Ref No:

< Sri Krishna Institute of Technology, Bangalore>



# COURSE PLAN

Academic Year 2019

Program:	B E – Electrical and Electronics Engineering
Semester :	3
Course Code:	18EE33
CourseTitle:	TRANSFORMER AND GENERATOR
Credit / L-T-P:	4/ 4-0-0
Total Contact Hours:	50
Course Plan Author:	SHWETA B

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Note : Remove "Table of Content" before including in CP Book Each Course Plan shall be printed and made into a book with cover page Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

# 18EE33: TRANSFORMERS AND GENRERATORS

# A. COURSE INFORMATION

#### 1. Course Overview

Degree:	BE	Program:	EE
Year / Semester :	3 <sup>rd</sup>	Academic Year:	2019-20
Course Title:	Transformer and generator	Course Code:	18EE33
Credit / L-T-P:	4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	60 Marks
CIA Marks:	40	Assignment	0.5/ Module
Course Plan Author:	SHWETA B	Sign	Dt:
Checked By:		Sign	Dt:

#### 2. Course Content

Mod	Module Content	Teaching	Module	Blooms
ule		Hours	Concepts	Level
1	Operation of practical transformer under no - load and on - load with phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency- commercial and all-day. Voltage regulation and its significance. Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and V/V, choice of connection. Phase conversion - Scott connection for three- phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups		Characteristics and operation Winding connection	
2	<b>Parallel Operation of Transformers:</b> Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase. Load sharing in case of similar and dissimilar transformers Autotransformer and Tap changing transformers: Introduction to auto transformer - copper economy, equivalent circuit, no load and on load tap changing transformers		Load sharing Copper saving in transformer	
3	Tertiary winding Transformers: Necessity of tertiary winding, equivalent circuit and voltage regulation, tertiary winding in star/star transformers, rating of tertiary winding.Direct current Generator: Armature reaction, Commutation and associated problems, Synchronous generators: Armature windings, winding factors, e.m.f equation. Harmonics – causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit	10	Working of Tertiary winding Characteristics of DC generator	L3,L4,L4
4	Synchronous generators (continuation): Generator load characteristic. Voltage regulation, excitation control for constant terminal voltage. Generator input and output. Parallel operation of generators and load sharing.Synchronous generator on infinite bus-bars – General load diagram, Electrical load diagram and V – curves. Power angle characteristic and synchronizing power. Effects of saliency, two-reaction theory, Direct and Quadrature reactance, power angle diagram, reluctance power, slip test	10	Operation of AC generator Characteristics of AC generator	
5	<b>Synchronous generators</b> (continuation): Open circuit and short circuit characteristics, Assessment of reactance- short circuit ratio, synchronous reactance, adjusted synchronous reactance and Potier	10	Test on Synchronous generator Hunting in AC	L3,L4,L4

reactance.	Voltage	regulation	by	EMF,	MMF,	ZPF		generators			
methods.Pe	rformance	of synchron	ous	generato	ors: Capa	ability					
curve for la	methods.Performance of synchronous generators: Capability curve for large turbo generators and salient pole generators.										
Starting, syr	chronizing	and control. I	Hunti	ng and d	lampers						

#### 3. Course Material

Mod	Details	Available
ule		
1	Text books	
	I J nagaranth khothari	In Lib
	M G Say <b>Synchronous generators</b>	
2	Reference books	
	M V Deshpande	In dept
	K R siddhapura	
3	Others (Web, Video, Simulation, Notes etc.)	
		Not Available

### 4. Course Prerequisites

SNo	Course Code	Course Name	Module / Topic / Description	Sem	Remarks	Blooms Level
1	18EE33	Transformer and Generator	1.Working diagram of transformer	3		
	-		2. Knowledge of AC and DC Generator	-	Plan Gap Course	

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

#### **B. OBE PARAMETERS**

#### 1. Course Outcomes

#	COs	Teach. Hours		Instr Method	Assessment Method	Blooms' Level
	Ideal,On load, No load Characteristics,regulation of transformer all day efficiency	10	Characteristi cs and operation	Lecture	Slip Test	L2 Understan d
	Three phase transformer different winding connection star-Delta Delta- star Y-Y	05	Winding connection	Lecture	Assignment	L2 Understan ding
	Conditions for load sharing,Load sharing In similar and dissimilar transformer		Load sharing	Lecture	Assignment and Slip Test	L4 Analysis
	Equivalent circuit of auto transformer,derivation of copper saving, efficiency and voltage regulationArticulation Matrix		Copper saving in transformer		Assignment	L3 Apply
	Necessity of tertiary winding equivalent circuit and connection	07	Working of Tertiary winding	Lecture	Slip test	L5 Evaluate
	Armature reaction of AC and DC and Commutation of generation numerical on generators		Characteristi cs of DC generator		Assignment	L3 Apply
	Harmonics of Synchronous generator Equivalent circuit	06	Operation of AC generator		Assignment and Slip Test	L5 Evaluate

	Load and No load characteristics Excitation for generator,load sharing	07	Characteristi cs of AC generator	Lecture	Assignment	L2 Understan ding
	Open circuit and short circuit test, V curves and inverted V curves , Voltage regulation	07	Test on Synchronou s generator	Lecture	Assignment	L4 Analyze
	Capability curve of generators, Hunting and different methods to minimize hunting	06	Hunting in AC generators	Lecture	Assignment	L3 Apply
-	Total	66	-	-	-	-

Note: Identify a max of 2 Concepts per Module. Write 1 CO per concept.

### 2. Course Applications

SNo	Application Area	CO	Level
1	Used in Industries	CO1	L2
2	Understanding Power generation	CO2	L2
3	Used in domestic purpose	CO3	L2
4	Use Backtracking technique for searching a set of solutions or for searching an	CO4	L3
-	optimal solution		
5	Apply characteristics of different rating of transformer	CO5	L2
6	Apply characteristics of different rating of generators	CO6	L2
7	Evaluate starting of generators	CO7	L3
8	Apply different methods to get efficiency of a machine	CO8	L2
9	Able to solve different faults in transformer and generators	CO9	L2
10	Able to solve numericals for different parameters	CO10	L4

Note: Write 1 or 2 applications per CO.

