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First/Second Semester B.E. Degree(CBCS)Examination

Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. A circuit has 1000 turns enclosing a magnetic circuit $20\ cm^2$ in section, with $4\ A$ the flux density is $1.0\ T$ and with $9\ A$ it is $1.4\ T$. Find the mean value of the inductance between these current limits and the induced electromotive force if the current fell uniformly from $9A\ to\ 4\ A$ in $0.05\ s$. Also determine the energy stored at the end of $0.05\ s$. **(05 Marks)**

b. Find the value of R and the current flowing through it in the circuit shown when the current in branch OA is zero. Workout the problem stating the reasons at different steps. **(05 Marks)**

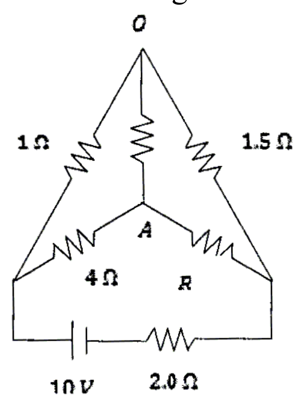

Fig. Q1 (b)

c. When $10\ \Omega$ load is applied to a unknown voltage source a current of $2.5\ A$ flows and when the load resistance is increased to $20\ \Omega$, the current drops to $2\ A$.If a load of $15\ \Omega$ is connected across the source, what is the voltage across is it? Also calculate the power dissipated in the circuit. **(06 Marks)**

OR

2 a. Calculate the power delivered to $16\ \Omega$ in the circuit shown in Fig. Q2 (a). **(05 Marks)**

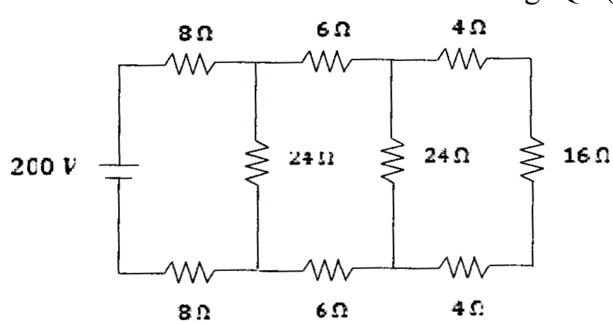

Fig. Q2 (a)

b. A square coil of 10 cm side and with 100 turns is rotated at a uniform speed of 1000 rpm about an axis at right angles to a uniform field having a flux density of 0.5 T. Calculate the instantaneous value of induced emf when the plane of the coil is (a) at 30° to the field, and (b) in the plane of the field. **(05 Marks)**

c. Two toroidal solenoids are wound around the same form so that the magnetic field of one passes through the turns of the other. Solenoid 1 has 700 turns and solenoid 2 has 400 turns. When the current in solenoid 1 is 6.52 A, the average flux through each turn of solenoid 2 is 0.0320 Wb.
(a) What is the mutual inductance of the pair of solenoids?
(b) When the current in solenoid 2 is 2.54 A, what is the average flux through each turn of solenoid 1. **(06 Marks)**

Module-2

3 a. Explain the principle of operation of dc motor. **(05 Marks)**

b. Explain with a diagram (legible), the constructional features and operation of an induction type single phase energy meter. Show that revolutions of the disc is proportional to the energy consumed. **(05 Marks)**

c. In a $110\ V$, compound generator the resistance of armature, shunt and series windings are $0.06\ \Omega, 25\ \Omega$ and $0.04\ \Omega$ respectively. The load consists of 200 lamps each rated at $55\ W, 110\ V$. Find the total electromotive force and armature current when the machine is connected (a) long shunt; (b) short shunt. Ignore armature reaction and brush contact drop. **(06 Marks)**

OR

4 a. Deduce the relation between back emf and voltage applied to a short shunt compound dc motor. Explain the variation of back emf and load current with respect to load changes. **(05 Marks)**

b. Explain with a diagram (legible), the constructional features and operation of single phase dynamometer type wattmeter. What are its salient features? **(05 Marks)**

c. A 4 pole, lap wound dc shunt generator has a useful flux of 0.08 Wb. The armature winding has 260 turns, each of resistance $0.006\ \Omega$. Determine the terminal voltage when running at 1000 rpm and supplying an armature current of 55 A. **(06 Marks)**

Module-3

5 a. Calculate the impedance AB and the phase angle between voltage and current in the circuit shown in Fig. Q5 (a). **(05 Marks)**

