QP Code: SN22BTECH598 | Reg. No | | | | | | | | | | | AR 21

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur (GIET University)

B. Tech (Seventh Semester - Regular) Examinations, November – 2025

22BEEPE47021-Hybrid Electric Vehicles

(EEE)

Time: 3 hrs Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	What are the resistive forces that retard the motion of 4-wheel vehicle?	CO1	K2
b.	List the factors which determine the performance of a vehicle.	CO1	K1
c.	List various types of hybrid drive train topologies	CO2	K1
d.	Explain coulometric capacity.	CO4	K2
e.	What are the major functions of the control system used in EVs & HEVs.	CO6	K2

PART – B **(15 x 4 = 60 Marks)**

Answer ***all*** the questions		Marks	CO #	Blooms Level
2. a.	State the historical background of EV/HEVs technology in brief.	8	CO1	K1
b.	Explain the term rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals.	7	CO1	K3
	(OR)			
c.	An EV has the following parameter values: ρ=1.16 kg/m^3, m=692 kg, C_D = 0.2, A_F = 2 m^2, g = 9.81 m/s^2, C_0 = 0.009, and C_1 = 1.75*10^{-6} s^2/m^2. The EV undergoes constant F_{TR} acceleration on a level road starting from rest at t=0. The maximum continuous F_{TR} that the electric motor is capable of delivering to the wheels is 450 N. (a) Find $V_T(F_{TR})$, and plot it. (b) If F_{TR}=350N: (i) Find V_T. (ii) Plot $v(t)$ for t=0. (iii) Find t_{vT} (iv) Calculate the time required to accelerate from 0 to 60 mph. (v) Calculate $P_{TR,pk}$, , and e_{TR} corresponding to acceleration to 0.98 V_T.	8	CO1	K3
d.	Compare and differentiate between the battery electric vehicle (BEV), hybrid EV (HEV) and Plug-in HEV (PHEV) technologies.	7	CO1	K4
3.a.	Discuss the power flow control in parallel hybrid electric vehicle with the help of a block diagram.	8	CO2	K4
b.	Explain the basic concept of electric traction.	7	CO2	K2
	(OR)			
c.	With help of block diagram, explain power flow control in series-parallel hybrid electric vehicle.	8	CO2	K4
d.	Compare various electric drive-train topologies and analyze their performance.	7	CO2	K5

4.a.	Explain two quadrant operation of chopper DC motor drive with suitable waveforms for electric vehicles.	8	CO3	K3
b.	Explain in detail, the Nickel – Metal Hydride Battery.	7	CO4	K4
	(OR)			
c.	Analyze the performance of BLDC and induction motors for electric and hybrid electric vehicle application.	8	CO3	K2
d.	What is Fuel Cell? Explain different types of fuel cell.	7	CO4	K2
5.a.	Explain sizing the power electronics.	8	CO5	K3
b.	Classify different energy management strategies	7	CO6	K1
	(OR)			
c.	Explain constant power speed ratio with a neat diagram.	8	CO5	K3
d.	Classify and explain the basic principle of Rule based energy management system. Elaborate on any one of the Rule based energy management system.	7	CO6	K4

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