CS/B.Tech(PWE-Old)/SEM-4/EE-401/2012

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) A commutator in a d.c. generator can convert

a) a.c. to d.c. b) d.c. to a.c.

c) pulsating to d.c. d) none of these.

ii) In Swinburne's method for the determination of efficiency of a d.c. machine

a) the no load losses are calculated and the copper losses are measured

b) the no load losses are measured and the copper losses are calculated

c) both the no load losses and the copper losses are measured

d) none of these.

iii) Best electric drive for locomotive is

a) squirrel cage induction motor

b) d.c. shunt motor

c) synchronous motor

d) d.c. series motor.

iv) Why are the transformer core made up of laminated sheet ?

a) To reduce eddy current loss

b) To reduce hysteresis loss

c) To reduce frequency

d) None of these.

v) 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.

vi) The object of using compensating winding in d.c. machines is to neutralize the

a) armature reaction in the interpole zone

b) armature reaction in the compensating zone

c) armature reaction under the pole faces

d) cross magnetising armature reaction.

vii) In a 3-phase induction motor, the variable mechanical load is electrically represented by

a) a variable resistance only

b) a variable inductance only

c) a variable capacitance only

d) a combination of variable resistance and variable inductance.

viii) 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.

ix) In a 4-pole, 50 Hz, 3-phase induction motor running at 1485 r.p.m. with rotor copper loss of 2 kW, the rotor

input is

a) 100 kW b) 200 kW

c) 50 kW d) none of these.

x) Plugging of d.c. motors is normally executed by

a) reversing the field polarity

b) reversing the armature polarity

c) reversing both armature and field polarity

d) connecting a resistance across the armature.

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.

xii) The synchronous speed of an 8 pole 3-phase induction motor fed from 50 Hz supply is

a) 1000 r.p.m. b) 800 r.p.m.

c) 750 r.p.m. d) 700 r.p.m.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3x5 = 15

2. What are the conditions of parallel operation of two 3-phase transformers ? Explain the effects of parallel operation with improper conditions. 2 + 3

3. Explain the phenomena of cogging and crawling of a three phase squirrel cage induction moor.

4. Draw the vector diagram and connection diagram to convert 3-phase to 6-phase with double delta connection.

5. What is meant by armature reaction in a d.c. machine ? Explain briefly, the demagnetising and cross magnetising effects of armature reaction.

6. Why is Star-Delta method preferred over direct on line starting of an induction motor ? Describe the method of starting by Star-Delta method. 1 + 4

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3x15 = 45

7. a) In a Scott connected transformer, why the teaser winding has 86·6% of no. of turns of the main winding ? Why is the teaser winding connected at the centre of the main winding ?

b) A Scott connected transformer supplied from a 6.6 kV balanced supply supplies two single phase transformers at 110 volt, 500 kW and 300 kW at unity power factor.

Determine (i) the primary current, (ii) the secondary current.

Draw the phasor diagram.

8. a) Why are d.c. series motors are used in trains ? 3

b) Draw and explain the method of speed control of a d.c. motor by flux control method. Discuss the ranges of speed control by the flux control method. 6

c) A 250 V shunt motor has an armature resistance of 0·6 ohms and a field resistance of 250 ohms. When driving at 650 r.p.m., a constant torque load, the armature takes 20A. If it is required to raise the speed from 650 r.p.m. to 850 r.p.m., what resistance must be inserted in the shunt field circuit assuming linear magnetization characteristics ? 6

9. a) Explain the voltage build-up process in d.c. shunt generator. 4

b) It is found that the voltage of a d.c. shunt generator

does not build up. Explain the various causes of failure. 3

c) A 250 V compound generator has armature, series field and shunt field resistances 0·4 ohm, 0·2 ohm and 125 ohms respectively. If this generator supplies 10 kW at rated voltage, find the e.m.f. generated in the armature when the machine is connected as (i) long-shunt, (ii) short-shunt. Ignore armature reaction and allow 1 V per brush for contact drop. 4 + 4

10. Write short notes on any *three* of the following : 3x5

a) 4 point starter

b) Oscillating neutral in a transformer

c) Commutation

d) The cause of 3rd harmonic components of magnetizing current of a transformer be co-phasor.

11. What are the phasor groups used in 3-phase transformer connections ? Draw the connection and phasor diagrams for (i) Dy1 (ii) Dd6 and (iii) YZ 11.

12. a) Derive the speed-current characteristics of d.c. shunt, series and cumulative compound motors. Sketch these characteristics in one figure on assumption of (i) same speed at no load and (ii) rated speed at rated current.

b) A 4-pole d.c. series motor has wave-connected winding with 600 conductors. Total resistance of motor is 0·8 ohm. When fed from 250 V d.c. source, the motor supplies a load of 10 kW and takes 50 A with a flux per pole of 3 mwb. For these operating conditions, calculate the developed torque and shaft torque.

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