Code: 13A02301

R13

B.Tech II Year I Semester (R13) Regular Examinations December 2014

ELECTRICAL MACHINES – I

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is the expression for the energy stored in a magnetic field system?
(b) Express force and torque equation in double excited system.
(c) What are the methods for improving commutation?
(d) Distinguish between lap winding and wave winding.
(e) Write the minimum requirements to build up of EMF in self excited dc generators.
(f) What are the uses of equalizer bar in DC generators?
(g) Write different methods of speed control in dc series motor.
(h) Draw the speed torque characteristic of a DC compound motor.
(i) Explain why a dc motor should not be started direct on line.
(j) When did you say, DC motor had maximum efficiency?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) Derive the magnetic force and torque from energy.
(b) Derive the expression for energy in the magnetic field of singly excited system.

OR

3 (a) Show how torque can be determined in the multiply excited nonlinear system.
(b) Describe single excited magnetic field system.

UNIT - II

4 A 8-pole, 25 kW, and 120 V DC generator has a duplex lap-wound armature which has 64 coils with 16 turns per coil. Its rated speed is 2400 rpm.
(i) How much flux per pole is required to produce the rated voltage in this generator at no load conditions?
(ii) What is the current per path in the armature of this generator at the rated load?
(iii) What is the induced torque in this machine at the rated load?
(iv) If the resistance of this winding is 0.011 ohm per turn, what is the armature resistance R_a of this machine?

OR

5 (a) A 4-pole DC shunt generator supply a current of 143 A. It has 492 conductors on the armature lap connected while delivering full load: the brushes are given an actual lead of 10^0. Calculate the magnetizing ampere turns per pole. The filed winding is shunt connected and takes 10 A. Find the number of extra shunt field turns necessary to neutralize the demagnetization.
(b) Explain how commutation is improved by use of interlopes.

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UNIT - III

6 (a) Determine the internal characteristics from external characteristics of a DC shunt generator.

(b) A 4-pole, DC series motor has lap connected armature winding with 600 conductors. When fed from 250 V, the motor supplies a load of 10 kW and takes a line current of 50 A. The flux per pole is 0.03 Wb and runs at 3000 rpm. The friction and iron losses are 500 W. Calculate the armature torque and shaft torque developed by the motor.

OR

7 (a) Draw the Characteristics of separately excited dc generators.

(b) A 30 kW, 300 V, DC shunt generator has R_a = 0.05 Ω & R_{sh} = 100 Ω respectively. Calculate the total power developed by the armature when it delivers full load output.

UNIT – IV

8 (a) Explain the methods of braking in DC motors.

(b) A 200 V, D.C shunt machine has an armature resistance of 0.5 Ω and field resistance of 200 Ω. The machine is running at 1000 rpm as a motor drawing 31 A from the supply mains. Calculate the speed at which the machine must be driven to achieve this as generator.

OR

9 (a) Specify the necessity of Starters and explain the 3-point starters.

(b) A 6-pole DC motor has a wave connected armature with 87 slots, each slot Containing 6 conductors. The flux per pole is 20 mWb and the armature has a resistance of 0.13 Ω. When the motor is connected to 240 V supply and the armature draws a current of 80 A driving a load of 16 kW. Calculate: (i) Speed. (ii) Armature torque. (iii) Shaft torque.

UNIT – V

10 (a) Derive the condition for maximum efficiency in a DC machine.

(b) A brake test on a DC shunt motor gave the following results.
Weight on the brake drum = 4.5 kg and 0.5 kg.
Radius of the pulley = 12cm
Speed of the motor = 1200 rpm
Line current = 3.7 A
Supply voltage = 200 V
Compute the output torque and efficiency of the motor.

OR

11 (a) What is the effect of losses on the performance of dc motors?

(b) A 220 V, 12 kW, DC shunt motor has a maximum efficiency of 90% and a speed of 800 rpm. When delivering 80% of its rated output. The resistance of the shunt field is 80 ohm. Determine the efficiency, speed when the motor draws a current of 70 A from mains.

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