



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 :

$$10 \infty 1 = 10$$

- 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.



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° 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.

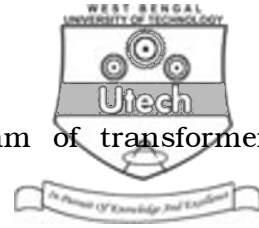
Draw a phasor diagram, indicating the terminal voltages V_1 , V_2 & the supply voltage with respect to current.

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

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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 Ω & the shunt field resistance is 80 Ω . 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 Ω resistor by the following methods :

Dia.

- i) Superposition theorem
- ii) Thevenin's theorem.
- b) Three inductive coils, each with a resistance of 15 Ω & 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

