18EE742

USN

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. Classify electrical heating method with necessary equations explain design of circular and ribbon or strip type conductors. **(06 Marks)**
   b. A three phase 415V, 45kW resistance oven employs nickel chrome wire for its heating elements. If the wire temperature is not to exceed 1200°C and temperature of change is to be limited to 800°C, calculate the diameter and length of the wire. Assume radiating efficiency as 0.57 and resistivity of the nichrome as $1.016 \times 10^{-6} \Omega/m$ and emissivity as 0.9. **(08 Marks)**
   c. Define Faraday's first law and second law of electrolysis. Explain i) Current efficiency ii) Energy efficiency iii) Electrode potential. **(06 Marks)**

OR

2. a. With neat diagram, explain i) Butt welding ii) Spot welding. **(06 Marks)**
   b. A copper refining plant uses 400 electrolytic cells and carries a current of 5000A, the voltage per cell being 0.3 volts. The plant works for 42 hours per week. Electro chemical equivalent of copper is 32.1×10^{-8} kg/C. Calculate the energy consumption per tonne. **(08 Marks)**
   c. Mention domestic and industrial application of electrical heating. Explain advantages of electric heating. **(06 Marks)**

Module-2

3. a. State and explain the laws of illumination. **(06 Marks)**
   b. Two sources of candle power or luminous intensity 200 candela and 250 candela are mounted at 8 meters and 10 meters respectively. The horizontal distance between the lamp posts is 40 meters. Calculate the illumination in the middle of the posts. **(08 Marks)**
   c. With neat diagram, explain construction and working of Flourescent lamp. **(06 Marks)**

OR

4. a. Define the following terms:
      i) Luminious flux
      ii) Luminous intensity
      iii) Illumination. **(06 Marks)**
   b. With neat diagram, explain two types of Lumer-Brodhun photometers. **(08 Marks)**
   c. Explain: i) Flood lighting ii) Light fittings. **(06 Marks)**

Module-3

5. a. Define the following terms:
      i) Crest speed
      ii) Average speed
      iii) *Schedule speed*. **(06 Marks)**

b. A train is required to run between two stops which are 4 kms apart with a schedule speed of 45kms and duration of stops being 30 seconds. The braking retardation is 3kmph-ps. Calculate the acceleration, if the ratio of maximum speed to average speed is 1.25. Assume trapezoidal speed-time curve. **(08 Marks)**

c. Discuss the mechanical and electrical characteristics of electric motors used for traction. **(06 Marks)**

OR

6 a. Derive an expression for tractive effort required for the propulsion of a train considering gradient and resistance to train movement. **(08 Marks)**

b. Explain: i) Tramways   ii) Trolley buses   iii) Diesel electric drive. **(06 Marks)**

c. An electric train weighing 300 tone has 12 motors geared to the driving wheels. Each wheel has a diameter of 100cm. The train has to be accelerated to 60kmph in 30 seconds up a gradient 1 in 100. The train resistance is 40 Newtons per tone. The effect of rotational inertia is 10%. The gear ratio is 4 and gear efficiency is 80%. Determine the torque developed by each motor. **(06 Marks)**

Module-4

7 a. With circuit diagrams explain: i) Rheostatic braking   ii) Regenerative braking. **(06 Marks)**

b. Derive an expression for energy returned to the line during regenerative braking on a level track. **(08 Marks)**

c. Write short notes on: i) Magnetic track brake   ii) Electro-mechanical drum brake. **(06 Marks)**

OR

8 a. With neat diagram, explain transmission lines to substations. **(07 Marks)**

b. With neat diagram, explain the function of negative booster in a tramway system. **(07 Marks)**

c. Write a short notes on: i) Electrolysis by current through earth   ii) Pantograph collector. **(06 Marks)**

Module-5

9 a. With block diagram, explain the working principle of hybrid electric drive train. **(10 Marks)**

b. With neat diagrams explain the configuration of series and parallel hybrid electric drive train. **(10 Marks)**

OR

10 a. With neat diagrams explain configurations of electric vehicle. **(10 Marks)**

b. With typical electric motor efficiency characteristics explain energy consumption. **(10 Marks)**

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