CBCS SCHEME

SRI SAIRAM COLLEGE OF ENGINEERING

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BEE714B

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
AI Techniques for Electric and Hybrid Electric Vehicles

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	What are the functional blocks and components of battery management system? Explain in detail.	10	L2	CO1
	b.	Using the connection diagram and relevant expressions for voltage and current, analyze the configuration of a battery pack and justify the arrangement used for efficient operation.	10	L4	CO1
		OR			
Q.2	a.	With the aid of block diagram, explain in detail the IoT based battery monitoring systems and list their advantages and disadvantages.	10	L3	CO1
	b.	Explain the different types of batteries used in hybrid and electric vehicles and describe the important parameters to be considered while selecting a suitable battery pack for HEV.	10	L2	CO1
		Module – 2			
Q.3	a.	With the aid of central control block diagram of BLDC motor drive, explain historical background of EV and advantages of EV.	10	L3	CO2
	b.	Draw VSI feb BLDC motor circuit and write mathematical representation of BLDC motor.	10	L4	CO2
		OR			
Q.4	a.	With the aid of block diagram and flow chart explain BLDC motor speed controller with ANN based PID controller.	10	L3	CO2
	b.	With the aid of block representation, explain the auto-tuning type fuzzy PID control system.	10	L3	CO2
		Module – 3			
Q.5	a.	With the aid of block diagram of Active Magnetic Bearing (AMB) and proposed closed loop AMB model, explain basic components of an AMB.	10	L2	CO3
	b.	List the advantages and disadvantages of electric vehicles over conventional vehicles. What are the design requirements of electric vehicles?	10	L2	CO3

		OR			
Q.6	**a.**	Discuss in detail the control strategies of active magnetic bearing using fuzzy logic controller for electric vehicles.	**10**	**L3**	**CO3**
	b.	With the aid of flow chart and block diagram explain in detail working and implementation of Particle Swarm Optimization (PSO) algorithm.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Analyze and obtain the switching model circuit and mathematical model for voltage source inverter fed surface mounted permanent magnet synchronous motor.	**12**	**L4**	**CO4**
	b.	Discuss in detail dynamic model of permanent magnet synchronous motor.	**8**	**L3**	**CO4**
		OR			
Q.8	**a.**	Discuss the mathematical analysis and derivation of the small signal model.	**8**	**L3**	**CO4**
	b.	With the aid of mathematical expressions analyze in detail small signal model transfer functions.	**12**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	Explain in detail the architecture of plug-in hybrid electric vehicle.	**10**	**L2**	**CO5**
	b.	Discuss "problem description", "objective" and "problem formulation" in hybrid energy storage system.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	With the aid of block diagram, explain in detail the modeling of hybrid energy storage system.	**10**	**L2**	**CO5**
	b.	Analyze the battery characteristics and ultra-capacitor characteristics in gradually accelerated and gradually decelerated vehicle.	**10**	**L4**	**CO5**

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