

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS

ENGINEERING II EEE II SEM R22

QUESTION BANK

SUBJECT: **EM-II**

PART-A

1. Explain the working principle of Induction generator.
2. Derive the condition for maximum torque at the time of starting in a 3- ϕ I.M.
3. Derive the condition for maximum torque under running conditions in a 3- ϕ I.M.
4. Explain the speed control of 3- ϕ IM using cascade connection.
5. Write the merits and demerits of slip-ring induction motor.
6. Write the effects of crawling and cogging on the performance of induction motor.
7. What is the procedure to conduct the blocked rotor test on 3- ϕ induction motor?
8. Describe the relation between torque and rotor power factor.
9. Define slip and its condition at the time of starting of 3- ϕ IM.
10. List out the applications of 3-phase induction motor?
11. What are types of 3-phase induction motor?
12. Why the induction motor is called asynchronous motor?
13. Give the conditions for maximum torque for 3-phase induction motor?
14. What are the advantages of 3-phase induction motor?
15. State the application of an induction generator?
16. What are the various methods available for making a single-phase motor self-starting?
17. What is the function of capacitor in a single-phase induction motor?
18. Give the names of three different types of single-phase motor.
19. State any four use of single-phase induction motor.
20. Why AC generator is called Alternator?
21. Why Alternator is called Synchronous generator?
22. Why a 3-phase synchronous machine will always run at synchronous speed?
23. Why almost all large size Synchronous machines are constructed with rotating field system type?

24. Write down the equation for frequency of emf induced in an Alternator.
25. How are alternators classified?
26. What are the advantages of salient pole type of construction used for synchronous machines?
27. Why is the stator core of Alternator laminated?
28. What is the relation between electrical degree and mechanical degree?
29. Define pitch factor or coil span factor.
30. Define distribution factor or winding factor or breadth factor or spread factor
31. what is slot angle β ?
32. What is meant by armature reaction in Alternators?
33. What is synchronous reactance?
34. What is synchronous impedance?
35. What are the advantages and disadvantages of estimating the voltage regulation of an Alternator by EMF method?
36. Why is the synchronous impedance method of estimating voltage regulation considered as pessimistic method?
37. Why is the MMF method of estimating the voltage regulation considered as the optimistic method?
38. What is meant by infinite bus-bars?
39. What are the methods of checking the phase difference?
40. What happens in all dark lamp method ?
41. List the factors that affect the load sharing in parallel operating generators?
42. How does increase in excitation of the Alternator connected to infinite bus-bars affect this operation?
43. What is need of parallel operation of alternator.

PART-B

Unit-I

1. Derive and explain rotating magnetic field in a three phase induction motor.
2. What are its advantages and disadvantages of wound rotor type induction motor?
3. Explain the torque speed characteristics of 3- ϕ IM.
4. Obtain the relation between rotor input, rotor copper losses and rotor output in terms of slip(s).
5. Explain the construction and working principle of three phase induction motor.
6. Derive a relation between full load torque and maximum torque of a three phase Induction Motor.

7. Derive the torque-slip equation for a 3-phase induction motor and also the equation for the slip at which maximum torque occurs?
8. The power input to the rotor of a 400V, 50Hz, 6 pole, 3-phase induction motor is 75 KW. The rotor electromotive force is observed to make 100 complete alterations per minute. Calculate (i) slip (ii) rotor speed (iii) rotor copper losses per phase (iv) Mechanical power developed.
9. A 10 kW, 400 V, 3-phase, 4 pole, 50 Hz delta connected induction motor is running at no load with a line current of 8 A and an input power of 660 W. At full load, line current is 18 A and input power is 11.20 kW. Stator effective resistance per phase is 1.2Ω and friction, windage loss is 420 W. For negligible rotor ohmic losses at no load, calculate stator core loss (ii) total rotor losses at full load (iii) total rotor ohmic losses at full load (iv) full load speed.
10. In a 6 pole, 3-phase 50 Hz induction motor with star connected rotor, the rotor resistance per phase is 0.3 ohm, the reactance at standstill is 1.5 ohm per phase and an emf between the slip rings on open circuit is 175V. Calculate:
- slip at a speed of 960 rpm
 - rotor emf per phase rotor frequency and reactance at a speed of 950 rpm.
11. A 3 phase induction motor has 2 poles and is connected to 400V, 50Hz supply. Calculate the actual rotor speed and rotor frequency when the slip is 4%.
12. A 3-phase, 400 V, 50 Hz induction motor takes a power input of 35 KW at its full load speed of 980 rpm. The total stator losses are 1 KW and the friction and windage losses are 1.5 KW. Calculate: (i) slip (ii) Rotor ohmic losses (iii) shaft power (iv) shaft torque (v) efficiency.
13. A 415 V, 29.8 kW, 50 Hz, delta connected motor gave the following test data: No-load: 415 V, 21 A, 1250 W Locked-rotor test: 100 V, 45 A, 2730 W Construct the circle diagram and determine (i) The line current and power factor for rated output (ii) The maximum torque. (iii) Slip (iv) efficiency. Assume stator and rotor cu losses equal at standstill.