#### 3. Articulation Matrix

#### (CO – PO MAPPING)

-	Course Outcomes						gram							
#	COs	PO1	PO2	PO3	PO <sub>4</sub>	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	Level
	Ideal,On load, No load Characteristics,regulation of transformer all day efficiency	Х	X			Х			Х					L2
	Three phase transformer different winding connection star-Delta Delta-star Y-Y		Х	Х	Х									L2
	Conditions for load sharing,Load sharing In similar and dissimilar transformer		X		Х									L2
	Equivalent circuit of auto transformer,derivation of copper saving, efficiency and voltage regulation		X											L3
	Necessity of tertiary winding equivalent circuit and connection	Х		Х										L2
	Armature reaction of AC and DC and Commutation of generation numerical on generators		Х		Х									L2
	Harmonics of Synchronous generator Equivalent circuit		Х	Х	Х									L3
18EE33.8	Load and No load characteristics Excitation for generator,load sharing		X		Х									L2
	Open circuit and short circuit test, V curves and inverted V curves , Voltage regulation	Х	Х		Х									L2

<ul> <li><b>18EE33.1</b>Capability curve of generators,</li> <li><b>0</b> Hunting and different methods to minimize hunting</li> </ul>		X						L2		
Note: Mention the mapping strength as 1, 2	Note: Mention the mapping strength as 1, 2, or 3									

#### 4. Mapping Justification

Мар	ping	Justification	Mappin
со	PO		g Level
CO1	PO1	Basic knowledge of transformer	L2
CO1	PO2	Analysing the operation of transformer at different load conditions	L2
CO1	PO5	Applying the apropriate technicque to reduce the eddy current loss	 L2
CO1	PO8	Operation of transformer without affecting the environmental condition	L2
CO2	PO1	Basic knowledge of 3ph transformer	L2
CO2	PO2	Analysing the operation of 3phase transformer at different load conditions	L2
CO2	PO3	Devolpment of different connection for 3phase transformer	L2
CO2	PO4	investigating different connection when phase failure occurs	L2
CO3	PO1	Basic knowledge of parallel of operation two transformer	L2
CO3	PO2	Analysing the parallel connection of transformer	L2
CO3	PO4	Conducting the parallel connection of transformer and finding the problems	L2
		associated with load sharing	
CO4	PO1	Basic knowledge of auto transformer	L3
CO4	PO2	Analysing copper saving and voltage regulation, efficiency of transformer	L3
CO5	PO1	Basic knowledge of tertiary winding connection	L2
CO5	PO3	Devolpement of tertiary winding connections	L2
CO6	PO1	Basic knowledge of aramture reaction in ac and dc machines	L2
CO6	PO2	Analysing the problem associated with the armature reaction	L2
CO6	PO4	Finding the problems and finding the solution to reduce the armature reaction	L2
CO7	PO2	Identify the problems caused due to harmonics in synchronous generator	L3
CO7	PO3	Devolping the equivalent circuit diagram of synchronous generator	L3
CO7	PO4	Finding the soluion to reduce harmonics in synchronous generator	L3
CO8	PO1	Basic knowledge of Characteristics of AC generator	L2
CO8	PO2	Analysing the Characteristics of AC generator	L2
CO8	PO4	Finding the solution for complexity in load sharing of generators	L2
CO9	PO1	Basic knowledge on method of testing on Synchronous generator	L2
COg	PO2	Analysing problems associated with the testing of generator	L2
CO9	PO4	Condjusting the test on synchronous generator and analysing the result	L2
CO10	PO2	Identifying and analysing the hunting in generators	L2
CO10	PO4	Finding the soluion to reduce hunting in generators	L2

Note: Write justification for each CO-PO mapping.

### 5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

Note: Write Gap topics from A.4 and add others also.

### 6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	<b>Resources Person</b>	PO Mapping
1					
2					
3					
4					

5			
6			
7			
8			
9			
10			

Note: Anything not covered above is included here.

### C. COURSE ASSESSMENT

#### 1. Course Coverage

Mod	Title	Teaching		No. of	f quest	ion in	Exam		CO	Levels
ule		Hours	CIA-1	CIA-2	CIA-3	Asg	Extra	SEE		
#							Asg			
	Single phase and Three-phase Transformers	16	2	-	-	1	1	2	CO1, CO2	L1, L2
2	Parallel Operation of Transformers	13	2	-	-	1	1	2	CO3, CO4	L2, L3
3	Tertiary winding Transformers:	9	-	2	-	1	1	2	CO5, CO6	L3, L4
4	Synchronous generators	10	-	2	-	1	1	2	CO7, C08	L2, L3
•	Performance of Synchronous generators	14	-	-	4	1	1	2	CO9, CO10	L4, L5
-	Total	62	4	4	4	5	5	10	-	-

Note: Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

### 2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	СО	Levels
CIA Exam – 1	30	CO1, CO2, CO3, CO4	L2, l3, l4, l2
CIA Exam – 2	30	CO5, CO6, CO7, C08	L1, L2, L3, L4
CIA Exam – 3	30	CO9, CO10	L3, L1
Assignment - 1	05	CO1, CO2, CO3, CO4	L2, L3, L4, L3
Assignment - 2	05	CO5, CO6, CO7, CO8	L1, L2, L3, L1
Assignment - 3	05	CO9, CO10	L3, L4
Seminar - 1	05	CO1, CO2, CO3, CO4	L2, L3, L4, L3
Seminar - 2	05	CO5, CO6,CO7,CO8	L1, L2, L3, L1
Seminar - 3	05	CO9, CO10	L3, L4
Other Activities – define –		CO1 to Co9	L2, L3, L4
Slip test			
Final CIA Marks	40	-	-

Note : Blooms Level in last column shall match with A.2 above.

