

9

34 April 2024

### Scoring Indicators

COURSE NAME : Internet of Things

COURSE CODE : 6131A (Rev 21)

QID : 2102240131-A

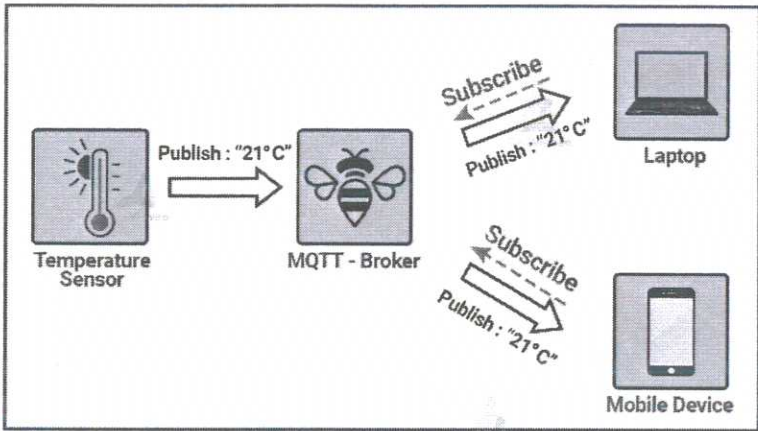
Max. marks

Q.No	Scoring Indicators	Split score	Sub Total	Total score
I	<b>PART A</b>			9
I.1	Smart Healthcare, retail, agriculture, logistics, home automation, etc. (Any two)	0.5x2	1	
I.2	Volume, Velocity, Variety, Variability, Veracity, Value, and Visualization (Any two)	0.5x2	1	
I.3	MQTT - Message Queuing Telemetry Transport	1	1	
I.4	Ethernet, Wifi, WiMax, LR-WPAN, BLE, Cellular (Any two)	0.5x2	1	
I.5	Uniform Resource Identifier - a generic term for the names of all resources connected to the World Wide Web.	1	1	
I.6	Fog nodes	1	1	
I.7	True	1	1	
I.8	Microcontroller based board	1	1	
I.9	Raspberry Pi OS (formerly Raspbian)	1	1	
II	<b>PART B</b>			24
II.1	<ul style="list-style-type: none"><li>• A dynamic global network infrastructure having self configuring capabilities.</li><li>• The devices are called <i>things</i> and have unique identities</li></ul>	3	3	