UNIT-II

- Explain the various speed controlled methods of a 3-phase IM.
 - Explain the procedure for conducting No load test on three phase induction motor.
 - Explain the speed control of induction motor using Rotor resistance control.
 - Explain the procedure of conducting of blocked rotor test on three phase induction motor.
 - Explain the working of Induction generator.
6. A 3-phase, 400V induction motor gave the following test readings: No- load: 400V, 1250W, 9A
Short-circuit: 150V, 4kW, 38A

Draw the circle diagram. If the normal rating is 20.27 hp (metric), find from the circle diagram, the full-load values of current, power factor and slip.

7. How is the speed of a 3-phase induction motor controlled by its stator voltage control?

8. A 4-pole induction motor and 6-pole induction motor are connected in cumulative cascade at 50 Hz supply. The frequency in the secondary circuit of the 6-pole motor is observed to be

1.0 Hz. Determine the slip in each machine and combined speed of the set.

9. Explain the induction motor operation under injection of an e.m.f. into the rotor circuit.

10. Briefly discuss the principle of cascade connection of induction machines.

UNIT-III

1. Derive the generalized expression for an induced e.m.f per phase in three phase alternator, when coils are not full pitch and concentrated in one slot.

b) An 8-pole, 3-phase, 60° spread, double layer winding has 72 coils in 72 slots. The coils are short-pitched by two slots. Calculate the winding factor for the fundamental and third harmonic.

2. Discuss the differences between distributed and concentrated windings of synchronous machines?

b) Determine the frequency of a 8 pole alternator rotating at 400 R.P.M. If the number of poles is doubled, then what will be its new frequency?

3. Explain synchronous impedance method to determine voltage regulation of an alternator.

4. Explain in detail about the constructional features of round rotor synchronous machines.

b).A 150 kVA, 500V, 3 phase star connected alternator has the following test results: OCC: Line to line voltage is 500V Field current is 4A

Air-gap line: Line to line voltage is 400V Field current is 3A
SCC: Field current is A

Armature current is 173.21 A

The armature resistance is negligible. Find unsaturated reactance in ohms and per unit.

5. Explain how the harmonics in the generated EMF can be suppressed in synchronous machines.

b) A three phase star connected alternator has an open circuit voltage of 6000V. The armature resistance and synchronous resistance are 0.4Ω and 4Ω per phase respectively. Find the terminal voltage and the phase difference between terminal voltage and open circuit EMF at a power factor of 0.9 leading. Given load current is 140A.

6. Explain in detail about finding the regulation of synchronous generators using ASA method.

b) Find the voltage regulation at full load, 0.9 power factor lagging for a three phase, 1000 kVA, 5000 V, star connected alternator having an armature resistance of 0.08Ω per phase and a synchronous reactance of 7Ω per phase.

7. Explain in detail about two reaction analysis.

b) The OCC of a 6-pole, 440V, 50Hz, three phase star connected alternator is as below

Field current (A)	2	4	6	7	8	10	12	14
Open circuit Voltage (V)	155	280	390	440	475	525	565	590

A field current of 7A is needed to circulate the full load rated current of 35A under short circuit conditions. The field current for rated terminal voltage under full load zero power conditions is 15A. The armature resistance is 0.3Ω per phase. Find the regulation at full load current of 35A at

0.9 lagging power factor using MMF method.

8. Give the constructional details of both salient pole and cylindrical rotor synchronous machines.

b) A three phase, 50 Hz Y connected alternator has a single layer winding distributed in 36 slots, each slot containing 16 conductors. The flux per pole is 0.04 wb. Calculate the terminal emf at open circuit.

