QPC: RN20BTECH677 AR 20 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Seventh Semester – Regular) Examinations, November – 2023

BPEEE7021 - Hybrid Electric Vehicles

(EEE)

Time: 3 hrs Maximum: 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 = 10 Marks)**

Q.1. Answer ***ALL*** questions			[CO#]	[PO#]
a.	Select the features of Hybrid Electric Vehicles		CO1	PO2
	(i) Idle Stop	(ii) EV Drive		
	(iii) Motor Assist	(iv) Regenerative Braking		
b.	The benefits of a hybrid car include :		CO1	PO2
	(i) reducing emissions	(ii) improving gas mileage		
	(iii) high fuel consumption	(iv) high speed driving		
c.	The most commonly used power plant in automobiles is		CO2	PO1
	(i) Gas turbine	(ii) I.C. engine		
	(iii) Battery	(iv) None of these		
d.	A machine member used to connect engine shaft to gear box is called		CO2	PO2
	(i) differential	(ii) clutch		
	(iii) flywheel	(iv) propeller shaft		
e.	Choppers converts		CO3	PO1
	(i) AC to DC	(ii) DC to AC		
	(iii) DC to DC	(iv) AC to AC		
f.	An electronic controller of HEV consists of		CO3	PO2
	(i) sensor	(ii) motor		
	(iii) gear box	(iv) power converter		
g.	Which is a type of ECU		CO4	PO1
	(i) Hybrid ECU	(ii) Transmission ECU		
	(iii) EM ECU	(iv) All of the above		
h.	Which is not the part of a Planetary gear set		CO4	PO2
	(i) Ring gear	(ii) triangular gear		
	(iii) Sun gear	(iv) Planetary gear		
i.	The Hybrid Electric Vehicle consists of :		CO1	PO1
	(i) Internal Combustion Engine + Electric Motor	(ii) Motor Electric 1 + Motor electric 2		
	(iii) NGV engine + Gasoline engine	(iv) None of these		
j.	Which is not a component of an electric vehicle		CO2	PO1
	(i) Battery	(ii) Motor		
	(iii) Power converter	(iv) None of the above		

PART – B: (Short Answer Questions) **(2 x 10 = 20 Marks)**

Q.2. Answer ***ALL*** questions	[CO#]	[PO#]
a. Outline the components of an automotive drive train.	CO1	PO2
b. List various kinds of transmissions used in vehicles.	CO1	PO3
c. Draw the block diagram of a hybrid drive train and show the different power flow routes.	CO2	PO2
d. Mention advantages and disadvantages of parallel hybrid electric drive train.	CO2	PO1
e. Why Choppers are used in EVs & HEVs?	CO3	PO2
f. Explain Specific energy and Specific power.	CO3	PO2
g. List different types of batteries used in EVs & HEVs	CO4	PO1
h. Mention different types of ECUs.	CO4	PO2
i. State Maximum Cruising speed & Gradeability.	CO1	PO2
j. List the major subsystems of EV.	CO2	PO2

PART – C: (Long Answer Questions) **(10 x 4 = 40 Marks)**

Answer ***ALL*** questions	Marks	[CO#]	[PO#]
3. a. Explain the term rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals.	5	CO1	PO2
b. Enumerate the resistive forces that retard the motion of a four-wheel vehicle, illustrated with a diagram.	5	CO1	PO2
(OR)			
c. Describe the general configuration of electric vehicle with block diagram.	5	CO1	PO2
d. State and explain the dynamic equation of vehicle motion.	5	CO1	PO2
4. a. What are the different classifications of series parallel hybrid train? Discuss the power flow control in EM dominated series parallel hybrid train.	5	CO2	PO2
b. Enlist different modes of operation in parallel hybrid electric vehicle technology and explain power flow control in it.	5	CO2	PO3
(OR)			
c. Enlist the different architectures of hybrid electric drive train and explain the series hybrid electric drive train.	5	CO2	PO3
d. What are the different configuration of modern electric drive train.	5	CO2	PO2
5. a. Explain two quadrant operation of chopper DC motor drive with suitable waveforms for electric vehicles.	5	CO3	PO3
b. Dissect the configuration and control of Switched reluctance motor.	5	CO3	PO2
(OR)			
c. Explain with neat cell structure the reactions during charging and discharging of the nickel cadmium battery.	5	CO3	PO2
d. Analyze the performance of BLDC and induction motors for electric and hybrid electric vehicle application.	5	CO3	PO3
6. a. Explain the Sizing the electric machine.	5	CO4	PO2
b. Explain constant power speed ratio with a neat diagram.	5	CO4	PO2
(OR)			
c. Draw and explain the typical CAN system of a hybrid electric vehicle.	5	CO4	PO2
d. Write short notes on Electronic control unit (ECU).	5	CO4	PO2

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