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18ELE13

First Semester B.E. Degree Examination, Dec.2018/Jan.2019
Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and explain Kirchhoff's laws as applied to an electric circuit. **(06 Marks)**

b. Given the network shown in Fig. Q1 (b), determine I_1, E, I_3 and I. If voltage across 9 Ω resistor is 27 V. **(08 Marks)**

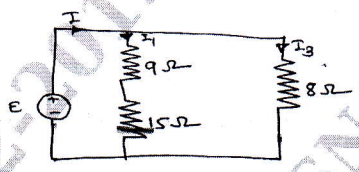

Fig. Q1 (b)

c. Derive the equation for root-mean-square value of an alternating current in terms of maximum value. **(06 Marks)**

OR

2 a. Define the (i) Frequency (ii) Form factor & (iii) Peak factor of sinusoidally varying voltage. **(06 Marks)**

b. The instantaneous values of two alternating voltages are represented respectively by $V_1 = 60\sin\theta$ volts and $V_2 = 40\sin\left(\theta - \frac{\pi}{3}\right)$ volts. Derive an expression for instantaneous value of : (i) the sum (ii) the difference of these voltages. **(08 Marks)**

c. For the network shown in Fig. Q2, calculate the power consumed by each resistor. **(06 Marks)**

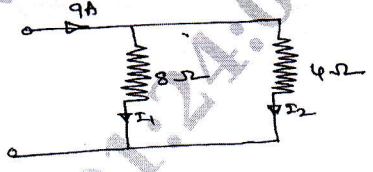

Fig. Q2

Module-2

3 a. Show that voltage and current in pure resistive circuit are in phase and power consumed in the circuit is equal to product of rms voltage and current. The circuit is excited by the a.c. source. **(06 Marks)**

b. A resistance of 7 Ω is connected in series with a pure inductance of 31.8 mH and the circuit is connected to a 100 V, 50 Hz, sinusoidal supply. Calculate
(i) Circuit current (ii) Phase angle (iii) Power factor (iv) Power. **(08 Marks)**

c. Two wattmeters are used to measure power in a 3-phase balanced load. The wattmeter readings are 8.2 kW and 7.5 kW. Calculate (i) Total power (ii) Power factor and (iii) Total reactive power. **(06 Marks)**

OR

4 a. Deduce the relationship between the phase and the line voltages of a three phase star connected system. **(06 Marks)**

b. Three coils are connected in delta to a three phase, three wire, 400 V, 50 Hz supply and take a line current of 5 A at 0.8 p.f. lagging. Calculate the resistance and inductance of the coils. **(06 Marks)**

c. A coil having a resistance of 20 Ω and inductance of 0.0382 H, is connected in parallel with a circuit consisting of a 150 μF capacitor in series with 10 Ω resistor. The arrangement is connected to a 230 V, 50 Hz supply. Determine current in each branch. Also find total supply current. **(08 Marks)**

Module-3

5 a. Explain the construction of a single phase transformer. **(06 Marks)**

b. A 50 KVA single phase transformer has primary and secondary turns of 300 and 20 respectively. The primary winding is connected to a 2200 V, 50 Hz supply.
Calculate (i) No load secondary voltage (ii) approximate values of the primary and secondary currents on full load (iii) Maximum value of flux density. **(06 Marks)**

c. With neat diagram, explain plate earthing. **(08 Marks)**

OR

6 a. Derive E.M.F equation of single phase transformer. **(06 Marks)**

b. With neat circuit and truth table, explain three way control of lamp. **(06 Marks)**

c. A 400 KVA transformer has a core loss of 2 kW and maximum efficiency at 0.8 p.f. occurs when the load is 240 kW. Calculate (i) The maximum efficiency at unity power factor. (ii) the efficiency on full load at 0.71 power factor. **(08 Marks)**

Module-4

7 a. Draw a labeled diagram of the cross section of a d.c. generator. What are the essential functions of the field coils, armature, commutator and brushes? **(08 Marks)**

b. A four-pole armature of d.c. generator has 624 lap-connected conductors and is driven at 1200 rpm. Calculate the useful flux per pole required to generate an E.M.F of 250 V. **(06 Marks)**

c. A four pole motor is fed at 440 V and takes an armature current of 50 A. The resistance of the armature circuit is 0.28 ohm. The armature winding is wave-connected with 888 conductors and useful flux per pole is 0.023 wb. Calculate back emf and speed. **(06 Marks)**

OR

8 a. Obtain from first principles an expression for torque developed in d.c. motor. **(06 Marks)**

b. Explain characteristics of d.c. shunt motor. **(06 Marks)**

c. A shunt generator running at 500 rpm delivers 50 kW at 200 V. The armature and field resistances are 0.02 and 40 Ω respectively. Calculate generated E.M.F if brush drop of 1 V per brush. **(08 Marks)**

Module-5

9 a. By means of a diagram, describe the main parts of synchronous generator with their functions. **(08 Marks)**

b. The stator of a 3-phase, 8 pole, 750 rpm alternator has 72 slots, each of which contains 10 conductors. Calculate the rms value of the emf per phase if flux per pole is 0.1 Wb sinusoidally distributed. Assume full pitch coils and winding distribution factor of 0.96. **(06 Marks)**

c. A 4-pole, 3300 V, 50 Hz induction motor runs at rated frequency and voltage. The frequency of the rotor currents is 2.5 Hz. Find slip and running speed. **(06 Marks)**

OR

10 a. Deduce an expression for the frequency of rotor current in an induction motor. **(06 Marks)**

b. A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50 Hz. Calculate,
(i) Synchronous speed.
(ii) The speed of the rotor when the slip is 0.04.
(iii) The frequency of the rotor current when the slip is 0.03.
(iv) The frequency of the rotor current at standstill. **(08 Marks)**

c. Derive e.m.f equation for synchronous generator. **(06 Marks)**

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