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 output power for synchronous motor.

b) Explain Coil Span factor and hence derive an expression for it.

c) Whether or not a synchronous motor self starting? Justify your answer.

d) Explain excitation circle concept for synchronous motor.

e) List down advantages of modeling of electrical machines.

Q.2 (20 Marks)

a) A 4 pole, 3 phase, 50 Hz star connected alternator has 60 slots with 2 conductors per slot and having a two layer winding. Coils are short pitched such that if one coil side lies in slot number 1, the other coil side lies in slot number 13. Determine useful flux per pole required to generate a line voltage of 6000 V.

b) Explain the assumptions made in calculating voltage regulation by EMF method.

Q.3 (20 Marks)

a) Find the synchronous reactance for a star connected, 1500 KVA, 2300 V alternator in which, given field current produces 700 V on open circuit and an armature current of 376 A on short circuit. The effective per phase armature resistance is 0.12Ω. Calculate % voltage regulation for full load, 0.8 lagging power factor.

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

Q.4 (20 Marks)

a) The synchronous impedance of a 3 phase, 50 Hz, star connected 6600 V synchronous motor is $(0 + j20)\Omega$ per phase. For a certain load the input power is 900 kW at normal voltage and the induced e.m.f. is 8500 V. Determine its line current and power factor.

b) Effect of change in excitation on parallel operation of two alternators under loaded condition.

Q.5 (20 Marks)

a) Explain Blondel's Two Reaction theory.

b) Two alternators operate in parallel and supply a load of 12 MW at 0.8 lagging power factor. **i)** By adjusting the prime mover input of alternator 1 it real power output is changed to 7 MW and by adjusting its excitation the power factor is changed to 0.9 lag. Find power factor of alternator 2. **ii)** If prime mover input is left unchanged but excitation is changed for alternator 2 such that its new power factor becomes 0.9 leading determine power factor for alternator 1.

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

a) Effect of variation in load with constant excitation on synchronous motor.

b) Slip Test.

c) Steady state analysis of an induction machine.

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