Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: eVehicles & Energy Storage (EPEC7023) **Semester: I**

Programme: M.Tech Energy System & M.Tech Renewable Energy Engg.

Time: 03 hrs. **Max. Marks: 100**

Instructions: Clearly mention any assumptions with proper justification

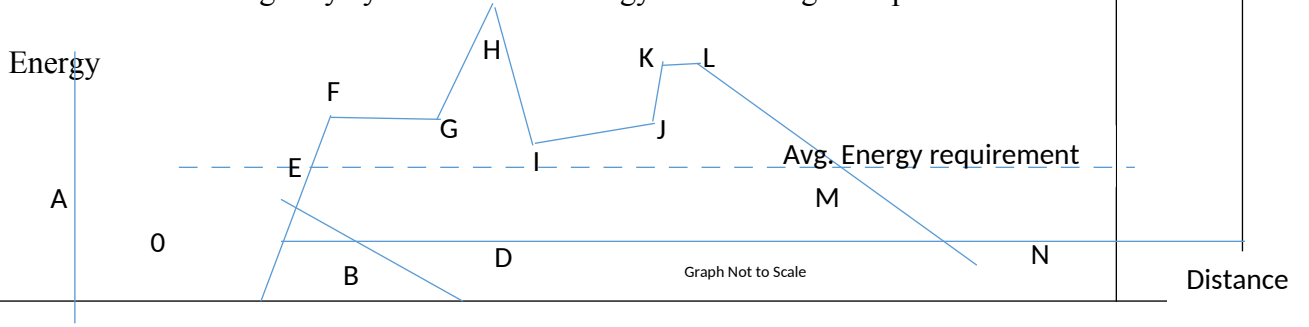
SECTION A

S. No.		Marks	CO
Q 1	Explain the socio economic impact of eVehicles.	4 M	CO1
Q.2	List and explain the suitability of various electric motors for eVehicles	4 M	CO2
Q.3	Explain fuel cells and with their characteristics	4 M	CO3
Q.4	A) Explain the importance and impact of regenerative braking on evehicle performance. B) Explain Breaking Energy vs speed characteristics for a typical vehicle.	4 M	CO4
Q.5	Explain the Battery Management system for eVs	4 M	CO4

SECTION B

Q.6	With neat diagram explain the architecture of Hybrid eV using Series Hybrid combination.	8 M	CO1
Q.7	Explain the Rolling Resistance & Gravitational Resistance and also explain their impact on the selection of 'Power Drive' for vehicles.	8 M	CO1
Q.8	Explain the Four quadrant operation of DC drive and also explain its necessity and importance for eVehicles.	8 M	CO2
Q.9	Explain the various parameters consideration while selecting Battery Bank for eVehicles. How aspiration V/S reality can be balanced in modern days.	8 M	CO3
Q.10	Develop a Generic Block Diagram, using Fuzzy Logic Controller for eVs.	8 M	CO4

SECTION-C

Q 11	A) Develope a hybrid Battery-Ultra Capacitor Energy management system for the following duty cycle. Show the Energy Flow during each part 	10 M	CO3

	C B) An electric vehicle is deigned such that, when its batteries are fully charged, gives a mileage of 100 kMs at a constant speed of 50 kM/hr. Energy Requirement for various resistances & for Drag is as follows: Rolling resistance: 3.2%, Aerodynamic: 4.8%, Gravitational & Acceleration (mass) : 4.9%, Passenger comfort System: 10%, Vehicle Lighting System: 6%, Transmission Losses: 12%, Rest is for Drag. The vehicle driver is driving vehicle @ 50 kM/hr, while type pressure is below standard and front windows are open. Due to open windows the Aerodynamic Drag Coefficient increased from 0.53 to 0.61 and due to less tyre pressure, the coefficient of rolling resistance increased to 0.008 from 0.005. If the rest parameters remain same, calculate the change in vehicle mileage.	**10 M**	**CO1**
Q.12	Design & Estimate the power of drive train required for a eVehicle on level surface with following specifications: Mass of Vehicle: 700 kg. (Without battery Bank and inc. of driver) Aerodynamic Drag Coefficient: 0.38 Coefficient of Rolling resistance: 0.0065 Air Density: 1.25 kg/m^3 The frontal Area of Vehicle: 1.6 m^2 Maximum speed 80 km/hr. Consider rise in mass of vehicle by 5% due to angular acceleration to rotating motor. The vehicle should accelerate from 0 to 50 kM/hr in 9.7 seconds. Assume motor is connected to rear wheels through gearbox of ratio 11. The diameter of tyre (wheel) is 18 inches. From the designed data, calculate the size of battery bank required for a mileage of 100 km per charge. During normal city driving consider an average acceleration of 0.2 m/s^2 and an average speed of 50 km/hr. For the battery bank design, consider proposed motor voltage rating as 72 V. If the battery specific Power to weight ratio is 100 wh/kg, estimate the weight of battery and also estimate the reduction in mileage due to increased weight of battery.	**20 M**	**CO2** **CO3**

