

# CBCS SCHEME

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18EE742

## 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  $32.1 \times 10^{-8} \text{kg/C}$ . 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 Fluorescent lamp. (06 Marks)

OR

- 4 a. Define the following terms:
  - i) Luminous 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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 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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