



Seventh Semester B.E. Degree Examination, June/July 2023
Utilization of Electrical Power

Max. Marks: 100

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

Module-1

- 1 a. Explain the principle of Dielectric heating. Derive the mathematical expression of power consumed in such process. (06 Marks)
- b. A 45kW, 3-phase, 415V resistance oven employs a nichrome strip of thickness 0.25mm for a 3-phase star connected heating elements. If the wire temperature is to be 1200°C and that of the charge to be 800°C, estimate the length of width of the strip. Assume radiating efficiency of 0.57 and emissivity of 0.9. The specific resistance of nichrome is $1.03 \times 10^{-6} \Omega\text{-m}$. (08 Marks)
- c. With a neat sketch, explain the construction and working principle of Ajax Wyatt furnaces. (06 Marks)

OR

- 2 a. Define Resistance welding and explain spot welding with neat sketch and its applications. (06 Marks)
- b. In a copper sulfate voltmeter, the weight of the copper cathode is increased by 100gms in 3 hours. Calculate the current required. Atomic weight of copper is 63.5 and its valency is 2. Atomic weight of silver is 108 and its valency is 1. The ECE of silver is $111.8 \times 10^{-8}\text{-Kg/C}$. (08 Marks)
- c. State and explain Faraday's laws of electrolysis. (06 Marks)

Module-2

- 3 a. State and explain the laws of illumination. (08 Marks)
- b. Define the following terms with respect to illumination
 i) Luminous flux ii) Illumination iii) Utilization factor iv) MSCP (04 Marks)
- c. Explain the working of sodium vapour lamp with neat diagram. (08 Marks)

OR

- 4 a. Explain the concept of measurement of men spherical candle power by integrating sphere. (07 Marks)
- b. A lamp of luminous intensity 1,200CP is mounted at a height of 12m above the centre of a circular area 20m in diameter. Determine the maximum and minimum illumination produced on the area. (07 Marks)
- c. Explain two general principles employed for designing street light installations. (06 Marks)

Module-3

- 5 a. Derive an expression for distance traveled between two stations. Assume Quadrilateral speed time curve. (10 Marks)
- b. Considering trapezoidal speed time curve approximation, prove that Crest speed is given as

$$V_m = \frac{T}{K} - \sqrt{\left(\frac{T}{K}\right)^2 - \frac{7200D}{K}} \text{ where, } K = \frac{1}{\alpha} + \frac{1}{\beta} \quad (10 \text{ Marks})$$

OR

- 6 a. Explain the tapped field control or control by field weakening method of controlling of motors in electric traction. (05 Marks)
- b. A 250 tonne motor coach has 4 motor each developing a 6000N-m torque during acceleration starting from rest. If gradient is 40 in 1000, gear ratio = 4, efficiency of gear transmission = 87%, wheel diameter = 80cm, train resistance = 50 NW/tonne. Calculate time taken to attain 50Kmph. Allow 12% for additional rotational inertia. If line voltage is 3000V, DC and motor efficiency = 85%. Find current drawn during notching period. (10 Marks)
- c. With relevant figure, explain the steps involved in bridge transition method of series – parallel starting of two DC series motors. (05 Marks)

Module-4

- 7 a. What is Regeneration braking system? Derive the expression for energy returned during regeneration. (07 Marks)
- b. A train weighing 400 tonnes has speed reduced by regenerative braking from 40 to 20Kmph over a distance of 2km along down gradient of 2%. Calculate the electrical energy and average power returned to the line. Tractive resistance is 40N/tonne and allow rotational inertia of 10% and conversion efficiency of 75%. (09 Marks)
- c. Discuss mechanical braking arrangement used in electric traction. (04 Marks)

OR

- 8 a. Explain feeding and distributing system on AC traction and for DC tram ways. (06 Marks)
- b. Sketch and explain the following arrangements of current collection used in electric traction:
i) The bow collector ii) Current collecting shoe iii) Trolley – wire section. (06 Marks)
- c. Explain the function of a negative booster in a tramway system. (08Marks)

Module-5

- 9 a. Explain with block diagram of electric vehicles configuration. (07 Marks)
- b. Discuss the energy consumption in electric vehicles. (08 Marks)
- c. Mention advantages of electric vehicle. (05 Marks)

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OR

- 10 a. Write a short notes on :
i) Series Hybrid Electric drive trains (05 Marks)
ii) Parallel hybrid drive trains (05 Marks)
- b. Discuss the hybrid electric derive train working principle, with relevant block diagram. (10 Marks)

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