### D1. TEACHING PLAN - 1

#### Module - 1

Title:	Single and three phase transformer	Appr	16 Hrs
		Time:	
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand the working of transformer	CO1	L2
2	Understand the NO-load and ON-load	CO2	L3

b	Course Schedule	-	-
lass No	o Module Content Covered	СО	Level
1	Operation of practical transformer under no - load and on - load with phasor diagrams.	C01	L2
2	calculation of equivalent circuit parameters and predetermination of		
2	efficiency- commercial and all-day Voltage regulation and its significance.Three-phase Transformers		
<u>3</u> 4	Introduction, Constructional features of three-phase transformers.		
<u>4</u> 5	Choice between single unit three-phase transformer and a bank of three		
6	single-phase transformers. Transformer connection for three phase operation – star/star,		
	delta/delta, star/delta		
7	Transformer connection for three phase operation – zigzag/star and V/V, choice of connection		
8	Phase conversion - Scott connection for three-phase to two-phase conversion		
9	Labelling of three-phase transformer terminals, vector groups		
10	Equivalent circuit		
11	Open circuit and Short circuit tests of transformers		
с	Application Areas	со	Level
1	Use to find characteristics of transformers	CO1	L3
2	Efficiency of transformer in industrial applications	CO2	<u></u> L4
d	Review Questions	-	-
1	Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?	CO1	L1
2	Explain with neat sketch the construction of three phase core type and shell type transformer.	CO1	L3
3	Derive an equation for a single phase transformer.	CO2	L2
4	Draw and explain vector diagram of transformer loaded with Inductive and capacitive load	CO2	L4
5	Explain open-delta connection with the help of neat diagram. Show that open-delta connection has a KVA rating of 58% of the rating of the normal delta-delta connection.	CO2	L2
6	Show the terminal connections of a three-phase transformer with phasor diagram and corresponding clock method representation 1)Ddo 2) Yy6 3) Dy1 4) Yd11	CO2	L5
7	A 50KVA, 4400/220V, transformer has $R_1=3.45\Omega$ , $R_2=0.009\Omega$ , The Values of reactance's are $X_1=5.2\Omega$ , $X_2=0.015\Omega$ , calculate for the transformer (i) Equivalent resistance as referred to primary ii)Equivalent resistance as referred to both primary and secondary iv) Total copper loss, first using individual resistances of the windings and secondly, using equivalent resistances as referred to both sides.	CO2	L2
8	A 25KVA single phase transformer has 250 turns on the primary and 40 turns on the secondary winding. The primary is connected to 1500V, 50Hz .Calculate i) Primary and secondary currents on full load ii) Secondary EMF iii) Maximum flux in the core	CO2	L3
9	Derive an equation for a single phase transformer .Draw and explain vector diagram of transformer loaded with Inductive and capacitive load.	CO2	L4
10	A 25KVA single phase transformer has 250 turns on the primary and 40 turns on the secondary winding. The primary is connected to 1500V, 50Hz .Calculate i) Primary and secondary currents on full load ii) Secondary EMF iii) Maximum flux in the core	CO1	L1

е	Experiences	-	_
1		CO1	L2
2			
3			
4		CO3	L3
5			

Title:	Parallel operation of transformer	Appr Time:	10 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Parallel operation of transformers	CO3	L4
2	Connection of 3 phase transformer	CO4	L3
b	Course Schedule	_	-
Class No	o Module Content Covered	со	Level
17	Parallel Operation of Transformers		
18	Load sharing in case of similar and dissimilar transformers		
19	Autotransformer		
20	Tap changing transformers		
21	equivalent circuit		
22	no load and on load tap changing transformers		
23	Necessity of Parallel operation		
24	conditions for parallel operation		
25	Single phase and three phase transformers		
с	Application Areas	со	Level
1	Used in distribution system	CO3	L3
2	Used in industrial application for sharing	CO4	L4
d	Review Questions	-	-
12	Write a brief note on parallel operation of two-single phase transformers	CO3	L1
	with unequal voltage ratio. Derive the necessary relation.		
13	List the advantages and disadvantages of an autotransformer	CO4	L3
14	Two 250KVA transformers supplying a network are connected in parallel on both primary and secondary sides. Their voltage ratios are the same. The resistance drops are 1.5% & 0.9% and the reactance drops are 3.33% & 4% respectively. Calculate the KVA loading on each transformer and its power factor when the total load on the transformers is 500KVA & at 0.707 lagging p.f.	CO3	L2
15	What are the conditions to operate two transformers in parallel?	CO4	L4
16	Derive an expression for the copper savings in an autotransformer as compared with 2 winding transformer.	CO4	L2
17	A 400/100V, 10 KVA, 2 winding transformer is to be employed as an autotransformer to supply a 400volts circuit from 500volts source. When tested as 2 winding transformer at rated load of 0.85 p.f lagging, its efficiency is 97%. Determine its KVA rating and efficiency as an autotransformer	CO3	L5
18	Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?	CO3	L2
19	Explain on load tap changing with neat diagram.	CO3	L3
е	Experiences	-	-
1		CO1	L2
2			
3			
4		CO3	L3

5

# E1. CIA EXAM – 1

# a. Model Question Paper - 1

		18EE33	Sem:	3	Marks:	30	Time:	75	minute	S	
Coui	rse:	Transform									1
-	-				s, each carry e				Marks	со	Level
1		winding th	e taps ar	e provided			State or	n which		CO1	L1
					vith neat diagi				6		L2
	С	open-delta	a conne		n with the hel a KVA rating a					CO2	L3
2					peration of tw ve the necess		ase trans	formers	6		L2
					vantages of ar		rmer		8		L4
	С	on both pr The resista 4% respec	imary ar ince dro tively. Ca tor whe	nd seconda ps are 1.5% alculate the	pplying a netw ry sides. Their & 0.9% and the & KVA loading load on the	r voltage rati e reactance o 1 on each tra	os are th drops are insformer	e same 3.33% & and its	L		L3
	d	What are t	he cond	itions to ope	erate two trans	sformers in p	arallel?		4		L2
3	а	Derive an compared	express with 2 w	ion for the rinding trans	copper savir sformer.	ngs in an au	totransfo	rmer as	8	CO3	L1
	b	autotransfo tested as	ormer to 2 windii is 97%.	supply a 4 ng transfori	ing transform 00volts circuit mer at rated e its KVA ra	from 500vo load of 0.8	lts source 5 p.f lage	e. When ging, its		CO4	L2
	С		th neat s		construction o	of three phas	se core ty	ype and	8		L1
4			e O.C ar		nd equivalent s conducted		kplain the e constar				L2
	b	reactance' Equivalent referred to primary a resistances	s are > resistan o secon nd secc s of the \	<1=5.2Ω,X2=0 ce as refen dary iii) Ec ondary iv) windings an	mer has R <sub>1</sub> =3.4 .015Ω, calcul red to primary juivalent reac Total copper d secondly, us lent impedan	ate for the / ii) Equival ctance as r r loss, first sing equivale	e transfo ent resist referred using in ent resista	rmer (ii ance as to both dividual ances as			L2
		Show the t	erminal nd corre	connection	s of a three-p lock method r	hase transfo	rmer with	n phasor			L1

