

2012

ELECTRICAL MACHINES

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 :

10x1 = 10

i) Which of the following windings is connected in series with armature winding of DC machine ?

- a) Series winding
- b) Auxiliary winding
- c) Compensating winding
- d) Commutating pole winding.

ii) What happens if field winding of a running shunt motor suddenly breaks open ?

- a) Its speeds slows down
- b) Its speed becomes dangerously high
- c) It gives out sparks
- d) It stops at once.

iii) If the connections of field winding of *dc* shunt motor is changed

- a) Motor will not run
- b) It will run in same direction
- c) It will run in opposite direction
- d) Motor speed will change.

iv) A shunt generator can be self-excited

a) only if resistance of field circuit is less than critical value

b) only if resistance of field circuit is greater than critical value

c) irrespective of value of resistance of the field circuit

d) none of these.

v) The symbol Y_{d11} represents a 3-phase transformer with *h.v.* line phasor

a) leading the *l.v.* line phasor by 30°

b) leading the *l.v.* line phasor by 150°

c) lagging the *l.v.* line phasor by 30°

d) lagging the *l.v.* line phasor by 60° .

vi) A star-delta starter is equivalent to an auto-transformer starter with a tapping of

a) 86.6% b) 57.73%

c) 57% d) 58%.

vii) The field controlled method of speed control of *dc* motor is used for

a) controlling the speed above the base speed

b) controlling the speed below the base speed

c) either (a) or (b)

d) none of these.

viii) The speed torque characteristics of a *dc* shunt motor is

a) straight line passing through origin

b) parabolic in nature

c) an ellipse

d) straight line having negative slope.

ix) The slip of an induction machine during motoring action is

a) negative b) greater than one

- c) equal to one d) in between 0 to 1.
- x) Rotor of a induction motor cannot run with synchronous speed because
- a) Lenz's law would be violated
 - b) Rotor torque would then become zero
 - c) air friction prevents it from doing so
 - d) induction motor would then become synchronous motor.
- xi) A rotating magnetic field produced by a balanced 3-phase supply in a balanced 3-phase system having
- a) constant magnitude
 - b) zero magnitude
 - c) variable magnitude
 - d) no magnitude.

GROUP – B

(Short Answer Type Questions)

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

2. Explain briefly the effects of armature reaction in DC machines.
3. Explain why the rotor of a polyphase IM can never attain synchronous speed.
4. Describe the role of compensating winding and interpoles in improving the performance of the DC machine.
5. State the disadvantages of a three-phase autotransformers as compared to three-phase two-winding transformers.
6. Describe the auto-transformer starting method of three phase IM.

GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the working principle of a three point starter

with a neat sketch.

b) Why are the interpoles designed to provide mmf more than the armature mmf in commutating zone ?

c) Brushes of a certain lap connected 400 kW, 6 poles, generator are given a lead of 18° electrical. From the data given calculate :

i) Demagnetizing AT

ii) Cross magnetizing AT

The full load current is 750A and total number of conductors are 900. 7 + 4 + 4

8. a) Explain how a rotating magnetic field is produced by a balanced 3-phase supply in a balanced 3-phase system.

b) Show P_g : rotor ohmic loss : $P_m = 1 : S : (1 - S)$.

c) A 6 pole, 50Hz, 3 ϕ IM running on full load develops a useful torque of 162 N-m and it is observed that the rotor emf makes 90 complete cycles per minute.

Calculate the brake HP. If the mechanical torque lost in friction be 13.5 N-m, find the copper loss in the rotor windings, input to the motor and the efficiency. Total stator loss is 750 W. 6 + 3 + 6

9. a) With the help of a neat diagram, explain how can two phase be obtained from three phase supply mains.

b) What are the adverse effects due to the unbalanced operation of a three phase transformers ?

c) State the various conditions that must be fulfilled, for the successful parallel operation of 3-phase transformers. 8 + 3 + 4

10. a) Show the maximum internal torque developed by a polyphase IM does not depend on rotor circuit resistance.

b) A 250 V shunt motor on no-load runs at 1000 rpm and

takes 5 A. Armature and shunt field resistance are 0.2 and 250 respectively. Calculate the speed when loaded taking a current of 50 A. The armature reaction weakens the field by 3%. 8 + 7

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

- a) Ward Leonard method of speed control
- b) Delayed commutation
- c) Single phase induction regulator
- d) Series-parallel method of speed control in a DC series motor
- e) Ydll & Dyl.

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