SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF INFORMATION TECHNOLOGY

(Common to Electronics and Communication Engineering & Medical Electronics)

QUESTION BANK

VI SEMESTER

1908609– INTERNET OF THINGS AND ITS APPLICATIONS

Regulation – 2019

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SUBJECT : 1908609– INTERNET OF THINGS AND ITS APPLICATIONS

SEM/YEAR : VI / III

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**	**BT Level**	**Competence**
1	Define IoT.	BTL-1	Remember
2	Give the evolutionary phases of IoT.	BTL-2	Understand
3	Interpret the tasks carried out by IT and OT.	BTL-2	Understand
4	Pointout the challenges faced by Internet of Things.	BTL-4	Analyze
5	Summarize the benefits of correct convergence of IT and OT as IoT.	BTL-5	Evaluate
6	List the applications of IoT.	BTL-1	Remember
7	Define Big data. Give two examples where Big data is generated in IoT systems.	BTL-2	Understand
8	Illustrate the IoT Reference model.	BTL-3	Apply
9	Compare two IoT architectures oneM2M and IoTWF.	BTL-4	Analyze
10	List the layers and sublayers of the functional stack of core IoT.	BTL-1	Remember
11	Examine the hierarchy of Fog, Edge and Cloud.	BTL-1	Remember
12	Distinguish the following: active and passive sensor, Invasive and non-invasive sensor.	BTL-2	Understand
13	Summarize the criteria used to classify Actuators.	BTL-5	Evaluate
14	Summarize the purpose of Sensors, Actuators and Smart Objects.	BTL-5	Evaluate
15	What is called as IoT ecosystem? Name the functional blocks of it.	BTL-1	Remember
16	Mention the defining characteristics of Fog Computing.	BTL-3	Understand
17	Illustrate smart object.	BTL-3	Apply
18	Compare Fog and Edge computing.	BTL-4	Analyze
19	Quote the trends in smart Objects.	BTL-1	Remember
20	Formulate the communication criteria used for connecting smart objects.	BTL-6	Create
PART – B			
1	Summarize the IoT enabling technologies. Explain any three of these with examples. (13)	BTL-2	Understand
2	Illustrate each layer of the oneM2M IoT standardized architecture with neat diagram. (13)	BTL-3	Apply
3	Describe the seven layers of IoT Reference model designed by IoTWF. (13)	BTL-1	Remember
4	(i).Tabulate the description of Alternative IoT Reference Models. (6) (ii). Describe the simplified IoT Architecture. (7)	BTL-1	Remember
5	(i). Draw and explain the expanded view of simplified IoT	BTL-1	Remember

	architecture. (7) (ii).Discuss about components of Core IoT functional stack that must work together for the functioning of an IoT network.(6)		
6	(i).Describe the architectural classification of 'Things' or 'smart objects' in core IoT functional stack. (7) (ii).Write short notes on access technologies used in IoT. (6)	BTL-1	Remember
7	Analyze the following functions of applications and analytics layer of IoT network. (i) Analytics versus Control applications (4) (ii) Data Versus Network analytics (4) (iii) Data analytics Versus Business benefits (5)	BTL-4	Analyze
8	(i) Summarize the smart services offered by applications and analytics layer of IoT. (7) (ii) Summarize the responsibilities of IT and OT in the IoT reference model. (6)	BTL-5	Evaluate
9	Draw the layered structure of IoT data management and compute stack with fog layer. Justify why fog layer is introduced in it. Also comment about Edge computing (13)	BTL-6	Create
10	Analyze in detail the Hierarchy followed in Edge, Fog and Cloud with suitable illustration. (13)	BTL-4	Analyze
11	Explain in detail about actuators and Micro Electro Mechanical Systems. (13)	BTL-4	Analyze
12	(i). Examine the different ways of categorizing sensors with necessary explanation (7) (ii). Give examples for any six types of sensors and relate its name with its principle of operation. (6)	BTL-3	Apply
13	List out and explain the communication criteria that must be considered in connecting smart objects (13)	BTL-2	understand
14	Analyze the defining characteristics of smart objects (9) Illustrate about the trends in smart objects that are impacting IoT (4)	BTL-2	Understand
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. (15)	BTL-4	Analyze
2	Identify the need for incorporation of Fog and Edge layers in to the traditional Cloud computing model and explain how the requirements are satisfied by these layers. (15)	BTL-5	Evaluate
3	Develop a narration on IoT Access technologies that plays a major role in market. Give suitable examples explaining the technologies. (15)	BTL-6	Create
4	Prepare a detailed analysis of smart objects and their architecture thereby elaborating the design limitations and role within IoT Networks.(15)	BTL-6	Create
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			
Q.No.	**Questions**	**BT Level**	**Competence**

