UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Sem Examination, Jan 2021

Course: e-Vehicle & Energy Storage   Semester: I
Programme: M.Tech (REE) & M.Tech (ES)   Max Marks:100
Course Code: EPEC 7023   Duration : 3 Hrs.

S. No.		Marks	CO
	Section A Short Answer Question. Each Question carries 5 marks		
Q.1	Fill in the Blanks: a) As per Well to Wheel efficiency chart, eVehicles create indirect pollution at _____(Generation/utility) level. b) High mileage eVs are very costly due to high cost of _____ c) Conventional vehicles are better compared to eV in terms of _____	2+2+1	CO1
Q.2	In an eV, the rolling resistance (drag) is 14 N at a speed of 60kmph. If speed is increased to 70 kmph, what is new value of Rolling resistance (drag)?	5	CO2
Q.3	With respect to PE control of Electric motors mention 'True' or 'False' A) DC motor speed control is achieved by Armature & field voltage control. B) In Fourth quadrant, DC motor works in forward motoring mode. C) THD level of PWM inverter is limited by minimum switching frequency. D) The 3-phase induction motor speed can be controlled by varying the supply frequency. E) In dual converters, converts DC to Ac and again AC to DC	1*5	CO3
Q.4	Match the pair for vehicles: A) Gear Box P) Operation in 3rd Quadrant (A) = (?) B) IC Engine Q) High Friction plate (B) = (?) C) Clutch R) For curvature roads (C) = (?) D) Differential gear S) Speed Control (D) = (?) E) Reverse gear T) Electric Motor (E) = (?)	1*5	CO2
Q.5	Complete sentence using correct word (P=Series, Q=Parallel, R=Series – Parallel, S=Complex, T=Performance) A) In _____ hybrid system power can flow from IC Engine to Motor & vice versa B) In--------------- hydrid system only one power system will transfer power to wheels. C) The _____of eVs can be improved by hybridization. D) In_____ hybridization, both power system should have high power rating. E) IC engines will supply power to wheels as well as motors in _____hybrid system. (A=?, B=?, C=?, D=?,E=?)	1*5	CO3

Q.6	Choose correct word:
	   A) The acceleration of vehicles is affected by (motor/battery) size.
	   B) The mileage of eVs will be affected by (type of road/Motor voltage)
	   C) Series hybridization is used in (PHEV/BEV)
	   D) As per Battery management system, supply of Energy to (power brake / Power windows) is priority.
	   E) IC engine based vehicles use (clutch / gear Box) to match the characteristics.
		1*5	**CO4**

	Section B		
	Each Question carries 10 marks		
Q.1	Explain the need and essence of eVs in modern transportation system.	**10**	**CO1**
Q.2	With neat diagram, enumerate the Torque-Speed characteristics of vehicles. Explain the effect of rolling resistance and aerodynamic drag.	**10**	**CO2**
Q.3	Explain the architecture of Hybrid eV using Parallel Hybrid combination. With neat diagram, elucidate power flow.	**10**	**CO3**
Q.4	Describe the operation of PWM inverter and elaborate its necessity and importance for speed control of Induction motors for eVehicles.	**10**	**CO3**
Q.5	Write in brief about following associated with batteries and their importance: 1) State of Charge 2) Energy Density 3) Power Density 4) BMS	**10**	**CO1**
	Section 'C'		
	Long Answer Question (20 Marks)		
Q 1	An electric vehicle is deigned such that, when its batteries are fully charged, gives a mileage of 180 kMs at an average speed of 70 kM/hr. Energy Requirement for various resistances, drags and propulsion is as follows: (averaged at average speed of 70kMPh and over 180 kMs distance) Rolling resistance: 5 %, Aerodynamic: 11%, Averaged Gravitational pull: 5.1%, Passenger comfort System: 9 %, Vehicle Lighting System: 5%, Transmission Losses: 21%, Rest is for Propulsion(including starting). Estimate the performance of vehicles in terms of Energy available for propulsion and effect on mileage when vehicle is running at following Average speeds: A= 50 kmph, B= 60 kmph, C= 80 kmph, D=100 kmph Please note: Estimate performance (energy available for propulsion and mileage) for each case. Preferable you can draw a graph of Energy available & Mileage Vs Speed (within 50 kmph to 100 kmph). Hand drawn graph is okay. Assume all other parameters are independent of speed and hence remain unchanged with speed variation.	**20 M**	**CO4**