Code: 13A02301 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2015

ELECTRICAL MACHINES – I

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A
(Compulsory question)

1 Answer the following: (10 X 02 = 20 Marks)
- (a) Express the torque equation
- (b) Define the co-energy and energy in non linear magnetic system.
- (c) What are the two functions of a commutator in dc machine?
- (d) What component causes a generator to produce direct current rather than alternating current?
- (e) What is the significance of critical resistance in DC generators?
- (f) What is the need for cross connection of filed windings?
- (g) Justify, the use of dc series motor for electric traction.
- (h) Write the parameters which affect the speed of the dc motor.
- (i) What is the type of test to be performed to find friction and windage losses in DC machine?
- (j) Why Swinburne's test is preferred instead of Brake test in DC machines?

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

UNIT - I

2 (a) Explain the mechanical energy and work done in singly excited system when actual displacement occurs.

(b) Show that the torque developed in a doubly exited magnetic system is equal to the rate of increase of filed energy with respect to the displacement at constant currents.

(OR)

3 For linear magnetic circuits derive the expression for the stored energy. Hence show that the stored energy is given by expression $(\beta 2/2\mu v)\ dv$ Joules. Where v stands for volume of the magnetic field and the permeability is constant.

UNIT - II

4 (a) Explain the effects of armature reaction in a D.C generator and discuss briefly the methods to minimize these effects.

(b) A 4 – pole generator supplies a current of 286 A. It has 984 armature conductors (i) Wave-wound. (ii) Lap-wound. When delivering full load, the brushes are given an actual lead of 10^0. Calculate the demagnetizing amp-turns/pole. The filed winding is shunt connected and takes 10 A. Find the number of extra shunt field turns necessary to neutralize this demagnetization.

(OR)

5 (a) Explain the function of commutator in dc machine.

(b) The armature of 6 pole dc generator has a wave winding containing 664 conductors. Compute the generator EMF when flux per pole is 0.06 Weber and the speed is 250 RPM. At what speed must be the armature an EMF of 250 V if the flux per pole is reduced to 0.058 Weber.

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UNIT - III

6 (a) Explain the load characteristics of dc compound generator.

(b) The open circuit characteristics of a shunt generator at 800 RPM gives:

Field current (A):	0	0.5	1.0	2.0	3.0	4.0	5.0
Inducted emf (V):	10	50	100	175	220	245	262

Find graphically the critical resistance of shunt filed circuit. If the field circuit resistance is changed to 75 Ω what will be the critical speed for the machine to build up.

(OR)

7 (a) State the need for parallel operation. What are the conditions to be satisfied to connect to DC generators parallel? Explain

(b) 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 load of 10 degree. Calculate the magnetizing ampere turns per pole. The filed winding is shunt connected and takes 10 A. Find the number of extra shunt filed turns necessary to neutralize the demagnetization.

UNIT - IV

8 (a) What is commutation? What are the methods to mitigate the commutation?

(b) A 220 V D.C series motor has armature and filed resistances of 0.15 Ω and 0.10 Ω respectively. It takes a current of 30 A from the supply while running at 1000 rpm. If an external resistance of 1 Ω is inserted in series with the motor, calculate the new steady state armature current and the speed. Assume the load torque remains constant.

(OR)

9 (a) Explain, what is the need for speed control of DC machines. How to achieve the above rated speed in DC shunt motor?

(b) A 500 V dc shunt motor has $R_a = 1.5\ \Omega$ and $R_{sh} = 400\ \Omega$ respectively. When running on no load the current taken is 5 A and the speed is 1000 rpm. Calculate the speed when motor is fully loaded and the total current drawn from the supply is 30 A. Also estimate the speed at this load, if the shunt field current is reduced by 15%.

UNIT - V

10 A 50 KW, 440 V shunt generator having an armature circuit resistance including inter-pole winding of 0.15 ohm at normal working temperature was run as a shunt motor on no-load at rated voltage and speed. The total current drawn by the motor was 5 A including shunt field current of 1.5 A. Compute the efficiency of the shunt generator at 3/4th full-load.

(OR)

11 (a) Explain the process to predetermine the efficiency of dc motor by using Swinburne's test.

(b) The Hopkinson test on two similar dc shunt machines gave the following results:
Line voltage: 220 V; Line current excluding filed current: 40 A; Armature current of motoring machine: 200 A; field currents are 6 A and 7 A. Calculate the efficiency of each of the machine at the given load conduction. The armature resistance of each machine is 0.05 Ω.

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