# b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Note.	A UISLINCE ASSI	gnment to be assigned to each student.			
Crs C	ode: 18EE33	Model Assignment QuestionsSem:3Marks:5 / 10Time:9	0 – 120 I	minute	5
Cours		mer and Generators	0 1201	milato	5
Note		to answer 2-3 assignments. Each assignment carries equal mar	ſk.		
SNo		Assignment Description	Marks	со	Level
1	1KT17EE002	Write a brief note on parallel operation of two-single phase		CO1	L2
		transformers with unequal voltage ratio. Derive the necessary	r		
		relation.			
	1KT17EE004	List the advantages and disadvantages of an autotransformer	5	CO2	L3
3	1KT17EE005	Two 250KVA transformers supplying a network are connected in parallel on both primary and secondary sides. Their voltage		CO2	L4
		ratios are the same. The resistance drops are 1.5% & 0.9% and			
		the reactance drops are 3.33% & 4% respectively. Calculate the			
		KVA loading on each transformer and its power factor when			
		the total load on the transformers is 500KVA & at 0.707	,		
		Lagging p.f.			
4	1KT17EE006	What are the conditions to operate two transformers in parallel?	5	CO1	L3
5	1KT17EE007	Derive an expression for the copper savings in an		CO1	L2
5		autotransformer as compared with 2 winding transformer.		001	
6	1KT17EE008	A 400/100V, 10 KVA, 2 winding transformer is to be employed		CO2	L3
		as an autotransformer to supply a 400volts circuit from			
		500volts source. When tested as 2 winding transformer at			
		rated load of 0.85 p.f lagging, its efficiency is 97%. Determine	•		
		its KVA rating and efficiency as an autotransformer		<u> </u>	
7	1KT17EE009	Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?		CO2	L4
8	1KT17EE0010	Explain on load tap changing with neat diagram.		CO1	L3
	1KT17EE011	Explain the reason for tap changing in transformer. State on		CO1	 L2
		which winding the taps are provided & why?			
10	1KT17EE012	Explain with neat sketch the construction of three phase core		CO2	L3
		type and shell type transformer.		001	
	1KT17EE013	Derive an equation for a single phase transformer.		CO2	L4
12	1KT18EE400	Draw and explain vector diagram of transformer loaded with		CO1	L3
13	1KT17EE401	Inductive and capacitive load Explain open-delta connection with the help of neat diagram.		CO1	L2
13		Show that open-delta connection has a KVA rating of 58% of		001	
		the rating of the normal delta-delta connection.			
14	1KT17EE002	Show the terminal connections of a three-phase transformer		CO2	L3
		with phasor diagram and corresponding clock method	l		
		representation 1)Ddo 2) Yy6 3) Dy1 4) Yd11			
15	1KT17EE003	A 50KVA, 4400/220V, transformer has $R_1=3.45\Omega$ , $R_2=0.009\Omega$ , The Values of reactance's are $X_1=5.2\Omega$ , $X_2=0.015\Omega$ , calculate for		CO2	L4
		the transformer (i) Equivalent resistance as referred to primary			
		ii)Equivalent resistance as referred to secondary iii) Equivalent			
		reactance as referred to both primary and secondary iv) Total			
		copper loss, first using individual resistances of the windings			
		and secondly, using equivalent resistances as referred to	)		
		each side v) Equivalent impedance referred to both sides.		001	
16	1KT17EE004	A 25KVA single phase transformer has 250 turns on the primary and 40 turns on the secondary winding. The primary		CO1	L3
		is connected to 1500V, 50Hz .Calculate i) Primary and			
		secondary currents on full load ii) Secondary EMF iii)			
		Maximum flux in the core			
17	1KT17EE005	Derive an equation for a single phase transformer .Draw		CO2	L4
		and explain vector diagram of transformer loaded with			
		Inductive and capacitive load.			

1	18	1KT17EE006	A 25KVA single phase transformer has 250 turns on the	CO1	L3
			primary and 40 turns on the secondary winding. The primary		
			is connected to 1500V, 50Hz .Calculate i) Primary and		Í
			secondary currents on full load ii) Secondary EMF iii)		
			Maximum flux in the core		

## D2. TEACHING PLAN - 2

Title:	Divide and Conquer	Appr	16 Hrs
	· · ·	Time:	
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Test on Transformers and connections	CO5	L2
2	Conversion of 3phase to 2 phase	CO6	L3
b	Course Schedule		
	Module Content Covered	CO	Level
1	Tertiary winding Transformers	C6	
2	Necessity of tertiary winding		
3	equivalent circuit and voltage regulation,		
4	tertiary winding in star/star transformers		
5	rating of tertiary winding. Direct current Generator	C5	
6	Armature reaction		
7	Commutation and associated problems		
8	Synchronous generators: Armature windings, winding factors		
9	e.m.f equation		
10	Harmonics – causes		
11	reduction and elimination		
12	Synchronous reactance		
13	Armature reaction		
14	Equivalent circuit		
С	Application Areas	СО	Level
1	Used in industrial applications	CO1	L3
2	Used in Generating,transmission and distribution	CO2	L4
d	Review Questions	-	_
1	What is voltage regulation of a 3 phase synchronous generator? Describe the synchronous impedance method to determine regulation of an alternator for lagging and leading power factor	CO1	L1
2	Draw and explain equivalent circuit of tertiary transformer.	CO1	L3
3	Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?	CO2	L2
4	Explain current inrush phenomenon in transformer.	CO2	L4
5	Derive an equation for the emf induced in an alternator.	CO2	L2
6	What is armature reaction? With neat figure explain armature reaction in DC machines under normal working condition.	CO2	L5
7	What are the sources of noise in transformer? How to reduce the noise problem in transformer?	CO2	L2
8	Derive the necessary expression for cross magnetizing effect and de- magnetizing effect.	CO2	L3
9	An 8 pole wave wound dc generator has 840 armature conductors. The armature current is 200A. find the armature reaction demagnetizing and cross magnetizing ampere turns per pole if i) brushes are on G.N.A and ii) brushes are shifted 6° electrical from G.N.A	CO2	L4
10	With neat diagram explain the process of commutation in DC machines.	CO1	L1
11	Draw and explain the characteristics of DC series generator.	CO1	L4
12	State the possible causes of failure of excitation of self excited generator.		