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SECTION A

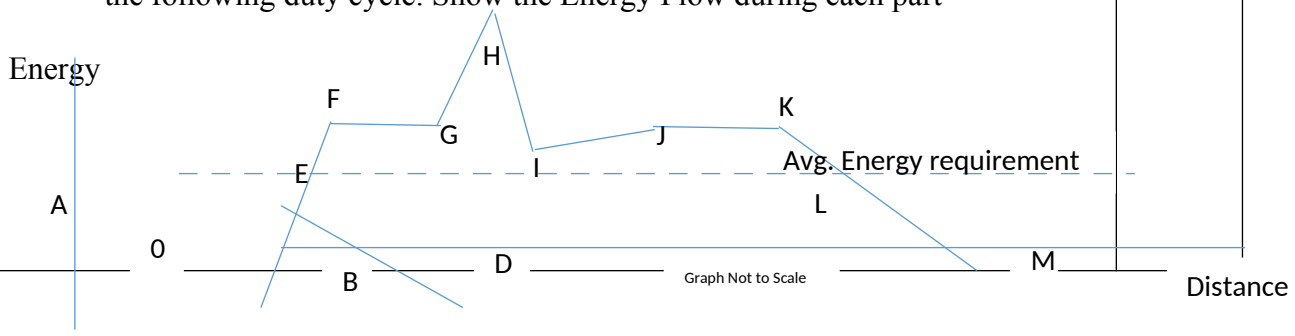
S. No.		Marks	CO
Q 1	Explain the impact of eVehicle on future transportation system.	4 M	CO1
Q.2	List and explain the characteristics of various DC motors.	4 M	CO2
Q.3	Explain the design consideration for selection of batteries for eVs	4 M	CO3
Q.4	Explain the steering mechanism and role of differential in Vehicles	4 M	CO4
Q.5	Explain the Series-parallel hybrid system	4 M	CO4

SECTION B

Q.6	With neat diagram, explain the architecture of Hybrid eV using Parallel Hybrid combination.	8 M	CO1
Q.7	Explain the Aerodynamic Resistance & Acceleration thrust and explain their impact on the selection of 'Power Drive' for vehicles.	8 M	CO1
Q.8	Explain the *v/f* control of Induction motor and explain the characteristics of IM adapted *v/f* control.	8 M	CO2
Q.9	A) Explain the importance and role of Battery Discharge characteristics while choosing the batteries for eVs. B) Explain the term specific power & specific energy related to energy storage. Also, explain how they affect the performance of eVs.	8 M	CO3
Q.10	Develop a Generic Block Diagram, using Fuzzy Logic Controller for eVs.	8 M	CO4

SECTION-C

Q 11	A) Develope a hybrid Battery-Ultra Capacitor Energy management system for the following duty cycle. Show the Energy Flow during each part	10 M	CO3



	C B) An electric vehicle is deigned such that, when its batteries are fully charged, gives a mileage of 100 kMs at a constant speed of 50 kM/hr. Energy Requirement for various resistances & for Drag is as follows: Rolling resistance: 3.2%, Aerodynamic: 4.8%, Gravitational & Acceleration (mass): 4.9%, Passenger comfort System: 10%, Vehicle Lighting System: 6%, Transmission Losses: 12%, Rest is for Drag. The vehicle driver is driving vehicle @ 50 kM/hr, while type pressure is below standard and front windows are open. Due to open windows the Aerodynamic Drag Coefficient increased from 0.53 to 0.61 and due to less tyre pressure, the coefficient of rolling resistance increased to 0.008 from 0.005. If the rest parameters remain same, calculate the additional battery AH required to maintain the mileage of 100 km.	**10 M**	**CO1**
Q.12	Design & Estimate the power of drive train required for a eVehicle on inclined 5^0 surface with following specifications: Mass of Vehicle: 750 kg. (Without battery Bank and inc. of driver) Aerodynamic Drag Coefficient: 0.30 Coefficient of Rolling resistance: 0.006 Air Density: 1.3 kg/m^3 The frontal Area of Vehicle: 1.75 m^2 Maximum speed 85 km/hr. Neglect rise in mass of vehicle due to angular acceleration to rotating motor. The vehicle should accelerate from 0 to 50 kM/hr in 9.1 seconds. Assume motor is connected to rear wheels through gearbox of ratio 11.8. The diameter of tyre (wheel) is 20 inches. From the designed data, calculate the size of battery bank required for a mileage of 100 km per charge. During normal city driving consider an average acceleration of 0.21 m/s^2 and an average speed of 45 km/hr. For the battery bank design, consider proposed motor voltage rating as 60 V. If the battery specific Power to weight ratio is 95 wh/kg, estimate the weight of battery. The design engineer has proposed to revise the vehicle body shape and thus Aerodynamic drag coefficient to compensate the reduction in mileage. Estimate the new Aerodynamic drag coefficient.	**20 M**	**CO2** **CO3**