JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

(54)

B.Tech-VIII Semester (BI)

COURSE CODE (CREDITS): 25B1WCI835 (3) MAX MARKS: 35

COURSE NAME: FOG COMPUTING IN IOT

COURSE INSTRUCTOR: AAYUSH SHARMA MAX. TIME: 2 Hours

***Note:*** *(a) All questions are compulsory.*

*(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems*

*(c) Use of calculator is allowed*

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| Q.No | Question | CO | Marks |
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| Q1 | Match each term in Column A with its correct description in Column B.<br>**Column A:**<br>1. Fog Computing<br>2. Cloud Computing<br>3. WSN (Wireless Sensor Network)<br>4. Latency<br>5. Edge Node<br>**Column B:**<br>A. A centralized service that provides on-demand storage and processing over the internet<br>B. A device placed close to data sources to process data before sending it to the cloud<br>C. The delay between sending a request and receiving a response<br>D. A network of small, low-power devices that sense the physical environment<br>E. A computing layer between IoT devices and the cloud that processes data near the source | [CO1] [CO2] | 5 |
| Q2 | **(a)** Draw or describe the three-layer fog computing architecture (IoT devices, fog layer, cloud layer). For each layer, state *one* main function it performs.<br>**(b)** State *two* advantages of fog computing over cloud-only computing in an IoT smart home system. Give one real example for each advantage.<br>**(c)** A smart agriculture system uses soil sensors across a 10-acre farm. State whether fog computing or cloud computing is better suited for generating immediate irrigation alerts, and give two reasons for your choice. | [CO3] [CO6] | [2+2+2] |
| Q3 | **(a)** A fog node receives sensor data from 50 IoT devices. Each device sends a 200-byte packet every 10 seconds. Calculate the total data rate arriving at the fog node in *bytes per second*. If the fog node can only forward 20% of raw data to the cloud, how many bytes per second reach the cloud?<br>**(b)** A cloud server takes 150 ms to respond to a sensor request. A fog node placed in the same building as the sensors takes 8 ms. A time-critical application requires a response within 20 ms. State which option meets the requirement and calculate by how much the cloud *exceeds* the deadline.<br>**(c)** A fog node runs continuously at 5 W. It is powered by a 10,000 mAh battery at 5 V. Calculate the battery life in hours. If the node enters low-power mode at 0.5 W for 80% of the time and active mode at 5 W for the remaining 20%, calculate the new average power and the new battery life in hours. | [CO4] | [2+2+2] |
| Q4 | **(a)** Explain in simple terms what *anomaly detection* means in the context of fog computing. A | [CO5] | [2+2+2] |

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| | temperature sensor in a server room normally reads between 20 degree C and 30 degree C. The fog node receives the following readings in order: 22, 24, 23, 25, 47, 26, 24. Identify which reading is an anomaly, explain how a simple threshold rule would catch it, and state one action the fog node should take automatically when it detects this anomaly.<br>**(b)** State *two* security threats that are specific to fog computing (not present in pure cloud systems). For each threat, suggest one practical countermeasure that can be applied at the fog layer.<br>**(c)** What is *data aggregation* in fog computing? A fog node collects temperature readings from 10 sensors every minute: 21, 23, 22, 24, 20, 25, 23, 22, 21, 24. Calculate the average, minimum, and maximum. State one reason why sending this summary to the cloud is better than sending all 10 raw values. | | |
| **Q5** | A hospital has deployed a fog-based patient monitoring system. Each patient room has sensors for heart rate, blood pressure, and room temperature. A fog node on each floor processes the data locally and sends summaries to a central cloud server. The hospital administrator notices three problems after one month of operation: (1) Alerts for abnormal heart rate are arriving at the nurses station 12 seconds after the reading is taken, which is too slow for emergencies. (2) The fog node on Floor 3 was found to be running an unauthorized firmware version, raising a security concern. (3) The cloud bill is very high because all raw sensor data is being sent to the cloud every second from all 60 rooms.<br>**(a)** For each of the three problems above, identify the root cause and suggest one specific change to the fog system design that would fix it. Present your answer as: Problem / Root Cause / Fix.<br>**(b)** The hospital wants to upgrade to an edge-fog-cloud three-tier architecture. Describe what processing should happen at each of the three tiers for the heart rate monitoring use case. Then state one metric you would use to measure whether the new system is performing better than the old one, and explain how you would measure it.<br>**(c)** The hospital board suggests replacing the entire fog system with a pure cloud solution to save on local hardware costs. Write your technical response covering: two reasons why cloud-only is *not* suitable for real-time patient monitoring, one scenario where cloud-only would actually be acceptable in a hospital setting, and one fog computing challenge that the hospital will still need to manage even with the best fog design. | **[CO4]**<br>**[CO5]**<br>**[CO6]** | **[4+4+4]** |

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