



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(EEE)/SEM-6/EEE-601/2012
2012
ELECTRICAL MACHINES - II

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 :

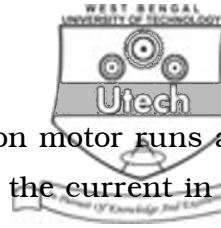
$10 \times 1 = 10$

- i) A 3-phase slip-ring induction motor has 4-pole stator and 2-pole rotor. With its stator energised from 50 Hz source, the rotor would run at a no-load speed of
- a) somewhat less than 1500 rpm
 - b) somewhat less than 3000 rpm
 - c) somewhat less than 1000 rpm
 - d) of zero rpm.

- 6011



- vi) The effect of leading power factor on the voltage regulation of an alternator is
- a) decreasing in nature
 - b) increasing in nature
 - c) decreasing or increasing
 - d) inconsequential.
- vii) The magnetic circuit of 3-phase alternator at unity pf is
- a) underexcited
 - b) overexcited
 - c) normally excited
 - d) none of these.
- viii) In a 3-phase salient pole synchronous machine where x_d = d -axis synchronous reactance and x_q = q -axis synchronous reactance
- a) $x_d = x_q$
 - b) $x_d < x_q$
 - c) $x_d > x_q$
 - d) $x_q = 0$.
- ix) The direction of rotation of a 1-phase induction motor can be reversed by
- a) reversing the leads of supply
 - b) reversing the leads of main winding only
 - c) reversing the leads of auxiliary winding only
 - d) either (b) or (c).



- x) A 6-pole, 50 Hz, single phase induction motor runs at a speed of 900 rpm. The frequencies of the current in the cage rotor will be
- a) 5 Hz, 55 Hz b) 5 Hz, 75 Hz
- c) 5 Hz, 95 Hz d) 10 Hz, 95 Hz.
- xi) Rotational voltage in *ac* commutator motor is
- a) in phase with exciting field
- b) out of phase with exciting field
- c) either (a) or (b)
- d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) What is a circle diagram ? What assumptions are made in drawing the circle diagram ?
- b) Why is reduced stator voltage applied to perform the blocked rotor test of 3-phase induction motor ?
 $(1 + 2) + 2$
3. How do the change in supply voltage and frequency affect induction motor performance ?
 $2 \frac{1}{2} + 2 \frac{1}{2}$
4. 3-phase synchronous motors are not self starting. Explain. How this problem can be overcome ?
 $4 + 1$
5. What will happen when a *dc* shunt motor is operated from a single phase *ac* supply of same nominal voltage ?
6. Explain why in single phase induction motor, the direction of rotation is always from auxiliary winding to main winding whether a resistance or capacitance is connected in series with auxiliary winding.

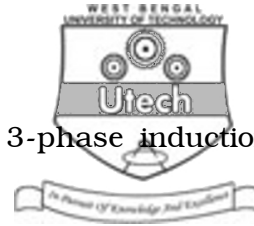


GROUP – C

(Long Answer Type Questions)

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

7. a) A single phase induction motor has no starting torque but running torque. Explain from double revolving field theory.
- b) A 220 V, 50 Hz, single phase induction motor has rotational loss of 15 W and the following parameters are given :
- $$r_1 = 2.5 \text{ ohm}, x_1 = 5.5 \text{ ohm}, x_m = 98 \text{ ohm},$$
- $$r_2 = 6.5 \text{ ohm}, x_2 = 4.3 \text{ ohm}.$$
- Find the input current, shaft output and efficiency at 4% slip. $6 + (4 + 3 + 2)$
8. a) Why does synchronous impedance method is known as pessimistic method of computation of voltage regulation ?
- b) Two reaction theory is applied only to salient pole machines. Explain.
- c) A 3.3 kV, 3-phase, star connected alternator has a full-load current of 100 A. Under short circuit condition it takes 5A field current to produce full load current. The *emf* on open circuit for the same excitation is 900 V (L – L). The armature resistance is 0.9 ohm/ph. Determine regulation for 0.8 pf lagging and 0.8 pf leading conditions. $3 + 4 + 8$



9. a) Derive an expression for torque in 3-phase induction motor.

b) What will happen to the speed of a 3-phase slip-ring induction motor when (i) in phase slip frequency voltage, (ii) out-of-phase slip frequency voltage are injected into rotor circuit ?

c) A 3-phase, 4-pole, 10 kW, 400 V delta connected machine gives the following test results :

No-load test : 400 V, 8 A, 250 W

Blocked Rotor test : 90 V, 35 A, 1350 W

The *dc* resistance of the stator winding per phase measured immediately after the blocked rotor test is 0.6 ohm. Calculate the rotational loss and equivalent circuit parameters.

3 + 4 + (2 + 6)

10. a) What is a universal motor ? Explain how it develops torque.

b) Draw the phasor diagram of an uncompensated *ac* series motor and show that it operates at a higher speed on *dc* supply than on *ac* supply for same supply voltage and load current.

c) How the use of compensating winding improves motor performance.

(1 + 3) + (4 + 4) + 3



11. Write short notes on any *three* of the following : 3×5

- a) Speed control of 3-phase induction motor
- b) Cross field theory of single phase induction motor
- c) Variable Reluctance Stepper Motor
- d) Armature reactance in alternator
- e) Permanent magnet machines
- f) Classification of single phase induction motor.

