33159

Name : .....

Reg. No: .....

FOURTH SEMESTER B.TECH (04 SCHEME) DEGREE EXAMINATION, FEBRUARY 2013

EE 04 405 – ELECTRICAL MACHINES

Time : Three Hours **Maximum : 150 Marks**

Answer ALL questions.

Part A

I
(a) Compare lap and wave windings of a d.c. machine.
(b) What is reactance voltage in d.c. machines? Derive the expression for reactance voltage.
(c) Give the classification of d.c. generators and their applications.
(d) Explain the different losses in a d.c. generator.
(e) Derive the equation for armature torque of a d.c. motor.
(f) Explain the different power stages in a d.c. motor.
(g) What are the conditions for parallel operation of two single phase transformers?
(h) How does change in frequency affect the operation of a given transformer?

(8 x 5 = 40 Marks)

Part B

II (a) Explain commutation in d.c. machines with neat sketches. Also discuss the different methods of improving commutation. (15)

(Or)

(b) (i) What is armature reaction in d.c. machines? What are the effects of armature reactions (8)
(ii) A 22.38 kW, 440 V, 4 pole wave wound d.c. shunt motor has 840 armature conductors and 140 commutator segments. Its full load efficiency is 88% and shunt field current is 1.8 A. If brushes are shifted backward through 1.5 segments from the geometrical neutral axis, find the demagnetizing and distorting amp-turns/pole. (7)

III (a) Explain the necessity of parallel operation of d.c. shunt generators. Also explain the process of paralleling of two shunt generators. (8)
(b) A d.c. compound generator supplies 200 A at 100 V. The resistance of armature, series field and shunt field windings are 0.04 Ω, 0.03 Ω and 60 Ω respectively. Find the e.m.f. generated if the machine is connected in (i) short shunt and (ii) long shunt. (7)

(Or)

(c) What is critical resistance and critical speed for a d.c. generator? How are they determined from open circuit characteristics? (8)
(d) A d.c. shunt generator delivers 195 A at terminal p.d. of 250 V. The armature and shunt field resistances are 0.02 Ω and 50 Ω respectively. The iron and friction losses equal 950 W. Find (i) emf generated (ii) generator efficiency. (7)

IV (a) Explain the use of different types of d.c. motors with support of their characteristics. (8)
(b) The armature winding of a 4 pole, 250 V, d.c. shunt motor is lap connected. There are 120 slots, each slot containing 8 conductors. The flux per pole is 20 mWb and current taken by the motor is 25 A. The armature and field resistances are 0.1 Ω and 125 Ω respectively. If the rotational losses amount to 810 W, find (i) armature torque (ii) efficiency. (7)

(Or)

Turn over

(c) Explain how efficiency of d.c. machine can be calculated from Hopkinson's test. (9)

(d) A 4 pole, 220 V shunt motor has 540 lap wound conductors. It takes 32 A from the supply mains and develops output power of 5.595 kW, the field winding takes 1A, the armature resistance is 0.9 Ω and flux per pole is 30 mWb. Calculate (i) speed (ii) torque developed in Nm. (6)

V (a) Explain Sumpner's test of transformers. (8)

(b) A 600 KVA, single phase transformer has an efficiency of 92% both at full load and half load at u.p.f. Determine its efficiency at 60% of full load at 0.8 p.f. lag. (7)

(Or)

(c) Derive the expression for amount of Cu saved in autotransformer when compared to that of two winding transformer. Also list the applications of auto transformer. (8)

(d) A 10 KVA, 200/400 V, 50 Hz single phase transformer gave the following test results:

O.C. test : 200 V, 1.3 A, 120 W

S.C. test : 22 V, 30 A, 200 W

Draw the equivalent circuit referred to L.V. winding. (7)

(4 x 15 = 60 Marks)

******