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Question Paper Code : 20966

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 3031 – INTELLIGENT CONTROL OF ELECTRIC VEHICLES

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are commutation transients?

2. What does the term "intelligent control" mean in the context of electric vehicles.

3. What is the significance of speed control in electric vehicles?

4. List different types of vector control techniques.

5. Define the term "fuzzy set" and "membership function" in fuzzy logic.

6. How the uncertainty is handled in fuzzy logic?

7. What does FPGA stand for? What is its primary purpose in digital electronics?

8. Expand VHDL and explain its role in FPGA design.

9. What is the primary function of an inverter in an electrical system?

10. How does a grid tied inverter differ from an "off-grid inverter in terms of its operation and application'?

PART B — (5 × 13 = 65 marks)

11. (a) Describe the mathematical model of a BLDC motor, including its fundamental equations and variables involved. Discuss the significance of each parameter in the model.

Or

(b) Discuss the advantages and disadvantages of using BLDC motors in electric vehicles. How do the motors characteristics impact its performance in an electric vehicle application?

12. (a) Explain the design and functioning of an anti-wind up controller in the context of wind turbine systems. Discuss the key components, control strategies, and technologies used to mitigate the adverse effects of wind gusts and turbulence on wind turbines.

Or

(b) Discuss the fundamental principles and techniques used to achieve precise control of the motor speed and torque characteristics.

13. (a) Explain the process of fuzzy inference and the role of rule-based systems in fuzzy logic.

Or

(b) Provide a detailed explanation of fuzzy logic and its core principles, including the concept of membership functions and linguistic variables. How does fuzzy logic handle imprecision and uncertainty in decision-making?

14. (a) Explain the architecture of an FPGA in detail. Discuss the key components, including configurable logic blocks (CLBs), and memory resources.

Or

(b) Explain the design and implementation of a speed detection system on an FPGA using VHDL.

15. (a) Discuss the principles behind Hall effect sensors and how they detect the rotor's magnetic field.

Or

(b) Analyze the advantages and limitations of both open-loop and fuzzy logic control in terms of precision, efficiency, and adaptability to varying conditions.

PART C — (1 × 15 = 15 marks)

16. (a) Evaluate the implications of the mathematical model and characteristics analysis on the overall performance and reliability of BLDC Motor.

Or

(b) Discuss the challenges and requirements of electric vehicle charger including the impact of varying loads and environmental conditions.

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