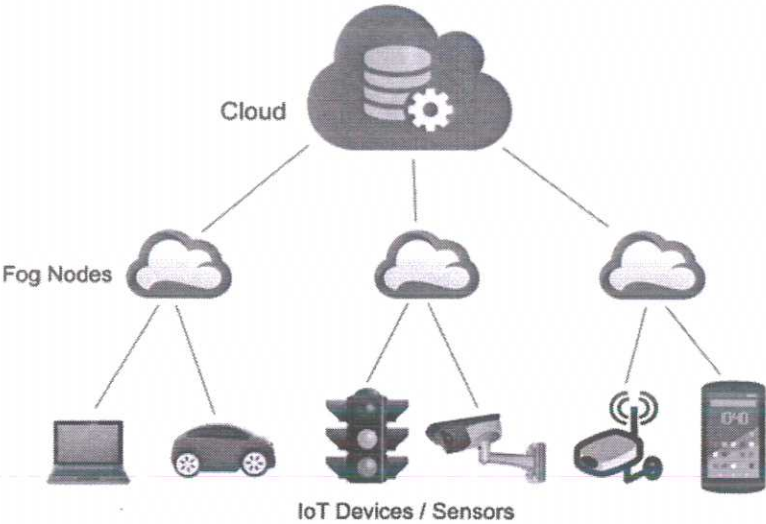
	<p>and physical attributes.</p> <ul style="list-style-type: none"> <li>• The things use intelligent interfaces to communicate data with the users and their environment.</li> <li>• They use standard and interoperable communication protocols.</li> <li>• They are seamlessly integrated into the information network.</li> </ul>											
II.2	<p>Things in IoT refers to IoT devices which have unique identities and can perform remote sensing, actuating and monitoring capabilities. They are seamlessly integrated into the information network.</p> <p>Eg: Sensors such as temperature sensors, humidity sensors, industrial motors, wearables, vehicles.</p>	2 Eg. 1	3									
II.3	<p>It is a wireless communication technology which uses the visible light spectrum (also UV and IR spectrums, if needed) for high-speed data transfer between devices, terminals, and servers. Provides faster transmission speeds, higher bandwidth, and the ability to work in spaces that are vulnerable to electromagnetic interference, such as airplanes, hospitals, or highly-sensitive industries such as the petroleum industry.</p>	3	3									
II.4	<p>CoAP is an application-layer protocol that is intended for use in low-power, low-bandwidth, resource-constrained Internet devices, such as wireless sensor network nodes and IoT nodes. Designed to easily translate to HTTP for simplified integration with the web. Follows a client-server model in the form of request-response pattern. Uses UDP in the transport layer.</p>	3	3									
II.5	<table border="1"> <thead> <tr> <th>IPv4</th> <th>IPv6</th> </tr> </thead> <tbody> <tr> <td>32 bit length</td> <td>128 bit length</td> </tr> <tr> <td>Dotted decimal notation</td> <td>Hexadecimal notation</td> </tr> <tr> <td>Broadcast is available</td> <td>No broadcast, but anycast and</td> </tr> </tbody> </table>	IPv4	IPv6	32 bit length	128 bit length	Dotted decimal notation	Hexadecimal notation	Broadcast is available	No broadcast, but anycast and	Any three x 1	3	
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II.6	<p>Data Security and Privacy</p> <p>Cost Management</p> <p>Multi-Cloud Environments</p> <p>Performance Challenges</p> <p>Interoperability and Flexibility</p> <p>High Dependence on Network</p> <p>Lack of Knowledge and Expertise</p>	Any three x 1	3																			
II.7	<p>Features of devices to be managed.</p> <p>Service offerings by the provider.</p> <p>Scalability of the cloud platform.</p> <p>Security features for the data.</p> <p>Data management for storing, processing and analysis.</p>	Any three x 1	3																			
II.8	<table border="1"> <thead> <tr> <th>SENSOR</th> <th>ACTUATOR</th> </tr> </thead> <tbody> <tr> <td>Converts physical characteristics into electrical signals.</td> <td>Converts electrical signals into physical characteristics.</td> </tr> <tr> <td>Takes input from the environment.</td> <td>Takes input from the processing unit of the system.</td> </tr> <tr> <td>It gives output to the processing unit of the system.</td> <td>It gives output to the environment.</td> </tr> <tr> <td>Sensors generate electrical signals.</td> <td>Actuator generates heat or motion.</td> </tr> <tr> <td>It is placed at the input port of the system.</td> <td>It is placed at the output port of the system.</td> </tr> <tr> <td>Used to measure the physical quantity.</td> <td>Used to measure the continuous and discrete process parameters.</td> </tr> <tr> <td>It gives information to the system about the environment.</td> <td>It accepts commands to perform a function.</td> </tr> <tr> <td>Example: temperature sensor</td> <td>Example: Stepper motor</td> </tr> </tbody> </table>	SENSOR	ACTUATOR	Converts physical characteristics into electrical signals.	Converts electrical signals into physical characteristics.	Takes input from the environment.	Takes input from the processing unit of the system.	It gives output to the processing unit of the system.	It gives output to the environment.	Sensors generate electrical signals.	Actuator generates heat or motion.	It is placed at the input port of the system.	It is placed at the output port of the system.	Used to measure the physical quantity.	Used to measure the continuous and discrete process parameters.	It gives information to the system about the environment.	It accepts commands to perform a function.	Example: temperature sensor	Example: Stepper motor	Any three x 1	3	
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II.9	<p>while loop</p> <pre>while expression:     statement(s)</pre> <p>Example.</p> <p>for loop</p> <pre>for iterator_var in sequence:     statements(s)</pre> <p>Example.</p>	<p>Any one - 1.5 marks</p> <p>Eg - 1.5 marks</p>	3	
II.10	<p>Soil moisture sensors measure or estimate the amount of water in the soil. These sensor measurements permit farmers to take action when a field condition, such as low water levels, goes from safe limit. It can enable automatic sprinklers to spray water to the desired area to raise the moisture to the specific limit.</p>	3	3	
<b>PART C</b>				42
III	<p>Sensors - some features and examples.</p> <p>Cloud Computing - basics and overview of IaaS, PaaS, SaaS, etc.</p> <p>Big data Analysis - basics and some V's</p> <p>Embedded computing boards and systems - features and examples.</p>	<p>Any two.</p> <p>List -1, Expln 3 marksX</p> <p>3</p>	7	
IV	<p>Device Hardware: Sensors, actuators and processing units. Eg: Gas sensor, stepper motor, NodeMCU respectively .</p> <p>Device Software: Programs and embedded OS. Eg: RPi OS.</p> <p>Communications: How devices connect to the internet and transfer data. eg: wifi, BLE, cellular, etc.</p> <p>Cloud Platform: Internet based data centers. eg: AWS, MS Azure</p> <p>Cloud Applications: Run on top of the cloud platform and provide the end-user with a way to interact with the IoT system.</p>	7	7	