е	Experiences	-	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

Title:		Appr Time:	16 Hrs
а	Course Outcomes	_	Blooms
-	The student should be able to:	-	Level
1	Voltage regulation of alternator	CO7	L2
2	Understand different test of transformer	CO8	L3
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	Generator load characteristic		
2	Voltage regulation		
3	excitation control for constant terminal voltage		
4	Generator input and output		
5	Performance Analysis		
6	Parallel operation of generators and load sharing		
7	Synchronous generator on infinite bus-bars – General load diagram		
	Electrical load diagram and V – curves		
8	Power angle characteristic and synchronizing power		
9	Effects of saliency		
10	two-reaction theory		
11	Direct and Quadrature reactance		
12	power angle diagram		
13	reluctance power		
14	slip test		
15			
16			
с	Application Areas	со	Level
1	Used in distribution system	CO8	L3
2	Used in industrial application for sharing	C07	L4
d	Review Questions	-	_
1	Explain Parallel operation of generators and load sharing	CO7	L1
2	Draw Power angle characteristic of generator and explain	CO7	L3
3	Write short note on Voltage regulation of generator	CO8	L2
4	With a phasor diagram explain the concept the two reaction theory in a salient pole machine	C07	L4
5	Write short note on V-curves of synchronous generator	CO8	L2
6	With a neat diagram, Explain the slip lest on salient pole synchronous machine	CO8	L5
7	What is synchronization of alternator		L2
8	What are the conditions for proper synchronization of alternator		L3
е	Experiences	-	-
1		CO7	L2
2			
3			
4		CO8	L3

5

### E2. CIA EXAM – 2

#### a. Model Question Paper - 2

Crs (			minute	S	
Cour	rse:	Transformer and Generators			1
-	-	Note: Answer any 2 questions, each carry equal marks.	Marks	со	Level
1	а	What is voltage regulation of a 3 phase synchronous generator? Describe the synchronous impedance method to determine regulation of ar alternator for lagging and leading power factor		CO5	L1
		What is armature reaction? With neat figure explain armature reaction ir DC machines under normal working condition.			L2
	С	An 8 pole wave wound dc generator has 840 armature conductors. The armature current is 200A. find the armature reaction demagnetizing and cross magnetizing ampere turns per pole if i) brushes are on G.N.A and iii brushes are shifted 6° electrical from G.N.A	ł	CO6	L3
	d	Derive an equation for the emf induced in an alternator.			L1
2	а	Draw and explain equivalent circuit of tertiary transformer.	20	CO7	L2
	b	Derive the necessary expression for cross magnetizing effect and de- magnetizing effect.			L4
	С	With a phasor diagram explain the concept the two reaction theory in a salient pole machine	1		L3
	d	Explain Parallel operation of generators and load sharing			L2
3	а	What is synchronization of alternator	20	CO8	L1
	b	What are the conditions for proper synchronization of alternator		CO8	L2
	С	What are the sources of noise in transformer? How to reduce the noise problem in transformer?	è		L1
	d	Derive the necessary expression for cross magnetizing effect and de- magnetizing effect.	-		L2
4	а	What are the conditions for proper synchronization of alternator	20		L2
	b	With neat diagram explain the process of commutation in DC machines.			L2
	С	Draw and explain the characteristics of DC series generator.			L1
	d	State the possible causes of failure of excitation of self excited generator.			L3

1

#### b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

	Model Assignment Questions										
Crs C	ode:	18EE33	Sem:	3	Marks:	5 / 10	Time:	90 - 120	minutes	5	
Cours	se:	Transfor	mers and ger	nerators							
Note	Each	student	to answer 2-;	3 assignmen	its. Each as	signment ca	rries equal ma	ark.			
SNo	l	JSN		Assig	nment Des	cription		Marks	СО	Level	
1	1KT17	'EE002					synchronou		CO8	L2	
							nce method t				
				0	an alternat	or for laggin	ng and leadin	g			
			power factor								
2	1KT17	'EE004	Draw and ex	plain equiva	lent circuit	of tertiary tr	ansformer.	5	COg	L3	
3	1KT17	'EE005					rmer. State o	n	CO10	L4	
			which windir	ng the taps a	are provideo	d & why?					
4	1KT17	'EE006	Explain curre	ent inrush ph	nenomenon	in transform	ner.	5	COg	L3	
5	1KT17	'EE007	Derive an eq	uation for th	e emf indu	ced in an alt	ernator.		CO1	L1	
6	1KT17	'EE008	What is arm	ature reactio	on? With ne	eat figure ex	plain armatur	re	CO1	L3	
			reaction in D	C machines	under norn	nal working	condition.				
7	1KT17	'EE009	What are the	e sources of	noise in tr	ansformer?	How to reduc	e	CO2	L2	
			the noise pro	blem in trar	nsformer?						
8	1KT17	'EE0010	Derive the n	ecessary ex	pression fo	or cross mag	netizing effec	ct	CO2	L4	

		and de-magnetizing effect.		
9	1KT17EE011	An 8 pole wave wound dc generator has 840 armature conductors. The armature current is 200A. find the armature reaction demagnetizing and cross magnetizing ampere turns per pole if i) brushes are on G.N.A and ii) brushes are shifted 6° electrical from G.N.A	CO2	L2
10	1KT17EE012	With neat diagram explain the process of commutation in DC machines.	CO2	L5
11	1KT17EE013	Draw and explain the characteristics of DC series generator.	CO2	L2
12	1KT18EE400	Explain Parallel operation of generators and load sharing	CO2	L3
13	1KT17EE401	Draw Power angle characteristic of generator and explain	CO2	L4
14	1KT17EE002	Write short note on Voltage regulation of generator	CO1	L1
15	1KT17EE003	With a phasor diagram explain the concept the two reaction theory in a salient pole machine	CO1	L4
16	1KT17EE004	Write short note on V-curves of synchronous generator		
17	1KT17EE005	With a neat diagram, Explain the slip lest on salient pole synchronous machine		
18	1KT17EE006	What is synchronization of alternator		
19	1KT17EE007	What are the conditions for proper synchronization of alternator		

