Code: 15A02302 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 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) Draw the schematic representation of electromechanical energy conversion.
(b) Write the equation for mechanical force.
(c) Write the principle of operation of DC generator.
(d) What is the role of commutator?
(e) Define self excited generator.
(f) What are the different types of losses in DC machine?
(g) Draw the internal characteristics of DC series motor.
(h) Draw the external characteristics of DC shunt motor.
(i) Write the general formula for efficiency.
(j) Write the applications of fields test.

PART – B

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

UNIT – I

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

OR

3 (a) Derive an expression for co-energy density of an electromechanical energy conversion device.
(b) In an electromagnetic relay, the exciting coil has 1200 turns the cross sectional area of the core is 25 cm^2. Reluctance of the magnetic path may be neglected. Find the inductance of the coil with an air gap of 1 cm. Find the field energy and force on armature if current in the coil is 2 amp.

UNIT – II

4 (a) Derive an expression for induced e.m.f in the armature of d.c machine.
(b) A separately excited generator, when running at 1000 r.p.m supplied 200 A at 125 V. What will be the load current when the speed drops to 800 rpm? If field current is unchanged? Given the armature resistance = 0.04 and brush drop = 2 V.

OR

5 (a) Explain about compensating windings and inter poles.
(b) A 10 kW, 250 V, 8-pole, 600 r.p.m lap-connected d.c. generator has 400 armature conductors. At rated voltage and current, armature ohmic losses are 150 watts. Compute the useful flux per pole.

UNIT – III

6 (a) What is critical filed resistance and critical speed.
(b) The open circuit characteristic for a d.c. shunt generator at 800 r.p.m is given by the following data.

I_f (A)	0	0.1	0.3	0.55	1.02	1.75	3.15	5.0
E (V)	10	30	70	110	160	200	240	260

Determine the critical filed resistance at 900 r.p.m.

OR

7 (a) What is an equalizer connection? What is necessity of equalizer connection?
(b) An 8-pole, DC generator has per pole flux of 40 mWb and winding is connected in lap with 960 conductors. Calculate the generated EMF on open circuit when it runs at 400 r.p.m. If the armature is wave wound, at what speed must the machine be driven to generate the same voltage.

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UNIT – IV

8 (a) Draw different characteristics of shunt, series and compound motors.

(b) With a neat sketch, explain the construction and working of a 3-point starter. What are the limitations of 3-point starter?

OR

9 (a) Derive an expression for the torque of a DC motor.

(b) A 220 V dc shunt motor takes no-load current of 10 A and runs at 750 r.p.m. At full load the armature current is 100 A and the motor runs at 690 r.p.m. Resistance of the armature is 0.1 ohms. Calculate the following: (i) Back e.m.f at no load and full load. (ii) Percentage of reduction in flux due to armature reaction.

UNIT – V

10 (a) Explain Field test for series motor.

(b) Explain Swinburne's test on DC machine when the machine act as motor.

OR

11 (a) Obtain the condition for maximum efficiency in dc motors.

(b) A 230 V d.c. shunt motor takes 3 A on no-load running at 1500 r.p.m. The armature resistance is 1 ohm and shunt field resistance is 200 ohms calculate: (i) The speed. (ii) Torque developed when the input is 7.5 kW.

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