

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.*

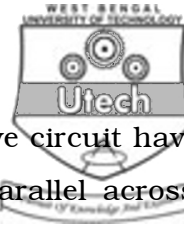
**GROUP – A**

**( Multiple Choice Type Questions )**

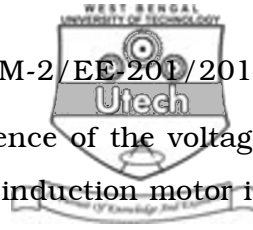
1. Choose the correct alternatives for the following :

$$10 \times 1 = 10$$

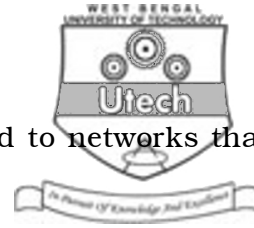
- i) When a linear network is excited by an alternating waveform, the response in all parts of the network would have the same waveform and frequency if the excitation has a
- a) sinusoidal waveform
  - b) triangular waveform
  - c) square waveform
  - d) sawtooth waveform.



- 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  $120^\circ$
  - b) phase voltage  $a$  lags the phase voltage  $c$  by  $120^\circ$
  - c) phase voltage  $b$  leads the phase voltage  $c$  by  $120^\circ$
  - 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.



- 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.



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)  $90^\circ$
- b)  $120^\circ$
- c)  $180^\circ$
- d)  $270^\circ$ .



**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 unknown resistance, *R*, so that maximum power will be transferred to load. Also find maximum power.

Dia.



- b) Apply the Thevenin's theorem to calculate the current in 6  $\Omega$  resistor for the following circuit

Dia.

8 + 7

8. a) A coil having resistance of 50  $\Omega$  and inductance of 0.02H is connected in parallel with a capacitor of 25  $\mu$ F 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

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

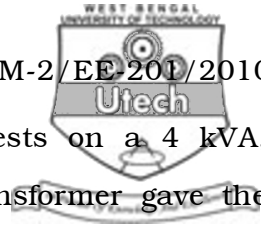
$$i_3 = 5 \cos \left( \omega t + \frac{\pi}{6} \right) \text{ and } i_4 = 10 \sin \left( \omega t + \frac{3\pi}{6} \right).$$

10 + 5

9. a) A 2200/250 volt transformer has primary resistance and reactance of 5  $\Omega$  and 6.2  $\Omega$  respectively. The secondary resistance and reactance values are 0.03  $\Omega$  and 0.06  $\Omega$ .

Calculate,

- equivalent resistance referred to primary side
- equivalent resistance referred to secondary side
- equivalent reactance referred to primary side
- equivalent reactance referred to secondary side.



- 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<sup>2</sup> 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



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

=====