V	<ol style="list-style-type: none"> <li>1. Dynamic and Self adapting with changing context and taking actions based on their operating conditions.</li> <li>2. Self-configuring allows a large number of devices to work together to provide certain functionality.</li> <li>3. Interoperable Communication Protocols to communicate with each other and with the infrastructure.</li> <li>4. Unique Identity to identify each device and helps the devices to communicate with each other.</li> <li>5. Integrated into Information Network to communicate and exchange data with other devices and systems for storing, processing and visualizing the data.</li> </ol> <p>(Any three with explanation)</p>	7	7	
VI	<ul style="list-style-type: none"> <li>● Security challenges: Malware, network attacks, vulnerabilities, lack of encryption, device security, testing, updation.</li> <li>● Design challenges: May not be considering the end use.</li> <li>● Scalability challenges: in terms of data, network capacity, device management.</li> <li>● Reliability challenges: Failure of device, network, data accuracy.</li> <li>● Power consumption: Battery life, energy efficiency, power management.</li> <li>● Deployment challenges: Connectivity, compatibility, network layout, device and data management, skillset.</li> </ul>	7	7	
VII	 <p>● A <b>publish/subscribe</b> protocol and uses TCP/IP.</p>	3	7	4

	<ul style="list-style-type: none"> <li>● Lightweight: Requires minimal resources so it can be used on small microcontrollers.</li> <li>● Allows bi-directional communication and security.</li> <li>● Client devices publish messages (sensor data) to the brokers (servers) as specific topics. The broker sends this message to those clients who have subscribed to the corresponding topic.</li> </ul>			
VIII	<ul style="list-style-type: none"> <li>● BLE is a power-conserving variant of Bluetooth PAN technology, designed for use by Internet-connected machines and appliances, especially in IoT.</li> <li>● It is a low-power wireless technology that transmits a small amount of data at lower speeds.</li> <li>● It is used in low bandwidth applications, transfer sensor data, and control devices.</li> <li>● This is helpful because many IoT nodes use batteries as the power source.</li> <li>● It has a quicker connection capability.</li> <li>● It remains in dormant mode until the connection is initiated, hence saving the energy.</li> <li>● Some common applications for BLE are Fitness trackers, Smartwatches and Home automation devices.</li> </ul>	7	7	
IX	<ul style="list-style-type: none"> <li>● On-Demand Self-Service.</li> <li>● Flexibility.</li> <li>● Broad Network Access.</li> <li>● Resource Pooling.</li> <li>● Rapid Elasticity and Scalability.</li> <li>● Measured Service.</li> <li>● Higher Security.</li> <li>● High Availability.</li> <li>● Disaster Recovery.</li> <li>● Fault Tolerance.</li> <li>● No Location Constraints.</li> </ul>	Any seven with 1-2 sentence x 7	7	

