

Name :

Roll No. :

Invigilator's Signature :

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

2012

ELECTRICAL MACHINE-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) In capacitor start single phase induction motor, a capacitor is connected
- a) in series with the main winding
 - b) in parallel with the main winding
 - c) in series with the auxiliary winding
 - d) in parallel with the auxiliary winding.

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- ii) A synchronous motor is floating on infinite mains at no load. If its excitation is increased, it will draw
- a) unity power factor current
 - b) zero power factor lagging current
 - c) zero power factor leading current
 - d) no current.
- iii) Armature reaction AT of a synchronous generator at rated voltage zero power factor lagging is
- a) magnetizing
 - b) demagnetizing
 - c) cross magnetizing
 - d) both magnetizing and cross magnetizing .
- iv) In a salient pole synchronous machine, where. X_d = d-axis synchronous reactance, X_q = quadrature axis synchronous reactance,
- a) $X_q = X_d$
 - b) $X_q > X_d$
 - c) $X_q < X_d$
 - d) $X_q = 0$.
- v) A stepper motor is
- a) a dc motor
 - b) a single phase ac motor
 - c) a two phase motor
 - d) a multi-phase motor.

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vi) A ceiling fan uses

- a) Split phase motor
- b) Capacitor start capacitor run motor
- c) Universal motor
- d) Capacitor start motor.

vii) A synchro has

- a) 3-phase winding on rotor and 1-phase winding on stator
- b) 3-phase winding on stator and commutator winding on rotor
- c) 3-phase winding on stator and 1-phase winding on rotor
- d) 1-phase winding on stator and commutator winding on rotor.

viii) A 400V-60 Hz synchronous machine has 6 poles. The synchronous speed in rpm is

- a) 1200
- b) 3000
- c) 1000
- d) 1500.

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- ix) Cylindrical rotor synchronous machines are mainly used in
- a) hydel power plants
 - b) steam power plants
 - c) in both hydel and steam power plants
 - d) none of these.
- x) A 6 pole, 50 Hz single phase induction motor runs at a speed of 900 r.p.m. The frequency of current in the cage rotor will be
- a) 5 Hz
 - b) 55 Hz
 - c) 95 Hz
 - d) 100 Hz.
- xi) A salient pole synchronous machine has maximum power output when the power angle δ is
- a) 90°
 - b) 45°
 - c) less than 90°
 - d) more than 90° .
- xii) Induction generator runs at
- a) supersynchronous speed
 - b) sub-synchronous speed
 - c) synchronous speed
 - d) none of these.

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GROUP - B

(Short Answer Type Questions)

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

2. What are the methods adopted to start a single phase induction motor ? Explain with the help of connection diagram the principle of operation of a capacitor run motor.
3. What is hunting in an alternator ? Discuss the measures to be taken to minimize such hunting.
4. Draw the phasor diagram of a salient pole synchronous machine and find out the power with help of the phasor diagram.
5. Derive the expression for distribution factor and pitch factor of a synchronous machine.
6. Discuss construction and working principle of an induction generator.

GROUP - C

(Long Answer Type Questions)

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

7. a) Discuss the nature of armature reaction of an alternator for zero p.f. lagging, zero p.f. leading and unity p.f. load.
b) Describe the effect of change of excitation and mechanical input of an alternator. $8 + 7$

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8. a) How will you synchronize two alternators to work in parallel in the laboratory with the help of three lamps ? Draw a neat circuit diagram and describe the procedure.
- b) What is voltage regulation ? Explain the zero power factor lagging method for calculating the voltage regulation of an alternator.
- c) Why E.M.F method is called Pessimistic Method and M.M.F method is called Optimistic Method for calculating the voltage regulation of an alternator ?

6 + 6 + 3

9. a) Will a dc shunt motor operate when energized from an alternating voltage supply ? Explain.
- b) A 230 V 50 Hz, 4 pole, single phase induction motor has the following circuit parameters :

$$R_{lm} = 2.2 \, \Omega \quad R_2' = 4.5 \, \Omega \quad X_{lm} = 3.1 \, \Omega$$

$$X_2' = 2.6 \, \Omega \quad R_M = 80 \, \Omega$$

Friction, windage and core loss = 40 W.

For a slip of 0.03 pu, calculate its :

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- (i) Input current
- (ii) Power factor
- (iii) Developed power
- (iv) Output power
- (v) Efficiency. 5 + 10

10. a) Derive the equation for developed power in a salient-pole synchronous generator. What is reluctance power in a salient-pole synchronous generator ?

- b) A 9 KVA, 208 V, 1200 r.p.m., 3-phase, 60 Hz, star-connected generator has a field winding of 4.5Ω . The armature impedance is $(0.3 + j5) \Omega$ per phase. When the generator operates at full load and 0.8 p.f. lagging, the field winding current is 5A. Its rotational loss is 500 W. Determine (i) voltage regulation, (ii) efficiency of alternator and (iii) torque applied by the prime mover.

8 + 7

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

- a) Synchro
- b) Linear induction machine
- c) Stepper motor
- d) Hysteresis motors
- e) AC servo motor.