Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech (EE)/SEM-7/EE-703/2011-12

2011
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) If the resitance to electric train movement is given by $F_r = a + bv + cv^2$. In the given expression *b* is likely to cover

    a) air resistance   b) track resistance

    c) frictional resistance   d) none of these.

    ii) Choke is provided in fluorescent lamp to

    a) avoid radio interference

    b) improve power factor

    c) produce high starting voltage

    d) all of these.

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iii) Electric Traction in comparison to other traction systems has the advantages of

    a)   Higher acceleration and braking retardation

    b)   Cleanest system ideally suitable for underground and tube railways

    c)   Better speed control

    d)   All of these.

iv) At low frequency of the order of $^1/_2$ Hz to 10 Hz, the induction motors develop

    a)   high starting torque with excessive starting current

    b)   high starting torque without excessive starting current

    c)   low starting torque with excessive starting current

    d)   low starting torque without excessive starting current.

v) In a welded joint poor fusion is an account of

    a)   improper current

    b)   high welding speed

    c)   uncleaned metal surface

    d)   lack of flux.

vi) The normal value of coefficient of adhesion is

    a)   0·25   b)   0·35

    c)   0·50   d)   1·50.

vii) Dielectric loss is proportional to

    a)   frequency   b) $(frequency)^2$

    c) $(frequency)^3$ d) $(frequency)^{\frac{1}{2}}$.

viii) The most common system of traction system in India is

a) D.C. Traction (600V) b) D.C. Traction (750V)

c) A.C. Traction (25 kV) d) A.C. Traction (1500V).

ix) The speed of a steam locomotive is controlled by

a) applying brakes

b) gear box

c) regulating steam flow to engine

d) flywheel

x) Which of the following lamps gives nearly monochromatic light ?

a) Fluorescent tube

b) low pr. sodium vapour lamp

c) mercury vapour lamp

d) high pr. sodium vapour lamp.

xi) 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.

xii) The lumen output is highest for

a) sodium vapour lamp b) Hg vapour lamp

c) incandescent lamp d) neon lamp.

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xiii) The value of coefficient of adhesion will be high when rails are

    a)   wet   b)   cleaned

    c)   greased   d)   sprayed with oil.

xiv) The Welding transformer should ahve

    a)   resing V-I characteristic

    b)   horizontal V-I characteristic

    c)   drooping V-I characteristic

    d)   none of these.

xv) The sodium vapour lamp

    a)   is only suitable for a.c. and so needs choke control

    b)   needs capacitor in its auto-transformer circuit to improve the power factor which is very low (about 0·3 lagging).

    c)   comes up to its rated output in approximately 15 minutes

    d)   all of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

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

3.   Describe the conditions of maximum output for an electric arc furnace.

4.   Describe the working principle of outrasonic welding for joining of plastic materials.

5. Explain the operations of the following with circuit diagrams :

    a) LP sodium vapour lamp

    b) LP mercury vapour lamp

6. Write short notes on any *one* of the following :

    a) Resistance heating
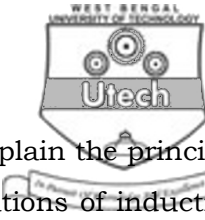
    b) Induction heating

    c) Dielectric heating.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Explain the factors to be taken into account for designing schemes for (i) street lighting (ii) flood lighting.

    b) What are the advantages of using coiled coil filaments in tungsten filament lamps ?

    c) State and explain LOR.

    d) Estimate the number and wattage of lamps which would be required to illuminate a workshop space 60 m × 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 lumen per watt. Assume a space-height ratio of unity and candle power depreciation of 20%.

                                  3 + 3 + 2 + 7

8. State the advantages of electric heating. Explain the principle of induction heating. What are the applications of induction heating ? What are dielectric heating and dielectric loss ?

A low frequency induction furnace operating at 10 volts in the secondary circuit takes 500 kW at 0·5 p.f. when the hearth is full. If the secondary voltage be maintained at 10 volts, estimate the power absorbed and the power factor when the hearth is half-full. Assume the resistance of the secondary circuit to be thereby doubled and reactance to remain same. 3 + 3 + 2 + 3 + 4

9. 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 2 kmphps for 30 secs
      ii) Coasting for 50 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

10. a) State the law of electrolysis. What is meant by anodizing ? Explain the process of anodizing and describe the equipment used for it.

   Calculate the ampere-hour required to deposit a coating of silver 0·06 mm thick on a sphere of 6 cm radius. Assume electro-chemical equivalent of silver = 0·001118 and density of silver to be 10·5.

   b) Describe briefly the various types of arc welding process. Differentiate between carbon and matallic arc welding. 9 + 6

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

   a) Conductor rail system

   b) Kando system of electrification

   c) SCADA system in traction

   d) Microwave Oven

   e) Lummer Brodhun Photometer

   f) Buck Boost method of speed control in traction system.

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