

EIGHTH SEMESTER B TECH DEGREE EXAMINATION

13.804 ELECTRIC POWER UTILISATION & ELECTRICAL SAFETY (E)

Time :3 Hrs

Max. Marks: 100

PART A
(Answer all questions)

1. What are the advantages of electric heating?
2. List out various welding process?
3. State Faradays laws of electrolysis?
4. What are the requirements of an ideal traction system?
5. Sketch the typical speed time curves for urban, sub urban and mainline service?
6. What are the factors affecting the specific energy consumption in traction system?
7. State and explain laws of Illumination?
8. Explain the factors affecting human comfort in air conditioning?
9. What are the main components of human body impedance?
10. Define electrocution equation? **(10 X 2 = 20 marks)**

PART B
Module I

11. a. Explain the design of heating element with rectangular cross section for a resistance oven. **(10 marks)**
b. A 30kW, 3phase 400V resistance oven is to employ nickel chrome strip 0.254mm thick for the three star connected heating elements. If the wire temperature is to be 1100°C and that of charge to be 700°C, estimate a suitable width for the strip. Assume emissivity=0.9 and radiating efficiency to be 0.5 and resistivity of the strip material is $101.6 \times 10^{-8} \Omega m$. **(10 marks)**

OR

12. a. Explain the working principle of dielectric heating? List out its advantages and applications? **(10 marks)**
b. It is required to repair a worn out circular shaft 14cm in diameter and 30cm long by coating it with a layer of 1.5mm of nickel. Determine the theoretical value of quantity of electricity required and time taken if the current density used is 200A/m². Electrochemical equivalent of nickel is 30.4×10^{-8} kg/C of electricity and density of nickel is 8.9×10^3 kg/m³. **(10 marks)**

Module II

13. a. Explain the various speed control methods adopted in electric traction? **(10 marks)**
b. A train has schedule speed of 60 km/h between the stops which are 6 km apart. Determine the crest speed over the run, assuming trapezoidal speed time curve. The train accelerates at 2 km/h/s and retards at 3km/h/s. Duration of stops is 60 seconds? **(10 marks)**

OR

- . 14. a. Explain how regenerative braking can be obtained in DC locomotives.
- . b. A 300 tonne EMU is started with a uniform acceleration and reaches a speed of 40km/h in 24 seconds on a level track. Assuming trapezoidal speed time curve find specific energy consumption if rotational inertia is 8%, retardation is 3 km/h/s, distance between stops is 3 km, motor efficiency is 0.9 and train resistance is 40N/tonne. **(10 marks)**

Module III

- . 15. a. With a neat diagram explain the working of domestic refrigerator. **(10 marks)**
- . b. A hall measuring 27.45m X 45.5m is to be illuminated using 200 watt filament lamps. The luminous efficiency of the 200 watt filament lamp is 14.4 lumens/watt. Inside the hall an average illumination of 108 lumens/m² is to be provided on the working plane. The walls and ceiling are brightly painted. Take coefficient of utilisation as 0.35 and depreciation factor as 0.9. Calculate the number of lamps required for this. **(10 marks)**

OR

- . 16. a. List different parts of an air conditioning system and explain its working in detail. **(10 marks)**
- . b. Explain the factors to be considered for designing the lighting scheme. **(10 marks)**

Module IV

- . 17. Explain the ground grid design procedure? **(20 marks)**

OR

- . 18. a. Explain the methods of determining charging current? **(10 marks)**
- . b. What are the remediations of stray current problem? **(10 marks)**