International Institute of Information Technology - Hyderabad
Embedded System Workshop (Final Exam)
28 November 2025

- Number of questions: 5; Total points: 30; Time Limit: 90 minutes.
- Read all instructions and questions carefully.
- This is a closed-book exam.

Q1. State whether the following statements are True or False. Give a reason for your statement in 2-3 sentences. No step marking: both the statement and reason must be right. Note that simple negation is not a reason. (1 mark each: total 10 marks)

a) The frequency band of Wi-SUN communication in India is 465-468 MHz.

b) The ATMEGA328 microcontroller has SRAM of 32 kB.

c) The Raspberry Pi board has an in-built flash memory of 16 GB.

d) The range of a sensor is high if its sensitivity is also high.

e) Using a Wheatstone bridge circuit for RVC readout provides a linear output.

f) Indoor air pollution data can reveal privacy information.

g) FM Radio is an example of duplex communication

h) ESP32 supports the WiFi standard IEEE 802.11ah.

i) The hidden node problem can occur in wireless communication even at short distances.

j) When the spreading factor in LoRaWAN increases from n to $n+1$, the symbol rate doubles.

Q2. A pressure sensor has a calibrated sensitivity of 10 mV/kPa. Its calibrated zero drift is +1 V. Now, because of wear and tear, the sensitivity and zero drift are known to change by $\pm 10\%$ over time. With this change, for an applied pressure of 200 kPa, what is the range within which the output voltage is expected to be [3]? What is the range of pressure if the output voltage is detected to be +2 V [2]?   [3+2 = 5 marks]

Q3. What are the advantages/disadvantages of Wi-SUN communication over other wireless communication protocols? [5 marks]

Q4. Answer the following questions based on the slides on communication technologies for IoT:

a) IEEE 802.11ac was modified to create IEEE 802.11ah so that it is suitable for IoT applications. Give two examples of PHY modifications and explain how they suit IoT applications. (2 marks)

b) Give one use-case where LoRaWAN would not be suitable and explain why? (1 mark)

c) For cellular IoT, compare the power saving mode (PSM) and the extended discontinuous reception (eDRX) in terms of purpose, power consumption, typical durations, and wake-up trigger. (2 marks)

Q5. You have been tasked with architecting a "Smart Water Management System" for a university campus (similar to the Smart City Living Lab case study). The system must address two specific challenges:

i. **Real-time Leakage Detection:** Identifying burst pipes immediately to prevent water waste.

ii. **Long-term Planning:** Analyzing water usage trends over months to optimize supply schedules

Propose a high-level architectural strategy for this system. In your answer, you must:

a) Explain where you would place the computation for *Leakage Detection* versus *Long-term Planning* (Edge, Fog, or Cloud). Justify your choice for *each* based on latency, energy consumption, and data volume (2 marks)

b) The campus uses sensors from five different vendors using different communication protocols (MQTT, CoAP, HTTP). How will your architecture ensure these devices can communicate seamlessly? (2 marks)

c) Describe a scenario where the system might need to dynamically switch its processing strategy and what might trigger these? (1 mark)