

Instructions:

- Question No: 1 is compulsory.
- Answer any three from the remaining five questions.
- Figures to the right indicate full marks.
- Assumptions made should be clearly stated.
- Assume any suitable data wherever required but justify the same.
- Answers to questions should be grouped and written together.

- Q.1 a) Synchronous motor is not self-starting. Why 20
- b) What are the reasons for making field as rotor in a synchronous alternator
- c) Draw alternator phasor diagram for lagging power. How one can distinguish whether phasor diagram is for an alternator or a synchronous motor?
- d) What are the conditions to be satisfied to connect a synchronous generator to infinite bus..
- Q2 a) Explain Steady state analysis of induction machine 10
- b) Derive coil span factor, breadth factor and the induced emf equation of a synchronous generator 10
- Q3 a) Explain excitation circle and power circle of synchronous motor 10
- b) A salient pole synchronous generator has the following per unit parameters 10
 $X_d = 1.2, X_q = 0.8, r_a = 0.025$
Compute the excitation voltage E_f on a per unit basis, when the generator is delivering a rated kVA at rated voltage and at 0.8 lagging power factor.
- Q4 a) Explain armature reaction in a synchronous machine. 10
- b) Derive synchronous machine voltage equations in d q o variables by the use of coupled circuit theory and Park's transformation. 10
- Q5) a) A basic three phase, two pole synchronous machine of the salient pole type has the following inductances, where θ is the angle measured from d-axis to the axis of phase A 06
- Phase A self-inductance, $L_a = 0.9 + 0.2 \cos 2\theta$
Mutual inductance between phase A and Field winding F,
 $M_{af} = 8 \cos \theta$
- Mutual inductance between phase B and C,
 $M_{bc} = -0.4 + 0.2 \cos 2\theta$
- a) Write expression for all the self and mutual inductances in

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terms of θ

b) Determine L_d , L_q , and L_0

b) A 3300 V star connected synchronous motor has synchronous impedance of $0.4 + 5j \Omega$ per phase. For an excitation emf of 4000 V and motor input power of 1000 kW at rated voltage, compute line current and power factor 10

c) Explain synchronous motor starting methods 04

Q6 Write short notes on any two 20

a) Synchronizing power and synchronizing torque

b) Hunting, causes effects and remedies

c) Synchronous condenser

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