CBCS SCHEME

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18ELE13/23

First/Second Semester B.E. Degree Examination, June/July 2024
Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State Ohm's law. Mention its limitations. **(05 Marks)**

b. Define the following with reference to AC quantities, (i) Instantaneous value (ii) Frequency (iii) Time period (iv) Form factor (v) Peak factor. **(07 Marks)**

c. A 8 ohms resistor is in series with a parallel combination of two resistors 12 ohms and 6 ohms. If the current in the 6 ohms resistor is 5 A, determine the total power dissipated in the circuit. **(08 Marks)**

OR

2 a. State and explain Kirchoff's laws. **(08 Marks)**

b. Derive for an average value of sinusoidal voltage in terms of its maximum value. **(06 Marks)**

c. For the circuit shown in Fig. Q2 (c), the total power dissipated is 488 W. Calculate the current flowing in each resistance and pd between A and B. **(06 Marks)**

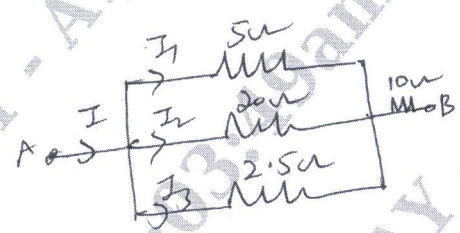

Fig.Q2 (c)

Module-2

3 a. List the advantages of three phase system over the single phase system. **(06 Marks)**

b. Prove that current in a purely inductive circuit lags behind the applied voltage by 90°. **(06 Marks)**

c. In a series parallel circuit, the two parallel branches A and B are in series with C. The impedances are $Z_A = (10 - j8)\Omega$, $Z_B = (9 - j6)\Omega$ and $Z_C = (3 + j2)\Omega$. The voltage across branch C is 100 V. Find the current Z_A and Z_B and phase difference between them. **(08 Marks)**

OR

4 a. Derive an expression for power in pure capacitor circuit and draw the voltage, current and power waveforms. **(06 Marks)**

b. In a three phase star connection, find the relation between line and phase values of currents and voltages. Also derive the equation for 3 phase power. **(06 Marks)**

c. Estimate the power factor in each of the following cases of Two Wattmeter method of measuring three phase power:

(i) Wattmeter readings are equal.

(ii) Wattmeter readings are equal and opposite.

(iii) Wattmeter readings are in the ratio 1 : 2

(iv) One Wattmeter reads zero. **(08 Marks)**

Module-3

5 a. Derive EMF equation of transformer. **(05 Marks)**

b. Define Earthing. Explain any pipe earthing with a neat diagram. **(08 Marks)**

c. A transformer is rated at 100 KVA. At full load its copper loss in 1200 W and its iron loss in 960 W. Calculate

(i) The efficiency at full load, unity power factor.

(ii) The efficiency at half load, 0.8 pf.

(iii) The load KVA at which maximum efficiency will occur.

(iv) Maximum efficiency at 0.85 pf. **(07 Marks)**

OR

6 a. Derive the condition for which the efficiency of a transformer is maximum. **(06 Marks)**

b. With neat sketches, explain 2-way and 3-way control of lamp with switching table. **(08 Marks)**

c. A 10 KVA, single phase transformer has a primary winding of 300 turns and secondary winding of 750 turns, cross section area of core in 64 cm^2. If primary voltage is 440 V at 50 Hz, find maximum flux density in the core emf induced in secondary of transformer. Calculate the efficiency of transformer at 0.8 pf lag if full load copper loss is 400 W and iron loss is 200 W. **(06 Marks)**

Module-4

7 a. Derive the EMF equation of DC generator. **(06 Marks)**

b. Sketch torque versus armature current and speed versus armature current characteristics of a DC motor and mention its applications. **(06 Marks)**

c. A 500 V DC shunt motor has 4 poles and wave connected winding with 492 conductors. The flux per pole is 0.05 wb. The full load current is 20 amps. The armature and shunt field resistances are 0.1 Ω and 250 Ω respectively. Calculate the speed and torque developed. **(08 Marks)**

OR

8 a. Explain with neat sketch, the constructional features of DC Generator and mention the function of each part. **(08 Marks)**

b. Derive an expression for the armature torque developed in a dc motor. **(06 Marks)**

c. A 4 pole generator with wave wound armature has 51 slots, each having 24 conductors. The flux per pole is 0.01 weber. At what speed must the armature rotate to give an induced emf of 220 V. What will be the voltage developed if the winding is lap connected and the armature rotates at the same speed. **(06 Marks)**

Module-5

9 a. Differentiate between salient pole type and non-salient pole type rotors of a synchronous generator. **(08 Marks)**

b. Define slip. Derive an expression for frequency of rotor current. **(05 Marks)**

c. A 2 pole, 3 phase alternator running at 3000 rpm has 42 armature slots with 2 conductors per slot. Calculate the flux/pole required to generate a line voltage of 2300 V. Distribution factor is 0.952 and pitch factor is 0.956. **(07 Marks)**

OR

10 a. Derive EMF equation of an Alternator. **(06 Marks)**

b. Explain the principle of operation of three phase Induction motor and give reason for an induction motor cannot run at synchronous speed. **(08 Marks)**

c. A 3 phase, 6 pole, 50 Hz Induction motor has a slip of 1% at no-load and 3% at full load. Determine :

(i) Synchronous speed
(ii) No-load speed
(iii) Full load speed
(iv) Frequency of rotor current at stand still
(v) Frequency of rotor current at full load. **(06 Marks)**

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