understand the key components that make up an IoT system
2	Comprehension	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
3	Knowledge	Understand famous IoT relevant Operating systems and hardware.
4	Analysis	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system
5	Synthesis	Design and Develop IOT based applications such as Lake Monitoring System, Air Quality System and Smart Energy Meter.

Prerequisites:

1. Fundamentals of Networking, Operating Systems.
2. Fundamentals of Communication protocols
3. Must have completed the course on basic C programming.

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Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)											
CO. NO.	Domain Specific					Domain Independent						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	0	0	0	0	0	0	0	0	3
CO2	3	2	1	0	0	0	0	0	0	0	0	2
CO3	3	2	2	0	0	0	0	0	0	0	0	2
CO4	3	2	1	0	0	0	0	0	0	0	0	2
CO5	3	2	1	0	0	0	0	0	0	0	0	2
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	**Introduction: Objective, scope and outcome of the course**
2	2	**Introduction to IoT**
3	2	Definition and characteristics of IoT
4	2	Design of IOT, Physical design of IOT and Logical Design of IOT-Functional Blocks
5	2	Communication models, communication APIs
6	2	IOT enabling Technologies- Wireless Sensor Networks, Cloud computing
7	2	Big data analytics, IOT Levels and deployment templates
8	2	Introduction of Embedded systems
9	2	IOT Levels and deployment templates
10	3	**IoT Hardware and Software**
11	3	Basic Introduction of Sensor and actuator
12	3	Humidity sensors, Ultrasonic sensor, Temperature Sensor
13	3	Humidity sensors, Ultrasonic sensor, Temperature Sensor
14	3	Basic Introduction of Arduino and Programming
15	3	Basic Introduction of Raspberry Pi and Programming
16	3	Basic Introduction of LiteOS, RIoTOS, Contiki OS, Tiny OS
17	4	**Architecture and Reference Model**
18	4	Introduction, Reference Model and architecture
19	4	Representational State Transfer (REST) architectural style

20	4	Uniform Resource Identifiers (URIs)
21	4	Uniform Resource Identifiers (URIs)
22	4	Challenges in IoT- Design challenges
23	4	Development challenges
24	4	Security challenges and other challenges
25	**5**	**IOT and M2M**
26	5	M2M, Difference and similarities between IOT and M2M
27	5	M2M, Difference and similarities between IOT andM2M
28	5	Software defined networks
29	5	Software defined networks
30	5	Network function virtualization
31	5	Network function virtualization
32	5	Difference between SDN and NFV for IoT
33	**6**	**Case study of IoT Applications**
34	6	Domain specific IOTs- Home automation
35	6	Domain specific IOTs- Cities
36	6	Domain specific IOTs- Environment, Energy
37	6	Domain specific IOTs- Retail, Logistics
38	6	Domain specific IOTs- Agriculture
39	6	Domain specific IOTs- Industry
40	6	Domain specific IOTs- Health and Lifestyles

TEXT/REFERENCE BOOKS

1. Internet of Things, "A Hands on Approach", Vijay Madisetti, Arshdeep Bahga, University Press.
2. Introduction to Internet of Things: A practical Approach, Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, ETI Labs.
3. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj and Anupama C. Raman, CRC Press.
4. Internet of Things, Jeeva Jose,Khanna Publishing House, Delhi.

Teaching and Learning resources:

- **MOOC (NPTEL):** - https://nptel.ac.in/courses/106/105/106105166/
- **Unit Wise Internet Resourses**

Unit 2

1. https://iotbyhvm.ooo/physical-and-logical-design-of-iot/#:~:text=Physical%20Design%20of%20IoT%20refers,based%20server%20over%20the%20Internet.

2. https://iotbyhvm.ooo/iot-enabling-technologies/#:~:text=IoT%20is%20enabled%20by%20several,Internet%2C%20and%20Semantic%20Search%20engines.

