SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

VII SEMESTER

CS8081-INTERNET OF THINGS

Regulation - 2017

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SUBJECT : CS8081 –INTERNET OF THINGS

SEM / YEAR : VII - Final year

UNIT I FUNDAMENTALS OF IoT			
Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.			
PART A			
Q.NO	**QUESTIONS**	**COMPETENCE**	**LEVEL**
1.	**Define** IoT.	Remember	BTL-1
2.	**Give** the evolutionary phases of IoT.	Understand	BTL-2
3.	**Pointout** the challenges faced by Internet of Things.	Analyze	BTL-4
4.	**Summarize** the characteristics of IoT.	Evaluate	BTL-5
5.	**List** the applications of IoT.	Remember	BTL-1
6.	**Illustrate** the IoT Reference model.	Apply	BTL-3
7.	**Define** Fog Computing.	Remember	BTL-1
8.	**Examine** the hierarchy of Fog, Edge and Cloud.	Remember	BTL-1
9.	**Summarize** the criteria used to classify Actuators.	Evaluate	BTL-5
10.	Quote the trends in smart Objects.	Remember	BTL-1
11.	**Differentiate** IoT and M2M.	Understand	BTL-2
12.	**Give** IoT Data Management and Compute Stack.	Understand	BTL-2
13.	**Classify** the functional Block of IoT ecosystem.	Apply	BTL-3

14.	**Generalize** the "things" in IoT.	Create	BTL-6
15.	**Compare** Fog and Edge computing.	Analyze	BTL-4
16.	**Analyze** the purpose of Sensors, Actuators and Smart Objects.	Analyze	BTL-4
17.	**List** the functional stack of core IoT.	Remember	BTL-1
18.	**Summarize** the characteristics of Fog Computing.	Understand	BTL-2
19.	**Classify** the different types of Sensors.	Apply	BTL-3
20.	**Formulate** the communication criteria used for connecting smart objects.	Create	BTL-6
	PART B		
1.	**Describe** the IoT enabling Technologies with suitable explanations.	Understand	BTL-2
2.	**Illustrate** the oneM2M IoT standardized architecture and explain the layers with neat diagram	Apply	BTL-3
3.	**Analyze** in detail the Hierarchy followed in Edge, Fog and Cloud with suitable illustration.	Analyze	BTL-4
4.	**(i) List** the "things" in IoT and explain briefly. (6) (ii) **Describe** the process of Connecting Smart Objects.(7)	Remember	BTL-1
5.	**Compare** in detail the OneM2M IoT Architecture and IoTWF standardized reference model.	Analyze	BTL-4
6.	**Summarize** in detail IoT data management and Compute stack.	understand	BTL-2
7.	**Discuss the following in detail** (i) Sensors and Actuators. (6) (ii) Connecting Smart Objects. (7)	Understand	BTL-2
8.	**Describe** in detail (i) MEMS – Micro Electro Mechanical Systems. (ii) Sensor Networks.	Remember	BTL-1
9.	**(i) Compare** the two IoT Architectures briefly. (7) **(ii) Explain the** IoTWF standardized Architecture in detail. (6)	Evaluate	BTL-5
10.	**(i)Tabulate** the Alternative IoT Reference Models. (6) (ii) **Describe** the simplified IoT Architecture. (7)	Remember	BTL-1
11.	(i) **Analyze** in detail about Sensors, Actuators and Smart Objects. (6) (ii) **Pointout** the Communication criteria and Access Technologies for connecting smart Objects. (7)	Analyze	BTL-4
12.	**Describe** the seven layers of IoT Reference model designed by IoTWF.	Remember	BTL-1
13.	**Demonstrate** the Simplified IoT Architecture and Core IoT Functional Stack with neat diagram.	Apply	BTL-3
14.	**(i) Generalize** the various enabling technologies of IoT. (7) (ii) **Formulate** the evolutionary trend of IoT with necessary illustration. (6)	Create	BTL-6

