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**Seventh Semester B.E. Degree Examination, June/July 2018**  
**Electrical Power Utilization**

Time: 3 hrs.

Max. Marks:100

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

**PART – A**

- 1 a. Discuss the AJAX WYATT furnace with a neat diagram. Also mention the advantages. (08 Marks)
- b. Explain the properties of good heating element. (04 Marks)
- c. Calculate the time taken to melt 4 ton of steel in a 3 $\phi$  Arc furnace, with a current of 5000A, specific heat of steel 0.12 kcal/kg/ $^{\circ}$ C, Arc voltage = 60 V, latent heat of steel = 8.89 kcal/kg Melting point of steel = 1370 $^{\circ}$ C, Initial temperature = 18 $^{\circ}$ C, Resistance and reactance of transformer is 0.003  $\Omega$  and 0.005  $\Omega$  respectively. Assume overall efficiency of 55%. (08 Marks)
- 2 a. State and explain Faraday's law of electrolysis. (06 Marks)
- b. Explain the copper refining process with a neat sketch. (06 Marks)
- c. A copper refining plant using 500 electrolytic cells carries a current of 6000A, voltage per cell being 0.25 V. If the plant were to work 40 hr/week, calculate the energy consumption per ton. Assuming ECE of copper as 0.3281 mg/columb of electricity. (08 Marks)
- 3 a. What is photometer? Explain it with a neat sketch. (06 Marks)
- b. State and explain the laws of illumination. (08 Marks)
- c. A workshop measuring 15m  $\times$  40m is illuminated by 24 lamps of 500 W each. The luminous efficiency of each lamp is 15 lumen/watt. Assuming a depreciation factor of 0.7 and the coefficient of utilization of 0.5. Determine the illumination on the workshop. (06 Marks)
- 4 a. What are the factors to be considered in the design of lighting scheme? (06 Marks)
- b. With a neat diagram, explain the construction and working of a mercury vapour lamp. (06 Marks)
- c. In a street lighting scheme 2 lamps of 500 W with a lamp efficiency of 25 lumen/watt are mounted on 2 lamp posts 10 m apart. The lamp posts are at an height of 3 m and 4 m. Calculate the illumination on the ground at a point midway between the posts. (08 Marks)

**PART – B**

- 5 a. Derive an equation for the actual distance travelled between 2 stations using the quadrilateral speed time curve. (08 Marks)
- b. Discuss the requirement of an ideal traction system. (05 Marks)
- c. An electric train has a schedule speed of 30 kmph between stations 1 km apart. The duration of stop is 20 sec. The crest speed is 25% higher than average running speed, braking retardation is 3 kmphs. Calculate the acceleration required to run the service, considering the trapezoidal speed time curve. (07 Marks)
- 6 a. Derive an expression for the specific energy output on a level track using simplified trapezoidal speed time curve. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

b. A 220T motor each has 4 motor each developing 7500 N-m torque during acceleration starts from rest. If the gradient is 25 in 1000, gear ratio 3.2, gear transmission efficiency 90%, wheel radius of 46 cm, train resistance 45 N/T and additional rotational inertia of 8%. Calculate (i) the time taken to attain speed of 72 kmph. (ii) If the line voltage is 3000 V and efficiency of motor is 87%. Find the current during notching period. (10 Marks)

7 a. Derive an expression of tractive effort for the propulsion of train. (08 Marks)

b. A 320T electric train runs up an ascending gradient of 1.2% with the following data:

(i) Acceleration of 2 kmphs for 20 sec.

(ii) Constant speed for 45 sec

(iii) Coasting for 25 sec.

(iv) Braking at 2.645 kmphs.

Calculate the specific energy consumption of the train if the train resistance is 45 N/T. Effect of rotational inertia is 8% and overall efficiency of transmission gear is 78%.

(12 Marks)

8 Write short notes on any four:

a. Hybrid vehicles

b. Train lighting system

c. DC series motor for traction service

d. Series parallel control used for DC motor

e. Linear Induction motors.

(20 Marks)

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