**EE 2302 - ELECTRICAL MACHINES II**

**UNIT –I**

**SYNCHRONOUS GENERATOR**

**PART-A**

1. Why is the field system of an alternator made as a rotor?
2. What is synchronous reactance?
3. What is meant by armature reaction in alternators? **Nov 2012, Nov**

**2013)**

1. What are the conditions for parallel operation of alternators?
2. What are the reasons for drop in voltage from no load to full load?

**(Nov -2012)**

1. Why alternators are synchronized in power plant?
2. What you meant by single layer winding and double layer winding?

**(Nov** -**2011)**

1. Define the terms ‘distribution factor’ and ‘pitch factor’
2. What are the various function of damper winding provided with

alternator?

1. Why the stator core is laminated? **(APR 2011)**
2. Define voltage regulation. **(Apr 2011, Nov 2013)**
3. What are the test data required for predetermining the voltage

regulation of an alternator by potier method?

1. What is meant by synchronous impedance of an alternator?
2. Calculate the pitch factor for the under given winding: 36 slots.4 poles

coil span 1200 electrical.

1. Draw the OCC of an alternator
2. What are the test data required for predetermining the voltage

regulation of an alternator by potier method?

1. State the advantages of stationary armature.
2. Calculate the distribution factor for a 36 slots.4 poles, single layer

three phase Winding

1. Give any two difference between salient pole and cylindrical pole

rotors.

1. What is capacity curves?

**PART-B**

1. (i) With neat sketch describe the construction and principle of operation

of salient pole alternator. **(6) (NOV- 2012)**

(ii) Derive the EMF equation of an alternator. **(6) NOV-2010,2011, 2012,**

**2013)**

(iii) A 4 pole alternator has an armature with 25 slot and 8 conductor per

slot and rotates at 1500 rpm and flux per pole is 0.05 wb. Calculate

the e.m.f generated, If winding factor is 0.96 and all the conductors

are in series. **(4) (Nov-2012)**

2. (i) Elaborate the discussion on capability curve with its boundaries of

synchronous machine**.(8) (Nov-2010)**

(ii) Discuss the parallel operation of two alternators with identical

speed/laod characteristics(8) **(Nov-2010)**

3. (i) Define armature reaction and explain the effect of armature reaction

on different power factor loads of synchronous generators. (8)

(**MAY- 2012)**

(ii) Describe a method of synchronizing the 3 phase alternator to the

infinite bus giving the relevant diagram**(8) (MAY-2012)**

4. Explain Clearly the ZPF method of determining regulation of an

alternator.(10) **(MAY-2012)**

5. (i) A 2000 KVA, 11KV, 3-phase star connected alternator has a

resistance of 0.3 Ω and reactance of 5 Ω/phase. It delivers full load

current at 0.8 lagging power factor at rated voltage. Compute the

terminal voltage for the same excitation and load current at 0.8

power factor leading. (10)

(ii) A 500 V, 50 kVA single phase alternator has an effective armature

resistance of 0.2 . An excitation current of 10 A produces 100 A

armature current on short circuit and an emf of 450 V on open

circuit. Calculate synchronous reactance. (6)

6. (i) State and explain the conditions for parallel operation of

alternators.**(8)(Nov-2012**

(ii) What is synchronizing power of an alternator? Derive an expression

for the synchronizing power between the two alternators connected

in parallel(8) **(MAY-2012)**

7. (i) Explain the determination of direct axis reactance Xd and

quadrature axis reactance Xq using slip test **(Nov -2011) (8)**

(ii) For the salient synchronous machine, derive the expression for

power developed as a function of load angle. **(Nov -2011) (8)**

8. (i) The following open circuit and sort circuit are made on a

6000KVA, 6600V,star connected,2 pole,60HZ turbine driven

alternator. If I=12A at open circuit terminal voltage =8200V. with

armature short circuited I=125A.IL=800A(line). At the rated load

and UPF armature loss loss is 1.5 % of out put. Determine the

percentage regulation at rated load and 0.8 p.f lag (**8)(Nov -2011)**

(ii) A 3 phase 16-pole alternator has star connected winding with 144

slots and 10 conductors per slot.the flux per pole is 0.04 wb and is

distributed sinsoidally. The speed is 375 rpm. Find the frequency,

phase emf and line emf.the coil span is 1200 electrical.(8)**(Nov-2013)**

9. (i) List the methods used to predetermine the voltage regulation of

synchronizing machine and Explain the mmf method (12)

(ii) A 4-pole alternator has an armature with 25 slots and 8 conductors

per slot and rotates at 1500 rpm and flux per pole is 0.05 Wb.

