

7. Write short notes on the followings (any *two*) :

- (i) Electric double layer ultra capacitors. (7.5)[CO3]
(ii) Hybridization of different energy storage devices.
(7.5)[CO3]
(iii) Sizing of the propulsion motor. (7.5)[CO2]
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Roll No.

Total Pages : 4

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**B.Tech. (EL)-VI SEMESTER
Electrical and Hybrid Vehicles
(ELPE-612)**

Time: 3 Hours]

[Max. Marks. : 75

Instructions :

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

PART-A

- (a) Define Gradability and mention the value of grade at a slope of 6° and 45° . (1.5) [CO1]

(b) Sketch the torque speed characteristics of IC Engine and electric motor. (1.5) [CO1]

(c) What is Pseudo spectra method? (1.5) [CO3]

(d) Define epicyclic basic ratio. (1.5) [CO3]

(e) List various advantages of using permanent magnets for the field excitation in AC machines. (1.5) [CO1]

(f) Explain how the fuel economy characteristics of an internal combustion engine is generally evaluated.

(1.5) [CO1]

(g) What are the advantages of using Nickel/Cadmium battery as compared to Nickel/Iron battery? (1.5) [CO2]

(h) Define (i) specific energy (ii) theoretical specific energy and (iii) SOC. (1.5) [CO2]

(i) Mention three common arrangements for the rotor circuit in case of PMSM. (1.5) [CO1]

(j) Discuss why the Ultrahigh-speed flywheel appears to be a feasible means for fulfilling the stringent energy storage requirements for EV and HEV applications.

(1.5) [CO2]

PART-B

2. (a) Describe the History of Hybrid and Electric Vehicles and how did it evolve over time? (8) [CO1]

(b) Explain the effect of wind on the range of the vehicle for an EV with vehicle speed of 100 km/hr,

$C_D = 0.2$, $A = 5 \text{ m}^2$, Energy available = 10 KW hr,
air density = 1.25 kg/m^3

Range (No wind) = = 120 Km (approx.)

Range (opposing wind at 10 Km/hr) = 100 Km
(approx). (7) [CO1]

3. (a) Discuss the various techniques to improve vehicle fuel efficiency. (8) [CO1]

(b) Describe the Vehicle Transmission characteristics for manual gear and Hydrodynamic transmission. (7) [CO1]

4. (a) Discuss the configuration and phase-advance angle control scheme of PM Brushless DC motor. (7)[CO2]

(b) Derive the formula for calculating the drive system efficiency. (7) [CO1]

5. (a) Explain the major technologies of Lithium based batteries in detail. (8) [CO2]

(b) Discuss the power flow control of series-parallel hybrid system for the ICE dominated and EM dominated categories. (7)[CO2]

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. (8)[CO3]

(b) Discuss briefly the comparison of different approaches for Global Optimization based EMS. Also discuss the Stochastic Dynamic Programming (SDP) method. (7)[CO3]