ONE TIME EXIT SCHEME

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10EE54

Fifth Semester B.E. Degree Examination, April 2018
DC machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. What is armature reaction? Explain with relevant diagrams, the effects of armature reaction in a d.c. generator. **(08 Marks)**

b. Explain the functions of interpoles and equalizer rings. **(06 Marks)**

c. A 6-pole, wave-wound d.c. generator has armature conductors 360, armature current 80A, angle of load 5°(mech) from GNA. Calculate the demagnetizing and cross magnetizing AT_s/pole. **(06 Marks)**

2 a. Explain the characteristics of d.c. compound motors and mention their applications. **(06 Marks)**

b. Explain with a diagram, the working of a three-point starter used for d.c. shunt motor. **(07 Marks)**

c. A 200 V, d.c. shunt motor with constant main field drives a load, the torque of which varies at the square of the speed. When running at 600 rpm, it takes 30A. Find the speed at which it will run and the current it will draw, if a 20Ω resistor is connected in series with the armature. Neglect the armature resistance and field current. **(07 Marks)**

3 a. Draw the power low diagram of a d.c. motor. **(06 Marks)**

b. Derive the condition for maximum efficiency in a d.c. machine and armature current at maximum efficiency. **(06 Marks)**

c. A 60 kW, 250 V shunt motor takes 16A when running light at 1440 rpm. The resistances of armature and field are 0.2 Ω and 125 Ω respectively when hot. Determine the (i) efficiency of the motor when taking 152A and (ii) the efficiency if working as a generator and delivering a load current of 152A at 250V. **(08 Marks)**

4 a. With connection diagram, explain the fields test for series machines and derive the efficiency equations. **(10 Marks)**

b. Two identical d.c. shunt machines when tested by Hopkinson's method, gave the following data :
Line voltage 230 V; Line current excluding both the field currents 40A; motor armature current 350 A; field currents 5A and 4.2 A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.02 Ω. **(10 Marks)**

PART – B

5 a. What are the advantages of short pitched and distributed winding in an alternator. **(07 Marks)**

b. Derive E.M.F. equation of an alternator. **(06 Marks)**

c. Draw the vector diagram of non-salient pole alternator for different power factors. **(07 Marks)**

6 a. Define short circuit ratio and show that it is the reciprocal of synchronous reactance in p.u (06 Marks)

b. Draw the phasor diagram of a salient pole synchronous generator based in Two-Reacti theory. (04 Marks)

c. A 220 V, 50 Hz, 6-pole, Y-connected synchronous generator with armature resistance 0.06 Ω/phase, gave the following data:

I_f(A)	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.8
E_L(V) on open circuit	29	58	87	116	146	172	194	232

Find the percentage regulation at full-load current of 40A at 0.8 p.f. lagging by Amper Turn's method. (10 Marks)

7 a. What is infinite bus? What conditions must be fulfilled before an alternator can be connect to an infinite bus? (05 Marks)

b. Derive the power flow equations including armature resistance of non-salient pole alternat (10 Marks)

c. A 3-phase synchronous generator is delivering a power of 0.9 p.u. to an infinite bus at rat voltage and at 0.8 p.f. lagging. The generator has X_d = 1.0 p.u. and X_q = 0.6 p.u., determi the load angle and the excitation voltage. (05 Marks)

8 a. Draw the phasor diagram of cylindrical rotor synchronous motor and derive its torq equation. (07 Marks)

b. Explain the V-curves and inverted V-curves of a synchronous motor. (07 Marks)

c. What are the functions of synchronous condenser and damper winding with respect operation of synchronous motor? (06 Marks)

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