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Paper Code : EE-702

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)

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

i) The filament of a GLS is made of

a) Tungsten b) Copper

c) Carbon d) Aluminium.

ii) The average working life of a fluorescent lamp is about

a) 1000 hrs b) 4000 hrs

c) 3000 hrs d) 5000 hrs.

iii) Electric traction in comparison to other tractic system has the advantages of

a) higher acceleration and braking retardation

b) cleanest system ideally suitable for underground and tube railway

c) better speed control

d) all of these.

iv) When the speed of the train is estimated taking into account the time of stop at a station in addition to the actual running time between stops, is known as

a) average speed b) schedule speed

c) notching speed d) free running speed.

v) In underground traction system, the supply system is

a) 500V-1000V DC b) 25kV, 50Hz AC

c) 25kV, 25Hz AC d) none of these.

vi) Radiant heating is used for

a) melting of ferrous

b) annealing of metals

c) drying of points and metal

d) all of these.

vii) Non-conducting materials are heated by

a) Eddy current heating

b) Arc heating

c) Induction heating

d) Dielectric heating.

viii) During plugging the dissipated energy comes from

a) the supply

b) the rotating (moving) masses

c) both (a) and (b)

d) none of these.

ix) Steel rails are welded by

a) argon arc welding b) gas welding

c) resistance welding d) none of these.

x) Voltage-current characteristics of the supply for welding must be

a) dropping b) rising

c) steady d) none of these.

xi) Colour of light depends on

a) frequency

b) wavelength

c) both frequency and wavelength

d) speed of light.

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 questions. 3 × 5 = 15

2. State the advantages of electric heating.

3. What is stroboscopic effect ? What is its harmful effect in case of rotating machines ? How is it avoided ?

4. Explain the operation of the following with circuit diagram :

   a) LP sodium vapour lamp

   b) HP mercury vapour lamp.

5. What is tractive effort ? Explain the component for the tractive effort.

6. Explain "free running", "coasting and braking" with reference to the electric traction system.

GROUP – C

(Long Answer Type Questions)

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

7. a) State the laws of illumination. What do you mean by M.S.C.P and M.H.C.P ? How do you find MSCP and MHCP from polar curve ?

   b) Estimate the number and wattage of lamps which would be required to illuminate a workshop space 60 m x 15 m by means of lamps mounted 5 m above the working plane. The average illumination required is about 100 lux, coefficient of utilization 0.4, luminous efficacy 16 lumens per watt. Assume a space height ratio of unity and candle power depreciation of 20%. 7 + 8

8. a) Define the term "Coefficient of adhesion" and explain the factors on which it depends.

   b) The distance between two stations is 16 km and the average speed of the train is 40 kmph. The acceleration, retardation during coasting and braking are 2 km/h/s, 0.16 km/h/s and 3.2 km/h/s respectively. Assume quadrilateral approximation of the speed-time curve. Determine the duration of accelerating, coasting and braking period and the distance covered during this period. 6 + 9

9. a) What do you mean by dielectric heating and dielectric loss ?

   b) A slab of material 2 cm thick and 15 cm^2 of area, having relative permittivity 4 and p.f 0.04 is to be heated using dielectric heating. The power required is 200 watts at a frequency of 30MHz. Determine the voltage required and the current that will flow through the material. If the voltage were to be limited to 600V, what should be the frequency for the same power requirement ? 6 + 9

10. a) Describe the working principle of direct core type induction furnace. What are the advantages in Ajax-Wyatt induction furnace.

    b) Describe the advantages of coreless type induction furnace over core type.

    c) A low frequency induction furnace, whose secondary voltage is maintained constant at 10 volts, takes 400 kW at 0.6 p.f. when the hearth is full. Assuming the resistance of the secondary circuit to vary inversely as the height of charge and reactance to remain constant, find the height up to which hearth should be filled to obtain maximum heat. 6 + 3 + 6

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

    a) Energy efficient lamp

    b) Laser welding

    c) Application of dielectric heating

    d) Anodizing and its application

    e) Current collector.