B.Tech/AEIE/CSE/ECE/IT/1st Sem/ELEC-1001/2015

2015

BASIC ELECTRICAL ENGINEERING

(ELEC 1001)

Time Alloted : 3 Hours *Full Marks : 70*

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : **[10×1=10]**

   i) Kirchhoff's current law (KCL) is based on
   (a) conservation of energy
   (b) conservation of charge
   (c) both (a) and (b)
   (d) none of the above

   ii) The efficiency in case of maximum power transfer theorem is
   (a) 100% (b) 50%
   (c) 25% (d) None of the above

   iii) Eddy current loss is proportional to
   (a) 1/frequency (b) frequency^2
   (c) frequency^3 (d) frequency

   iv) The core of the transformer is laminated to reduce
   (a) hysteresis loss (b) eddy current loss
   (c) copper loss (d) all of the above

   v) When resonance occurs in R-L-C series circuit, the circuit becomes
   (a) capacitive (b) inductive
   (c) resistive (d) no change occurs

   vi) If a dc series motor is started at no load, the speed will be
   (a) very high (b) rated speed
   (c) zero (d) half of rated speed

   vii) The internal resistance of an ideal current source is
   (a) zero (b) infinite
   (c) high (d) none of the above

   viii) Three resistors of 4 ohm, 6 ohm and 8 ohm are in parallel. In which resistor, power dissipation will be maximum?
   (a) 4 ohm (b) 6 ohm
   (c) 8 ohm (d) equal in all resistors

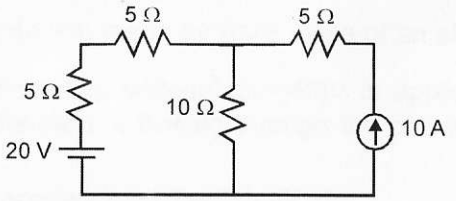
   ix) For a six pole wave winding machine the number of parallel path will be
   (a) 4 (b) 6
   (c) 2 (d) 3

   x) What is the synchronous speed of a 3 phase induction motor with 12 pole at 50 Hz supply?
   (a) 3000 rpm (b) 1500 rpm
   (c) 1000 rpm (d) 500 rpm

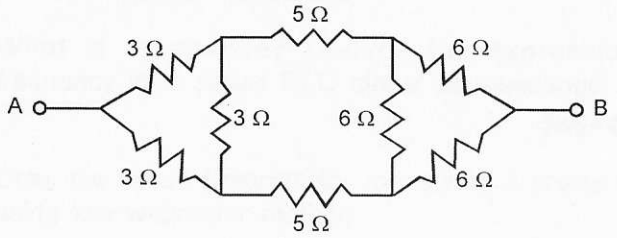
GROUP - B

2. (a) State and explain Thevenin's Theorem.

   (b) Find out the current through 10Ω resistance of the following circuit using Superposition Theorem.



   (c) Find out the equivalent resistance across the terminals A and B of the following circuit.



3+5+4 = 12

3. (a) Derive the EMF equation of DC generator.

   (b) Draw and explain the open circuit characteristic of a separately excited DC generator.

   (c) What do you understand by critical field resistance of DC shunt generator?

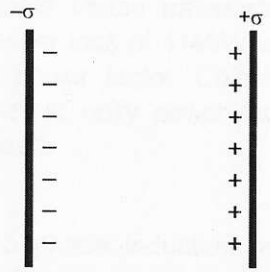
   (d) Calculate the emf generated by a 4 pole wave wound armature having 48 slots with 16 conductors per slot when driven at 1000 rpm. The flux per pole is 0.018 wb.

4+3+2+3 = 12

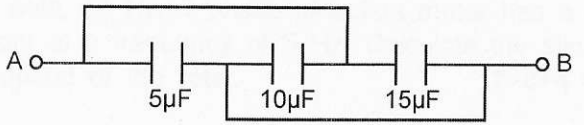
GROUP - C

4. (a) State and explain Gauss's law.

   (b) Two large conducting plate are placed parallel to each other and they carry equal and opposite charge with surface charge density σ as shown in figure below. Find the electric field (i) at the left of the plates, (ii) in between the plates and (iii) at the right of the plates.



   (c) Find the equivalent capacitance between terminals A and B of the following circuit and also find out the energy stored in each capacitor when a 100V battery is connected across the terminals A and B.



(2+2)+(1+2+1)+4 = 12

5. (a) Define self-inductance and mutual inductance. What do you mean by co-efficient of coupling?

   (b) When two coils are connected in series, their effective inductance is 10 H. When the connection of one coil is reversed, the effective inductance becomes 6H. Find the mutual inductance between the coils.

(c) Calculate the magnetomotive force (mmf) required to produce a flux of 0.02 Wb across an air gap 2.0 mm thick, having an effective area of 100 cm^2.

4+3+5 = 12

Group - D

6. (a) What do you mean by RMS value of an electric current?

(b) An alternating voltage (80+j60)V is applied to a circuit and the current flowing through the circuit is (–4+j10)A. Find

(i) impedance of the circuit

(ii) power factor

(iii) active power consumed

(c) What is resonance? Deduce the expression for frequency in a series RLC circuit at resonance.

3+5+4 = 12

7. (a) Draw the circuit Diagram for measuring 3 phase power using two wattmeter method.

(b) Prove that the total power consumed in a 3 phase system is the algebraic sum of two wattmeter readings.

(c) The input power to a 3 phase motor was measured by two wattmeter method. The readings are 5.2 KW and 1.7 KW, the later reading obtained after reversal of current coil connection. The line voltage was 400V. Calculate (I) total power, (ii) power factor, (iii) the line current.

2+4+6 = 12

GROUP - E

8. (a) "For a two winding transformer the current in the primary side increases when the load is connected in the secondary side, though the primary side is not physically connected with secondary." – Justify with reasons.

(b) Draw well-labelled phasor diagram for a transformer under lagging power factor load.

(c) A 40 KVA single phase transformer has iron loss of 800W and copper loss of 1140W when supplying its full load at unity power factor. Calculate the efficiency of the transformer at unity power factor, at full load and also at half load.

3+3+6 = 12

9. (a) Classify the 3 phase induction motors based on the construction of rotor.

(b) Explain the generation of rotating magnetic field in 3 phase induction motor when 3 phase supply is applied to its stator winding.

(c) A 4 pole, 50 Hz, 3 phase induction motor has a rotor current at a frequency of 5 Hz. Calculate the slip and the speed of the rotor. **2+6+4 = 12**