Reg. No.

B.E / B.TECH. DEGREE EXAMINATION, MAY 2023
Seventh Semester
EE18703 – ELECTRIC VEHICLES
(Regulation 2018)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1 Acquire knowledge on the architecture of Electric Vehicles.
CO 2 Analyze different propulsion technology used for electric vehicle application.
CO 3 Analyze different energy storage technology used for electric vehicle application.
CO 4 Design the subsystems of an electric vehicle.
CO 5 Acquire knowledge on energy management strategies and charging technologies in EVs.

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

		CO	RBT LEVEL
1.	Compare Electric Vehicle and ICE Vehicle based on configuration and range.	1	4
2.	Plot the EV force-speed characteristics with fixed gearing.	1	2
3.	Identify the methodologies used for ripple reduction in I_a of a two-quadrant chopper fed separately excited DC motor drive in an EV.	2	3
4.	List any four reasons for BLDC motor drive used as most promising candidate in EV and HEV applications.	2	3
5.	Determine the discharge current of a 100Ah battery for C/5-rate.	3	3
6.	Supercapacitors are not used as a major source of energy in EV and HEV applications. Justify.	3	4
7.	Identify the significant features of FlexRay communication protocol to use in EV application.	4	3
8.	What factors influence the selection of an energy storage system in EVs?	4	3
9.	List the EV- BMS SoC estimation techniques.	5	2
10.	Differentiate on-board and off-board chargers.	5	4

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	Discuss the modes of operation, merits and limitations of a series hybrid and parallel hybrid electric drive train.	(14)	1	2
	(OR)			
(b)	Explain in detail the categorization of electric vehicles based on their propulsion systems and energy sources.	(14)	1	2
12. (a)	Identify a suitable converter to control a DC motor operated in both motoring and braking mode in EV application. Explain its control in detail.	(14)	2	4
	(OR)			

(b) **(i)** Compare the requirements of EV motors with industrial motors in all aspects.   (6)   2   4

     (ii) Depict the torque-speed characteristics of SRM and explain its operating regions.   (8)   2   4

13. (a) An electric vehicle has the following parameter values: m=800 kg, C_D=0.2, A_F=2.2 m^2, C_0=0.008, C_1=1.6*10^{-6} s^2/m^2. Also, take density of air ρ=1.18 kg/m^3, and acceleration due to gravity g=9.81 m/s^2. The vehicle is on level road. It accelerates from 0 to 70 mph in 8 s, such that its velocity profile is given by   (14)   3   4

$$v(t) = 0.280123t^2 \;\; for \;\; 0 \le t \le 8 \; s.$$

Determine

       (a) Tractive Force $F_{TR}(t)$ for $0 \le t \le 8$ s.

       (b) Instantaneous Power $P_{TR}(t)$ for $0 \le t \le 8$ s.

(OR)

(b) Compare and contrast lead acid batteries and lithium-ion batteries. Explain the working principle of anyone in detail.   (14)   3   4

14. (a) Tabulate and explain the epicyclic gear input–output relationships in the context of matching the electric drive and ICE.   (14)   4   3

(OR)

(b) Enumerate the subsystems connected to control units in EVs and explain its functioning in EV.   (14)   4   3

15. (a) Compare the various charging algorithms employed in battery storage system. Suggest a suitable algorithm specific to Li-ion battery and explain it briefly.   (14)   5   4

(OR)

(b) Analyze how the switched capacitor balancing helps in battery cell voltage equalization.   (14)   5   4

PART- C (1 x 10 = 10 Marks)
(Q.No.16 is compulsory)

	Marks	CO	RBT LEVEL
16. "India aims to achieve 30 percent electrification of the country's vehicle fleet by 2030". Justify the reasons for the global automobile market moving towards EV and provide suitable solutions for the issues and limitations in EVs.	(10)	1	4

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