PART C			
1.	**Analyze** the challenges and requirements faced by the IoT systems, which paved way to network architecture and compare the two best known architecture supported by OneM2M and IoTWF.	Analyze	BTL-4
2.	**Prepare** a detailed analysis of smart objects and their architecture thereby elaborating the design limitations and role within IoT Networks.	Create	BTL-6
3.	**Develop** a narration on IoT Access technologies that plays a major role in market. Give suitable examples explaining the technologies.	Create	BTL-6
4.	**Measure** the different types of physical conditions for denoting the various types of sensors and tabulate them.	Evaluate	BTL-5
UNIT II IoT PROTOCOLS			
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT			
PART A			
1.	**Define** IEEE 802.15.4	Remember	BTL-1
2.	**Where IEEE. 802.15.4** can be deployed?	Remember	BTL-1
3.	**Analyze** the use of ZigBee.	Analyze	BTL-4
4.	**Examine** the use of IEEE 1901.2a.	Remember	BTL-1
5.	**Illustrate** the high level ZigBee Protocol stack.	Apply	BTL-3
6.	**Give** the purpose of IEEE 802.15.4 MAC layer.	Understand	BTL-2
7.	**Compare** ZigBee and ZigBee IP.	Analyze	BTL-4
8.	**Analyze** the process to optimize IP for IoT.	Analyze	BTL-4
9.	**Demonstrate** the use of MQTT.	Apply	BTL-3
10.	**Express** the IEEE 802.15.4 MAC Format.	Understand	BTL-2
11.	**Examine** the use of RoLL.	Apply	BTL-3
12.	**Generalize** on CoAP.	Create	BTL-6
13.	**Distinguish** IEEE 802.15.4g and IEEE 802.15.4e.	Understand	BTL-2
14.	**Define** SCADA.	Remember	BTL-1

15.	**Evaluate** the protocol translation of SCADA.	Evaluate	BTL-5
16.	**Formulate** on constrained nodes and constrained networks.	Create	BTL-6
17.	**Differentiate** Mesh Under vs Mesh-Over Routing.	Understand	BTL-2
18.	**Conclude** the process from 6LoWPAN to 6Lo.	Evaluate	BTL-5
19.	**Define** LoRaWAN and draw MAC format.	Remember	BTL-1
20.	**List** the IoT Application Transport methods.	Remember	BTL-1
	PART B		
1.	(i)**Tabulate** the protocol stacks utilizing IEEE 802.15.4. (5) (ii) **Describe** on IEEE 802.15.4g and IEEE 802.15.4e. (8)	Remember	BTL-1
2.	**Analyze** in detail LoRa WAN technology, illustrating the layers , MAC format and Architecture.	Analyze	BTL-4
3.	**Compare** and contrast the physical and MAC layers of IoT Access technologies with suitable illustrations.	Evaluate	BTL-5
4.	**Discuss** the following: (i) Optimizing IP for IoT: (6) (ii) Need for Optimization Constrained nodes and Networks. (7)	Understand	BTL-2
5.	**Examine** the following with neat illustration (i) 1901.2a, (6) (ii) 802.11ah (7)	Remember	BTL-1
6.	**Demonstrate** in detail about IP versions and Optimizing IP for IoT.	Apply	BTL-3
7.	**Summarize** the Application Transport Methods: Supervisory Control and Data Acquisition.	Understand	BTL-2
8.	**Describe** about Application Layer Protocols: (i) CoAP (7) (ii) MQTT (6)	Remember	BTL-1
9.	**Tabulate** the main characteristics of Access Technologies and the variation in each of them.	Remember	BTL-1
10.	**Discuss** in detail about Application transport method and Application layer protocol.	Understand	BTL-2
11.	**Analyze** in detail Supervisory Control and Data Acquisition with suitable illustration.	Analyze	BTL-4
12.	**Demonstrate** Routing over Low Power and Lossy Networks with suitable explanation.	Apply	BTL-3
13.	**Generalize** in detail about: (i) Optimizing IP for IoT (6) (ii) 6LoWPAN to 6Lo (7)	Create	BTL-6
14.	**Analyze** Lossy Networks and RoLL in detail.	Analyze	BTL-4

