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17EE742

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Utilization of Electrical Power

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1 a. What are the advantages of Electrical heating? **(04 Marks)**
   b. Derive and explain the design procedure of circular heating element. **(08 Marks)**
   c. A piece of insulating material is to be heated by dielectric heating. The size of piece is 12cm × 12cm × 3cm. A frequency of 20MHz is used and power is absorbed is 450W. If the material has a relative permittivity of 5 and a power factor of 0.05. Calculate the voltage necessary for heating and current that flows in the material, assume $\epsilon_0 = 8.854 \times 10^{-12} F/m$. If the voltage were limited to 1700V, what will be the frequency to get the same loss. **(08 Marks)**

OR

2 a. State and explain Faraday's laws of electrolysis. Define Current efficiency and Energy efficiency. **(08 Marks)**
   b. What is electrodeposition? Mention any two factors which affect the quality of electrodepositing. **(08 Marks)**
   c. Calculate the maximum voltage required for electrolysis of water if one Kg of hydrogen on oxidation to water liberates 13.985×10^7 joules and E.C.E of hydrogen is 1.0384×10^{-8} kg/C. **(04 Marks)**

Module-2

3 a. State and explain the laws of Illumination. **(06 Marks)**
   b. A section of a road is to be illuminated by 2 lamps of 500cp and 400cp, both horizontally 20m apart and are suspended 6m above the surface level. Calculate the illumination at A directly below the lamp of 500cp and at B directly below lamp of 400cp. Also calculate illumination at C in the middle points of A and B. **(06 Marks)**
   c. With a neat diagram, explain the construction and working of the sodium vapour lamp. **(08 Marks)**

OR

4 a. Define the following terms and mention their units :
       i) Laminous flux   ii) Luminous Intensity   iii) Illumination
       iv) Mean spherical candle power. **(08 Marks)**
   b. Explain the following : i) Flood lighting   ii) Street lighting. **(06 Marks)**
   c. Discus the factors to be taken into account for design of lighting scheme. **(06 Marks)**

Module-3

5 a. Mention the significance of speed time curve. Derive the expression for total distance traveled between two stations and the velocity at braking. Assume quadrilateral speed time curve. **(08 Marks)**
   b. Define co-efficient of adhesion and mention the factors on which it depends. **(04 Marks)**

c. A train is required to run between two stations 2kms apart at a schedule speed of 36km/hr, the duration of stops being 20seconds. The braking retardation is 2.7km/h/s. Assuming a trapezoidal speed time curve, calculate the acceleration if the ratio of maximum speed to average speed is 1.2. **(08 Marks)**

OR

6 a. What is Tractive effort? Derive an expression for tractive effort of train considering the gradient and train resistance? **(10 Marks)**
   b. Explain with the aid of diagrams, series parallel control of motors. **(10 Marks)**

Module-4

7 a. Discuss the advantages of electric braking over mechanical braking. **(06 Marks)**
   b. Mention and write a note on any two factors to be considered while selecting a motor for electric traction purpose. **(06 Marks)**
   c. Explain Series parallel control of DC motors. Discuss how the energy is saved in this method. **(08 Marks)**

OR

8 a. Explain Regenerative braking in traction system. **(06 Marks)**
   b. Explain the function of a negative booster in a tramway system. **(06 Marks)**
   c. Show how sag and tension are calculated in a trolley wires. **(08 Marks)**

Module-5

9 a. With relevant block diagram, discuss the working principle of Hybrid electric vehicle. **(10 Marks)**
   b. Discuss the performance of electric vehicle using speed – power characteristics. **(10 Marks)**

OR

10 a. Discuss electric vehicle performance interms of maximum cruising speed, gradeability and acceleration. **(10 Marks)**
    b. Discuss the Electric energy consumption in an electric vehicle. **(10 Marks)**

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