Unit -3

1. https://iotbyhvm.ooo/iot-sensors-actuators/

Unit 4

1. https://iotnotesbyparita.wordpress.com/architecture-reference-model/

2. https://www.finoit.com/blog/enterprise-challenges-in-iot/

3. https://www.iotevolutionworld.com/iot/articles/445866-top-five-challenges-iot.htm

Unit 5

1. https://www.peerbits.com/blog/difference-between-m2m-and-iot.html

2. https://ardas-it.com/what-is-the-difference-between-m2m-and-iot

3. https://www.sdxcentral.com/networking/sdn/definitions/what-the-definition-of-software-defined-networking-sdn/

4. https://www.sdxcentral.com/networking/nfv/definitions/whats-network-functions-virtualization-nfv/

Assessment Methodology:

1. Two Midterm exams where student have to showcase subjective learning.
2. Final Exam (subjective paper) at the end of the semester.

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7E1721

Roll No. _____

Total No of Pages: 2

7E1721

B. Tech. VII - Sem. (Main) Exam., Feb.- March - 2021
PCC Computer Science & Engineering
7CS4 – 01 Internet of Things

Time: 2 Hours

[To be converted as per scheme]
Max. Marks: 82
Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) [10×2=20]

All questions are compulsory

Q.1 What is wireless sensor network?

Q.2 What is big-data and why we are using big-data in IoT?

Q.3 What is cloud computing?

Q.4 Differentiate between WiFi and WiMax.

Q.5 What is the role of controller service in an IoT system?

Q.6 How do data collection and analysis approaches differ in M2M and IoT?

Q.7 What instruction set architecture is used in Raspberry Pi?

Q.8 How to collect data in structural health monitoring system?

Q.9 What are the architectural constraints of REST?

Q.10 How to monitor Air-Pollution?

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 Explain about IoT Communication APIs in detail.

Q.2 Describe functional view specification of IoT design methodology.

Q.3 Describe home automation in domain specific IoT.

Q.4 Explain about interfacing an LED and switch with Raspberry Pi.

Q.5 Differentiate between IoT and M2M.

Q.6 What is IEEE 802.15.4 protocol? How it is related to IoT?

Q.7 What is the difference between sensors and actuators? Explain with an example.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 What is the function of communication functional block in an IoT system? What are the other components of a complete IoT system? Explain with diagram.

Q.2 What are the different layers of IoT protocols? Explain functions of all the layers.

Q.3 Explain IoT cloud based data collection, storage and computing services.

Q.4 Explain in detail about network function virtualization.

Q.5 Design and implement the functionality of a home intrusion detection IoT system by interfacing a webcam. Implement the function in the controller to capture the image from webcam and send it as an attachment in the email alert when an intrusion is detected.

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TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY
B. TECH IV – YEAR (VII SEM.)
Computer Science & Engineering
Internet of Things (7CS4-01)
Mid Term I

Max Marks: 70 **Time: 2 Hrs**

Note:
1) The paper is divided into 2 parts: Part-A and, Part-B
2) Part-A contains 10 questions and carries 2 mark each.
3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

PART – A

1.	Explain about IoT communication APIs in detail.	[CO1]
2.	What is cloud computing	[CO1]
3.	Explain the working principle of Ultrasonic sensor.	[CO2]
4.	Short note on Arduino.	[CO2]
5.	What are architectural constraints of REST.	[CO3]
6.	Short note on Uniform Resource Identifiers.	[CO3]
7.	How do data collection and analysis approaches differ in M2M & IoT?	[CO4]
8.	Differentiate between SDN & NFV.	[CO4]
9.	How to collect data in structural Health monitoring system?	[CO5]
10.	How to Monitor Air Pollution?	[CO5]

PART – B

1.	What are the IoT levels of deployment? Explain highest Level with diagram.	[CO1]
	OR	
1.	What are the different layers of IoT protocols? Explain functions of all the layers	[CO1]

2.	Difference between sensors and actuators? Explain with example.	[CO2]
	OR	
2.	Explain in detail about Contiki OS.	[CO2]

3.	Discuss in detail challenges in IoT design	[CO3]
	OR	
3.	What is REST architecture style for IoT design?	[CO3]

4.	Explain in detail about network function virtualization.	[CO4]
	OR	
4.	Differentiate between IoT & M2M.	[CO4]

5.	Describe home automation in domain specific IoT	[CO5]
	OR	
5.	Describe Health & Lifestyles in domain specific IoT	[CO5]

