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Question Paper Code : 41384

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Sixth/Seventh Semester

Mechanical Engineering

ME 3791 — MECHATRONICS and IoT

(Common to : Mechanical and Automation Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Provide examples of optical sensors and their applications in mechatronics.
2. How do brushless permanent magnet DC motors differ from traditional brushed DC motors in terms of their construction and operation?
3. Sketch the VI characteristics of a TRIAC.
4. Draw the Darlington pair circuit.
5. List any two communication protocols used in IoT devices.
6. Define IDE.
7. Differentiate compiled and interpreted language.
8. List the features of NodeMCU.
9. Mention the purpose of an electronic ignition system in a vehicle.
10. Write the uses of ABS in vehicles.

PART B — (5 × 13 = 65 marks)

11. (a) Describe the working principle of a piezoelectric sensor and its applications in mechatronics.

Or

- (b) Describe the main components and operation of solid-state sensors, and discuss their advantages over traditional mechanical sensors in mechatronics.

12. (a) Explain the various blocks contained in a typical data acquisition system.

Or

(b) Explain the construction and working of a Wheatstone Bridge Amplifier and illustrate how they help in force measurement.

13. (a) Compare Arduino, Raspberry Pi and Beaglebone Boards in terms of its Processor, RAM, Input voltage, Storage, Ports, Networking and OS. Mention their areas of application along with their advantages and limitations.

Or

(b) Illustrate the use of various Peripherals used in an Embedded system with application for each of them.

14. (a) Explain the components of a Linux system. List any 4 Linux Commands along with their usage.

Or

(b) With neat diagram, explain the working principle of the ultrasonic distance sensor. Write an Arduino based program to measure distance using ultrasonic sensor.

15. (a) How does computer vision contribute to the autonomy of robots in dynamic environments? Discuss the algorithms associated with vision systems into autonomous robot navigation.

Or

(b) What are the key components of a drone's control system? Explain the role of actuators in drone actuation and control systems and how do they interact to stabilize flight?

PART C — (1 × 15 = 15 marks)

16. (a) A leading automotive manufacturer is planning to release a new line of electric vehicles (EVs) with advanced safety and convenience features. As a mechatronics engineer, you are responsible for designing the vehicle's electronic ignition system, anti-lock braking system (ABS), electronic brake-force distribution (EBD), and adaptive cruise control. Develop a comprehensive plan for integrating these mechatronic systems into the EV platform, ensuring optimal performance, reliability, and safety.

Or

- (b) A municipality in a drought-prone region is facing challenges with water management, agricultural sustainability, and transportation efficiency. Propose an integrated IoT solution that addresses these challenges by implementing remote monitoring systems for water resources, remotely operated autonomous systems for precision agriculture, centralized water management systems for optimizing water usage, IoT-enabled robotic camera dollies for monitoring environmental changes, portable, wireless, interactive IoT sensors for real-time agricultural monitoring, and IoT vehicle management systems with network selection for optimizing transportation routes and vehicle efficiency. Discuss the potential benefits, challenges, and implementation considerations of your proposed solution.
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