INSTITUTE OF AERONAUTICAL ENGINEERING

Dundigal, Hyderabad - 500 043

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ASSIGNMENT

Course Name	:	Electrical Machines-III
Course Code	:	A50218
Class	:	III - B. Tech I Sem
Branch	:	EEE
Year	:	2017 – 2018
Course Faculty	:	Mr. K Devender Reddy, Assistant professor

OBJECTIVE:

This subject is an extension of previous machines courses. It deals with the detailed analysis of synchronous generators and motors which are the prime source of electrical power generation and its utilities. Also concerns about the different types of single phase motors which are having significant applications in household appliances and control systems.

S.No	QUESTION	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT-I **SYNCHRONOUS MACHINES AND CHARACTERISTICS** **SHORT ANSWER QUESTION**		
1	State different type of synchronous generators used in hydro electrical power station.	Evaluate	1
2	What are the main parts of synchronous generator	Remember	1
3	Write the EMF equation of an Alternator.	Remember	1
4	What is the speed of a 4 pole 50Hz Synchronous machine?	Remember	1
5	Define Synchronous speed.	Remember	1
6	How can a DC generator be converted into an alternator?	Remember	1
7	Discuss about armature reaction in synchronous generator	Understand	1
8	Define distribution factor.	Understand	1
9	Define pitch factor.	Remember	1
10	Define winding factor.	Remember	1

11	Define the following
	    a) Short pitch winding
	    b) Full pitch winding
		Understand	1

12	Define the following
	    a) Concentrated winding
	    b) Distributed winding
		Understand	1

13	Define the following
	   a) Single layer winding
	   b) Double layer winding
		Understand	1

14	Explain effect of changing the power factor on terminal voltage by keeping the Load current, Field current and Speed constant	Understand	1
15	Draw the equivalent circuit for three phase alternator	Remember	1

<div align="center">**LONG ASNWERS QUASTIONS**</div>

1	Deduce the relation between the number of poles, the frequency and the speed of the synchronous generator	Apply	1
2	What are the causes of harmonics in the voltage waveform of an alternator?	Understand	1
3	What is an armature reaction? Explain its effect on the terminal voltage of an alternator at unity power factor load.	Understand	1
4	In brief, derive an expression for the winding factor of an alternator	Apply	1
5	Derive EMF equation of an alternator	Apply	1
6	Discuss about the determination of synchronous reactance of an alternator	Understand	1
7	Draw the load characteristics of synchronous generator and describe the same	Apply	1
8	What is the difference between integral slot and fractional slot windings	Understand	1
9	With phasor diagram, discuss about the leakage reactance of synchronous generator	Apply	1
10	Compute the distribution factor for a 36-slot, 4-pole, single-layer 3-Phase winding.	Apply	1
11	Compute the distribution factor for a 60-slot, 12-pole, single-layer 3-Phase winding.	Apply	1
12	Derive EMF equation and describe how the induced 'emf' in armature winding is affected by (a) form factor (b) pitch factor and (iii) distribution factor	Apply	1
13	Explain the alternator on load for different power factors	Understand	1
14	Explain the harmonic suppression techniques	Understand	1
15	Explain slot and space harmonics in alternator	Understand	1

<div align="center">**UNIT-II**
REGULATION OF SYNCHRONOUS GENERATOR</div>

<div align="center">**SHORT ANSWER QUESTION**</div>

1	Write different methods for determining the voltage regulation of synchronous generator.	Remember	2
2	Define regulation of Alternator.	Remember	2

3	What are the components of synchronous impedance?	Remember	2
4	Discuss the importance of synchronous impedance method	Remember	2
5	Discuss two reaction analysis	Remember	2
6	Define Xd and Xq	Remember	2
7	Why voltage regulation calculated by Potier's method is somewhat lower?	Remember	2
8	What are the parameters can be determined from slip test	Understand	2
9	What are the differences between MMF and EMF methods	Understand	2
10	Distinguish between salient pole and cylindrical rotor synchronous generators?	Remember	2
11	Advantages of EMF method	Remember	2
12	Advantages of MMF method	Remember	2
13	Advantages of Potier triangle method	Remember	2
14	Explain about leakage reactance	Understand	2
15	Advantages of ASA method	Remember	2

