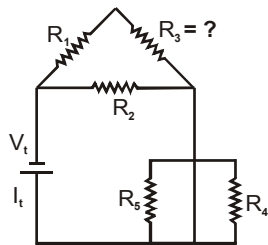


Solved Paper 2013

Electrical Engineering (Paper II)

1. (a) (i) An oven operates on a 15.0 A current from a 120 V source. How much energy will it consume in 3.0 h of operation? (10)
- (ii) How many 100 W light bulbs connected to a 120 V supply can be turned on at the same time without blowing a 15.0 A fuse? (10)
- (iii) 3.0 A, 125 V circuit contains a 10.0 W resistor. What resistance must be added in series for the circuit to have a current of 5.0 A? (10)
- (b) In the following circuit, find the total resistance, R_3 , V_2 and I_4 . (30)



$$\begin{aligned}R_1 &= 9 \Omega \\R_2 &= 4 \Omega \\R_4 &= 12 \Omega \\R_5 &= 36 \Omega \\R_t &= 12 \text{ V} \\I_t &= 1.0 \text{ A}\end{aligned}$$

2. (a) What do you understand by magnetic hysteresis? Differentiate between hard and soft magnetic materials. (30)
- (b) Deduce an expression for the average power in a single phase RL circuit and hence explain the term power factor. (30)
3. (a) Describe the working principle and construction of an induction type wattmeter. What are the errors in induction type wattmeter, and how are they compensated? (30)

- (b) The four arms of a Maxwell A.C. bridge are as follows:

AB and BC are non-inductive resistors of 100Ω each, DA is a standard variable inductor L of resistance 32.7Ω and CD comprises a standard variable resistor R in series with a coil of unknown impedance. Balance is obtained when $L = 47.8 \text{ mH}$ and $R = 1.36 \Omega$. Find the resistance and inductance of the coil. (30)

4. (a) (i) What are factors that control the speed of a DC motor? (10)
- (ii) A 500 V shunt motor runs at its normal speed of 250 rpm when the armature current is 200 A. The resistance of armature is 0.12Ω . Calculate the speed when a resistance is inserted in the field reducing the shunt field to 80% of normal value and the armature current is 100 A. (20)

- (b) A three phase induction motor having a 6-pole, star connected stator winding runs on 240 V, 50 Hz supply. The rotor resistance and standstill reactance are 0.12Ω and 0.85 ohm per phase. The ratio of stator to rotor turns is 1.8. Full load slip is 4%. Calculate the developed torque at full load. (30)

5. (a) What is loss load factor? Explain in detail how the loss load factor can be determined. (30)
- (b) Discuss various bus bar systems for distribution networks. (30)
6. (a) Discuss the laws of illumination and their limitations in actual practice. (30)
- (b) Draw the output characteristics of a common-emitter transistor. Show various regions of operation of the BJT on this characteristic. Describe the applications of operating the BJT into different regions. (30)