

USN

--	--	--	--	--	--	--	--	--	--

Fifth Semester B.E. Degree Examination, July/August 2005

Electrical & Electronics Engineering

D.C. Machines & Synchronous Machines

Time: 3 hrs.]

[Max.Marks : 100

- Note:** 1. Answer any FIVE full questions.
 2. Assuming any missing data, if any, suitably.
 3. Draw neat sketches wherever necessary.

1. (a) With the support of illustrative diagrams, explain the phenomenon of ARMATURE REACTION in a D.C. machine. (8 Marks)
- (b) What is commutation? What causes sparking at the commutator surface? Explain the process of reversal of current during commutation. (7 Marks)
- (c) Determine the reactance voltage for a DC machine with data as follows, assuming linear commutation:
 - Self inductance of coil : 0.15mH
 - Current per conductor : 40A
 - Brush span : 3 commutator segments
 - No. of commutator segments : 50
 - and speed of the machine ; 600 r.p.m (5 Marks)
2. (a) Explain giving reasons for the following statements:
 - i) A series motor should never be started on no-load.
 - ii) A shunt motor should not be put on with its field winding open. (6 Marks)
- (b) Name the machines used for these applications on D.C. supplies:
 - i) Reciprocating pumps iv) Boosters
 - ii) Centrifugal pumps v) Electric traction
 - iii) Lathes vi) Battery charging (6 Marks)
- (c) A 250 Volts, shunt motor runs at 1000 rpm on no load, and takes 5 Amps. The armature resistance including the brush contact resistance is 0.2 ohm. The field resistance is 250 ohms. Calculate the speed of the machine on load, taking a current of 50Amps, if the armature reaction weakens the field by 3 percent. (8 Marks)

3. (a) Discuss on the principle involved and the methods adopted for the speed control of D.C. shunt motors. (6 Marks)
- (b) Explain the construction, speed torque characteristics and applications of permanent magnet DC motors. (7 Marks)
- (c) A DC shunt motor operating at 230 volts, runs at 800 RPM and takes an armature current of 20Amps. Calculate the additional resistance to be inserted in series with the armature to reduce the speed to 600 rpm, with the same armature current. Take armature resistance as 0.5 ohm. (7 Marks)
4. (a) With usual notations, derive the EMF equation of an alternator with distributed and short pitched windings. (5 Marks)
- (b) Discuss the comparison between the following in an alternator:
- i) Single-layer and Double-layer windings
 - ii) Full-pitch and fractional pitch coils
 - iii) Concentrated and distributed winding (9 Marks)
- (c) A 440 volts, D.C. Shunt motor takes a no load current of 2.5Amps. The resistance of shunt field and armature are 550 ohms and 1.2 ohms respectively. The full load line current is 32 Amps. Determine the full-load output and efficiency of the motor. (6 Marks)
5. (a) Explain the advantages of stationary armature type of construction for synchronous machines. (6 Marks)
- (b) What are the methods used to reduce harmonics in three phase alternators. Explain. (6 Marks)
- (c) A 3 - phase, 8-pole, 50c/s, Y-connected alternator has 96 solts, with 4 conductors per slot. The coil span is 10 solts and the flux per pole is 0.06 Webers. Determine the line voltage generated. If each phase is capable of carrying 650 Amps, what is the KVA rating of the machine? (8 Marks)
6. (a) Define and explain the significance of the following with respect to an AC generator:
- i) Synchronous reactance
 - ii) Voltage regulation
 - iii) Potier reactance (9 Marks)

(b) Why does the EMF method of determination of voltage regulation of an alternator provide pessimistic results while the MMF method, provides optimistic results? Reason out. (5 Marks)

(c) The following test results are obtained on a 6.6kV, Y-connected alternator

OC voltage (line) - volts :	4900	5196	6600	8300
Field current (Amps) :	25	30	37.5	70

A field current of 20 Amps. is found necessary to circulate full load current on short circuit of armature. Calculate the percentage voltage regulation at 0.8 leading power factor on full load, using Ampere - turns method. Neglect armature resistance and leakage reactance. (6 Marks)

7. (a) Write explanatory notes on the following topics

- Hunting in synchronous machines
- Parallel operation of salient pole alternators
- Compounding curves of synchronous generators. (12 Marks)

(b) A synchronous generator has a direct axis synchronous reactance of 0.8 per unit and a quadrature axis synchronous reactance of 0.5 per unit. It is supplying full load at rated voltage at 0.8PF lagging Find the open circuit voltage. (6 Marks)

8. (a) Explain the principle of slip test on salient pole alternators. (6 Marks)

(b) Why are synchronous motors not self starting? Discuss briefly on the starting methods used in practice. (6 Marks)

(c) A 440 volts, 50Hz, 3 phase, Y-connected circuit takes 35Amps at a lagging PF of 0.8. A star connected synchronous motor is used to improve the power factor to unity. Calculate the KVA input, and the power factor of the synchronous motor when it is also supplying a load of 12kW and has an efficiency of 85%. (8 Marks)

** * **