1	Mention the significance of IEEE 802.15.4 standard.	BTL-1	Remember
2	Define the medium access methods used in IEEE 802.15.4 standard.	BTL-1	Remember
3	Where the ZigBee protocol can be deployed?.	BTL-2	Understand
4	Give the relationship between IEEE 1901.2a and NB-PLC.	BTL-2	Understand
5	Illustrate the high level ZigBee Protocol stack.	BTL-3	Apply
6	List the topologies supported by IEEE 802.15.4 standard.	BTL-1	Remember
7	Compare ZigBee and ZigBee IP.	BTL-4	Analyze
8	Point out the relationship between IEEE 1901.2a and NB-PLC.	BTL-2	Understand
9	Assess the MAC Layer Security offered by IEEE 802.15.4g/e .	BTL-5	Evaluate
10	How does the data rate vary in LoRaWAN?.	BTL-3	Apply
11	Analyze the process to optimize IP for IoT.	BTL-3	Analyze
12	Write about the concept of constrained nodes and constrained networks.	BTL-2	Understand
13	What is an acronym of 6LoWPAN? explain	BTL-1	Remember
14	Outline the features of 6LoWPAN	BTL-3	Apply
15	Differentiate 6LoWPAN from 6Lo.	BTL-4	Analyze
16	Examine the use of RoLL working group.	BTL-6	Create
17	Why the protocol translation of SCADA is needed in IoT protocols.	BTL-6	Create
18	Classify the IoT Application Transport methods.	BTL-5	Evaluate
19	Name the three level of QoS supported by MQTT.	BTL-1	Remember
20	Identify the protocol used for resource-oriented applications in constrained networks.	BTL-1	Remember
	PART – B		
1	(i) Draw the MAC frame format of IEEE 802.15.4 and explain. (10) (ii)list the types of topology used in IEEE 802.15.4 protocol. (3)	BTL-1	Remember
2	Illustrate the security header format of IEEE 802.15.4g/e and also specify the improvements in physical and MAC layers for IoT use cases. (13)	BTL-2	Understand
3	Describe how does the LoRa WAN technology offer connectivity between gateways and backend network with necessary diagrams. (13)	BTL-3	Apply
4	Compare and contrast the physical and MAC layers of IoT Access technologies with suitable illustrations. (13)	BTL-5	Evaluate
5	Explain the following: (i) LoRaWAN security (6) (ii) Narrowband Power line communication (7)	BTL-1	Remember
6	Analyze the following access technologies with connectivity over IoT networks (i) IEEE 802.11g, (6) (ii) IEEE 802.11ah (7)	BTL-4	Analyze
7	Examine the role of wired access protocol IEEE1901.2a working group in connecting smart objects. (13)	BTL-4	Analyze
8	(i)Mention the need for Optimizing IP for IoT using adaptation layer. (3) (ii) Compare the characteristics of 6LoWPAN Protocol stack using adaptation layer with standard IP Protocol stack. (10)	BTL-1	Remember
9	Differentiate 6LoWPAN working group from 6Lo working group. (6) Write a detailed notes on RPL network (7)	BTL-5	Evaluate
10	Categorize the IoT Application Transport Methods and explain in detail about Supervisory Control and Data Acquisition. (13)	BTL-2	Understand

