Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2023

Program Name: B.TECH-Automotive Design Engineering **Semester : IV**
Course Name : Hybrid and Electric Vehicles **Time : 03 hrs.**
Course Code : MEAD2010 **Max. Marks: 100**
Nos. of page(s) : 02
Instructions: Attempt All Questions. One question from section B and C have an internal Choice. Assume any missing data if required.

SECTION A
(5Qx4M=20Marks)

S. No.	Statement of question	Marks	CO
Q1	What is BJT? Explain its classification with the advantages and disadvantages of each.	**4**	**CO1**
Q2	Explain the effect of aerodynamic drag on a vehicle.	**4**	**CO1**
Q3	Draw and explain a series-hybrid architecture of Hybrid and Electric Vehicle.	**4**	**CO1**
Q4	Define a mild hybrid vehicle with a suitable example.	**4**	**CO2**
Q5	Draw and explain B-H characteristics of magnetic materials.	**4**	**CO2**
	SECTION B **(4Qx10M= 40 Marks)**		
Q6	Deliberate the braking force, power, and energy of a 1500 kg passenger car in an FTP 75 urban drive cycle. Assume the relevant parameters for discussion.	**10**	**CO2**
Q7	Discuss other alternative novel energy resources for hybrid and electric vehicles.	**10**	**CO2**
Q8	Discuss various drivetrain control techniques with advantages and disadvantages.	**10**	**CO3**
Q9	Demonstrate the optimal energy recovery of series braking with a suitable braking forces diagram. **OR** Discuss how Regenerative braking can be used as an Electronically Controlled Regenerative braking system. Explain it with a suitable diagram.	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q10	The parameters of a vehicle are given below: Vehicle mass:1400 Kg Driver/one passenger: 70 kg Rolling resistant coefficient: 0.01	**20**	**CO3**

	Wheel radius: 0.3501 m Aerodynamics drag coefficient: 0.45 Frontal Area: 2.2 m^2 The vehicle accelerates from 0 velocities to 20 m/s in 7 s on a 0.55% roadway grade when it reaches the maximum power limit of the propulsion unit. The vehicle then accelerates in the constant power mode for another 7 s. The maximum power limit is 145kW. a. Write the dv/dt equation for constant power acceleration for the given conditions. b. What is the velocity after a total time of 10s? c. What is the velocity at 12s if the roadway grade changes to 4% at 10 s?		
Q11	Deduce a mathematical expression for the total mass of a series hybrid and electric vehicle (HEV) by considering that there are no electric acceleration capabilities. **OR** A new-age mid-size HEV has an average mass of 1418 Kg. The dimensions of the base are 70.5 inches wide and 55.3 inches tall. The ground clearance and side curvature factor value is 0.08. The frontal area of the HEV is 2.01 m^2, the coefficient of drag is 0.24, and the rolling coefficient is 0.0065. The HEV must accelerate from 0 to 60 mph in 11 sec. Calculate the mass of the motor, generator, battery and transmissions in a parallel architecture. **Note: Assume any missing data.**	**20**	**CO3**