



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH/EE(O)/SEM-5/EE-501/2012-13

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)

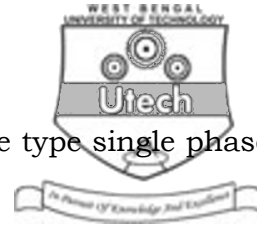
1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) The parameters x_1, x_2, r_2 of the equivalent circuit of single phase induction motor can be determined from
- a) no load test
 - b) blocked rotor test
 - c) *dc* stator resistance test
 - d) none of these.

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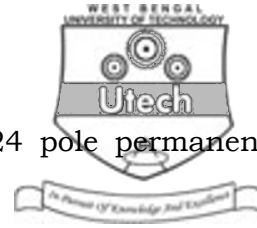
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- ii) The direction of rotation of split phase type single phase induction motor is reversed by
- a) reversing the main winding leads
 - b) reversing the auxiliary winding leads
 - c) either (a) or (b)
 - d) both (a) and (b).
- iii) In a shaded pole motor the direction of rotation of rotor is
- a) from shaded portion to the un-shaded portion of the pole
 - b) from un-shaded portion to the shaded portion of the pole
 - c) either (a) or (b) at a time
 - d) none of these.
- iv) Which one is correct for single phase induction motor ?
- a) The resistance of main winding is higher than that of auxiliary winding
 - b) The resistance of auxiliary winding is higher than that of main winding
 - c) The resistance of main winding is equal to resistance of auxiliary winding
 - d) The resistance of main winding is may be equal or higher than that of auxiliary winding.



- v) In case of an alternator or synchronous generator when $E_f \cdot \cos \delta > V_t$
- generator delivers reactive power and operates at lagging p.f.
 - generator absorbs reactive power and operates at lagging p.f.
 - generator delivers reactive power and operates at leading p.f.
 - generator absorbs reactive power and operates at leading p.f.
- vi) What is the other name of distribution factor ?
- Breadth factor
 - Winding factor
 - Pitch factor
 - None of these.
- vii) In a cylindrical rotor synchronous machine if armature current lags the excitation emf by 90 degree, then the nature of armature mmf is
- cross magnetizing in case of an alternator
 - partly magnetizing in case of an alternator
 - demagnetizing in case of an alternator
 - independent of armature current and excitation emf in case of an alternator.



viii) The stepping angle for a 3-phase, 24 pole permanent stepper motor is

- a) 15 degree b) 8 degree
- c) 5 degree d) 4 degree.

ix) The power factor of a single phase series motor decreases

- a) with the increase in load torque
- b) with the decrease in load torque
- c) both (a) and (b)
- d) none of these.

x) Why the reluctance motor has low efficiency ?

- a) Because of constant reluctance
- b) Because of varying reluctance
- c) Because of constant current
- d) The question is wrong. It has higher efficiency.



xi) For the same no. of poles which stepper motor produces largest stepping angles ?

- a) Variable reluctance type
- b) Hybrid type
- c) Permanent magnet type
- d) All of these.

GROUP – B

(Short Answer Type Questions)

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

2. Explain the principle of operation of capacitor-start capacitor-run type single-phase induction motor with necessary diagrams and phasor.
3. Briefly explain the static excitation process used in synchronous machine with neat diagram.
4. Find an expression for the reactive power as a function of load angle δ .
 - a) for a salient pole synchronous motor working at a lagging p.f.
 - b) for a salient pole synchronous generator working at lagging p.f.
5. Write down the working principle of hysteresis motor with necessary diagram.
6. "The synchronizing power in a synchronous machine is transient in nature." Explain.



GROUP – C

(Long Answer Type Questions)

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

7. a) Describe the armature reaction phenomenon of a cylindrical rotor alternator with necessary diagram and phasor at zero p.f. lagging load.
- b) Describe the two reaction theory of salient pole synchronous machine with necessary diagram and phasor.
- c) A 3-phase, 400 V, star connected synchronous machine is synchronized with an infinite bus at rated voltage. The synchronous machine is now made to deliver a shaft load of 9.5 kW. The machine resistance is negligible and $X_d = 5 \Omega$ per phase and $X_q = 3.2 \Omega$ per phase. Friction, windage and core loss total 500 watts. For this shaft output, calculate power angle, armature current, *pf* and draw the phasor diagram. $6 + 4 + 5$
8. a) How the power factor of a synchronous motor connected to an infinite bus can be controlled ? Describe with necessary phasor and curves.
- b) Why the synchronous motor is not self-starting ?
- c) A 3300 V, star connected synchronous motor has synchronous impedance $0.4 + j 5 \Omega$ per phase. For an excitation *emf* of 4000 V and motor input power of 1000 kW at rotated voltage, compute the line current & *pf*. $6 + 4 + 5$



9. a) Write down the conditions of parallel operation of alternators.
- b) Derive the condition for maximum starting torque of a resistor split phase type single phase induction motor.
- c) "An alternator is running at synchronous speed. Its field is now energised from an *ac* source at rated frequency." Discuss the nature of the generated voltage and the alternator performance.
- d) Draw the phasor diagram of an *ac* series motor & explain it. 2 + 6 + 4 + 3
10. Write short notes on any *three* of the following : 3 × 5
- a) Stepper motor
- b) Hunting of synchronous motor
- c) Brushless DC motor
- d) Induction generator
- e) Switched Reluctance motor.

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