

**Fifth Semester B.E. Degree Examination, June/July 2023**  
**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. Explain the process of commutation in d.c. machine and list out methods to improve it. (06 Marks)
- b. Derive the equations for cross magnetizing Ampere – turns and demagnetizing Ampere – turns for D.C generator. (07 Marks)
- c. The magnetization characteristic for a 4-pole, 110V, 1000rpm, shunt generator is as follows :

Fields current (A)	0	0.5	1	1.5	2	2.5	3
O.C voltage (V)	5	50	85	102	112	116	120

Armature is vap connected with 144 contactors. Field resistance is 45 ohms. Determine :

- i) Voltage build up by the generator (maximum)
  - ii) The critical field resistance (07 Marks)
- 2 a. With usual notation, derive torque equation of d.c motor. (06 Marks)
  - b. With neat sketch, explain three point starters for d.c motor. (07 Marks)
  - c. A 250V d.c shunt motor has armature resistance of 0.25ohm, on load it takes an armature current of 50A and runs at 750 rpm. If the flux of motor reduced by 10% without changing the load torque, find the new speed of the motor. (07 Marks)
- 3 a. What are the losses occurring in a D.C machine. Hence draw power flow diagram for D.C generator. (08 Marks)
  - b. Derive the condition for maximum efficiency of a DC generator. (04 Marks)
  - c. A shunt generator has full load current of 196A at 220V. The stray losses are 720W and shunt field coil resistance is 55Ω. If it has a F.L efficiency of 88%, find the copper loss and corresponding armature resistance. (08 Marks)
- 4 a. Describe Swinburne's test with the help of neat connection diagram to find out the efficiency of d.c shunt machine. (06 Marks)
  - b. Explain briefly Fields test for determination of efficiency of d.c series machine. (06 Marks)
  - c. The Hopkinson's test on two shunt machines gave the following results for full load.  
 Line voltage = 250V, Current taken from supply system excluding field currents = 50A,  
 Motor armature current = 380A, field current 5A (for motor) and 4.2A (for generator).  
 Calculate the efficiency of the machine working as motor. Armature resistance of each machine is 0.2Ω. (08 Marks)

**PART – B**

- 5 a. Explain the terms coil-span factor and distribution factor in connection with alternator armature windings and deduce the e.m.f equation of an alternator incorporating the effects on these factors. (08 Marks)
- b. Explain the armature reaction main alternator and its effect depending on the type of the load. (06 Marks)

- c. In a 50KVA, star-connected, 440V, 3-phase 50Hz alternator, the effective armature resistance is 0.25 ohm per phase. The synchronous reactance is 3.2 ohm per phase. Determine E.M.F generated at rated load and unity power factor. (06 Marks)
- 6 a. Explain the MMF method of determining the voltage regulation on alternator. (07 Marks)  
b. A 100KVA, 3000V, 50Hz and 3-phase star connected alternator has effective armature resistance of  $0.2\Omega$ . The field current of 40A produces short circuit current of 200A and open circuit e.m.f of 1040V (Line value). Calculate the full load voltage regulation at 0.8p.f lagging and 0.8 p.f leading. Using synchronous impedance method. (07 Marks)  
c. With neat sketch of circuit, explain slip test to determine  $x_d$  and  $x_q$ . (06 Marks)
- 7 a. What is the necessity of parallel operation of alternators and state the conditions necessary for paralleling alternator. (06 Marks)  
b. For a cylindrical rotor synchronous generator, neglecting the effect of armature resistance, derive an expression for power developed as a function of load angle. (07 Marks)  
c. What is the capability curve of a synchronous generator? What information are available from the curve? (07 Marks)
- 8 a. Explain the operation of synchronous motor under constant load and varying excitation. (06 Marks)  
b. Write a note on V curves and inverted V- curves. (08 Marks)  
c. How synchronous motor operates as synchronous condenser and mention applications of synchronous motor. (06 Marks)

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