

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)

- Derive condition for maximum input power for synchronous motor.
- Derive the EMF equation for an alternator. State the assumptions made.
- Write a short note on 'V curves' of a synchronous motor.
- Explain power angle characteristics for non-cylindrical rotor synchronous machine.
- List down advantages of modeling of electrical machines.

Q.2

(20 Marks)

- 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.
- Explain armature reaction for lagging and leading power factor load.

Q.3

(20 Marks)

- Define 'regulation' and hence explain 'Magneto-motive Force method' used to calculate regulation.
- Draw neat labeled phasor diagrams for salient pole synchronous motor for lagging, leading and unity power factor.

Q.4

(20 Marks)

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

- Explain Blondel's Two Reaction theory.
- 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° . Compute their terminal voltage; load currents and power factors.

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

(20 Marks)

- Hunting.
- Power Circle and Excitation Circle.
- Basic machine relation in 'd-q' variables for an induction machine.

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