---------- **All the Best** ----------

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Sample Viva Voce questions

1. What are the characteristics of IoT.
2. What are the different components of IoT?
3. What are the challenges or risks associated with IoT?
4. What are different types of sensors in IoT?
5. What are different layers of the IoT protocol stack? Write the classification of IoT protocols.
6. What are different communication models in IoT?
7. State the difference between IoT and M2M.
8. What do you mean by IoT Gateway? What is the role of a gateway in IoT?
9. What do you mean by MQTT (Message Queue Telemetry Transport Protocol)?
10. What impacts will the Internet of Things (IoT) have on the Agriculture Sector?
11. What impacts will the Internet of Things (IoT) have on the Energy Sector?
12. What are the distinctive parts where the Internet of Things can really enhance the present procedures?
13. Should the customers be worried about security and protection issues considering the measure of information Internet of Things (IoT) gathers?
14. What impacts will the Internet of Things (IoT) have on the Health Care Sector?
15. How might Internet Address (IPv6) affect the development and implementation of the Internet of Things?
16. What is the difference between a wireless sensor network (WSN) and the Internet of Things (IoT) network?
17. What are the hardware communication interfaces present in the Arduino board?
18. What is Bluetooth Low Energy (BLE) Protocol for an Internet of Things (IoT)?
19. How to run Raspberry pi in headless mode?
20. WHAT DOES IT MEAN WHEN PEOPLE TALK ABOUT SDN DECOUPLING HARDWARE FROM SOFTWARE?

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Quiz Questions

1. _____ allows us to control electroniccomponents

A. retful api

B. restful api

C. http

D. mqtt

2. MQTT stands for

A. mq telemetry things

B. mq transport telemetry

C. mq transport things

D. mq telemetry transport

3. MQTT is better than HTTP for sending and receiving data.

A. true

B. false

4. MQTT is protocol.

A. machine to machine

B. internet of things

C. machine to machine and internet of things

D. machine things

5. Which protocol is lightweight?

A. mqtt

B. http

C. coap

D. spi

6. Hardware address is known as

A. mac address

B. ip address

C. network interface card

D. address resolution protocol

7. MAC stands for

A. media area control

B. memory access control

C. memory area control

D. media access control

8. What translates IP address into MAC address?

A. organizationally unique identifier

B. address resolution protocol

C. network interface card

D. burned in address

9. Communication between _____and _____ is encrypted for security.

A. cloud and device

B. b) end user and data center

C. c) network and device

D. d) cloud and network

10. What is the microcontroller used in Arduino UNO?

A. atmega328p

B. atmega2560

C. atmega32114

D. at91sam3x8e

11. Which protocol is used to link all the devices in the IoT?

A. tcp/ip

B. b) network

C. c) udp

D. d) http

12. _____tags, devices, smart phones useful in identification.

A. ietf 6lowpan

B. b) ieft coap

C. c) rfid/nfc

D. d) ieee802.15.4.lo wpan

13._____ supports low energy radiooperation.

A. ietf6lowpan

B. b) ieftcoap

C. c) rfid/nfc

D. bluetooth

14. is an application layer protocol for resource constrained devices.

A. coap

B. hmtp

C. mqtt

D. tcp/ip

15. resources are identified byUniform Resource Identifiers.

A. coap

B. b) hmtp

C. c) mqtt

D. d) tcp/ip

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Assignment – 1

Q.1 Explain the different characteristics of IoT.

Q.2 Enlighten different IoT Protocols.

Q.3 What are the digital and physical value-creation layers in an Internet of Things application? Explain

Q.4 Explain about the advanced message queuing protocol.

Q.5 Explain the constrained application protocol (CoAP).

Q.6 Explain different application layer protocols for the IoT.

Assignment –2

Q.1 Explain difference between WiFi & WMax.

Q.2 How to collect data in structural health monitoring system.

Q.3 What is difference between sensors and actuators? Explain with example.

Q.4 Explain in detail about network function Virtualization.

Q.5 Explain ioT Cloud based data collection, Storage and computing services.

Q.6 Explain about interfacing and LED and switch with Raspberry Pi

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