PART C			
1.	**Analyze** in detail the IoT Application protocol and their characteristics with suitable illustration.	Analyze	BTL-4
2.	**Prepare** a brief report on IEEE 802.15.4, IEEE 802.15.4g and IEEE 802.15.4e, IEEE 1901.2a, IEEE 802.11ah, LoRaWAN	Create	BTL-6
3.	**Generalize** in detail about Application transport method: SCADA and Application layer protocol: CoAP and MQTT	Create	BTL-6
4.	**Explain** in detail the need for optimization and Optimizing IP for IoT: From 6LoWPAN to 6Lo,	Evaluate	BTL-5
UNIT III DESIGN AND DEVELOPMENT			
Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.			
PART A			
1.	**List** the steps involved in IoT Design methodology.	Remember	BTL-1
2.	**Give** the characteristics of Embedded computing.	Remember	BTL-1
3.	**Name** the IoT system building blocks.	Remember	BTL-1
4.	**Give** an example IoT device and explain briefly.	Analyze	BTL-4
5.	**Differentiate** functional view and operational view of IoT Design methodology.	Understand	BTL-2
6.	**Examine** the integration of device and component in IoT design methodology.	Apply	BTL-3
7.	**Compare** sensors and actuators.	Analyze	BTL-4
8.	**Examine** the use and purpose of Arduino.	Remember	BTL-1
9.	**Name** the linux version on Raspberry Pi.	Remember	BTL-1
10.	**Summarize** on Raspberry Pi.	Evaluate	BTL-5
11.	**Discuss** on Arduino software program sketches.	Understand	BTL-2
12.	**Illustrate** the block diagram of IoT Device.	Apply	BTL-3
13.	**Discuss** on interfacing LDR with Raspberry Pi.	Understand	BTL-2
14.	**Analyze** the interfaces in Raspberry Pi.	Analyze	BTL-4
15.	**Summarize** on the need of microcontroller in embedded system.	Analyze	BTL-2
16.	**Generalize** on controlling LED with Raspberry Pi.	Create	BTL-6

17.	**Illustrate** the basic arduino board.	Apply	BTL-3
18.	**Summarize** on other IoT devices apart from Raspberry Pi.	Evaluate	BTL-5
19.	**Generalize** on the various chips on embedded system.	Create	BTL-6
20.	**List** the essential requirements for setting up Raspberry Pi.	Remember	BTL-1
	PART B		
1.	**Demonstrate** the key steps involved in IoT Design methodology, explain the steps involved in	Apply	BTL-3
2.	(i) **Summarize** in detail about embedded computing. (6) (ii) **Explain** the microcontroller and chips involved in embedded devices. (7)	Evaluate	BTL-5
3.	**Formulate** on python programming for Raspberry Pi.	Create	BTL-6
4.	**Discuss** in detail the use of embedded computing in the design of IoT Sysems.	Understand	BTL-2
5.	(i) **Analyze** in detail an exemplary device: Raspberry Pi. (6) (ii) **Explain** in detail the Raspberry Pi interfaces. (7)	Analyze	BTL-4
6.	**Illustrate** the arduino board details and explain the steps for installing the board.	Apply	BTL-3
7.	**Discuss** in detail the building blocks of IoT and its functionalities with suitable illustration.	Understand	BTL-2
8.	**(i) List** the IoT design methodology. (6) (ii) **Examine** the building blocks of IoT. (7)	Remember	BTL-1
9.	**Describe** the steps for designing IoT system with neat diagram.	Remember	BTL-1
10.	(i) **Examine** the process of using the Integrated Development Environment (IDE) to prepare an Arduino sketch. (7) (ii) **Describe** the steps for setting up of arduino board. (6)	Remember	BTL-1
11.	**Define IoT** device and give a detailed narration of IoT device example in real world applications.	Remember	BTL-1
12.	**Discuss** in detail the Interfacing LED and switch with Raspberry Pi as an example. Give the procedure.	Understand	BTL-2
13.	**Analyze** the software and hardware features of Arduino board and explain the procedure to install IDE.	Analyze	BTL-4
14.	**Analyze** the embedded computing logic and use of microcontroller in embedded system with neat diagram.	Analyze	BTL-4
	PART C		
1.	**Analyze** in detail the design methodology used to implement IoT Devices, explain the level wise design steps with neat diagram.	Analyze	BTL-4
2.	**Pointout** some examples that define IoT devices and explain in brief the basic building block and layers in IoT system with diagram.	Evaluate	BTL-5