# D3. TEACHING PLAN - 3

Title:	Synchronous generator	Appr	16 Hrs
		Time:	
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	The operation and characteristics of generator	CO9	L2
2	Understand different test conducted on synchronous generator	CO10	L3
b	Course Schedule		
Class No	Module Content Covered	СО	Level
1	Open circuit and short circuit characteristics		
2	Assessment of reactance- short circuit ratio		
3	synchronous reactance		
4	adjusted synchronous reactance and Potier reactance		
5	Voltage regulation by EMF		
6	MMF, ZPF methods		
7	Performance of synchronous generators		
8	Capability curve for large turbo generators and salient pole generators		
9	Starting		
10	synchronizing and control		
11	Hunting and dampers		
с	Application Areas	со	Level
1	Used in generating station	CO10	L3
2	Used in industries	CO9	L4
d	Review Questions	-	-
1	Wright short note on capability of synchronous generator	CO10	L1
2	What is hunting in synchronous generator	CO10	L3
3	Explain role of damping winding	CO9	L2
4	With neat sketch explain OCC and SCC characteristics of synchronous generator	CO9	L4
5	Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance		L2

6	List the advantages and disadvantages of synchronous impedance of computing the regulation		L5
7	Define short circuit ratio		L2
8	What is the relation between short circuit ratio and synchronous reactance		L3
9	Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail		L4
10	A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A		L1
е	Experiences	-	_
1		CO10	L2
2			
3			
4		CO9	L3
5			

# E3. CIA EXAM – 3

# a. Model Question Paper - 3

Crs C	Code:	18EE33	Sem:	3	Marks:	30	Time: 7	75 minute	s	
Cour	se:	Transform	ner and g	enerators						
-	-	Note: Ans	wer any	2 questior	ns, each carry ea	qual mark	S.	Marks	СО	Level
1					ty of synchrono	us generat	or	20	CO9	L1
					ous generator					L2
				nping wind					CO9	L3
				explain O	CC and SCC ch	aracteristic	cs of synchronou	JS		L1
		generator								
				veen sync ier reactan		nce, adju	sted synchrono	JS		
2		List the a computing			advantages of	synchron	ous impedance	of 20	CO10	L2
	b	Define sho	ort circuit	: ratio						L4
	С	What is	the rela	ation betw	/een short circ	uit ratio	and synchronou	JS		L3
		reactance								
							e regulation for	3		L2
					e any one metho					
							has an effectiv roduced a curre			
							line) calculate th			
					agging for the fu					
3					eristics of DC se			20	CO10	L1
Ŭ					n of generators				CO10	L2
					stic of generato					L1
	d	Write shoi	rt note o	n Voltage r	regulation of ger	nerator				L2
		With a ph	asor dia	gram expla	ain the concept	the two re	eaction theory in	a		
		salient pol	le machi	ne	-		_			
4					of synchronous			20		L2
		With a ne machine	eat diagr	am, Explai	n the slip lest o	on salient	pole synchronol	ls		L2
	С	What is sy	nchroniz	zation of alt	ternator					L1
	d	What are	the conc	litions for p	oroper synchroni	zation of a	lternator			L3

#### b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

		M	odel Assignmer	nt Question	S		
Crs Code: 18EE33	Sem:	3	Marks:	5 / 10	Time:	90 – 120 minutes	