11	Write short notes on (i) IoT constrained nodes (7) (ii) IoT constrained networks (6)	BTL-2	Understand
12	Describe about Application Layer Protocols: (i) CoAP (7) (ii) MQTT (6)	BTL-6	Create
13	Tabulate and analyze the main characteristics of Constrained Application Protocol and Message Queuing Telemetry Transport Application Layer Protocols. (13)	BTL-1	Remember
14	Demonstrate how the routing solution is achieved through Routing over Low Power and Lossy Networks with suitable diagrams. (13)	BTL-3	Apply
PART – C			
1	Analyze in detail how the wireless access technology IEEE 802.15.4 adapts for low cost and low data rate devices and also to address a wide range of IoT use cases. (15)	BTL-5	Evaluate
2	Examine the amendments of IEEE 802.15.4 specification such as IEEE 802.15.4g and IEEE 802.15.4e, IEEE 802.11ah, LoRaWAN for IoT applications. (15)	BTL-6	Create
3	Develop the IETF working group 6LoWPAN and its successor 6Lo to optimize the transmission of IPv6 packets over constrained networks. (15)	BTL-6	Create
4	Evaluate the functions of web based IoT application layer protocols for constrained networks. Also explain about MQTT publish/subscribe framework based on the TCP/IP architecture. (15)	BTL-5	Evaluate

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

Q.No.	Questions	BT Level	Competence
1	List the steps involved in IoT Design methodology.	BTL-1	Remember
2	Analyze the role of Embedded computing in building IoT projects.	BTL-4	Analyze
3	Name the building blocks of the IoT system.	BTL-1	Remember
4	Mention the different modules of IoT SoC	BTL-2	Understand
5	Summarize the benefits of SoC.	BTL-2	Understand
6	List the interfaces of Raspberry Pi.	BTL-1	Remember
7	Write the major layers of IoT architecture..	BTL-2	Understand
8	Point out the services supported by Management Service Layer.	BTL-3	Apply
9	Compare sensors and actuators.	BTL-4	Analyze
10	Examine the use and purpose of Arduino in building IoT solutions	BTL-5	Evaluate
11	Justify how Raspberry Pi is different from a desktop computer	BTL-3	Apply
12	What is the use of GPIO pins in a IoT device?	BTL-1	Remember
13	List out various versions of raspberry pi devices till date.	BTL-2	Understand
14	Name the different IoT platforms	BTL-1	Remember
15	Analyze how programming raspberry pi works.	BTL-4	Analyze
16	Summarize on the need of microcontroller in embedded system.	BTL-6	Create
17	Write a python program to turn the LED ON/OFF with Raspberry Pi.	BTL-3	Apply
18	Differentiate Raspberry with Arduino	BTL-6	Create
19	Assess the characteristics of Python programming language.	BTL-5	Evaluate

20	List the essential requirements for setting up Raspberry Pi.	BTL-1	Remember
PART – B			
1	Demonstrate the key steps involved in IoT Design methodology, explain the steps involved in	BTL-3	Apply
2	(i) Summarize in detail about embedded computing. (6) (ii) Explain the microcontroller and chips involved in embedded devices. (7)	BTL-5	Evaluate
3	Formulate on python programming for Raspberry Pi.	BTL-6	Create
4	Discuss in detail the use of embedded computing in the design of IoT Sysems.	BTL-2	Understand
5	(i) Analyze in detail an exemplary device: Raspberry Pi. (6) (ii) Explain in detail the Raspberry Pi interfaces. (7)	BTL-4	Analyze
6	Illustrate the arduino board details and explain the steps for installing the board.	BTL-3	Apply
7	Discuss in detail the building blocks of IoT and its functionalities with suitable illustration.	BTL-2	Understand
8	(i) List the IoT design methodology. (6) (ii) Examine the building blocks of IoT. (7)	BTL-1	Remember
9	Describe the steps for designing IoT system with neat diagram.	BTL-1	Remember
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)	BTL-1	Remember
11	Define IoT device and give a detailed narration of IoT device example in real world applications.	BTL-1	Remember
12	Discuss in detail the Interfacing LED and switch with Raspberry Pi as an example. Give the procedure.	BTL-2	Understand
13	Analyze the software and hardware features of Arduino board and explain the procedure to install IDE.	BTL-4	Analyze
14	Analyze the embedded computing logic and use of microcontroller in embedded system with neat diagram.	BTL-4	Analyze
PART – C			
1	Analyze in detail the design methodology used to implement IoT Devices, explain the level wise design steps with neat diagram.	BTL-4	Analyze
2	Pointout some examples that define IoT devices and explain in brief the basic building block and layers in IoT system with diagram.	BTL-5	Evaluate
3	Analyze and explain in detail Programming Raspberry Pi with python by giving suitable example. Also elaborate on Raspberry Pi interfaces.	BTL-4	Analyze
4	Design a basic arduino board and explain the procedure for installing and setting up of IDE.	BTL-6	Create
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			
Q.No.	**Questions**	**BT Level**	**Competence**
1	Define Machine Learning.	BTL-1	Remember
2	Generalize the use of AWS in IoT.	BTL-6	Create
3	Compare Data in motion vs Data at Rest.	BTL-5	Evaluate
4	Define Neural networks.	BTL-1	Remember

