Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/SEM-2/EE-201/2010

2010

BASIC ELECTRICAL ENGINEERING

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) When a linear network is excited by an alternating waveform, the response in all parts of the network would have the same waveform and frequency if the excitation has a

      a) sinusoidal waveform

      b) triangular waveform

      c) square waveform

      d) sawtooth waveform.

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ii) To draw the phasor diagram of a reactive circuit having a number of branches connected in parallel across a common voltage, which of the following is more convenient to use as the reference phasor ?

a) Circuit current b) Branch current

c) Source voltage d) Input power.

iii) When the phase sequence of a three-phase sinusoidal system is stated as $a - b - c$, it implies that

a) phase voltage a leads the phase voltage b by 120°

b) phase voltage a lags the phase voltage c by 120°

c) phase voltage b leads the phase voltage c by 120°

d) all of these.

iv) Which of the following is not true of leakage flux ?

a) It links both the winding through air

b) It links the primary winding through air

c) It links the secondary winding through air

d) It does not link both the windings.

v) What is done to balance the *mmf* setup due to the secondary current ?

a) The primary voltage is increased

b) The core flux is increased immediately

c) The current in the primary is increased

d) All of these.

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vi) What happens when the phase sequence of the voltage applied to the stator of a three-phase induction motor is changed ?

a) Motor does not run

b) Slip changes

c) Direction of rotation is reversed

d) Motor gets heated.

vii) In order that a *dc* generator be able to excite & generate voltage, the value of the field winding resistance should be

a) of any value

b) less than the critical value

c) equal to the critical resistance

d) greater than the critical resistance.

viii) If the direction of current flowing in a conductor is in the plane of the paper, the magnetic flux lines by it are

a) concentric circles in the clock-wise direction

b) concentric circles in the anti-clockwise direction

c) straight lines parallel to the conductor & in the opposite direction of current flow

d) straight lines parallel to the conductor & in the direction of current flow.

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ix) Thevenin's theorem cannot be applied to networks that contain elements which are

a) linear b) non-linear

c) active d) passive.

x) Which of the elements in the following is not bilateral ?

a) Resistor b) Inductor

c) Capacitor d) Transistor.

xi) In a magnetic circuit, once a flux is set up

a) no further energy is required

b) energy is continuously required to maintain the flux

c) energy is released in the form of heat

d) none of these.

xii) Everytime a phasor is multiplied by the operator *j*, it causes the phasor to rotate in the anti-clockwise direction through

a) 90° b) 120°

c) 180° d) 270°.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Derive the expression for energy stored in electric field.

3. Define R.M.S. value of alternating quantity & derive its expression for sinusoidal current. 2 + 3

4. a) Explain what will happen to transformer if we give *DC* supply to it.

   b) Define voltage regulation of a transformer at a given load. 3 + 2

5. Explain with neat sketch the principle of operation of a *DC* generation.

6. Derive the relationship between the line current & phase current, line voltage & phase voltage for a balanced three-phase delta connected lagging power factor load connected across three-phase supply.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) In the following circuit, find the value of the unknow resistance, *R*, so that maximum power will be transferred to load. Also find maximum power.

Dia.

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b) Apply the Thevenin's theorem to colculate the current in 6 Ω resistor for the following circuit

Dia.

8 + 7

8. a) A coil having resistance of 50 Ω and inductance of 0·02H is connected in parallel with a capacitor of 25 μF across a 200 V, 50 Hz supply. Find the current in the coil and the capacitor. Also find total current taken from the supply and overall power factor. Draw a neat phasor diagram.

b) Find the resultant current in the following form :
$i = i_m \sin(\omega t \pm \phi)$, if the current at a node are

$i_1 = 5 \sin \omega t$, $i_2 = 10 \sin\left(\omega t - \frac{\pi}{6}\right)$,

$i_3 = 5 \cos\left(\omega t + \frac{\pi}{6}\right)$ and $i_4 = 10 \sin\left(\omega t + \frac{3\pi}{6}\right)$.

10 + 5

9. a) A 2200/250 volt transformer has primary resistance and reactance of 5 Ω and 6·2 Ω respectively. The secondary resistance and reactance values are 0·03 Ω and 0·06 Ω .

Calcuate,

i) equivalent resistance referred to primary side

ii) equivalent resistance referred to secondary side

iii) equivalent reactance referred to primary side

iv) equivalent reactance referred to secondary side.

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b) The open circuit & short circuit tests on a 4 kVA, 200/400V, 50 Hz, single phase transformer gave the following results :

OC test on the Lv side : 200V, 1A, 100W

SC test with the LV side opened : 15 V, 10 A, 85 W :

i) Determine the parameters of the equivalent circuit

ii) Draw the equivalent circuit referred to the LV side. 5 + 10

10. a) A cast steel ring has a cross-section area of 7·5 sq cm & a mean length with a circumference of 75 cm. The ring is uniformly wound with 900 turns. Find out the current required to produce a flux density of 1 Wb/m^2 in the ring if the relative permeability of cast steel is 1500. If a saw cut of 1·5 mm is made in the ring, find out the current required to give the same flux density in the ring.

b) Two coils having 3000 & 2000 turns are wound are wound on a magnetic ring. 60% of flux produced in first field coil links with second coil. A current of 3A produces flux of 0·5 mWb in the first coil & 0·3 mWb in the second coil. Determine the mutual inductance & the coefficient of coupling. 10 + 5

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11. a) The no-load speed of an induction motor is 1500 rpm. When it is connected across a voltage source of frequency 50 cycles/sec, the motor speed is 1200 rpm at full load.

Determine,

i) the number of poles

ii) slip

iii) rotor frequency

iv) speed of the rotor field with respect to the rotor

v) rotor speed with respect to the stator

vi) the speed of the rotor field in the air gap with respect to the stator field.

b) Draw & explain the equivalent circuit of a 3-phase induction motor. 9 + 6

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