U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July 2024 Semester End Main Examinations

Programme: B.E.
Branch: Mechanical Engineering
Course Code: 22ME5PEEHV / 21ME5DEEV1
Course: Electric and Hybrid Vehicles /
                Electric and Hybrid Vehicles - 1

Semester: V
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
                2. Missing data, if any, may be suitably assumed.

			UNIT - I	*CO*	*PO*	**Marks**
1	a)		Explain the advantages and limitations for battery electric vehicles.	*CO1*	*PO2*	**06**
	b)		Explain the working of ultra-capacitors for BEV's.	*CO1*	*PO2*	**06**
	c)		A Petrol engine consumes 15 kms/litre and equivalent EV consumes 150Wh/km with battery cells as 250Wh/kg and 500 Wh/litre. Petrol energy is 45 MJ/kg and its density as 0.75 kg/litre. Compute i) ratio of energy efficiency of EV Vs ICE ii) Ratio of battery weight and petrol weight per km of travel. iii) Ratio of battery volume and petrol volume per km of travel	*CO1*	*PO2*	**08**
			OR			
2	a)		Explain the working of Plug-in Hybrid Electric Vehicle (PHEV).	*CO1*	*PO2*	**08**
	b)		Describe the concept of well to wheel efficiency for IC Engines and pure EV's.	*CO1*	*PO2*	**06**
	c)		For 100 kms range, compute the size and reduction in the cost for using battery with 25 Wh/km to 15 Wh/km. Efficiency of the battery is 85% of its rated capacity.	*CO1*	*PO2*	**06**
			UNIT - II			
3	a)		A vehicle needs to reach maximum speed v_f in T seconds. Derive expressions for average power and peak power i) if it accelerates linearly. ii)if it accelerates at a rate "a_1" for first T/2 time and at a rate "$a_1/2$" from T/2 to T. Hence prove that peak power reduces to 2/3 rd of the peak power required for linear acceleration.	*CO2*	*PO1*	**08**
	b)		During Coast- Down Test for a car over the one-hour cycle on a flat road, the vehicle is cruising at 50 km/h for a time period t_1=1800s, cruising at 90 km/h for t_2 = 1200 s, and in idle mode	*CO2*	*PO1*	**06**

The table inside question 2 c):

Battery (kWh)	1	2	3	4
Cost (INR)	18,000/-	33,000/-	45,000/-	54,000/-

		for $t_3 = 600$ s. The magnitude of the coefficient A, B, and C for Coast down teat are 133.3, 0.7094 and 0.491 respectively. Determine the tractive power, total energy and distance covered by the car.			
	c)	Enlist the different resistance need to overcome for net tractive force for any vehicle and explain aerodynamic drag in detail.	CO2	PO1	**06**
		UNIT - III			
4	a)	Explain the advantages and disadvantages of using Li-Ion batteries.	CO3	PO2	**08**
	b)	Describe the six parameters incorporating six chemistries of Li-Ion batteries.	CO3	PO2	**06**
	c)	Explain the construction details of cylindrical, prismatic and pouch cells.	CO3	PO2	**06**
		OR			
5	a)	What are the essential *'Eight Ask'* for a good battery? Explain each.	CO3	PO2	**08**
	b)	A Manufacturer needed Li-ion battery with highest safety rating with increased life span. Please suggest the possible anode cathode combination. Explain any four reason why sodium-ion batteries can become a suitable alternative to lithium-ion batteries.	CO3	PO2	**06**
	c)	What is State of charge (SOC) for a battery? Enlist the methods for its measurement. Explain Coloumb counting in detail.	CO3	PO2	**06**
		UNIT - IV			
6	a)	Explain the working of Battery Management System in detail.	CO3	PO3	**06**
	b)	Explain Building mSnP battery pack and nPmS battery pack with example.	CO3	PO3	**06**
	c)	What is cell balancing? Explain its types in detail.	CO3	PO3	**08**
		UNIT - V			
7	a)	Explain the on-board and off board charges for EV's.	CO4	PO3	**06**
	b)	What is Standardization in battery charging? Why it is needed? Enlist the parameters needed for the same.	CO4	PO3	**06**
	c)	What is battery swapping? Explain its types. Describe its advantages and disadvantages.	CO4	PO3	**08**

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