5	Compare the two categories of machine learning.	BTL-4	Analyze
6	Analyze the use of NoSQL Database.	BTL-4	Analyze
7	Summarize on Hadoop.	BTL-4	Analyze
8	Differentiate Structured vs Unstructured Data.	BTL-2	Understand
9	Discuss on Hadoop ecosystem.	BTL-2	Understand
10	Give the benefits of flow analytics.	BTL-2	Understand
11	Summarize on Edge streaming analytics.	BTL-5	Evaluate
12	Define YARN.	BTL-1	Remember
13	Name the core functions of Edge Analytics.	BTL-1	Remember
14	Demonstrate the stages of data processing in an edge APU.	BTL-3	Apply
15	Examine the role of Python Web application framework – Django.	BTL-3	Apply
16	Discuss on Apache spark.	BTL-2	Understand
17	Formulate on Apache Kafka.	BTL-6	Create
18	Compare Big Data and Edge Analytics.	BTL-3	Apply
19	Define Amazon S3 and Amazon RDS.	BTL-1	Remember
20	Identify the role of various components of NETCONF-YANG.	BTL-1	Remember
PART – B			
1	Explain in detail the need of Data Analytics for IoT and brief the challenges faced by IoT Data Analytics.	BTL-4	Analyze
2	Discuss in detail about (i) Classification of Machine Learning in IoT. (6) (ii) Distributed analytics systems. (7)	BTL-2	Understand
3	Describe in detail about Hadoop ecosystem and the two key components with suitable illustration.	BTL-1	Remember
4	Compare in detail about (i) Structured Vs Unstructured Data. (6) (ii) Data in Motion Vs Data in Rest. (7)	BTL-3	Apply
5	Give a short note on the necessity of Apache Kafka and Apache Spark with diagram.	BTL-5	Evaluate
6	Write in detail about the Edge streaming analytics and compare it with data analytics. Also give the functions of Edge analytics.	BTL-2	Understand
7	Examine the need for Network Analytics and discuss on flexible Netflow Architecture.	BTL-1	Remember
8	Discuss in detail about Xively cloud for IT and Illustrate Xively dashboard device details.	BTL-2	Understand
9	Examine the Python Web Application framework – Django architecture and steps to develop a django project.	BTL-3	Apply
10	Generalize the purpose of Amazon Web service for IoT.	BTL-6	Create
11	Analyze the role of various components of NETCONF-YANG and steps for IoT device Management with NETCONF-YANG.	BTL-4	Analyze
12	Describe the key components of hadoop ecosystem: HDFS and Map reduce.	BTL-1	Remember
13	Write the use of (i) Python Web Application Framework – Django. (6) (ii) Flexible NetFlow architecture. (7)	BTL-4	Analyze
14	Discuss on Edge streaming analytics and Data analytics of IoT.	BTL-1	Remember
PART – C			
1	Summarize in detail about Apache spark and Apache kafka with data flow diagram.	BTL-6	Create
2	Discuss in detail about network analytics with smart grid FAN analytics with NetFlow example.	BTL-4	Analyze
3	Describe how a neural network recognizes an object in an image with an example.	BTL-5	Evaluate

