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EE73

Seventh Semester B.E. Degree Examination, Dec.08/Jan.09
Electrical Power Utilization

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Explain the properties of Good heating element. **(06 Marks)**

b. Define welding. Compare resistance and arc welding. **(08 Marks)**

c. A 27 kW, 3-phase 400 V resistance oven is to employ nickel-chrome strip 0.25mm thick for the three star connected heating elements. If the temperature of the strip is to be 1000°C and that of the charge to be 600°C, estimate suitable width for the strip. Assume emissivity = 0.9 and radiating efficiency to be 0.5 and resistivity of the strip material is 101.6×10^{-8} Ω-m. **(06 Marks)**

2 a. Explain the principles of Induction heating. **(05 Marks)**

b. With neat sketch explain the working of a vertical core type induction furnace. **(08 Marks)**

c. Calculate the efficiency of a high frequency induction furnace which takes 10 minutes to melt 1.8 kg of aluminium. The input to the furnace is 4.8 kW and initial temperature 15°C. Specific heat of aluminium = 0.88 kJ/kg °C. Melting point of aluminium = 660°C. Latent heat of fusion of aluminium = 32 kJ/kg. Assume 1 kJ = 2.78×10^{-4} kWh. **(07 Marks)**

3 a. Explain Faraday's laws of Electrolysis in detail. **(08 Marks)**

b. Explain the factors governing the electro-deposition. **(12 Marks)**

4 a. State and explain the laws of illumination. **(06 Marks)**

b. With neat figure, explain construction and working principle of fluorescent tube. **(06 Marks)**

c. Two lamps of 1000 cp and 500 cp respectively are 15 meters above the ground level and are 30 meters apart. Find the intensity of illumination at a point on the ground in line with the two lamps and 15 meters from the base of the more powerful lamp. **(08 Marks)**

5 a. Mention the significance of speed-time curves. Derive an expression for the total distance traveled between two stations and the velocity at breaking. Assume quadrilateral speed-time curve. **(08 Marks)**

b. Define co-efficient of adhesion and mention its values for different conditions of the rail. **(04 Marks)**

c. A train is required to run between two stations 2 kms apart at a schedule speed of 36 km/hr, the duration of stops being 20 seconds. The braking retardation is 2.7 km/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)**

6 a. Define specific energy consumption of train. Derive an expression for the specific energy consumption and mention the factors that affect the specific energy consumption. **(12 Marks)**

b. A 220 tonne motor coach having four motors, each developing a torque of 7500 N-m during acceleration, starts from rest. If up-gradient is 25 in 1000, gear ratio 3.2, gear transmission efficiency 90%, wheel diameter 92 cms, train resistance 45 N/t, rotational inertia effect 8%. Calculate

(i) The time taken by the coach to attain a speed of 72 km/h.

(ii) If the supply voltage is 3000 V and motor efficiency 87%, estimate current taken by each motor during the acceleration period. **(08 Marks)**

7 a. Mention the causes for poor power factor and discuss the disadvantages of poor power factor. **(07 Marks)**

b. Obtain an expression for most economical power-factor for a consumer based on constant kilowatt demand. **(07 Marks)**

c. A three phase, 50c/s, 400 V induction motor has a maximum load of 50 kVA at 0.75 PF (lagging). It is desired to improve the power factor to 0.95 (lagging) by means of static capacitors connected across each of the phases. Calculate the capacitance of the static capacitors if connected in delta across the load. **(06 Marks)**

(20 Marks)

8 Write short notes on any FOUR:

a. Explain requirement of good lighting.

b. Re-generative breaking.

c. Compare the DC and AC systems for railway electrification.

d. Series parallel control used for DC motors.

e. Principles of extractions of metals.

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