1         IKT17EE002         Draw and explain the characteristics of DC series generator.         5         COg         L2           2         IKT17EE004         Explain Parallel operation of generators and load         5         COg         L3           3         IKT17EE005         Draw Power angle characteristic of generator and explain         CO10         L4           3         IKT17EE006         Write short note on Voltage regulation of generator         5         CO10         L3           6         IKT17EE007         Write short note on V-curves of synchronous generator         CO1         L3           7         IKT17EE008         Write short note on V-curves of synchronous generator         CO2         L2           9         IKT17EE001         What is synchronous generator         CO2         L2           10         IKT17EE001         What is nort note on capability of synchronous generator         CO2         L2           11         IKT17EE003         Wright short note on capability of synchronous generator         CO2         L3           12         IKT17EE004         Wright short note on Capability of synchronous generator         CO2         L3           13         IKT17EE007         Wright short note on Capability of synchronous generator         CO2         L3           14			to answer 2-3 assignments. Each assignment carries equal mar			
2       IKT17EE004       Explain Parallel operation of generators and load       5       CO9       L3         3       IKT17EE005       Draw Power angle characteristic of generator and explain       CO10       L4         4       IKT17EE006       Write short note on Voltage regulation of generator       5       CO1       L3         6       IKT17EE007       Write short note on V-curves of synchronous generator       CO1       L3         7       IKT17EE008       Write short note on C-curves of synchronous generator       CO2       L2         8       IKT17EE001       What are the conditions for proper synchronization of atternator       CO2       L2         10       IKT17EE012       Wright short note on capability of synchronous generator       CO2       L2         11       IKT17EE013       What is hunting in synchronous generator       CO2       L3         12       IKT18E000       Explain note of amping winding       CO2       L3         13       IKT17EE002       Wright short note on capability of synchronous generator       CO2       L4         14       IKT17EE003       What is hunting in synchronous generator       CO2       L3         13       IKT17EE004       Wright short note on capability of synchronous       CO1       L1         1	SNo		Assignment Description	Marks	CO	Leve
sharing         Starting         Construction           3         IKT37EE006         Draw Power angle characteristic of generator and explain         CO10         L4           4         IKT37EE006         Write short note on Voltage regulation of generator         5         CO1         L3           6         IKT37EE008         Write short note on V-curves of synchronous generator         CO1         L3           7         IKT37EE008         Write short note on V-curves of synchronous generator         CO2         L2           8         IKT37EE012         What is synchronization of alternator         CO2         L2           9         IKT37EE012         What is houting in synchronous generator         CO2         L2           10         IKT37EE013         What is houting in synchronous generator         CO2         L2           11         IKT37EE013         What is hunting in synchronous generator         CO2         L3           13         IKT37EE014         With a neat sketch explain OCC and SCC characteristics of synchronous generator         CO2         L4           14         IKT37EE004         Define short circuit ratio         CO1         L4           14         IKT37EE004         Define short circuit ratio         CO1         L4           16         IK					-	
4         kK17tEE006         Write short note on Voltage regulation of generator         5         CO10         L3           5         ikT17tEE007         Write short note on V-curves of synchronous generator         CO1         L3           6         ikT17tEE008         Write short note on V-curves of synchronous generator         CO2         L2           7         ikT17tEE000         What are the conditions for proper synchronization of alternator         CO2         L2           8         ikT17tEE001         What are the conditions for proper synchronization of alternator         CO2         L2           10         ixT17tEE013         What is hunting in synchronous generator         CO2         L2           11         ixT17tEE013         What is hunting in synchronous generator         CO2         L2           12         ixK17tEE004         With are sketch explain OCC and SCC characteristics of synchronous generator         CO2         L3           13         ixT17tEE003         List the advantages and disadvantages of synchronous importance of computing the regulation         CO1         L1           14         ixT17tEE004         Define short circuit ratio         CO1         L1           17         ixT17tEE004         Define short circuit ratio         CO1         L3           16         ixT17tEE	2	1KT17EE004	sharing	5	CO9	L3
5       IKT17EE007       With a phasor diagram explain the concept the two reaction theory in a salient pole machine       CO1       L1         6       IKT17EE008       With a neat diagram. Explain the slip lest on salient pole synchronous machine       CO2       L2         7       IKT17EE009       With a neat diagram. Explain the slip lest on salient pole synchronous machine       CO2       L4         8       µKT17EE000       What is synchronization of alternator       CO2       L2         10       IKT17EE011       What are the conditions for proper synchronization of alternator       CO2       L2         10       IKT17EE012       Wright short note on capability of synchronous generator       CO2       L2         11       IKT17EE013       What is bunding in synchronous generator       CO2       L2         12       µKT18EE400       Explain role of damping winding       CO2       L3         13       IKT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L4         14       IKT17EE004       Define short circuit ratio       CO1       L1         14       IKT17EE005       What is the relation between short circuit ratio and synchronous generator       CO2       L2         18       IKT17EE007       A 2300V,60Hz 3 phase star co	3	1KT17EE005	Draw Power angle characteristic of generator and explain		CO10	L4
5       IXT17EE007       With a phasor diagram explain the concept the two reaction theory in a salient pole machine       CO1       L1         6       IXT17EE008       With a neat diagram. Explain the slip lest on salient pole synchronous machine       CO2       L2         7       IXT17EE009       With a neat diagram. Explain the slip lest on salient pole synchronous machine       CO2       L2         8       JXT17EE010       What are the conditions for proper synchronization of alternator       CO2       L2         10       IXT17EE011       What are the conditions for proper synchronization of alternator       CO2       L2         11       IXT17EE012       Wright short note on capability of synchronous generator       CO2       L2         12       IXT18EE400       Explain role of damping winding       CO2       L2         13       IXT17EE002       Differentiate between synchronous reactance.       adjusted       CO1       L1         14       IXT17EE002       Differentiate between synchronous reactance.       CO1       L4         17       IXT17EE003       List the advantages and disadvantages of synchronous generator       CO1       L4         16       IXT17EE004       Define short circuit ratio       CO1       L3         18       IXT17EE007       A 2300V,SOHZ 3 phase star connected a	4	1KT17EE006		5	CO10	L3
6       JKT17EE008       Write short note on V-curves of synchronous generator       CO1       L3         7       JKT17EE009       With a neat diagram. Explain the slip lest on salient pole synchronous machine       CO2       L2         8       JKT17EE0010       What is synchronization of alternator       CO2       L2         9       JKT17EE011       What are the conditions for proper synchronization of alternator       CO2       L2         10       IKT17EE012       Wright short note on capability of synchronous generator       CO2       L2         11       IKT17EE013       What is hunting in synchronous generator       CO2       L2         12       IKT18EE400       Explain role of damping winding       CO2       L3         13       IKT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         14       IKT17EE004       Define short circuit ratio       CO1       L3         15       IKT17EE004       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       IKT17EE007       A 2300V;90H2 3 phase star connected alternator has an effective amature resistance 0.20hm a field current of 35A is produced a current of 15AO an short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full loa		1KT17EE007	With a phasor diagram explain the concept the two reaction		CO1	L1
7       IkT17EE009       With a neat diagram. Explain the slip lest on salient pole synchronous machine       CO2       L2         8       IkT17EE001       What is synchronization of alternator       CO2       L4         9       IkT17EE01       What are the conditions for proper synchronization of alternator       CO2       L2         10       IkT17EE013       What is hunting in synchronous generator       CO2       L5         11       IkT17EE014       What sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         12       IkT18E002       Differentiate between synchronous reactance. adjusted synchronous reactance and Potier reactance       CO1       L1         14       IkT17EE004       Define short circuit ratio       CO1       L1         16       IkT17EE004       Define short circuit ratio       CO1       L1         17       IkT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L1         18       IkT17EE007       A 2300/SpH2 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780Vtine) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO2       L2         20       IkT17EE005       What is hunting in synchronou	6	1KT17EE008			CO1	L3
