ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2008

ELECTRICAL MACHINES - II

SEMESTER - 5

Time : 3 Hours] [Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) In a synchronous generator operating at zero power factor lagging, the effect of armature reaction is

a) magnetising

b) demagnetising

c) cross-magnetising

d) both magnetising and cross-magnetising.

ii) Short pitch winding results in

a) higher terminal voltage b) higher efficiency

c) higher power factor d) better voltage waveform.

iii) Capacitor start and run induction motor is basically a

a) single phase induction motor

b) two-phase induction motor

c) three-phase induction motor

d) single phase reluctance motor.

iv) In a repulsion motor, commutator provides a means of connecting the

a) stator winding b) armature winding

c) starting winding d) any one of these.

v) During hunting of synchronous motor

a) negative phase sequence currents are generated

b) harmonies are developed in the armature circuit

c) damper bar develops torque

d) field excitation increases. ☐

vi) The speed-torque characteristics of a repulsion motor resembles the speed-torque characteristics of which of the following *d.c.* motor ?

a) separately excited b) series

c) shunt d) compound. ☐

vii) Negative voltage regulation is observed in an alternator which is

a) overexcited b) underexcited

c) normally excited d) all of these. ☐

viii) The motor generally used in a tape recorder is

a) universal motor b) reluctance motor

c) split-phase motor d) hysteresis motor. ☐

ix) A single phase hysteresis motor can run at

a) synchronous speed

b) subsynchronous speed

c) synchronous and supersynchronous speed

d) synchronous and subsynchronous speed. ☐

x) A compensated winding in an *a.c.* commutator motor

a) reduces reactance drop and improves commutation

b) reduces reactance drop

c) reduces reactance drop but retards commutation

d) improves commutation only. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. A single phase induction motor when excited by a single phase supply produces two equal and opposite revolving fields. Justify the statement.

3. For a universal motor, the performance of the machine is better under *d.c.* operation than under *a.c.* operation. Justify.

4. What is distribution factor ? What are the advantages of distributing a winding in slots ?

5. In a salient pole synchronous machine, the value of X_d is greater than that of X_q; explain with reasons.

6. Explain why a synchronous motor is not self-starting.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions. 3 × 15 = 45

7. a) Explain what causes hunting in a synchronous machine. Explain the methods adopted to minimise hunting.

   b) A 100 kVA, 300 Volt, 50 Hz 3-phase star connected alternator has effective armature resistance of 0·2 ohm. A field current 40 amp produces short circuit current of 200 A and open circuit voltage of 1040 V (line-line). Calculate full-load voltage regulation at 0·8 *pf* lagging. Draw the phasor diagram. 7 + 8

8. a) For a single phase induction motor, derive the condition for maximum starting torque during capacitive starting.

   b) A 220 V, 4-pole, 50 Hz single phase induction motor gave the following test results :

   Blocked Rotor test : 110 V, 10 A, 400 Watt.

   No-load test : 220 V, 4 A, 100 Watt.

i) Find the parameters to develop equivalent circuit. State necessary assumption.

ii) Considering the speed of the motor as 1440 rpm, determine (a) line current, (b) power factor. 7 + 4 + 4

9. a) Explain two reaction field theory for a salient pole synchronous machine. Using this theory, draw the phasor diagram for lagging current for (i) salient pole generator, (ii) salient pole motor.

b) A star-connected, 11 kV turbo-generator, with synchronous impedance of $1 + j\,10\Omega$ per phase is connected to an infinite bus at rated voltage. The alternator delivers an armature current of 100 amp at unity *pf* to bus-bar.

i) With alternator output remaining constant, the alternator excitation is increased by 15%. Find new values of armature current, load angle and *pf*.

ii) With excitation of (i), discuss how alternator can be made to operate at unity *pf*. Under this condition, find armature current, load angle and power delivered to the bus. 6 + 9

10. a) Derive the equation of rotational and transformer *e.m.f.* of a single phase commutator machine as are produced by the pulsating field.

b) Show that at synchronous speed, *a.c.* commutator motor with *a.c.* input voltage and brush displaced from neutral, acts as a phase-shifter. 10 + 5

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

a) Brushless *d.c.* motor

b) Conditions for parallel operation of alternators

c) Induction generators

d) Switched reluctance motor

e) Tacho-generator.

END