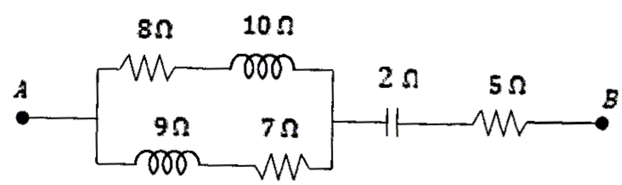

Fig. Q5 (a)

b. Explain the reason for the use of residual current circuit breaker. With relevant circuit diagram explain the operation of residual current circuit breaker. **(05 Marks)**

c. When a voltage of 100 V at 50 Hz is applied to coil A, the current taken is 8 A and the power 120 W. When applied to coil B the current is 10A and the power 500 W. What current and power is taken when 100 V is applied to the two coils connected in series. **(06 Marks)**

OR

6 a. Two voltages $V_{AB} = 50\ V$ and $V_{BC} = 75\ V$ at the same frequency and with a phase difference between them of $60°$ act in series in a circuit. Find the voltage V_{AC} and its phase position relative to V_{BC}. **(05 Marks)**

b. A voltage of 125 V at 60 Hz is applied across a non – inductive resistor connected in series with a capacitor. The current is 2.2 A. If the capacitive reactive power is 256.5 VAR, calculate the resistance, capacitance, power factor and the power delivered to the circuit. Neglect the loss in the capacitor. **(05 Marks)**

c. Write a short note on : (i) Miniature Circuit Breaker and (ii) Equipment Earthing **(06 Marks)**

Module-4

7 a. Prove that the line voltage in a star connected RYB phase sequence three phase system leads the phase voltage by 30^o. Obtain an expression for line voltage in terms of phase voltage. **(05 Marks)**

b. Each of two watt meters connected to measure the input to a three phase circuit reads 10 kW on a balanced load when the power factor is unity. What does each instrument read when power factor falls to 0.866 lagging. **(05 Marks)**

c. Find the number of armature turns in series per phase and the total number of armature conductors required for the armature of a 3 phase, 50 Hz, 10 pole alternator with ninety slots. The winding is to be star connected to give a line voltage of 11000V. The flux per pole is 0.16 Wb. Coil span is 9 slots. Do not make any assumption. **(06 Marks)**

OR

8 a. A balanced three phase, 400 V system supplies a balanced delta connected load. The current in each branch circuit is 20 A and the phase angle is 40^o lagging. Draw the phasor diagram showing the voltages and currents in the lines and circuits for the three phases. Mark the angles between phasors corresponding to phase A. The phase sequence is ABC. **(05 Marks)**

b. A 3 phase, 6 pole star connected alternator revolves at 1000 rpm. The stator has 90 slots and 8 conductors per slot. The flux per pole is 0.05Wb. The winding is chorded by one slot. Calculate the distribution factor, pitch factor and the line voltage generated. **(05 Marks)**

c. A three phase delta connected motor operating on a 400 V supply is delivering 25 HP at an efficiency of 0.87 and power factor of 0.42. Calculate the line current, phase current and the readings of two watt meters connected to measure the input. Assume, $\text{one horse power} = 746\ W$. Check the validity of wattmeter readings with any other available data in the problem. **(06 Marks)**

Module-5

9 a. With reasoning, for a transformer, show that

$$(i) v_1 i_1 = v_2 i_2 (ii) N_1 i_1 = N_2 i_2 and (iii) \frac{v_1}{N_1} = \frac{v_2}{N_2}$$

The transformer can be considered as ideal. **(05 Marks)**

b. A 6 pole alternator runs at 1000 rpm, and supplies power to a 4 pole, 3 phase induction motor. The frequency of rotor of induction motor is 2 Hz. Determine the slip and speed of the motor. Also, determine the slip at no load of the induction motor, if the difference between the synchronous speed and no load speed is 10 rpm. **(05 Marks)**

c. A transformer has a maximum efficiency of $98\,\%$ at three-fourth of its full load and unity power factor. The copper loss at three-fourth full load and unity power factor is $314\ W$. Compute the efficiency of the transformer at $50\,\%$ and $100\,\%$ rated full load at the same power factor. **(06 Marks)**

OR

10 a. Show that a three phase winding when excited by a three phase supply establishes a rotating magnetic field. **(05 Marks)**

b. Obtain an expression for the load kVA at which maximum efficiency occurs in a transformer. **(05 Marks)**

c. Discuss the variation in rotor emf frequency of three phase induction motor as the load changes. Derive any formula used to substantiate the variation. **(06 Marks)**

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