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

Electrical Machines – II

P. Pages : 2 **NRT/KS/19/3422**

Time : Three Hours * 0 1 3 0 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.

1. a) Explain difference between cylindrical & salient pole synchronous machine. **6**

b) A 4 pole, $3-\phi$, 50 Hz, Y – connected alternator has 60 slots with 4 conductors/slot. Coils are short pitched by 3 slots. If the phase spread is 60º, find the line voltage induced for flux/ pole of 0.943 wb distributed sinusoidally in space. **7**

OR

2. a) State the advantages & disadvantages of short pitched distributed armature winding over full pitched concentrated armature winding. **6**

b) Calculate the PITCH FACTOR for the given winding : **7**
i) 36 – stator slots, 4 – pole, coil span 1 to 8.
ii) 72 – stator slots, 6 – pole, coil span 1 to 10.
iii) 96 – stator slots, 6 – pole, coil span 1 to 12
Sketch the three coil spans.

3. a) Explain armature reaction in 3 – ph alternator at lagging, leading and unity power factor. **6**

b) A 3 – phase, star connected alternator is rated at 1600 kVA, 13,500 V. The armature effective resistance & synchronous reactance are 1.5 ohm & 30 ohm per phase respectively. Calculate the percentage regulation for a load of 1280 kW at power factors (a) 0.8 leading (b) 0.8 lagging. **8**

OR

4. a) Explain potier reactance method to find the regulation of 3 – phase alternator. **6**

b) A $3-\phi$, 50 Hz, Y – connected, 2000 kVA, 2300 V alternator gives a S.C. current of 600 Amp for a certain field excitation. With the some excitation the O.C. voltage was 900 V. The resistance between pair of terminals was 0.12Ω. **8**
Find full load regulation at (i) UPF & (ii) 0.75 p.f. lagging.

5. a) What is meant by synchronization of alternator. Explain the process of synchronization with suitable experimental set up. **6**

b) Explain the laboratory method to determine X_d and X_q of synchronous machine. **7**

OR

6. a) What is short circuit ratio and its significance? Prove that SCR is the reciprocal of direct axis reactance 'Xd'. **6**

b) A salient pole alternator has direct axis and quadrature axis reactance of 0. 8 p.u. and 0.5 p.u respectively. The effective resistance is 0.02 pu. Compute percentage regulation when generator is delivering rated load at 0.8 pf. lag of lead. Assume rated voltage & rated current as one per unit. **7**

7. a) Compare three phase synchronous motor with three phase induction motor. **6**

b) The excitation of a 415 V, 3 – phase, mesh connected synchronous motor is such that the induced emf is 520 V. The impedance / phase is $(0.5+j4)\Omega$. If the friction 2 iron losses are 1000 W. Calculate the power output, line current, power factor & efficiency for maximum power output. **7**

OR

8. a) Explain effect of changing excitation can armature current & power factor of synchronous motor. **6**

b) A 3980 V, 50 Hz, 4 pole, Y connected synchronous motor generates a back emf of 1790 V per phase. The resistance & reactance per phase are 2.2Ω & 22Ω respectively. The torque angle is 30^{o} electrical. Calculate : **7**

i) Resultant armature voltage
ii) Armature current per phase
iii) Power factor of motor.
iv) Gross torque developed by motor.

9. a) Draw & explain equivalent circuit diagrams of synchronous machine under steady state, transient & sub – transient condition. **7**

b) Define Xd" and Xq" of an alternator. Explain the laboratory method to determine Xd" and Xq". **6**

OR

10. a) Derive the expression for obtaining power angle characteristic of salient pole generator. What do you mean by reluctance power? **7**

b) Explain hunting in synchronous machine. What are its ill effects? **6**

11. a) Explain the construction & working of repulsion motor. **7**

b) With neat diagram, explain the operation of Brushless D. C. motor. **7**

OR

12. Write short notes on : **14**

a) A. C. Series motor.

b) Hysteresis motor.

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