3 Hours **Max.Marks:80**

Question 1 is compulsory

Attempt any three from question No.2 to Question No.6

Assumptions made should be clearly stated

Q1	Attempt any four	20
a.	a) Define the following : i) Pitch factor ii) distribution factor iii) coil pitch iv) pole pitch v) winding factor	5
b.	Compare salient and non-salient pole type alternator	5
c.	Draw alternator phasor diagram for lagging power factor.	5
d.	State conditions required for successful parallel operation of two alternators	5
e.	Explain steady state analysis 3 phase synchronous machine.	5
f.	Draw P-ɗ curve for cylindrical rotor and salient pole alternator with active power equation for both.	5
Q2.	Solve the following Questions	20
a.	Derive the expression for EMF induced in alternator with harmonics present in the system.	10
b.	The stator of three phase 16 pole and there are 4 conductors per slot and the conductors of each phase are connected in series. Total number of slots are 144. If the speed of alternator is 375 rpm, calculate the emf induced/phase, resultant flux in air gap is 5×10^{-2} wb/pole sinusoidally distributed. Assume the coil span as 150^{o} electrical.	10
Q3.	Solve the following Questions	
a.	Illustrate ZPF method with advantages and limitations.	10
b.	A 3-phase, 1500 kVA, star-connected, 50-Hz, 2300V alternator has a resistance between each pair of terminals as measured by direct current is 16Ω.Assume that the effective: resistance is 1.5 times the ohmic resistance. A field current of 70 A produces a short-circuit current equal to full-load current of 376 A in each line. The same field current produces an e.mf. of 700 V on open circuit. Determine the synchronous reactance of the machine and its full load regulation at 0.8 power factor lagging. (EMF method)	10

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Q4. Solve the following Questions.

a. Two similar alternators operating in parallel have the following data 10

Alternator 1- 700 kW, frequency drops from 50Hz at no-load to 48.5Hz at full load.

Alternator 2- 700 kW, frequency drops from 50.5Hz at no-load to 48Hz at full load.

Calculate how a total load of 1200kW is shared by each generator along-with operating frequency at bus bar for this load.

b. Illustrate "three dark lamp method" for synchronization of alternator with infinite bus with neat diagram. What is the condition of connection if the lamps are having circulatory motion? 10

Q5. Solve the following Questions.

a. Justify "synchronous motor is not self-starting". State various starting methods of synchronous motor and explain any one in brief 10

b. Elaborate "Hunting" phenomenon in synchronous machine. How it can be eliminated?

Q6 Solve the following Questions.

a. Derive the expression for induced emf for salient pole alternator using Blondel's two reaction theory. 10

b. Elaborate slip test on synchronous machine and comment on direct and quadrature axis reactance . 10

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