Calculate the e.m.f generated, If winding factor is 0.96 and all the

conductors are in series.(4) **(Nov-2012)**

10 (i) With a neat diagram explain the parallel operation of alternators by

any one method. (12)

(ii) A 3 phase 6-pole star connected alternator revolves at 1000 rpm the

stator has 90 slots and 8 conductors per slot. the flux per pole

0.05wb and is distributed sinusoidally. Calculate the voltage

generated by the machine if the winding factor is 0.96.**(4)(Nov-2010)**

**UNIT-II**

**SYNCHRONOUS MOTOR**

**PART A**

1. What is synchronous capacitor? (**NOV-2011,2012)**
2. What are V- curves? (NOV-2011)
3. What is hunting? (**May-2011,2012,NOV-2012, NOV 2013)**
4. What is meant by Torque angle? **(May-2011,NOV -2012)**
5. What are the uses of damper winding in synchronous motor? **(NOV 2013)**
6. How the synchronous motor is made self-starting?
7. Why synchronous motors are not self starting?
8. Compare synchronous motor and induction motor
9. Name any two methods of starting a synchronous motor. **MAY/JUNE 2014**
10. Define pull out torque in synchronous motor
11. Mention four applications of synchronous motor.
12. List the inherent disadvantages of synchronous motor**(Nov-2010)**
13. When is a synchronous motor said to receive 100 % excitation? **Nov-2010)**
14. Why a synchronous motor is a constant speed motor?(**May-2012)**
15. Write the features of synchronous motor.
16. Define pull in torque in synchronous motor
17. What are the causes of hunting?
18. Draw the equivalent circuit of 3 phase synchronous motor.
19. What are the techniques used to reduce hunting?
20. State the condition for maximum power developed in synchronous motor.

**PART B**

1. (i)Draw and explain the phasor diagram of a synchronous motor operating at lagging and leading power factor **(8 marks, APR 2011, NOV -2010,2013)**

(ii) Derive an expression for power flow of a synchronous motor. (8)

1. Write short notes on

i) V curves of synchronous motor **( 8 marks, NOV -2011,2013)**

ii) Synchronous condenser **(8 marks, APR 2011)**

1. Explain the effect of changing field current excitation at constant load (**16 marks, NOV- 2011)** **(May-2012)**
2. (i)Why synchronous motors are not self starting? Explain**.(8)(May-2012)**

(ii)A synchronous motor having 40% reactance and a negligible

resistance is

to be operate at rated load at

(1) U.p.f.

(2) 0.8 p.f (lag).

(3) 0.8 p.f. (lead).

What are the values of induced e.m.f? Indicate assumption made if any. **(8)**

1. Describe in detail about the effect of load change on load angle and power factor of a 3 phase synchronous motor operating on infinite bus bar and constant excitation **(10 marks, NOV- 2012,May-2012)**
2. Describe the various methods of starting the synchronous motor **(16 marks, NOV -2010,2012)**
3. The synchronous reactance per phase of a three phase, star connected 6600 V synchronous motor is 20 ohm. For a certain load the input is 900 kW at normal voltage and the induced line emf is 8500 V. Determine the line current and power factor.(8 marks, **NOV 2013)**
4. A 1000 KVA, 11KV, 3-phase star connected synchronous motor has an armature resistance and reactance per phase of 3.5 Ω & 40Ω respectively determine the induced emf and angular retardation of the rotor when fully loaded at 0.8 p.f lagging and 0.8 p.f leading **(8) (May-2011)**
5. A 3000V ,3 phase synchronous motor running at 1500 rpm has its excitation kept constant corresponding to no load terminal voltage of 3000V. determine the Power input ,Power factor and Torque developed for all armature current of 250A if the synchronous reactance is 5 Ω per phase and armature resistance is neglected.**(8 mark,Nov-2010)**
6. (i)Derive an expression for the maximum torque developed per phase of

synchronous motor**(8 mark ,May -2012)**

(ii)explain how synchronous motor can be used as a synchronous

condenser . Draw the phasor diagram. **(8 mark ,May -2012)**