LONG ASNWERS QUASTIONS

1	Discuss in brief, how voltage regulation can be computed by synchronous impedance method	Understand	2
2	Discuss in brief about the two-reaction analysis of a salient-pole synchronous machine	Understand	2
3	With relevant waveforms and connection diagram, describe the slip test of synchronous machine	Apply	2
4	What is the significance of zero power-factor characteristics of an alternator? Discuss in brief to obtain the same	Apply	2
5	Describe why, synchronous impedance method of computing the voltage regulation, leads to a pessimistic value at lagging power factor loads	Understand	2
6	Describe how, open-circuit and short-circuit tests are conducted on a synchronous machine	Understand	2
7	Discuss in brief, how voltage regulation can be computed by MMF method.	Understand	2
8	Discuss in brief, how voltage regulation can be computed by ASA method.	Understand	2
9	Discuss in brief, how voltage regulation can be computed for salient pole alternators.	Understand	2

10	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	Apply	2
11	Discuss in brief, how voltage regulation can be computed by EMF method.	Understand	2
12	A 3-phase, star-connected alternator is rated at 1300kva, 14500v. The armature resistance and synchronous reactance are 1.56 Ω and 35Ω respectively per phase. Calculate the percentage regulation for a load of 1380kw at 0.86leading power factor	Evaluate	2
13	A 3-phase, star-connected alternator is rated at 1400kva, 15500v. The armature resistance and synchronous reactance are 1.58 Ω and 36Ω respectively per phase. Calculate the percentage regulation for a load of 1180kw at 0.9leading power factor	Evaluate	2
14	A synchronous generator has X_d=0.7 pu and X_q=0.4 pu. It is supplying full-load at rated voltage at 0.85 lagging power factor. Draw the phasor diagram and compute the excitation emf	Apply	2
15	A 3-phase, star-connected alternator is rated at 1200kva, 14500v. The armature resistance and synchronous reactance are 1.49 Ω and 20Ω respectively per phase. Calculate the percentage regulation for a load of 1380kw at 0.95leading power factor	Evaluate	2

UNIT-III
PARALLEL OPERATION OF SYNCHRONOUS GENERATOR

SHORT ANSWER QUESTION

1	Write synchronous power equation for cylindrical pole rotor machine.	Understand	3
2	What are the conditions for parallel operation of alternators?	Understand	3
3	What is Power angle of an alternator?	Remember	3
4	What is an infinite bus?	Remember	3
5	A machine with large air-gap has a higher synchronizing power, why?	Remember	3
6	Define sub-transient of AC generators.	Remember	3
7	What is the effect of varying excitation of an alternator running in parallel with other alternator	Understand	3
8	How will the power angle and power factor of a 3-phase alternator supplying power to an infinite bus at constant excitation change if the steam input is reduces?	Remember	3
9	At what power angle a synchronous generator will develop maximum power?	Remember	3

10	What is synchronizing current?	Remember	3
11	Write synchronous power equation for salient pole rotor machine.	Understand	3
12	What is the synchronizing power?	Remember	3
13	Define transient of AC generators.	Remember	3
14	Define steady-state reactances of AC generators.	Remember	3
15	What is an infinite bus? Mention three conditions to be satisfied prior to synchronizing an alternator to an infinite bus.	Remember	3
	LONG ASNWERS QUASTIONS		
1	Derive expression for synchronizing power when two alternators are connected in parallel.	Apply	3
2	Describe the factors which affect the sharing of load between two alternators operating in parallel. .	Understand	3
3	Why bright lamp method is preferred over dark lamp method for synchronizing of alternators.	Understand	3
4	Discuss in brief about the short-circuit transient in synchronous machine	Understand	3
5	Describe the factors which affect the sharing of load between two alternators operating in parallel.	Understand	3
6	Derive expressions for synchronizing power and synchronizing torque when two AC generators are connected in parallel	Apply	3
7	Describe with relevant diagram, dark lamp method of synchronizing two 3-phase alternators	Understand	3
8	Describe with relevant diagram, bright lamp method of synchronizing two 3-phase alternators	Understand	3
9	Discuss the use of Synchro scope in the parallel operation of alternators.	Understand	3

10	Two single-phase generators operate in parallel on a load impedance of Z ohms. Their emfs are E1 and E2 and their synchronous impedances Z1 and Z2. Deduce the terminal voltage in terms of these and admittances Y,Y1 and Y2	Understand	3
11	Derive expression for synchronizing torque when two alternators are connected in parallel.	Apply	3
12	How do you calculate the time constants in case of an alternator?	Apply	3
13	Show that the behavior of a synchronous machine on infinite bus is quite different from its isolated operation.	Understand	3
14	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?	Understand	3
15	Discuss the load shearing between two alternators.	Understand	3

