(b) Discuss briefly the comparison of different approaches for Global Optimization based EMS. Also discuss the Stochastic Dynamic Programming (SDP) method. **7.5**

7. Write short notes on the following (any *two*) : **7.5+7.5**

(a) History of Hybrid and Electric Vehicles

(b) Electric double layer ultra capacitors

(c) Sizing of the propulsion motor.

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May 2024

B. Tech. (EL) (Sixth Semester)

Electrical and Hybrid Vehicles (ELPE-612)

Time : 3 *Hours*] [*Maximum Marks :* 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

1. (a) List various components of an Electric Vehicle. **1.5**

(b) Draw the ideal performance characteristics for a vehicle traction power plant. **1.5**

(c) Define rolling resistance force and rolling resistance coefficient. **1.5**

(d) What is the effect of the vehicle speed on power rating of electric motor if the speed increased from 100 km/hr to 120 km/hr ? **1.5**

(e) Define SOC of a battery and give its value when the battery is fully discharged. **1.5**

(f) List the various requirements for energy storage applied in an automotive application. **1.5**

(g) Enumerate the various advantages of the three-phase Induction motor over dc motor. **1.5**

(h) What is Pseudo spectra method ? **1.5**

(i) List the various factors that are considered in the sizing of components in an Electric vehicle (EV) powertrain ? **1.5**

(j) Enumerate the major advantages of an electric motor over an IC engine. **1.5**

Part B

2. (a) For an EV with vehicle speed of 100km/hr, $C_D = 0.2$ A = 3 m^2, Energy available = 10 kWhr, air density = 1.25 kg/m^3. Explain the effect of wind on the range of the vehicle in case of an EV/hr : **7.5**

   (i) When there is no wind

   (ii) When there is an opposing wind at 10 Km/hr

   (b) Describe in detail the various factors hindering the widespread adoption of EV from the point of view of customers. **7.5**

3. (a) Draw the fuel economic characteristics of Internal Combustion Engines and discuss the various techniques to improve vehicle fuel efficiency. 7.5

   (b) Describe the Vehicle Transmission characteristics for Hydrodynamic transmission. 7.5

4. (a) Discuss the configuration and variable voltage and variable frequency control scheme of the Induction Motor Drives. **10**

   (b) Discuss the configuration of the Switch Reluctance motor drives. 5

5. (a) Discuss the power flow control of series hybrid system under different operating modes. Also discuss the advantages and disadvantages of the series hybrid drive train. 7.5

   (b) Explain, why lithium instead of lead acid battery is used. Discuss briefly the major technologies of Lithium based batteries. 7.5

6. (a) Explain, how matching of electric drive and internal combustion engine (ICE) is done with the help of epicyclic gear input-output relationship for different configurations. 7.5