3.	**Analyze** and explain in detail Programming Raspberry Pi with python by giving suitable example. Also elaborate on Raspberry Pi interfaces.	Analyze	BTL-4
4.	**Design** a basic arduino board and explain the procedure for installing and setting up of IDE.	Create	BTL-6

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

PART A

1.	**Define** Machine Learning.	Remember	BTL-1
2.	**Generalize** the use of AWS in IoT.	Create	BTL-6
3.	**Compare** Data in motion vs Data at Rest.	Evaluate	BTL-5
4.	**Define** Neural networks.	Remember	BTL-1
5.	**Compare** the two categories of machine learning.	Analyze	BTL-4
6.	**Analyze** the use of NoSQL Database.	Analyze	BTL-4
7.	**Summarize** on Hadoop.	Analyze	BTL-4
8.	**Differentiate** Structured vs Unstructured Data.	Understand	BTL-2
9.	**Discuss** on Hadoop ecosystem.	Understand	BTL-2
10.	**Give** the benefits of flow analytics.	Understand	BTL-2
11.	**Summarize** on Edge streaming analytics.	Evaluate	BTL-5
12.	**Define** YARN.	Remember	BTL-1
13.	**Name** the core functions of Edge Analytics.	Remember	BTL-1
14.	**Demonstrate** the use of Xively cloud for IoT.	Apply	BTL-3
15.	**Examine** the role of Python Web application framework – Django.	Apply	BTL-3
16.	**Discuss** on Apache spark.	Understand	BTL-2
17.	**Formulate** on Apache Kafka.	Create	BTL-6
18.	**Compare** BigData and Edge Analytics.	Apply	BTL-3

19.	**Define** Amazon S3 and Amazon RDS.	Remember	BTL-1
20.	**Identify** the role of various components of NETCONF-YANG.	Remember	BTL-1
	PART B		
1.	**Explain** in detail the need of Data Analytics for IoT and brief the challenges faced by IoT Data Analytics.	Analyze	BTL-4
2.	**Discuss** in detail about (i) Role of Machine Learning in IoT. (6) (ii) NoSQL Databases. (7)	Understand	BTL-2
3.	**Describe** in detail about Hadoop ecosystem and the two key components with suitable illustration.	Remember	BTL-1
4.	**Compare** in detail about (i) Structured Vs Unstruct ured Data. (6) (ii) Data in Motion Vs Data in Rest. (7)	Apply	BTL-3
5.	**Evaluate** the necessity of Apache Kafka and Apache Spark with diagram.	Evaluate	BTL-5
6.	**Express** in detail Edge streaming analytics and compare it with data analytics. Also give the functions of Edge analytics.	Understand	BTL-2
7.	**Examine** the need for Network Analytics and discuss on flexible Netflow Architecture.	Remember	BTL-1
8.	**Discuss** in detail about Xively cloud for IT and Illustrate Xively dashboard device details.	Understand	BTL-2
9.	**Examine** the Python Web Application framework – Django architecture and steps to develop a django project.	Apply	BTL-3
10.	**Generalize** the purpose of Amazon Web service for IoT.	Create	BTL-6
11.	**Analyze** the role of various components of NETCONF-YANG and steps for IoT device Management with NETCONF-YANG.	Analyze	BTL-4
12.	**Discuss** the key components of hadoop ecosystem : HDFS and Mapreduce.	Remember	BTL-1
13.	**Analyze** the use of (i) Python Web Application Framework – Django. (6) (ii) AWS for IoT. (7)	Analyze	BTL-4
14.	**Discuss** on Edge streaming analytics and Data analytics of IoT.	Remember	BTL-1
	PART C		
1.	**Generalize** in detail about Apache spark and Apache kafka with data flow diagram.	Create	BTL-6
2.	**Analyze** in detail about Data Analytics in IoT and the role of Machine Learning with suitable illustration.	Analyze	BTL-4
3.	**Evaluate** the working of Xively Cloud dashboard device for IoT by giving suitable necessary explanation.	Evaluate	BTL-5
4.	**Generalize** the purpose of Python Web Application Framework – Django and Amazon Web service for IoT.	Create	BTL-6

