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10EE72

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Electrical Power Utilization

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART - A

1 a. Classify the different Electric Heating methods and explain them briefly any four methods. **(08 Marks)**

b. Explain Butt – Welding, with a neat diagram and mention its uses. **(08 Marks)**

c. A plywood board 0.5 × 0.25 × 0.02 mt is to be heated from 25^0C to 125^0C in 10 mins by dielectric heating employing a frequency of 30 MHz. Determine the power required in this heating process. Assume specific heat of wood 1500J/kg/^{0}C. Weight of wood 600 kg/m^3 and efficiency of process as 50% with 1Kwh as 3.6 MJ. **(04 Marks)**

2 a. State and explain the Faraday's laws of electrolysis. **(06 Marks)**

b. Define the following terms referred to electrolytic process :
i) Electrochemical equivalent ii) Current efficiency iii) Energy efficiency. **(06 Marks)**

c. A 24cm long portion of circular shaft of 10cm diameter is to be quoted with a layer of 1.5mm Nickel. Determine the quantity of electricity and time taken for the process. Assume a current density of 195 A/m^2 and a current efficiency of 95%. Density of nickel is 8900 kg/m^3 and ECE of nickel is 1.0954 kg per 1000 Ah. **(08 Marks)**

3 a. Define i) Luminous efficiency ii) Depreciation factor
iii) Coefficient of utilization iv) Space height ratio. **(08 Marks)**

b. Two Lamp posts 20 meter apart and are fitted with 200 Cp lamp each at height of 6m above the ground. Calculate the illumination on the ground i) under each lamp ii) midway between the lamps. **(06 Marks)**

c. Discuss the methods used for lighting calculations. **(06 Marks)**

4 a. Explain the principles which are adapted in street lighting. **(08 Marks)**

b. With a neat figure, explain the construction and working of a sodium vapour lamp. **(06 Marks)**

c. Determine the effective illumination of a room 12m × 15m illuminated by 15 lamps of 200 watts each. The luminous efficiency of each lamp is 12 lumens/watt. Coefficient of utilization is 0.4. **(06 Marks)**

PART - B

5 a. For a simplified quadrilateral speed – time curve, show that the speed at the end of coasting period is given by

$$V_2 = \frac{V_1 - \beta_c T + \frac{\beta_c}{\alpha} V_1}{1 - \beta_c/\beta}$$, where the symbols have usual notations. **(10 Marks)**

b. The distance between two stations is 1km, and the schedule speed is 30kmph. Station stopping time is 20 secs. Assuming braking retardation as 3kmphps and max speed as 1.25 times the average speed. Determine acceleration required to run the service. If the speed time curve is approximated by a trapezoidal curve. **(05 Marks)**

c. Discuss the requirement of an Ideal traction system. **(05 Marks)**

6 a. Define Tractive effort. Derive an expression for tractive effort of train considering its movement on an upward gradient and having track resistance. **(10 Marks)**

b. An electric train weighing 100 tonnes has a rotational inertia of 10%. This train while running between two stations which are 2.5km apart has an average speed of 50 kmph. The acceleration and retardation during braking are 1kmphps and 2kmphps. The percentage gradient between these two stations is 1% and the train is to move up the incline. The track resistance is 40N/tonne. If the combined efficiency of the electric train is 60%. Determine
i) Maximum power at the driving axle ii) Specific energy consumption.
Assume a trapezoidal speed time curve. **(10 Marks)**

7 a. Discuss the concept of energy saving in plain rheostatic starting and series parallel control. **(10 Marks)**

b. Explain i) Plugging ii) Regenerative braking as applied to traction motors. **(10 Marks)**

8 a. Discuss the linear induction motor along with its advantages and disadvantages. Mention its application. **(10 Marks)**

b. Briefly explain different systems of railway electrification. **(10 Marks)**

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