GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, November – 2021

(Seventh Semester)

BELOE7051 / BEEOE7051 – Hybrid Electric Vehicles

(EE / EEE)

Time: 3 hrs   Maximum: 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)   **(2 x 10 = 20 Marks)**

Q.1. Answer ALL questions   [CO#]   [PO#]

a. 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

b. The purpose of transmission in an automobile is   CO1   PO2

     i. To vary the speed of automobile   ii. To vary the torque at the wheels

     iii. To vary the power of automobile   iv. None of these

c. Which is not the part of torque converter?   CO1   PO1

     i. Impeller   ii. Turbine

     iii. Reactor   iv. Gear

d. A series hybrid drive train is a drive train where   CO2   PO2

     i. two power sources feed a single power plant   ii. one power sources feed a single power plant

     iii. One power sources feed the power plant and other source receive power   iv. two power sources receive power from a single power plant

e. Power flow control strategies aim satisfy the _____ goals   CO2   PO2

     i. maximum fuel efficiency   ii. maximum emissions

     iii. maximum system costs   iv. bad driving performance

f. Electric propulsion systems of EVs consist of   CO3   PO1

     i. Electric motors   ii. Power converters

     iii. Electronic controllers   iv. All of the above

g. How many cells are used in a 12 volt car battery   CO3   PO2

     i. 2   ii. 6

     iii. 4   iv. 8

h. Which of these is an ICU   CO4   PO1

     i. ICE ECU   ii. EM ECU

     iii. Transmission ECU   iv. None of these

i. Energy management is a key component of   CO4   PO2

     i. Environmental management   ii. Carbon management

     iii. Nitrogen management   iv. Water management

j. Building a stepped ratio automatic transmission without one-way clutches is described by   CO4   PO1

     i. Simpson type   ii. Wilson type

     iii. Lepelletier type   iv. None of these

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

Q.2. Answer *ALL* questions   [CO#]   [PO#]

a.	On which factors the acceleration of vehicle depends?	CO1	PO1
b.	Explain the function of clutch & torque converter.	CO1	PO2
c.	Draw the block diagram of a hybrid drive train and show the different power flow routes.	CO2	PO3
d.	Mention advantages and disadvantages of parallel hybrid electric drive train.	CO2	PO2
e.	What are the advantages of Electric Vehicle over the ICE vehicle?	CO2	PO1
f.	Why Choppers are used in EVs & HEVs?	CO3	PO2
g.	Explain Specific energy and Specific power.	CO3	PO1
h.	List different types of batteries used in EVs & HEVs	CO3	PO2
i.	Classify EMS.	CO4	PO1
j.	Draw the schematic of epicyclic gear set.	CO4	PO3

PART – C: (Long Answer Questions)   (15 x 4 = 60 Marks)

Answer *ALL* questions   Marks   [CO#]   [PO#]

		Marks	[CO#]	[PO#]
3. a.	Explain Social and environmental impact of hybrid electric vehicle.	7	CO1	PO2
b.	Explain the term rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals.	8	CO1	PO2

(OR)

		Marks	[CO#]	[PO#]
c.	Write down the advantages and disadvantages of Petrol & Diesel engine.	5	CO1	PO2
d.	An EV has the following parameter values: $\rho=1.16$ kg/m^3, $m=692$ kg, $CD=0.2$, $AF=2$ m^2, $g=9.81$ m/s^2, $C_0=0.009$, and $C1=1.75*10^{-6}$ s^2/m^2. The EV undergoes constant FTR acceleration on a level road starting from rest at $t=0$. The maximum continuous F_{TR} that the electric motor is capable of delivering to the wheels is 450 N. (a) Find $V_T(F_{TR})$, and plot it, (b) If $F_{TR}=350$N: (i) Find V_T, (ii) Plot $v(t)$ for $t=0$. (iii) Find tvT, (iv) Calculate the time required to accelerate from 0 to 60 mph. (v) Calculate $P_{TR,pk}$, , and e_{TR} corresponding to acceleration to 0.98 V_T.	10	CO1	PO2
4. a.	With a neat diagram, describe the power flow control in a parallel hybrid electric drive train topology.	8	CO2	PO3
b.	What are the factors need to be considered in modelling a battery that can be used in hybrid electric vehicle?	7	CO2	PO4

(OR)

		Marks	[CO#]	[PO#]
c.	Compare and differentiate between the battery electric vehicle (BEV), hybrid EV (HEV) and Plug-in HEV (PHEV) technologies.	8	CO2	PO2
d.	Enlist the different architectures of hybrid electric drive train and explain the series hybrid electric drive train.	7	CO2	PO3
5. a.	Write short notes on Hybridization of different energy storage devices.	7	CO3	PO2
b.	With the help of neat figures explain the general configuration of constant v/f control of induction motors.	8	CO3	PO2

(OR)

		Marks	[CO#]	[PO#]
c.	What is Fuel Cell? Explain different types of fuel cell.	7	CO3	PO1
d.	Explain the forward motoring and regenerative braking control of a dc motor with a single chopper. Give circuit diagram and show the quadrants of operation.	8	CO3	PO2
6. a.	Explain sizing the power electronics.	7	CO4	PO2
b.	Classify and explain the basic principle of Rule based energy management system. Elaborate on any one of the Rule based energy management system.	8	CO4	PO2

(OR)

		Marks	[CO#]	[PO#]
c.	Classify different energy management strategies	7	CO4	PO1
d.	Write short notes on Electronic control unit (ECU).	8	CO4	PO1

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