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Question Paper Code : 91387

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Seventh Semester

Mechanical Engineering

ME 3791 — MECHATRONICS AND IOT

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. 'Is smart watch a mechatronic product?' – justify your answer.

2. Define the terms 'response time' and 'lag' with reference to a sensor.

3. What is CMRR in an Opamp?

4. State any two application scenarios that benefit from using instrumentation amplifier.

5. Specify the importance of PWM peripheral in a microcontroller.

6. Mention any two IoT enabling technologies.

7. Differentiate C++ with Python programming language.

8. Depict the block diagram for the given scenario.

   "The state of LED is controlled by the state of pushbutton via Arduino."

9. List any four applications where drones are used.

10. How does the IoT enabled robotic camera Dolly help the TV and film industry?

PART B — (5 × 13 = 65 marks)

11. (a) (i) What are solid-state sensors? Explain any two types of solid-state sensors. (2+4)

(ii) 'Piezoelectric crystals can act as both sensors and actuators' – justify using an example. (7)

Or

(b) With a neat sketch, explain how inspection could be done using Vision system.

12. (a) How does the feedback configuration affect the stability and bandwidth of an operational amplifier circuit? Explain in detail.

Or

(b) Design a PLC program for the following application (coffee maker) and explain the same:

One toggle switch is used to dispense coffee, water, milk, and perform stirring. The machine should dispense the appropriate amount of coffee for 5 seconds, then water for 10 seconds, followed by milk for 8 seconds. The process should end with a stirring of 5 seconds.

13. (a) Describe the process of initializing a peripheral in an embedded system. Also state the list of some common registers that need to be configured during initialization a peripheral.

Or

(b) How does edge computing enhance the performance of IoT systems compared to traditional cloud computing models? Also specify some challenges associated with implementing edge computing in IoT applications.

14. (a) Assess the impact of connectivity options on the scalability of IoT projects using Raspberry Pi and Arduino. Which platform scales better and why?

Or

(b) Formulate a pseudocode to automate the quality control in an industry by monitoring product quality during manufacturing, by taking samples at regular intervals, tested, logged and generates alerts if quality falls below acceptable levels.

15. (a) Illustrate the working of ABS in an automobile. Highlight the integration of the sensors and actuators used.

Or

(b) Illustrate the IoT framework for vehicle fleet management.

PART C — (1 × 15 = 15 marks)

16. (a) An obstacle avoidance robot is required in a warehouse. It should move with high precision and accuracy and possess obstacle avoidance capability. The management is not interested in investing huge money in vision systems. Suggest the sensors and actuators required for development of the robot and justify the same. Also, explain the working principle of the suggested sensors and actuators. (2+3+10)

Or

(b) Appraise the effectiveness of IoT-based precision agriculture techniques over the traditional agricultural techniques in optimizing crop yields.