Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U3407

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

Professional Elective

Electrical and Electronics Engineering

21EEV407- INTELLIGENT CONTROL OF ELECTRIC VEHICLES

(Regulations 2021)

Duration: Three hours | Maximum: 100 Marks

Answer All Questions

PART – A (5 x 20= 100 Marks)

1.	(a)	Explain the working principle of a BLDC motor. Derive the mathematical model, including differential equations, transfer functions, and state-space equations, for a BLDC motor. Discuss the impact of motor parameters on the performance.	CO1-U	(20)
		Or		
	(b)	Explain the concept of commutation in BLDC motors and the transients that occur during this process. Discuss how these transients can be minimized or controlled using modern control techniques such as sensor less control and feedback loops	CO1-U	(20)
2.	(a)	Given the following PID control parameters, analyze how each parameter affects the performance of a BLDC motor: Kp = 10, Ki = 0.5, Kd = 2. What improvements could be made for better performance?	CO3-Ana	(20)
		Or		
	(b)	Break down the working principles of Vector Control for BLDC motors and analyze its advantages over scalar control. Illustrate the role of Field-Oriented Control (FOC) in improving the motor's efficiency and dynamic performance with relevant diagrams and equations	CO3-Ana	(20)

3.	(a)	Demonstrate defuzzification using the Centroid and Mean of Maxima methods, calculate the defuzzified outputs, and analyze which method better represents fuzzy data in control applications. Illustrate their advantages and disadvantages with examples.	CO2-App	(20)
		Or		
	(b)	In a fuzzy decision-making system, how would you aggregate fuzzy rules to determine the final output for controlling the temperature in a room?	CO2-App	(20)
4.	(a)	Write a simple example of an interrupt routine in an RTOS that toggles an LED every 1 second. Explain in details**.**	CO3-Ana	(20)
		Or		
	(b)	Describe how semaphores can be used to prevent race conditions in an embedded system with shared resources.	CO3-Ana	(20)
5.	(a)	Implement a small embedded application that collects environmental data (e.g., temperature, humidity) and sends it to a server for processing.	CO2-App	(20)
		Or		
	(b)	Create a simple flowchart that outlines the steps an autonomous car would take to detect and avoid an obstacle using embedded systems.	CO2-App	(20)