

SRK/KW/14/7069

Faculty of Engineering & Technology  
Fifth Semester B.E. (Electrical Engg.) (C.B.S.)  
Examination

**ELECTRICAL MACHINE—II**

Time : Three Hours]

[Maximum Marks : 80

**INSTRUCTIONS TO CANDIDATES**

- (1) All questions carry marks as indicated.
  - (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 Slide rule, Logarithmic tables, Non-programmable calculator, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
1. (a) Compare cylindrical rotor synchronous generator with salient pole rotor synchronous generator. 6
- (b) In a 3 phase, star connected alternator, there are two coil sides per slot and 16 turns per coil. Armature has 288 slots on periphery. When driven at 250 rpm it produces 6600 V between the lines at 50 Hz. The pitch of the coil is 2 slots less than the full pitch. Calculate the flux per pole. 7

**OR**

2. (a) Define short pitch winding. Mention its advantages. 5

(b) Calculate the RMS value of the induced emf/phase of a 10 pole, 3 phase, 50 Hz alternator with 3 slots/pole phase and 4 conductors/slot in two layers. The coil span is  $130^\circ$ . The flux pole has a fundamental component of 0.3 wb and a third component of  $20\%$ . 8

3. (a) State assumptions made for EMF method (Synchronous Impedance Method) of finding regulation of synchronous generator which introduce considerable error. 6

(b) A 3 phase, 1500 KVA, 50 Hz, star connected, 2300 V alternator has a resistance between each pair of terminals as measured by direct current is  $0.16 \Omega$ . Assume that 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 emf of 700 V on open circuit. Determine the synchronous reactance of the machine and its full load regulation of 0.8 pf lagging. 8

OR

4. (a) What is mean by zero power factor characteristics? Explain its significance. 4

(b) A 500 KVA, 6600 V, 3 phase, star connected alternator has a resistance of  $0.75 \Omega$  per phase. Estimate by zero power factor method the regulation

for a load of 500 A at 0.9 leading power factor from following data

Field Current (Amp)	Open Circuit Terminal Voltage	Zero Power Factor Voltage
32	3100	0
50	4900	1850
75	6600	4250
100	7500	5800
140	8300	7000

5. (a) Compare alternator with low value of SCR with high value of SCR (Short Circuit Ratio). 10 6

(b) Define negative sequence and zero sequence reactance of a synchronous machine and explain laboratory method of their measurement. 7

OR

6. (a) Write short note on synchronization of Alternators. 6

(b) Explain slip test to find  $X_d$  and  $X_q$  in laboratory. What will happen if the rotor is rotated in a direction opposite to that of the stator (armature) mmf? 7

7. (a) Compare  $3\phi$  Synchronous motor with  $3\phi$  Induction motor. 6

(b) A 3980 V, 50 Hz, 4 pole, star connected synchronous motor generates back emf of 1790 V per phase. The resistance and synchronous reactance per phase are  $2.2 \Omega$  and  $22 \Omega$  respectively. The torque angle is  $30^\circ$  electrical. Calculate :

- The resultant armature voltage
- Armature current per phase
- Power factor of motor
- Gross torque developed by the motor.

OR

8. (a) Derive the expression for obtaining Power-Angle characteristic of salient pole generator. Hence explain what do you mean by reluctance power ? 7
- (b) What do you mean by normal excitation, over excitation and under excitation ? Comment on power factor of synchronous generator when it is operated in under excitation and over excitation condition. 6

9. (a) Draw the oscillogram for short circuit current when 3 phase short circuit occurs on unloaded alternator for phase 'a'.

(Assume d.c. offset current = 0).

Explain how second harmonic currents are induced and why d.c. offset current is different in phases a, b and c. 7

- (b) Write short note on damper winding. 6

OR

10. (a) Define sub transient, transient and steady state reactances giving equivalent circuit. How can these reactances be found from oscillogram ? 7
- (b) Write short note on Hunting of Synchronous Generator. 6

11. Write short notes on :

- (1) AC Series Motor 7
- (2) Hysteresis Motor. 7

OR

12. Write short notes on :

- (1) BLDC Motor 7
- (2) Repulsion Motor. 7