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Total number of printed pages – 4

B. Tech  
BE 2102

First Semester Examination – 2013  
BASIC ELECTRICAL ENGINEERING

QUESTION CODE : C- 614

Full Marks – 70

Time : 3 Hours

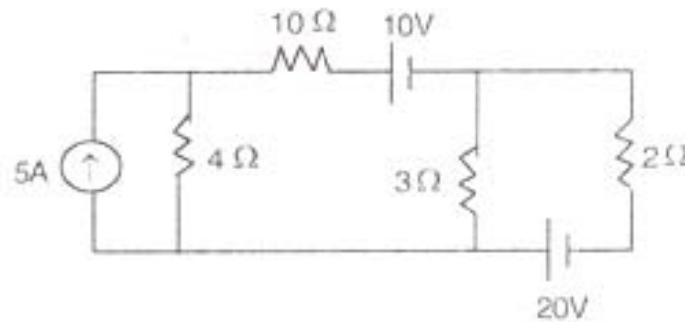
Answer Question No. 1 which is compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) Define resistivity. What are the factors affecting it ?
  - (b) A resistance R is connected across a d.c. supply of 220 V and dissipates energy of 440 watts. What is the value of R ?
  - (c) State and explain Superposition theorem.
  - (d) What do you understand by controlled voltage source ?
  - (e) Define retentivity and permeability with reference to magnetic circuit.
  - (f) Calculate the power dissipated in a 20 ohm resistor when a voltage of  $(400+400 \sin 314t)$  is applied across it ?
  - (g) An alternating voltage  $V=160+j120$  volts is applied to a circuit and the current flows  $I = -6+j15$  amp. What is the impedance of the circuit ?
  - (h) Define Form factor of an alternating quantity.



P.T.O.

- (i) A balanced 3 phase star connected load of 100 kW takes a lagging current of 100 amp when connected to a 440 V, 50 Hz supply .Find the impedance of the load per phase.
- (j) Write the speed equation of a d.c. motor . Also explain the term associated with it.
2. (a) Explain the characteristics of open and short-circuit in electrical network by drawing a circuit diagram. 5
- (b) Determine the current and voltage across the  $2\ \Omega$  resistor in the given Fig (1) below using KVL. 5



Fig(1)

3. (a) The current taken by a coil is 6A when a voltage of 120V at 50 Hz frequency is applied across its terminal .The power absorbed by the coil is 200 W. When the same voltage is applied to the second coil the current drawn is 4A and power absorbed is 160W. Now both the coils are connected in series and the series combination is connected across the same supply voltage. Find the current taken and power absorbed by this series combination. 5
- (b) Show from the fundamentals that the current in a series RC circuit leads the applied voltage by an angle less than  $90^\circ$  5
4. (a) Derive the mathematical expression for the charge stored in the capacitor of a R-C series circuit connected across a d.c. Voltage source. 5

- (b) A  $2\mu\text{F}$  capacitor is charged to a p.d. of  $200\text{ V}$  is discharged through a resistor of  $2\text{ M}\Omega$ . Calculate 5
- (i) The initial value of the discharge current
  - (ii) The value of the current after 4 sec later
  - (iii) The value of the capacitor charge after 4 sec
5. (a) In a single-phase series circuit consists of a non inductive resistor of  $10\ \Omega$ , an inductance of  $0.159\text{H}$  and a capacitance of  $106\ \mu\text{F}$ . The circuit is energized from a  $230\text{V}$ ,  $50\text{Hz}$  supply. Calculate 5
- (i) Impedance and current
  - (ii) Power factor and power absorbed in the circuit
- (b) What is the basic principle of operation of D.C motor? Also write down the expressions for the "back emf" induced in a DC shunt motor explaining each term. 5
6. (a) Derive the 'emf equation' for the emfs induced in the windings of a single-phase two winding transformer. 5
- (b) A magnetic circuit comprises two parts in series having each uniform cross-sectional area. They are 5
- (i) Iron length =  $90\text{ mm}$  and area  $75\text{ mm}^2$
  - (ii) An air gap length =  $0.8\text{ mm}$  and area of  $85\text{ mm}^2$

A Coil wound on the iron part takes a current of  $90\text{ Amp}$  to produce a flux density of  $0.6\text{ Tesla}$  in the air gap. The relative permeability of iron is  $2500$ . Calculate the number of turns required in the coil assuming all the flux to pass through the given magnetic circuit.

7. (a) Three impedances of each  $(8+6j)$  are star connected to a 3-phase, 400 V, 50 Hz supply. What will be the total power consumed? What would be the change in power consumed if the same impedances are connected in delta?

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- (b) What do you mean by the term 'Slip' of a three-phase induction motor? Calculate the slip of a 6 pole induction motor running at 960 rpm while drawing power from a three-phase balanced source of 440 V and 50 Hz frequency.

5

8. Write short notes on any two of the following :

5×2

- (a) Node Voltage Analysis .  
(b) Complex Power  
(c) Alternator.  
(d) Grounding and safety.

