B.E. Electrical (Electronics & Power) Engineering Fifth Semester

EP501 - Electrical Machines-II

P. Pages : 2 **GUG/W/18/1616**

Time : Three Hours * 1 2 7 0 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of non programmable calculator is permitted.

1. a) Explain speed control of 3-phase induction motor by changing supply frequency. Why in this method voltage/frequency ratio kept constant. **5**

b) Explain capacitor start single phase induction motor. **5**

c) Explain star delta starting of 3-phase Induction motor. **6**

OR

2. a) Explain dynamic braking in 3phase Induction motor. Explain Plugging. **8**

b) The induced emf between the slip ring terminal of a three phase induction motor, when the rotor is at standstill is 100V. The rotor winding is star connected & the resistance & reactance of 0.05 Ω & 0.1Ω per phase respectively. Calculate the rotor current & phase difference between rotor voltage & rotor current at (a) 4 percent slip (b) 100 percent slip **8**

3. a) Justify "Synchronous motor is not self starting" how will you make it self starting. **7**

b) Explain hunting in synchronous machine. **4**

c) Define distribution factor & pitch factor. Derive the expression for pitch factor. **5**

OR

4. a) Justify third order harmonics & their multiple doesn't appear in line. voltages of 3-phase star connected system. Hence write the generalized equation of line voltage with harmonic content. **7**

b) A 2 pole, 3 phase, 50Hz alternator has 42 slots each slot has 2 conductors in a double layer winding. The coil pitch is 17 slots. Each phase winding has 2 parallel paths. Calculate flux per pole required to generate a phase voltage of $23000/\sqrt{3}\,V$. **9**

5. a) Explain two reaction theory, hence draw the phasor diagram of salient pole synchronous generator considering armature resistance & lagging power factor. **8**

b) A 3 phase 400V, 50Hz, star connected 100KVA synchronous generator supplies rated current at rated voltage at 0.8 pf. lagging & 0.6pf leading. Calculate the induced emf, components of armature current $I_d \& I_q$: & load angle δ in both cases giving phasor diagram $Ia/ph = 0.02Pu,\ x_a/ph = 0.8pu \& x_q/ph = 0.6pu$ **8**

OR

6. a) Define short circuit ratio for synchronous generator show that $SCR = \frac{1}{x_s p.u}$ **8**

b) A 3300 Volt, 3 phase star connected alternator has a full load current of 100 Amp. on short circuit, a field current of 5Amp was necessary to produce full load current. The open circuit voltage measured between the lines for same excitation was 800 volts. The armature resistance was 0.8Ω/phase. Determine full load voltage regulation for **8**
i) 0.8 pf lagging ii) 0.8 pf leading

7. a) Explain 'V' and inverted 'V' curves in synchronous machines with the of phasor diagram. **8**

b) Derive the expression for electrical power input (P_{in}), electro mechanical output power (P_m) for cylindrical pole synchronous motor. Hence obtain the equation for same if armature resistance Ra is neglected. **8**

OR

8. a) What are the various conditions for parallel operation of 3-phase alternator? Explain dark lamp method of parallel operation of alternator. **8**

b) A 400V, 3 phase, delta connected synchronous motor has an effective resistance & synchronous reactance of $0.1\Omega \& 1\Omega$ respectively. The induced line emf is 500V. Calculate the line current & power factor when output is 150kw. Assume friction, windage & core losses are total 10 kw. **8**

9. a) Define subtransient, direct & quadrature axis reactance of salient pole synchronous machine, hence justify why $X_a'' < X_a''$ **5**

b) Explain the working principle & construction of universal motor. **7**

c) How will you measure positive sequence reactance in laboratory. **4**

OR

10. Write short notes on **any three.**

a) Power factor & speed control of Schrage motor. **6**

b) Hysteresis motor. **5**

c) Reluctance motor **5**

d) Repulsion motor. **5**

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