9. List out the different types of armature windings of synchronous machine and explain briefly.

b) The phase EMF of a 3-phase alternator consists of fundamental, 20% of 3rd harmonic and 10% of fifth harmonic. The amplitude of fundamental is 1000 V. Calculate the RMS value of line and phase voltage, when the alternator is connected in (i) Star (ii) Delta.

UNIT-IV

1. Discuss in brief about the two-reaction analysis of a salient-pole synchronous machine

b) A synchronous generator has $X_d = 0.75$ pu and $X_q = 0.5$ pu. It is supplying full-load at rated voltage at 0.8 lagging power factor. Draw the phasor diagram and compute the excitation emf.

2. Derive expression for synchronizing torque when two alternators are connected in parallel.

b) Two identical 2MVA alternators operate in parallel. The governor of first machine is such that the frequency droops uniformly from 50Hz on no-load to 47.5 Hz on full-load. The corresponding uniform speed drop of the second machine is 50Hz to 48Hz. How will they share a load of 3MW?

3. What is an infinite bus? State the characteristics of an infinite bus. What are the operating characteristics of an alternator connected to an infinite bus?

b) Describe the factors which affect the sharing of load between two alternators operating in parallel.

4. Why synchronous motor is not self-starting? Explain the methods of starting of synchronous motor.

b) A 500V, 6-pole, 3-phase, 50Hz, star-connected synchronous motor has a resistance and synchronous reactance of 0.3Ω and 3Ω per phase respectively. The open circuit voltage is 600V. If the friction and core losses total 1kw, calculate the line current and power factor when the motor output is 100hp.

5. Explain hunting of synchronous machines and methods of its prevention.

b) A 3-phase, 415V, 6-pole, 50Hz, star-connected synchronous motor has emf of 520V (L-L). The stator winding has a synchronous reactance of 2ohms per phase and the motor develop a torque of 220N-m. The motor is operating at 415V, 50Hz bus (i) calculate the current drawn from the supply and it's power factor (ii) draw the phasor diagram showing all the relevant quantities.

6. Discuss in detail about sub-transient, transient and steady state reactances.

b) Two similar 3000 kVA alternators operate in parallel. The governor of the first machine is such that frequency drops from 50 Hz at no load to 48 Hz on full load. The corresponding drop for the second machine is 50 Hz to 48.5 Hz. (i) how will they share a load of 4000 kW? (ii) How much maximum unity power factor load can they carry without any one of them getting overloaded?

7. Explain in detail about Synchronizing alternators with infinite bus bars.

b) A 3 MVA, 6 kV, 1500 rpm, three phase 50 Hz alternator is operating on infinite bus bar. Find synchronizing power per mechanical degree of angular displacement at no load. Also find synchronizing torque for a 0.5° mechanical displacement. Given the synchronous reactance is 30%.

8. a) Draw the phasor diagram of synchronous motor and explain.

b) A 2kV, three phase star connected synchronous motor has a synchronous reactance of 9Ω per phase . When the motor delivers 120 kW, the efficiency is 95% (exclusive of field loss). The power angle is 15° . Calculate (i) E per phase (ii) Power factor. Neglect resistance.

9) A 3 kV delta connected synchronous motor has synchronous reactance of 15Ω per phase. It operates at a leading power factor of 0.8 when drawing 700 kW from mains. Find excitation EMF?

10).A 15 MVA, 11kV, 1500 r.p.m, 3 phase, 50 Hz alternator is connected to a large power system. Finds synchronizing power per electrical degree of angular displacement at no load and (ii) full load at rated voltage and current at 0.8 p.f. lagging. Also find synchronizing torque for a 0.5 degree mechanical displacement in each case. Take $x_s=0.4pu$

11. Draw and explain the 'V-curves' and 'inverted V-curves' of synchronous motor.

b) Explain the different starting methods of synchronous motor.

12. Derive the expression for mathematical analysis of power developed by synchronous motor.

b) Explain the hunting of a synchronous machine. What is the purpose of damper Windings in a synchronous machine?

UNIT-V

1. Give the constructional features and explain the working principle of single phase induction motor and draw equivalent circuit.
b) Compare the AC series motor with Universal motor and mention their operational difficulties.
2. Explain about capacitor start capacitor run motors of a single phase induction motor.
b) Explain the working principle of permanent magnet motors.
3. Explain the principle of operation of single phase induction motor.
b) Explain the operating principle of universal motor.
4. Discuss in detail about the working principle of split phase motors.
b) Explain in detail about double revolving field theory.
5. Write short notes on double revolving field theory?