B 3531

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Eighth Semester

Electrical and Electronics Engineering

EE 041 — ELECTRIC ENERGY UTILISATION AND CONSERVATION

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Enumerate the requirements of good heating material.

2. What is the influence of skin effect on induction heating?

3. Define solid angle and glare.

4. State the factors to be considered while designing for street lighting.

5. State the assumptions to be made in approximating trapezoidal speed time curve.

6. Define specific energy consumption and bring out the factors that influence it for the given schedule speed.

7. The coulomb of electricity required to deposit 20 mg of copper is 60.31. Find the time taken for a current of 0.15 ampere to liberate this copper from copper sulphate solution.

8. Define Electro-cleaning process.

9. Define power factor tariff.

10. State the different types of depreciation methods in use.

PART B — (5 × 16 = 80 marks)

11. (i) Explain the process of Dielectric heating and derive an expression for power loss. (10)

(ii) Compare the salient features of Arc furnace and induction furnace. (6)

12. (a) (i) Derive an expression for Inverse Cube Law (6)

(ii) A lamp has a uniform candle power of 300 in all directions, and is provided with a reflector which directs 60% of the total emitted light uniformly on to a flat circular disc of 6 meters dia. placed 6 m vertically below the lamp. Determine the illumination (1) at the centre and (2) at the edge of the surface with and without reflector. Also find the average illumination. (11)

Or

(b) (i) With the help of neat diagrams explain the working of high pressure sodium vapour lamp. (8)

(ii) An illumination of 100 lux is to be provided in a drawing hall of size 30 m × 15 m × 5 m. Assuming a coefficient of utilisation of 0.5 and depreciation factor of 0.8 determine the number of lamps required, their spacing, mounting height and total wattage. Luminous efficacy of lamps is 16.67 lumens/watt for 300 watt. (8)

13. (a) (i) Briefly discuss about the requirements to be met for regenerative braking of traction motors. (6)

(ii) An Electric train weighing 400 T runs along an upgradient of 1% with the following speed-time curve :

(1) uniform acceleration of 1.5 kmphps for 30 sec

(2) free running for 36 sec

(3) coasting for 25 sec

(4) braking at 2.6 kmphps to rest.

Determine the specific energy consumption during power on, if the tractive resistance is 45 N/Tonne, rotational inertia effect 10% overall efficiency of transmission and motor 75% determine the specific energy consumption. (10)

Or

(b) (i) Briefly discuss various speed control schemes for electric traction. (6)

(ii) An electric train has quadrilateral speed time curve as follows :

(1) uniform acceleration from rest at 2 kmphps for 30 seconds;

(2) coasting for 50 seconds

(3) duration of braking 20 seconds.

If the train is moving a down gradient of 10%, Tractive resistance is 40 N/tonne, rotational inertia 10% of dead weight, overall efficiency of transmission gear and motor is 75%. Find total energy consumption for 200 tonne train. (11)

14. (a) (i) Define anodizing, polarization and current efficiency. (3)

(ii) Describe in detail the process of silver plating. (8)

Or

(b) (i) Nickel coating of 1 mm thickness is to be built on a cylindrical surface 15 cm dia. and 20 cm long in $1\frac{1}{2}$ hours. Calculate the electrical energy needed if E.C.E. of nickel is .3043 mgm/coulomb, specific gravity 8.9 and voltage used in electroplating is 10 volts. (8)

(ii) Discuss about the features unique to the power supply equipment used in electrolysis process. (8)

15. (a) (i) Discuss the impact of demand factor, load factor and diversity factor on the tariff of the energy supplied. (8)

(ii) State the basic requirements of a scheme for raising depreciation fund. Explain various schemes of determining depreciation and compare them in reference to the burden imposed on the electric utilities. (8)

Or

(b) (i) Write short notes on :

(1) Energy auditing

(2) Energy conservation measures. (6)

(ii) Obtain a two-part tariff for the consumers of a supply undertaking which generates 390×10^6 kwhr. per annum and has a maximum demand of 130 MW. The cost is distributed as follows : Fuel Rs. 5×10^6, generation Rs. 2.4×10^6, transmission Rs. 5×10^6 and distribution Rs. 3.4×10^6. Of these items 90%, 10%, 5% and 7% respectively are allocated to running costs, the remainder being a fixed charge. The total loss between the station and the consumers is 10% of the generated energy. If the load factor of the station is raised to 40% for the same maximum demand, find the percentage saving in the overall cost per kwhr. (10)