<p>X</p>	<p>Fog computing is a form of distributed computing that brings computation and data storage closer to the network edge, where many IoT devices are located. By doing this, fog computing reduces the dependence on the cloud for these resource-intensive tasks, improving performance and reducing latency. In fog computing, all the storage capabilities, computation capabilities, data along with the applications are placed between the cloud and the physical host. All these functionalities are placed more towards the host. This makes processing faster as it is done almost at the place where data is created. The devices in the fog are called fog nodes. Fog computing improves the efficiency of the system.</p> <p style="text-align: center;">Fog Computing Architecture</p>  <p>The diagram illustrates the Fog Computing Architecture. At the top is a large cloud icon labeled 'Cloud' containing a database symbol and a gear. Three lines connect this central cloud to three smaller cloud icons labeled 'Fog Nodes'. Each fog node is connected to a set of IoT devices and sensors. The first fog node is connected to a laptop and a car. The second fog node is connected to a traffic light and a security camera. The third fog node is connected to a satellite dish and a smartphone. The label 'IoT Devices / Sensors' is centered below these devices.</p>	<p>4</p>	<p>7</p>	
<p>XI</p>	<ul style="list-style-type: none"> <li>• Uno means 'one' in Italian. It is easy to use compared to other boards, such as the Arduino Mega board, etc. and hence it is most popular.</li> <li>• The various components present on the Arduino boards are Microcontroller, Digital Input/output pins, USB Interface and Connector, Analog Pins, Reset Button, Power button, LED's, Crystal Oscillator, and Voltage Regulator.</li> </ul>	<p>7</p>	<p>7</p>	

	<ul style="list-style-type: none"> <li>● It has a 16 MHz ATmega328P microcontroller with 2KB SRAM, 32KB flash, 1KB of EEPROM, 0.5 KB of the Flash Memory is used by the bootloader code.</li> <li>● The Arduino UNO includes 6 analog pin inputs, 14 I/O digital pins (out of which six capable of PWM output), a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header.</li> <li>● Its Operating Voltage is 5V but the supply voltage can be 6V to 20V. It can supply 5V/3.3V to sensors.</li> <li>● It is the most used standard form from the list of all available Arduino Boards.</li> </ul>			
XII	<p>Temperature</p> <p>Proximity</p> <p>Pressure</p> <p>Gas</p> <p>Humidity</p> <p>Motion</p> <p>Light</p> <p>Heartbeat</p> <p>Infrared</p> <p>Accelerometer</p> <p>Gyroscope sensor</p> <p>Moisture</p> <p>Water quality</p> <p>Smoke</p>	<p>(Any three)</p> <p>List 1</p> <p>Expln 3 x 2 marks</p>	7	
XIII	<p>Raspberry Pi is a series of small single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. By connecting peripherals like Keyboard, mouse, display to the Raspberry Pi, it will act as a mini personal computer. It provides a set of GPIO (general purpose input/output) pins, allowing you to control electronic components for physical computing and explore the Internet of Things (IoT).</p>	7	7	

	<p>Raspberry Pi is popularly used for real time Image/Video Processing, IoT based applications and Robotics applications. The Raspberry Pi operates in the open source ecosystem. It can run a variety of Linux OS, Windows IoT Core OS and its main supported official operating system, Raspberry Pi OS. Among these the Raspberry Pi OS is efficiently optimized to use with Raspberry Pi.</p> <p>A Raspberry Pi 3 has a Broadcom microprocessor, RAM, GPU, HDMI ports, Audio ports, camera serial interface port, Ethernet port, SD card slot, USB ports, Wifi/Bluetooth facilities, and a number of GPIO pins for IoT applications.</p>			
XIV	<p>IoT in Healthcare provides opportunities for healthcare professionals to monitor patients, as well as for patients to monitor themselves. IoT devices can automatically collect health metrics like heart rate, blood pressure, temperature, and more from patients who are not physically present in a healthcare facility, eliminating the need for patients to travel to the providers, or for patients to collect it themselves. When an IoT device collects patient data, it forwards the data to a software application where healthcare professionals and/or patients can view it. Algorithms may be used to analyze the data in order to recommend treatments or generate alerts.</p>	7	7	