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Paper Code : EE-702

PUID : 07278 (To be mentioned in the main answer script)

UTILIZATION OF ELECTRIC POWER

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) A d. c. shunt motor drives a load at rated speed and at rated voltage. If both the load and the supply voltages are halved, the speed of the motor will nearly be ..... the rated speed

a) doubled

b) halved

c) the same as before

d) less than.

ii) Dynamic braking is very effective if the d.c. motor

a) is series excited

b) is shunt excited

c) is separately excited

d) has cumulative compound excitation.

iii) Choke is provided in fluorescent lamp to

a) avoid radio interference

b) improve power factor

c) produce high starting voltage

d) all of these.

iv) The normal value of coefficient of adhesion is

a) 0·25 b) 0·35

c) 0·50 d) 1·50.

v) A capacitor is connected across the fluorescent lamp in order to

a) eliminate the noise

b) limit the current

c) improve the power factor

d) all of these.

vi) The lumen output is highest for

a) sodium vapour lamp

b) Hg vapour lamp

c) incandescent lamp

d) neon lamp.

vii) An auto transformer used with sodium vapour lamp should have

a) higher step-up ratio

b) high step-down ratio

c) high leakage resistance

d) high efficiency.

viii) Induction heating is used for

a) insulating material

b) magnetic material

c) conducting non-magnetic material

d) magnetic and conducting material.

ix) Quadrilateral speed-time curve is a better approximation to the actual conditions for

a) sub-urban services

b) urban services

c) main line service

d) urban and sub-urban service.

x) Candela is the unit of

a) Luminous flux b) Luminous intensity

c) Brightness d) Luminous efficiency.

xi) The average life of sodium lamps is around

a) 1000 hours b) 2500 hours

c) 6000 hours d) 10000 hours.

xii) Hysteresis and Eddy current heating are used in

a) Resistance heating

b) Dielectric heating

c) Induction heating of steel

d) Induction heating of brass.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. State the advantages of Induction heating.

3. Describe lumen method for indoor lighting calculation. What is Lambertian surface ? 4 + 1

4. Describe different ways of supply system for electric traction with their merits and demerits.

5. What is stroboscopic effect ? Draw relevant diagrams to illustrate and explain how this effect can be overcome. 2 + 3

6. What are the requirements of an ideal traction system ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Explain the flux method of calculation for interior lighting. An illumination on the working plane of 32 lux is required in a room of 80 m × 15 m. The lamps are required to be hung 4·5 m above the work bench. Assume a utilization factor of 0·5, lamp efficiency of 1·4 lumens per watt and candle power depreciation of 0·2, estimate the number of lamps and disposition of the lamps. Assume spacing/height ratio of 1·5.

8. a) Explain how rheostatic braking is employed to a d.c. series motor when at least two motors are working in parallel for electric traction system.

   b) Define tractive effort for acceleration and for overcoming the effect of gravity for propulsion of the train.

   c) An electric train has quadrilateral speed-time curve as follows :

      i) Uniform acceleration from rest at 3 kmphps for 30 secs.

      ii) Coasting for 55 secs.

iii) Braking period of 20 secs.

The train is moving a uniform gradient of 1%, tractive resistance of 40 newtons per tonne, rotational inertia effect 10% of dead weight, duration of station stop 15 secs and overall efficiency of transmission gear and motor as 75%. Calculate the value of its schedule speed and specific energy consumption of run. 3 + (2 + 2) + 8

9. a) Explain construction, operation performance and application of arc furnance. Illustrate your answer by appropriate graphs.

   b) Derive the condition for maximum output in an arc furnace.

10 + 5

10. a) Draw a neat sketch of high pressure sodium vapour lamp and label its different parts.

    b) Explain the working principle of the above lamp.

10 + 5

11. Write short notes on any *three* of the following : 3 × 5

a) Regenerative Braking

b) Linear induction motor

c) Resistance welding

d) Compact fluorescent lamp

e) Lummer-Brodhun photometer

f) High pressure mercury vapour lamp.