UNIT-1V
SYNCHRONOUS MOTORS AND POWER CIRCLES
SHORT ANSWER QUESTION

1	What are the main parts of synchronous motor?	Remember	4
2	Discuss why synchronous motor has no starting torque.	Understand	4
3	What is synchronous capacitor?	Remember	4
4	Synchronous motor always runs at synchronous speed why?	Remember	4
5	What is hunting?	Remember	4
6	What are V-Curves and inverted V curves?	Remember	4
7	What are the uses of damper windings in a synchronous motor?	Remember	4
8	How do you operate the synchronous motor at any desired pf?	Understand	4
9	What will be the pf when the synchronous motor is operated at under excited conditions?	Remember	4
10	What are the different methods of starting synchronous motor?	Remember	4
11	Why Synchronous motors are not self starting? Explain.	Understand	4

			4
12	What are the uses of damper winding in a synchronous motor?	Remember	
13	What is a synchronous condenser? What is the use of synchronous condenser?	Understand	4
14	Why it is necessary to increase the excitation to obtain minimum current with application of load?	Understand	4
15	What are the applications of synchronous motor?	Understand	4

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			4
1	Describe in brief the principle of operation of synchronous motor	Understand	
2	Draw and discuss the phasor diagrams of a 3-phase synchronous motor for lagging, leading and unity power factor conditions. Name all the phasors.	understand	4
3	What do you mean by constant power circle for synchronous motor? How it is derived?	Apply	4
4	Name different methods of starting a synchronous motor, explain any one in detailed.	Remember	4
5	Derive an expression of mechanical power developed for a synchronous motor in terms of E & V	Understand	4
6	Mention the various applications of synchronous motor and describe the functions of a damper winding in a synchronous motor	Apply	4
7	What could be the reasons if a 3-phase synchronous motor fails to start?	Understand	4
8	Write a short note on synchronous induction motor	Remember	4
9	Derive the expression for power developed in a synchronous motor, various conditions for maximum power developed	Apply	4
10	Describe how a synchronous motor can be operated as a synchronous condenser.	Understand	4

11	Find an expression for power in terms of load angle, for a salient pole synchronous motor working at a lagging pf. Armature resistance may be neglected.	Understand	4
12	Show that the current locus of a synchronous motor developing constant power is a circle. Determine its center and radius.	Apply	4
13	What are the advantages and disadvantages of the Synchronous motor?	Remember	4
14	Explain the power circle diagram of the synchronous motor.	Understand	4
15	Explain the characteristic features of a synchronous motor.	Understand	4

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UNIT-V

SINGLE PHASE MOTORS & SPECIAL MACHINES
SHORT ANSWER QUESTION

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1	What are the applications of AC series motor?	Remember	5
2	What is stepper motor?	Remember	5
3	What is the function of capacitor in a single phase induction motor?	Remember	5
4	In which direction does a shaded pole induction motor run?	Remember	5
5	Write the classification of stepper motor?	Remember	5
6	Why singe phase induction motor has low power factor?	Remember	5
7	What is meant by split phase motor?	Remember	5
8	What are the advantages of universal motor?	Remember	5
9	What are the applications of universal motor?	Remember	5

10	What are the applications of stepper motor	Remember	5
11	Why starting torque in capacitor start induction motor is more than resistance split phase induction motor?	Remember	5
12	Compare the constructional features of a.c series motor with d.c. series motor.	Remember	5
13	Explain the operating characteristics of ac series motor	Understand	5
14	Explain the function of compensating winding in ac series motor.	Understand	5
15	How rotor tooth pitch is defined?	Remember	5
LONG ASNWERS QUASTIONS			
1	Discuss in detail about the split-phase motors	Understand	5
2	Discuss about the principle and performance of AC series motor	Understand	5
3	Describe the phase control of 1-phase induction motor	Remember	5
4	Write a short notes on double revolving field theory	Remember	5
5	Discuss about Torque-Speed curve of single-phase induction motor	Apply	5
6	Show that the starting torque of a single phase-phase induction motor is zero	Apply	5
7	With a neat sketch, discuss about the operation of shaded pole motor with squirrel cage rotor	Understand	5
8	What type of operating characteristics does an ac series motor give?	Understand	5
9	What is the principle of operation of universal motor?	Understand	5

10	What is the principle of operation of stepper motor?	Understand	5
11	Neatly draw and explain the vector diagram of universal motor. Give your observations.	Understand	5
12	Compare the performance characteristics of ac series motor when it is connected across i) AC supply and ii) D.C Supply	Apply	5
13	What is conductively compensated and inductively compensated ac series motor?	Apply	5
14	Explain the operation of variable reluctance motor.	Understand	5
15	Write a note on hysteresis motor and its applications.	Understand	5