4	Explain the purpose of Python Web Application Framework – Django and Amazon Web service for IoT.	BTL-6	Create

UNIT - V: CASE STUDIES

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

PART – A

Q.No.	Questions	BT Level	Competence
1	List the six pillars/components of Cisco IoT Systems.	BTL-1	Remember
2	Define Watson IoT Platform.	BTL-1	Remember
3	Brief the sub layers of security in IoT systems.	BTL-1	Remember
4	Analyze the use of Fog Computing	BTL-4	Analyze
5	Classify the key features of IBM Watson platform.	BTL-3	Apply
6	Summarize the use of Watson Conversation services.	BTL-5	Evaluate
7	Describe in brief Converged Plantwide Ethernet Model.	BTL-1	Remember
8	Relate the use of blockchain services in IBM Watson IoT platform.	BTL-3	Apply
9	Classify the implementation and design guidance of CPwE.	BTL-3	Apply
10	Compose the three stages of power supply-chain in power utility industry.	BTL-6	Create
11	Compose the use of smart traffic application.	BTL-6	Create
12	Infer how IoT data are Securely connected, managed and analysed.	BTL-4	Analyze
13	Summarize on GridBlocks reference model.	BTL-2	Understand
14	Tell the challenges that become even more evident as the IT and OT networks become interconnected.	BTL-1	Remember
15	Give the benefits provided by The GridBlocks reference architecture to utility operators.	BTL-2	Understand
16	Discuss any one usecase of smart applications of IoT.	BTL-2	Understand
17	Conclude An IoT Strategy for Smarter Cities.	BTL-5	Evaluate
18	Express why LED technology is used in street lighting?	BTL-2	Understand
19	Define connected manufacturing.	BTL-1	Remember
20	Analyze the smart parking usecase.	BTL-4	Analyze

PART – B

1	Analyze the purpose of the Six-Pillar Approach for Cisco IoT System also explain the security framework.	BTL-4	Analyze
2	Examine the Features of IBM Watson IoT platform, and brief on the services provided in it.	BTL-1	Remember
3	(i) Describe an IoT strategy for connected Manufacturing. (6) (ii) Examine the architecture for connected factory. (7)	BTL-1	Remember
4	Analyze in detail the architecture of Converged Plantwide Ethernet Model with suitable illustration.	BTL-4	Analyze
5	Examine the challenges faced for parking in cities, and explain how smart parking provides a solution to this.	BTL-1	Remember
6	(i) Demonstrate the use of Power Utility Industry. (7) (ii) Examine the IT/OT divide in Utilities. (6)	BTL-3	Apply
7	Illustrate the 11-Tiered Reference Architecture of Grid Blocks and the use of reference model.	BTL-3	Apply
8	(i) Summarize in detail the architecture model of CPwE. (7) (ii) Discuss on design and implementation guidance of CPwE. (6)	BTL-2	Understand
9	Summarize on the solution for smart lighting and explain street lighting architecture in detail.	BTL-5	Evaluate

10	(i) Generalize an IoT strategy for smart city. (6) (ii) Design an smart city layered architecture and explain how security is provided. (7)	BTL-6	Create
11	Discuss the features of Cisco IoT System and explain the components and security involved in it.	BTL-2	Understand
12	Describe the architecture of smart traffic control architecture and explain the applications of smart traffic.	BTL-2	Understand
13	Analyze the grid block reference model and the reference architecture with suitable illustration.	BTL-4	Analyze
14	(i) Define any one usecse example of smart city examples. (6) (ii) Describe the smart city security architecture. (7)	BTL-1	Remember
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.	BTL-4	Analyze
2	Prepare an IoT strategy for smart city and design the layered architecture for implementing smart cities.	BTL-6	Create
3	Consider any use case example of smart applications of IoT, explain the architecture and technology need in building the application.	BTL-5	Evaluate
4	Formulate an Industrial application of IoT system and brief on the various usecase of smart and connected cities.	BTL-6	Create