Time: 3 Hours Marks: 80

Q.1 is compulsory.

Solve ANY THREE questions out of remaining.

ASSUME SUITABLE DATA wherever necessary.

Q.1 Answer (**ANY FOUR**). (20 Marks)

a) Derive condition for maximum input power for synchronous motor.

b) Derive the EMF equation for an alternator. State the assumptions made.

c) Write a short note on 'V curves'of a synchronous motor.

d) Explain power angle characteristics for non-cylindrical rotor synchronous machine.

e) List down advantages of modeling of electrical machines.

Q.2 (20 Marks)

a) For a three phase winding with 3 slots per pole per phase and coil span of 8 slots calculate coil span factor and distribution factor. The flux density in the machine air-gap is observed to contain 20% third harmonic component. Calculate the percentage increase in per phase e.m.f. due to this harmonic. The fundamental flux is of 1 Wb distributed sinusoidally.

b) Explain armature reaction for lagging and leading power factor load.

Q.3 (20 Marks)

a) Define 'regulation'and hence explain 'Magneto-motive Force method'used to calculate regulation.

b) Draw neat labeled phasor diagrams for salient pole synchronous motor for lagging, leading and unity power factor.

Q.4 (20 Marks)

a) Explain use of synchronous motor as 'synchronous condenser'.

b) A 6600 kV; star connected three phase synchronous motor runs with constant excitation and voltage. The synchronous impedance is $(1.5 + j12)\ \Omega$ per phase. For an input power of 1000 kW the power factor is 0.8 leading. Calculate new power factor for an input power of 1500 kW.

Q.5 (20 Marks)

a) Explain Blondel's Two Reaction theory.

b) Two three phase alternators running in parallel and supplying a load impedance of $(4 + j2)\Omega$ have their per phase synchronous impedances as $(0.2 + j3.2)\Omega$ and $(0.25 + j4.5)\Omega$ respectively. Their per phase excitation e.m.f.s are 230 volts with e.m.f of alternator 1 leading e.m.f. of alternator 2 by 10^0. Compute their terminal voltage; load currents and power factors.

Q.6 Write short notes on (**ANY TWO**). (20 Marks)

a) Hunting.

b) Power Circle and Excitation Circle.

c) Basic machine relation in 'd-q'variables for an induction machine.

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