

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech/SEM-1/EE-101/2009-10  
2009**

**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 any *ten* of the following :

$$10 \propto 1 = 10$$

- i) In an *a.c.* circuit having *R*, *L* & *C* in series & operating on lagging p.f., increase in frequency will
- a) reduce the current
  - b) increase the current
  - c) both (a) and (b) are possible
  - d) have no effect on current drawn.
- ii) KCL is a consequences of law of conservation of
- a) energy
  - b) change
  - c) flux
  - d) all of these.



- iii) In a transformer, the resistance between the primary & secondary must be
- a) zero
  - b)  $1\text{ k}\Omega$
  - c)  $100\text{ k}\Omega$
  - d) infinite.
- iv) The armature of a *d.c.* machine is laminated
- a) to reduce the hysteresis losses
  - b) to reduce the eddy current losses
  - c) to reduce the inductance of the armature
  - d) to reduce the mass of the armature.
- v) What will happen if the supply terminals of *d.c.* shunt motor are interchanged ?
- a) Motor will stop
  - b) The motor will run in the same original direction
  - c) The direction of rotation will reverse
  - d) Motor will run at a speed lower than the normal speed in the same direction.
- vi) The speed at which the rotating magnetic field produced by stator currents rotates is
- a) synchronous speed
  - b) rotor speed
  - c) greater than synchronous speed
  - d) lower than synchronous speed.



vii) A series circuit is given by  $z = 5 - j 12$ . Its susceptance is

- |                    |                       |
|--------------------|-----------------------|
| a) $\frac{5}{13}$  | b) $\frac{5}{169}$    |
| c) $\frac{12}{13}$ | d) $\frac{12}{169}$ . |

viii) The value of the resistance  $R_L$  for maximum power transfer will be

dia.

- |              |                |
|--------------|----------------|
| a) $5\Omega$ | b) $2\Omega$   |
| c) $6\Omega$ | d) $3\Omega$ . |

ix) The *d.c.* motor needs a starter during starting to control

- |            |            |
|------------|------------|
| a) speed   | b) current |
| c) voltage | d) flux.   |

x) In a 3-phase star connected system, the relation between the phase & line voltage is

- |                                 |                            |
|---------------------------------|----------------------------|
| a) $V_P = V_L$                  | b) $V_P = \sqrt{3} V_L$    |
| c) $V_P = \frac{V_L}{\sqrt{3}}$ | d) $V_P = \frac{V_L}{3}$ . |

- GROUP – B**

Answer any *three* of the following.

$$3 \propto 5 = 15$$

- $$1 + 2 + 1 + 1$$



4. The equation for a voltage wave is

$$v = 0.02 \sin ( 4000 t + 30^\circ ).$$

Find the frequency, the instantaneous voltage when  $t = 320 \mu \text{ sec}$ . What is the time represented by  $30^\circ$  phase difference ?

5. State & explain

a) Biot-Savart law

b) Ampere's circuital law.

5

6. Explain with the help of diagrams, how a rotating magnetic field is produced in the air-gap of a 3-phase induction motor.

5

### GROUP – C

#### ( Long Answer Type Questions )

Answer any *three* of the following.  $3 \times 15 = 45$

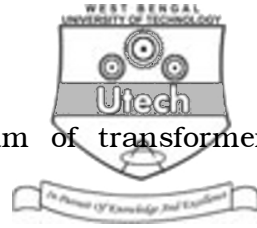
7. a) The circuit shown in the figure is connected to a 230 V, 50 Hz supply. Find the value of
- the current drawn
  - voltages  $V_1$  &  $V_2$
  - power factor.

Draw a phasor diagram, indicating the terminal voltages  $V_1$ ,  $V_2$  & the supply voltage with respect to current.

Dia.

- b) Prove that the average power in an *a.c.* circuit is equal to  $V I \cos \phi$ . Explain the significance of  $\cos \phi$  in the expression.

10 + 5



8. a) Draw & explain the phasor diagram of transformer when it is operating under no-load.

- b) A 5 kVA, 200 / 400 V, 50 Hz single-phase transformer gave the following results :

OC test : 200 V, 0.7 A, 60 W on *lv* side

SC test : 22 V, 10 A, 120 W on *hv* side.

Determine the values of parameters of the equivalent circuit.

5 + 10

9. a) Why does the *d.c.* motor draw a very high current at starting, when started directly on line ?
- b) How can you control the speed of a *d.c.* motor in the lower range of speed which is less than its rated value ?
- c) A 4-pole *d.c.* shunt generator with lap connected armature supplies a load of 100 A at 200 V. The armature resistance is 0.1  $\Omega$  & the shunt field resistance is 80  $\Omega$ . Find
- i) total armature current
  - ii) current per armature path
  - iii) *emf* generated.

Assume a brush contact drop of 2 V.

3 + 5 + 7



10. a) Deduce an expression of energy stored in magnetic field.
- b) An iron ring of mean length 60 cm has an air gap of 2 mm. It is wound with 300 turns of wire. If the relative permeability of iron is 300 when a current of 0.7 A flows through the coil. Find the flux density.

5 + 10

11. a) Solve the network shown in figure, for the current in the 8  $\Omega$  resistor by the following methods :

Dia.

- i) Superposition theorem
- ii) Thevenin's theorem.
- b) Three inductive coils, each with a resistance of 15  $\Omega$  & an inductance of 0.03 H are connected in star to 3-phase 400 V, 50 Hz supply. Calculate
- i) Phase current & line current
- ii) Total power absorbed.

10 + 5

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12. a) Define 'slip' of a 3-phase induction motor.
- b) Derive the relationship between the frequency of the rotor induced *emf* & the supply frequency to the stator.
- c) Sketch & explain the torque-slip characteristics of a 3-phase induction motor.
- d) An 8-pole alternator runs at 750 rpm. It supplies power to a 6-pole, 3-phase induction motor, which has a full load slip of 3%. Find the full load speed of the induction motor & the frequency of its rotor *emf*.

2 + 3 + 3 + 7

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