ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2008
ELECTRICAL MACHINE-I
SEMESTER - 4

Time : 3 Hours]   [Full Marks : 70

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :   10 × 1 = 10

i) If the load on a d.c. shunt motor is increased, its speed is decreased primarily due to

   a) increase in its flux   b) decrease in back e.m.f.

   c) increase in armature current d) increase in brush drop.   ☐

ii) The waveform of armature m.m.f. in a d.c. machine is

   a) square   b) rectangular

   c) triangular   d) sinusoidal.   ☐

iii) If the thickness of laminations of a d.c. machine is increased

   a) Eddy current loss decreases   b) Eddy current loss increases

   c) Hysteresis loss increases   d) Hysteresis loss decreases.   ☐

iv) In a d.c. machine armature reaction is produced actually by

   a) its field current   b) armature conductors

   c) load current in armature   d) none of these.   ☐

v) At 50 Hz, the maximum possible speed of a 3-phase induction motor is

   a) nearly 3000 r.p.m.   b) nearly 1500 r.p.m.

   c) nearly 6000 r.p.m.   d) none of these.   ☐

IV-247211 (5-A)

vi) In a 3-phase induction motor, the relative speed of stator flux with respect to rotor flux is

   a)   unity   b)   zero

   c)   3000 r.p.m.   d)   1500 r.p.m.

vii) The torque developed by a 3-phase induction motor depends on

   a) V b) V^2

   c) $\sqrt{V}$ d) $\frac{1}{V}$.

viii) Absence of odd harmonics in magnetising current will make the

   a)   voltage wave sinusoidal   b)   voltage wave non-sinusoidal

   c)   flux wave sinusoidal   d)   none of these.

ix) Two transformers connected in parallel share loads in the ratio of their kVA rating provided their ohmic impedances are

   a)   equal

   b)   in direct ratio of their ratings

   c)   in inverse ratio of their ratings

   d)   none of these.

x) A three phase induction motor should have small air gap length so that it has

   a)   more starting torque   b)   more pull out torque

   c)   better power factor   d)   improved efficiency.

xi) Blocked rotor test on a 3-phase induction motor helps to find out

   a)   short circuit power factor

   b)   fixed losses

   c)   motor resistance as referred to stator

   d)   none of these.

GROUP – B

(Short Answer Type Questions)

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

2. State and explain the conditions of parallel operation of two 3-phase transformers.

3. Sketch and explain the torque-slip and power-slip characteristics of three phase induction motor.

4. Explain the phenomena of cogging and crawling of 3-phase squirrel cage induction motor.

5. What are the different operational characteristics of d.c. generator ? Draw the load characteristics of a separately excited generator considering armature reaction from no-load characteristics ?

6. Why is d.c. series motor used in traction ? Draw the speed-torque characteristics from the basic torque and e.m.f. relations of a d.c. series motor.

GROUP – C

(Long Answer Type Questions)

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

7. What is understood by armature reaction in d.c. machine ? Explain armature reaction considering fluxes due to field poles and armature m.m.f. with neat sketch. State the adverse effects of armature reaction on the performance of a d.c. machine. What role do interpoles play in commutation process ?   2 + 5 + 4 + 4

8. a) Why is starter used for starting d.c. motor ?

    b) Derive an expression for determining the starter steps of a 3-point starter.

    c) Describe the process of building up of a shunt generator.

    d) Determine the demagnetising and cross-magnitising ampere turns per pole of a d.c. machine having 420 conductors lap connected in a 6-pole machine. The load current is 100 amps when the brushes are shifted by 10 mechanical degree in the direction of rotation.   2 + 4 + 4 + 5

IV-247211 (5-A)

9. a) Draw the phasor and connection diagrams of the following 3-phase transformers :

    i) Yd 1

    ii) Dy 11

    iii) Dz 6.

    b) Explain "rotating neutral" in a 3-phase transformer.   9 + 6

10. Describe briefly the principle of operation of a polyphase induction motor. Why is a starter required in a three phase induction motor although it is self starting ? What is the drawback of a DOL starter ?

A 10 kW, 400V, 3 phase, 4 pole, 50Hz delta connected induction motor is running at no load with a line current of 8A and an input power of 660 watts. At full load, the line current is 18 A and the input power is 11.20 kW. Stator effective resistance per phase is 1.2 ohms and friction, windage loss is 420 watts. For negligible rotor ohmic losses at no load, calculate

    a) Stator core loss

    b) Total rotor losses at full load

    c) Total rotor ohmic losses at full load

    d) Full load speed.   (5 + 1 + 1) + 8

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

    a) Single phase induction regulator.

    b) On load tap changer.

    c) Compensating winding.

    d) Scott connection of transformer.

    e) Auto transformer.

———————
END