



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (EE-NEW)/SEM-5/EE-501/2010-11

2010-11

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) In an alternator the voltage generated per phase is proportional to
 - a) number of turns per coil
 - b) flux per pole
 - c) frequency of waveform
 - d) all of these.
- ii) In which single phase motor, the rotor has no teeth or winding ?
 - a) Split phase motor
 - b) Reluctance motor
 - c) Hysteresis motor
 - d) Universal motor.



- iii) In a synchronous motor, damper winding is provided in order to
- a) stabilize rotor motion
 - b) suppress rotor oscillation
 - c) develop necessary starting torque
 - d) both (b) & (d).
- iv) The frequency of voltage generated by an alternator having 4 poles and rotating at 1800 r.p.m. is
- a) 60 Hz
 - b) 7200 Hz
 - c) 120 Hz
 - d) 450 Hz.
- v) The winding of a 4-pole alternator having 36 slots and a coil span of 1 to 8 is short pitched by
- a) 140°
 - b) 80°
 - c) 20°
 - d) 40° .
- vi) For parallel operation, a.c. poly-phase alternator must have the same
- a) speed
 - b) voltage rating
 - c) KVA rating
 - d) excitation.
- vii) The power factor of an alternator is determined by
- a) speed
 - b) load
 - c) excitation
 - d) prime mover.



- viii) At lagging load, armature reaction in an alternator is
- cross-magnetizing
 - demanetizing
 - non-effective
 - magnetizing.
- ix) A 3-phase induction motor, while supplying a constant load, has the fuse of one line suddenly blown off. The motor will run as a single phase induction motor with line current nearly increased to
- $\sqrt{3}$ times
 - 3 times
 - 5 times
 - 6 times.
- x) A capacitor start and run single phase Induction motor is basically a
- single phase induction motor
 - two-phase induction motor
 - three-phase induction motor
 - single phase reluctance motor.
- xi) The direction of rotation of a Single phase induction motor can be reversed by
- reversing the leads of main winding
 - reversing the leads of auxiliary winding
 - reversing the supply leads
 - reversing the leads of either main or auxiliary winding.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. What methods are adopted to start a single phase induction motor ? Explain with the help of connection diagram and phasor diagram, the principle of operation of capacitor start and capacitor run motor.
3. Derive the equation of rotational *emf* of a single phase commutator machine as are produced by pulsating field.
4. What is a damper winding ? Explain its use.
5. Explain the operating principle of a stepper motor.
6. Describe the Slip test to determine the *d*-axis synchronous reactance (X_d) and *q*-axis synchronous reactance (X_q) of a salient pole synchronous machine.



GROUP – C

(Long Answer Type Questions)

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

7. What do you mean by regulation of an alternator ? Describe the Synchronous Impedance method of determination regulation of an alternator at UPF load. Why is it called a pessimistic method ? $1 + 7 + 1$

A 3-phase star connected 400 V synchronous motor takes a power input of 5472 watt at rated voltage. Its synchronous reactance is 10 ohms per phase and resistance is negligible. If the excitation voltage is adjusted equal to the rated voltage 400 V, compute the load angle, power factor and the armature current. 6

8. a) For a single phase induction motor, derive the condition for maximum starting torque during capacitive starting. 7
- b) A 220 V, 4-pole, 50Hz, 1-phase induction motor gave the following test results :

Block rotor test : 110 V, 10 amp, 400 watt

No load test : 220 V, 4 amp, 100 watt

Find the parameter of equivalent circuit. Neglect R_0

Consider the speed of the motor as 1440 rpm.
Determine the

- i) line current
- ii) power factor. $4 + 4$



9. a) Describe the principle of operation and torque-speed characteristic of induction generator. 5 + 5 + 5
- b) Explain the principle of operation of Linear Induction Motor and performance of LIM.
- c) Explain the power developed in reluctance motor with the phasor diagram.
10. a) Explain with reasons why,
- i) compensating winding is provided in a universal motor for AC operation
 - ii) reluctance motor has low efficiency
 - iii) In a repulsion motor, the armature current is very high when the brush axis is aligned in the direction of stator field axis.
- b) A universal motor (a.c. operated) has two-pole armature with 690 conductors. At a certain load the motor speed is 5000 rpm and armature current is 4.6 A, the armature terminal voltage and input are 100 V and 300 W respectively. If the armature resistance is 3.5 Ω , compute the effective armature reactance and maximum value of useful flux/pole. 9 + 6



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

- a) Stepper motor
- b) Permanent magnet motor
- c) A.C. servo motor
- d) Hysteresis motor
- e) Repulsion type motor.

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