(3 Hours)   [Total Marks: 80]

N.B. 1) Question No. 1 is compulsory

   2) Attempt any three of the remaining Questions No. 2 to No. 6.

   3) Illustrate answers with diagrams wherever necessary.

   4) Assumptions made should be clearly stated.

Q 1.   Solve any four

   a) Why is rotating field system used in preference to a stationary field?   05

   b) Define voltage regulation. List out different methods to calculate voltage regulation.   05

   c) State the conditions necessary for paralleling alternators.   05

   d) Write a note on Steady-state analysis of synchronous machines.   05

   e) Explain the principle of operation of a 3-phase synchronous motor.   05

Q 2. a) Explain the phenomena of armature reaction when an alternator is delivering a load current at a) purely lagging pf b) unity pf c) purely leading pf.   10

   b) Explain how open circuit and short circuit test are conducted on a synchronous machine. What is an air gap line?   10

Q 3. a) State the applications of synchronous motors. Compare synchronous motor with three phase induction motor.   10

   b) Two station generators A and B operate in parallel. Station capacity of A is 50 MW and that of B is 100 MW. The full-load speed regulation of station A and station B is 4 %. Calculate the load sharing if the connected load is 100 MW. The no-load frequency is 50 Hz.   10

Q 4. a) Explain the effect of varying excitation on armature current and power factor in a synchronous motor. Draw V-curves and state their significance.   10

   b) Draw equivalent circuit and phasor diagrams for different loads of a cylindrical rotor synchronous motor.   10

Q 5. a) Explain Blondel's two-reaction theory of salient-pole synchronous machines.   10

   b) A 1500 KVA, Star connected, 2300 V, 3 phase, Salient pole synchronous generator has reactances X_d= 1.95 Ohms and X_q=1.40 ohms per phase. All losses may neglected. Find the excitation voltage for operation at rated KVA and power factor of 0.85 lagging.   10

Q 6.   Solve any two.   20

   a) Derive the basic machine relation in dq0 Variables.

   b) Explain two important function served by damper winding in a synchronous machines.

   c) What is an infinite bus? State the characteristics of an infinite bus.

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