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Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016
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. With a neat sketch, explain the construction, principle of operation and application of Ajax Wyatt furnace. **(08 Marks)**

   b. A three phase arc furnace is used to melt 4.3 tonnes of steel in one hour. Determine the average kW and kVA input to the furnace, arc voltage, arc resistance and power factor of the current drawn from the supply.
   Specific heat of steel = 444 J/kg/°C   Latent heat of steel = 37.25 kJ/kg
   M. P. of steel = 1370°C   Initial temperature of steel = 19.1°C
   Overall efficiency of furnace = 50%
   Input current = 5700 A, Resistance and Reactance of transformer referred to secondary are 0.008 and 0.014 ohm respectively. **(12 Marks)**

2   a. Explain the principle of Dielectric Heating. Derive the mathematical expression of power consumed in such process. State important applications of dielectric heating. **(06 Marks)**

   b. A low frequency induction furnace, whose secondary voltage is maintained constant at 10 volts, takes 400 kW at ac power factor when the hearth is full. Assuming the resistance of the secondary circuit to vary inversely as the height of the charge and reactance to remain constant, find the height up to which hearth should be filled to obtain maximum heat. **(08 Marks)**

   c. Explain High Frequency Eddy current heating. **(06 Marks)**

3   a. With a neat sketch, explain flash butt welding and spot welding. **(06 Marks)**

   b. State and explain laws of illumination. **(06 Marks)**

   c. Discuss the factors influences the electrodeposition process. **(08 Marks)**

4   a. With a neat sketch, explain the construction and working principle of a low pressure mercury vapour lamp. **(06 Marks)**

   b. Explain the principle of street lighting, types of street lighting and lamps used in street lighting. **(06 Marks)**

   c. A 60 CP, 250 Volt metal filament lamp has a measured candle power of 71.5 CP at 260 Volts and 50 CP at 240 volts.
   i)   Find the constant for the lamp in the expression $C = aV^b$ where C = candle power and V = voltage.
   ii) Calculate the change of candle power per volt at 250V. Determine the percentage variation of candle power due to a voltage variation of $\pm$ 4% from the normal value. **(08 Marks)**

PART – B

5   a.   State the main requirements of an ideal traction system.   **(06 Marks)**

     b.   Explain the various systems of track electrification.   **(08 Marks)**

     c.   Define : (i) Crest speed   (ii) Average speed and   (iii) Schedule speed. Discuss the factors which affect the schedule speed of a train.   **(06 Marks)**

6   a.   Draw a main-line service speed-time curve. Derive an expression for maximum speed of a train interms of total distance travelled acceleration & retardation by using a suitable simplified s-t curve.   **(06 Marks)**

     b.   A train is required to run between two stations 1.6 km apart at an average speed of 40 km/h. The acceleration, retardation during coasting and braking are 2 km/h/s, 0.16 km/h/s and 3.2 km/h/s respectively. Assuming quadrilateral approximation of speed-time curve, determine

       i)   The duration of acceleration, coasting and braking periods and

       ii)   The distance covered during these periods.   **(08 Marks)**

     c.   Explain mechanism of Train movement and define (i) Adhesive weight and (ii) Co-efficient of adhesion.   **(06 Marks)**

7   a.   Define specific energy output and specific energy consumption. Derive the expression of specific energy o/p and specific energy consumption using simplified speed-time curve.   **(10 Marks)**

     b.   Discuss the mechanical features and electrical characteristics of electric motors used for traction work.   **(10 Marks)**

8   a.   A tramcar is equipped with two motors which are operating in parallel. Calculate the current drawn from the supply mains at 500 V when the car is running at a steady speed of 40 kmph and each motor is developing a tractive effort of 1800 Newtons. Resistance of each motor is 0.4 ohm. The friction, windage and other losses may be assumed as 3200 watts per motor.   **(06 Marks)**

     b.   What is Hybrid vehicle? Explain configuration and performance on hybrid vehicle.   **(08 Marks)**

     c.   What are the Advantages and disadvantages of Regenerative braking of electric traction motor?   **(06 Marks)**

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