CBCS SCHEME

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18EE752

Seventh Semester B.E. Degree Examination, June/July 2023
Electric Vehicles

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Give brief account on Laws of motion in vehicle mechanics and vehicle kinetics. **(10 Marks)**

b. Write brief notes on propulsion power and maximum gradability of a vehicle with appropriate equations. **(10 Marks)**

OR

2 a. What is constant FTR? Derive equations for distance traversed and tractive power in an electric vehicle. **(12 Marks)**

b. An electric vehicle has the following parameters:
$M = 800kg$, $C_D = 0.2$, $A_F = 2.2m^2$, $C_O = 0.008$, $C_1 = 1 \times 0.6 \times 10^{-6}s^2/m^2$. Also take density of air $\rho = 1.18kg/m^3$ and acceleration due to gravity $g = 9.81m/s^2$. The vehicle is on level road. It accelerates from 0 to 65 mi/h in 10s such that its velocity profile is given by $v(t) = 0.29055t^2$ for $0 \le t \le 10s$.

i) Calculate $F_{TR}(t)$ for $0 \le t \le 10s$

ii) Calculate $P_{TR}(t)$ for $0 \le t \le 10s$

iii) Calculate energy loss due to non conservative forces E_{loss}

iv) Calculate Δe_{TR}. **(08 Marks)**

Module-2

3 a. With neat sketch, explain the components of general electric vehicle in detail. **(12 Marks)**

b. With appropriate graphs, explain traction motor characteristic and tractive effort of electric vehicle. **(08 Marks)**

OR

4 a. Explain the concept of hybrid electric train briefly. **(08 Marks)**

b. Classify hybrid electric vehicles based on its architecture with neat diagrams. Compare and contrast series and parallel hybrid electric drive trains. **(12 Marks)**

Module-3

5 a. Explain the parameters of battery in detail. **(10 Marks)**

b. List the types of batteries used in electric vehicles. Explain any two types briefly. **(10 Marks)**

OR

6 a. Draw the structure of fuel cell and explain its operation. **(06 Marks)**

b. Discuss the types of fuel cell briefly. **(06 Marks)**

c. With neat sketch, explain a fuel cell based electric vehicle. **(08 Marks)**

Module-4

7 a. Explain in detail about DC motor drives with neat sketches of armature voltage and field control. **(10 Marks)**

b. Explain various control methods employed in induction motor drive. **(10 Marks)**

OR

8 a. What is a permanent magnet machine? Explain control of PMBLDC in detail. **(10 Marks)**

b. Give a detailed account on SRM control for electric vehicles and explain regenerative braking principle. **(10 Marks)**

Module-5

9 a. Explain the power rating design of the traction motor and engine/generator of series hybrid electric drive train. **(10 Marks)**

b. How will you control series hybrid electric train drive? Explain the strategies. **(10 Marks)**

OR

10 a. Explain in detail, the various control strategies of parallel Hybrid drive train. **(10 Marks)**

b. Explain the design of engine power capacity of parallel hybrid drive train. **(10 Marks)**

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