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS			
Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control			
PART A			
1.	**List** the six pillars/components of Cisco IoT Systems.	Remember	BTL-1
2.	**Define** Watson IoT Platform.	Remember	BTL-1
3.	**Brief** the sub layers of security in IoT systems.	Remember	BTL-1
4.	**Analyze** the use of Fog Computing.	Analyze	BTL-4
5.	**Classify** the key features of IBM Watson platform.	Apply	BTL-3
6.	**Summarize** the use of Watson Conversation services.	Evaluate	BTL-5
7.	**Describe** in brief Converged Plantwide Ethernet Model.	Remember	BTL-1
8.	**Relate** the use of blockchain services in IBM Watson IoT platform.	Apply	BTL-3
9.	**Classify** the implementation and design guidance of CPwE.	Apply	BTL-3
10.	**Compose** the three stages of power supply-chain in power utility industry.	Create	BTL-6
11.	**Compose** the use of smart traffic application.	Create	BTL-6
12.	**Infer** how IoT data are Securely connected, managed and analysed.	Analyze	BTL-4
13.	**Summarize** on GridBlocks reference model.	Understand	BTL-2
14.	**Tell** the challenges that become even more evident as the IT and OT networks become interconnected.	Remember	BTL-1
15.	**Give** the benefits provided by The GridBlocks reference architecture to utility operators.	Understand	BTL-2
16.	**Discuss** any one usecase of smart applications of IoT.	Understand	BTL-2
17.	**Conclude** An IoT Strategy for Smarter Cities.	Evaluate	BTL-5
18.	**Express** why LED technology is used in street lighting?	Understand	BTL-2
19.	**Define** connected manufacturing.	Remember	BTL-1
20.	**Analyze** the smart parking usecase.	Analyze	BTL-4

	PART B		
1.	**Analyze** the purpose of the Six-Pillar Approach for Cisco IoT System also explain the security framework.	Analyze	BTL-4
2.	**Examine** the Features of IBM Watson IoT platform, and brief on the services provided in it.	Remember	BTL-1
3.	(i) **Describe** an IoT strategy for connected Manufacturing. (6) (ii) **Examine** the architecture for connected factory. (7)	Remember	BTL-1
4.	**Analyze** in detail the architecture of Converged Plantwide Ethernet Model with suitable illustration.	Analyze	BTL-4
5.	**Examine** the challenges faced for parking in cities, and explain how smart parking provides a solution to this.	Remember	BTL-1
6.	(i) **Demonstrate** the use of Power Utility Industry. (7) (ii) **Examine** the IT/OT divide in Utilities. (6)	Apply	BTL-3
7.	**Illustrate** the 11-Tiered Reference Architecture of Grid Blocks and the use of reference model.	Apply	BTL-3
8.	**(i) Summarize** in detail the architecture model of CPwE**. (7)** (ii) **Discuss** on design and implementation guidance of CPwE. (6)	Understand	BTL-2
9.	**Summarize** on the solution for smart lighting and explain street lighting architecture in detail.	Evaluate	BTL-5
10.	(i) **Generalize** an IoT strategy for smart city. (6) (ii) **Design** an smart city layered architecture and explain how security is provided. (7)	Create	BTL-6
11.	**Discuss** the features of Cisco IoT System and explain the components and security involved in it.	Understand	BTL-2
12.	**Describe** the architecture of smart traffic control architecture and explain the applications of smart traffic.	Understand	BTL-2
13.	**Analyze** the grid block reference model and the reference architecture with suitable illustration.	Analyze	BTL-4
14.	(i) **Define** any one usecse example of smart city examples. (6) (ii) **Describe** the smart city security architecture. (7)	Remember	BTL-1
	PART C		
1.	**Analyze** the IoT platform designed by IBM Watson, explain what it can do to your business, and infer how IoT data are securely connected, managed and analyzed.	Analyze	BTL-4
2.	**Prepare** an IoT strategy for smart city and design the layered architecture for implementing smart cities.	Create	BTL-6
3.	**Consider** any use case example of smart applications of IoT, explain the architecture and technology need in building the application.	Evaluate	BTL-5
4.	**Formulate** an Industrial application of IoT system and brief on the various usecase of smart and connected cities.	Create	BTL-6