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

B. Tech (Sixth Semester - Regular) Examinations, April 2026

23BELPE36011/23BEEPE36011 – Hybrid Electric Vehicles

(EE & EEE)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	Define regenerative braking.	CO1	K1
b.	What are the advantages of Hybrid Electric Vehicle over the ICE vehicle?	CO2	K2
c.	Define State of Charge.	CO3	K1
d.	What are the factors need to be considered to measure the performance of EM.	CO4	K2
e.	List the main constituents of a PHEV.	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

		Marks	CO #	Blooms Level
	Answer ***ALL*** the questions			
2. a.	Explain the history and evolution of hybrid and electric vehicles and their technological advancements.	5	CO1	K1
b.	Explain the concept of an Internal Combustion Engine (ICE) and illustrate its characteristic curves with a neat diagram.	5	CO1	K1
	(OR)			
c.	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 65 mph in 10 s, such that its velocity profile is given by V(t) = 0.29055t2 for $0 \le t \le 10s$ (a) Calculate F_{TR} (t) for for $0 \le t \le 10s$ (b) Calculate P_{TR} (t) for for $0 \le t \le 10s$ (c) Calculate the energy loss due to non-conservative forces E_{loss}. (d) Calculate Δe_{TR}	10	CO1	K3
3.a.	Explain the basic concept of hybrid traction and its significance in hybrid electric vehicles.	5	CO2	K2
b.	Analyze the configuration and control of DC motor drives used in electric vehicles.	5	CO2	K4
	(OR)			
c.	With help of block diagram, explain power flow control in series hybrid electric drive train.	5	CO2	K2
d.	Analyze the general configuration of constant V/f control of induction motors with the help of neat figures.	5	CO2	K4
4.a.	Explain the energy storage requirements in hybrid and electric vehicles and their	5	CO3	K2

	impact on vehicle performance.			
b.	Analyze the key parameters influencing the selection of energy storage systems in electric and hybrid vehicles.	5	CO3	K4
	(OR)			
c.	Explain the concept of a fuel cell and classify the different types of fuel cells.	5	CO3	K2
d.	Compare and analyze battery-based and fuel cell-based energy storage systems in terms of efficiency, cost, and environmental impact.	5	CO3	K4
5.a.	Describe the architecture and working of Controller Area Network (CAN) in in-vehicle communication systems.	5	CO4	K2
b.	Apply suitable design principles to size the electric machine used in electric/hybrid vehicles.	5	CO4	K3
	(OR)			
c.	Describe the transmission selection and gear step selection in electric/hybrid vehicles.	5	CO4	K2
d.	Apply suitable design principles to size the power electronics for an electric drive system.	5	CO4	K3
6.a.	Explain the architecture, components, and working principle of Plug-in Hybrid Electric Vehicles (PHEVs) with a neat diagram.	5	CO5	K2
b.	Analyze different modes of operation in PHEVs and their impact on vehicle performance and efficiency.	5	CO5	K4
	(OR)			
c.	Explain the advantages, limitations, and future scope of Fuel Cell Vehicles in modern transportation systems.	5	CO5	K2
d.	Illustrate and examine the working of blended PHEVs under various driving conditions such as city and highway driving.	5	CO5	K4

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