


Name:			
Enrolment No:			
<b>UPES</b> <b>End Semester Examination, December 2023</b>			
<b>Course: Electric and Hybrid Vehicles</b> <b>Program: M.Tech-E-Mobility</b> <b>Course Code: MEEM-7001</b>		<b>Semester : 1<sup>st</sup></b> <b>Time : 03 hrs.</b> <b>Max. Marks: 100</b>	
<b>Instructions: Assume any missing data and mention it clearly.</b>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
S. No.		Marks	CO
Q 1	A Hybrid and Electric vehicle uses a 25 KW motor and 120 KW gasoline engine. Is it mild, mild hybrid or full hybrid? State the advantages and disadvantages of it by considering its hybridness.	4	CO1
Q 2	Differentiate series and parallel hybrids with the suitable line diagram of both.	4	CO1
Q 3	Discuss the effect of aerodynamics drag on the performance of hybrid vehicles.	4	CO1
Q 4	Discuss torque-speed characteristics of hybrid vehicles.	4	CO2
Q 5	How is the fuel economy of hybrid vehicles calculated? Explain with mathematical formulae.	4	CO2
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
Q 6	<p>A straight roadway has a profile in the x–y plane given by <math>f(x_f) = 7\sqrt{x_f}</math> for <math>0 \leq x_f \leq 2</math> miles = 10,560 feet</p> <p><math>f(x_f)</math> and <math>x_f</math> are in ft.</p> <p>a. Derive an expression for slope of roadways(<math>\beta(x_f)</math>). Calculate <math>\beta</math> (1 mile).</p> <p>b. Calculate the tangential road length, s from 0 to 2 miles.</p>	10	CO1
Q 7	Discuss the vehicle kinetics and roadways by considering all parameters (forces, grade-ability etc.).	10	CO2
Q 8	A hybrid electric vehicle has a downsized engine, an electric motor/generator and an ultracapacitor-bank for electric propulsion assistance. The vehicle is driven for 30 min at a constant velocity of 25 m/s with engine operating at BSFC = 270 g/kWh and electric motors. The traction power required for this constant velocity cruise is 15.2 kW. However, the ultracapacitor-bank has an additional 960 kJ of energy captured during a regenerative braking. Calculate the fuel economy when	10	CO3

	all the ultracapacitor energy is utilized for propulsion within the 30 min constant velocity cruising period.		
Q 9	Discuss the speed vs time and acceleration vs time curve of the Japanese (JP-015) drive cycle. <b>OR</b> Discuss the speed vs time and acceleration vs time curve of the Extra Urban drive cycle (EUDC).	<b>10</b>	<b>CO3</b>
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
Q 10	The parameters of a vehicle are given below: Vehicle mass:2000 Kg Driver/one passenger: 80 kg Rolling resistant coefficient: 0.01 Wheel radius: 0.3305 m Aerodynamics drag coefficient: 0.45 Frontal Area: 2.5 m <sup>2</sup> The vehicle accelerates from 0 velocities to 21 m/s in 5 s on a 0.5% roadway grade when it reaches the maximum power limit of the propulsion unit. The vehicle then accelerates in 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 10 s? c. What is the velocity at 12s, if the roadway grade changes to 4% at 10 s?	<b>20</b>	<b>CO2</b>
Q 11	Discuss the mechanism of automatic transmission in power split hybrid vehicles. <b>OR</b> The performance of Hybrid vehicles depends upon its architecture. Discuss all hybrid-based architecture in detail with labeled diagram.	<b>20</b>	<b>CO3</b>