Time: **3 Hrs**   Marks:**80**

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

Q1 **a)** Derive active and reactive power equation of Salient pole synchronous machine. What is the significance of reluctance power?   **10**

b) By using excitation circle and power circle explain development of V curves and O curves   **10**

Q2 **a)** Explain Steady state analysis of synchronous machine   **10**

b) How armature reaction influences the field distribution of alternator. Illustrate the effect under different power factor   **10**

Q3 **a)** Explain Blondel's two reaction theory   **10**

b) A three phase, 50Hz, 2 pole star connected alternator has 54 slots with 4 conductors per slot. The pitch of the coil is one slot less than the pole pitch. If the machines give 3300 V between lines on open circuit with sinusoidal flux distribution determine the useful flux per pole   **10**

Q4 **a)** A 220 V , 50 Hz 6 pole star connected alternator with ohmic resistance of 0.06 Ω / phase , gave the following data for O.C and S.C characteristics   **12**

Field current If(amp)	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.8	2.2	2.6	3.0	3.4
O.C.voltage Ef (volts)	29	58	87	116	146	172	194	232	261.5	284	300	310
S.C.current Isc (amp)						40			---	---	---	---

Find % voltage regulation at full load current of 40 amp at 0.8 p.f. lagging by EMF method and MMF method

b) Explain with phasor diagram why short circuit characteristics of a generator is a straight line.   **8**

Q5 **a)** Derive the expression for active and reactive power of salient pole synchronous machine. Also plot P-δ curve.   **10**

b) Explain the need and operation of synchronous condenser   **10**

Q6 Write short notes on any two   **20**
a) Synchronizing power and synchronizing torque
b) Synchronous motor starting methods
c) Parallel operation

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