B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

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 co-energy?
(b) Write the principle of electromechanical energy conversion.
(c) What is the function of brushes?
(d) List the different types of generators.
(e) Define separately excited generator.
(f) What are the constant and variable losses?
(g) What is back EMF?
(h) Define armature reaction.
(i) Write the condition for maximum efficiency in DC machines.
(j) Write the applications of Swinburne's test.

PART – B

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

UNIT – I

2 (a) Prove that energy and co-energy in a linear magnetic system are given by identical expressions.
(b) Derive the torque equation in round rotor machines.

OR

3 (a) Briefly explain the various phenomena useful for electromechanical energy conversion in rotating machines.
(b) In a rectangular electromagnetic relay the exciting coil has 100 turns. Cross sectional area of the core is 25 cm^2 neglect the reluctance value of the magnetic circuit. Calculate maximum mechanical force on the armature if the saturated flux density in the iron is 1.8 tesla.

UNIT – II

4 (a) Draw the winding table for a 2-pole 'ap connected DC machine with 12 armature conductors. Indicate the brush positions and polarity of induced e.m.f.
(b) Explain armature reaction in detail.

OR

5 (a) From the construction point of view, enumerate the common essential features of rotating electrical machines.
(b) Derive an expression for the emf generated in a d.c machine.

UNIT – III

6 (a) Explain the voltage build up process in d.c. shunt generator.
(b) Draw the external characteristics of various types of d.c generators in one figure assuming the same no-load terminal voltage. Discuss the nature of these characteristics and compare them.

OR

7 (a) Explain experimental determination of critical field resistance for a self excited generator.
(b) A 10 kW, 250 V d.c shunt generator has total no-load rotational loss of 400 W. The armature circuit resistance and shunt filed resistances are 0.5 Ω and 250 Ω respectively. Calculate the shaft power input and the efficiency at rated load.

Contd. in page 2

UNIT – IV

8 (a) Derive the torque equation of d.c motor.

(b) A 5 kW, 250 V d.c shunt motor takes a no load armature current of 4 A at rated voltage and runs at 1200 rpm. The armature circuit resistance is 0.4 Ω and field resistance is 250 Ω. At rated load and rated voltage, the motor takes 26 A and the armature reaction weakens the field flux by 3%. Calculate the full load speed and the corresponding torque of the motor.

OR

9 (a) Draw and explain the operation of 4-point starter.

(b) A 440 V D.C shunt motor is running at 1500 rpm and it takes a line current of 30 A. The output is 15HP. The load torque varies as the square of speed. Calculate the resistance to be connected in series with the armature for reducing the motor speed to 1300 rpm.

UNIT – V

10 (a) Explain a suitable method for determining the efficiency of a series motor.

(b) In Hopkinson's test on two identical d.c shunt machines, the following readings were obtained: Line current: 49.4 A; Line voltage: 460 V; Motor armature current: 300 A; Field currents: 5 A and 4.4 A. The armature resistance of each machine is 0.05 ohms. Calculate the efficiency of each machine.

OR

11 A 240 V DC shunt motor takes 60 A and runs at 1200 rpm. R_a = 0.4 ohms and R_f = I00 ohms. Find the: (i) Output. (ii) Copper losses. (iii) Efficiency if iron and frictional losses amount to 1400 W.

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