8       1KT17EE000       What is synchronization of alternator       CO2       L4         9       1KT17EE01       What are the conditions for proper synchronization of alternator       CO2       L2         10       1KT17EE012       Wright short note on capability of synchronous generator       CO2       L2         11       1KT17EE013       What is hunting in synchronous generator       CO2       L2         13       1KT17EE001       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO1       L1         14       1KT17EE003       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         15       1KT17EE004       Define short circuit ratio       CO1       L1         16       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       1KT17EE006       Name the various method for determining of voltage regulation for 3phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO3       L2         11       1KT17EE004       What is hunting in synchronous generator       CO3       L2         19       1K			With a neat diagram, Explain the slip lest on salient pole			L2
9       IKT17EE011       What are the conditions for proper synchronization of alternator       CO2       L2         10       1KT17EE012       Wright short note on capability of synchronous generator       CO2       L2         11       1KT17EE013       What is hunting in synchronous generator       CO2       L2         12       1KT18EE000       Explain role of damping winding       CO2       L3         13       1KT17EE001       Differentiate between synchronous reactance, adjusted synchronous generator       CO1       L1         14       1KT17EE002       Differentiate between synchronous reactance       CO1       L1         15       1KT17EE003       List the advantages and disadvantages of synchronous impedance of computing the regulation       CO1       L1         16       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       1KT17EE007       A 2300V.50HZ 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE004       What is hunting in synchronous generator       CO2       L4         19       1KT17EE004       Wright short note on capability of synchronous generator       CO3       L2         20       1KT17EE004       Wright short note on capability of synchronous generator </td <td>8</td> <td>1KT17EE0010</td> <td></td> <td></td> <td>CO2</td> <td>L4</td>	8	1KT17EE0010			CO2	L4
11       IKT17EE013       What is hunting in synchronous generator       CO2       L2         12       IKT18EE400       Explain role of damping winding       CO2       L3         13       IKT17EE401       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO1       L4         14       IKT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         16       IKT17EE004       Define short circuit ratio       CO1       L1         17       IKT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       IKT17EE006       Name the various method for determining of voltage regulation of 3 phase alternator and describe any one method in detail       CO2       L2         19       IKT17EE007       A 2300V.50HZ 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 15OA on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf       CO3       L2         14       IKT17EE005       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         12       IKT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         1	-	1	What are the conditions for proper synchronization of			L2
11       IKT17EE013       What is hunting in synchronous generator       CO2       L2         12       IKT18EE400       Explain role of damping winding       CO2       L3         13       IKT17EE401       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO1       L4         14       IKT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         16       IKT17EE004       Define short circuit ratio       CO1       L1         17       IKT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       IKT17EE006       Name the various method for determining of voltage regulation of 3 phase alternator and describe any one method in detail       CO2       L2         19       IKT17EE007       A 2300V.50HZ 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 15OA on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf       CO3       L2         14       IKT17EE005       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         12       IKT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         1	10	1KT17FF012			CO2	15
12       1KT18EE400       Explain role of damping winding       CO2       L3         13       1KT17EE401       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO1       L4         14       1KT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         15       1KT17EE003       List the advantages and disadvantages of synchronous impedance of computing the regulation       CO1       L4         16       1KT17EE004       Define short circuit ratio       CO1       L1         17       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       1KT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE007       A 2300V50HZ 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO2       L2         20       1KT17EE002       Wright short note on capability of synchronous generator       CO3       L2         21       1KT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator <td></td> <td></td> <td></td> <td></td> <td></td> <td> L2</td>						 L2
13       1KT17EE401       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L4         14       1KT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         15       1KT17EE003       List the advantages and disadvantages of synchronous impedance of computing the regulation       CO1       L4         16       1KT17EE004       Define short circuit ratio       CO1       L1         17       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO2       L2         18       1KT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE007       A 2300V,50HZ 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 35A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO3       L2         20       1KT17EE004       What is hunting in synchronous generator       CO3       L2         21       1KT17EE004       What is hunting in synchronous generator       CO3       L2         21       1KT17EE004       What is hunting in synchronous generator       CO3       L2						
14       1KT17EE002       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO1       L1         15       1KT17EE003       List the advantages and disadvantages of synchronous       CO1       L4         16       1KT17EE004       Define short circuit ratio       CO1       L3         17       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO2       L3         18       1KT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE007       A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 15A on short circuit and open circuit em 780V(line) calculate the voltage regulation of 0.8 pf       CO3       L2         20       1KT17EE004       What is hunting in synchronous generator       CO4       L5         21       1KT17EE004       What is hunting in synchronous generator       CO4       L5         23       1KT17EE004       What is hunting in synchronous generator       CO4       L5         23       1KT17EE004       What is hunting in synchronous generator       CO4       L5         24       1KT17EE004       What is hunting in synchronous reactance, adjust			With neat sketch explain OCC and SCC characteristics of			L4
15       IKT17EE003       List the advantages and disadvantages of synchronous impedance of computing the regulation       CO1       L4         16       IKT17EE004       Define short circuit ratio       CO1       L1         17       IKT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       IKT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       IKT17EE007       A 2300V.50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO2       L2         20       IKT17EE005       Explain role of damping winding       CO3       L2         21       IKT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO4       L4         23       IKT17EE008       List the advantages and disadvantages of synchronous       CO3       L3         24       IKT17EE009       Define short circuit ratio       CO4       L4         24       IKT17EE009       Define the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2	14	1KT17EE002	Differentiate between synchronous reactance, adjusted		CO1	L1
16       1KT17EE004       Define short circuit ratio       CO1       L1         17       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO2       L2         18       1KT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE007       A 2300V.50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 15OA on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO3       L2         20       1KT17EE006       Wihat is hunting in synchronous generator       CO4       L5         21       1KT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         23       1KT17EE007       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO4       L4         25       1KT17EE008       List the advantages and disadvantages of synchronous constructuratio       CO2       L3         26       1KT17EE000       What is the relation between short circuit ratio and synchronous reactance       CO4       L4         26       1KT17EE000       What is the relation between short circuit ratio and synchronous reactanc	15	1KT17EE003	List the advantages and disadvantages of synchronous		CO1	L4
17       1KT17EE005       What is the relation between short circuit ratio and synchronous reactance       CO1       L3         18       1KT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE007       A 2300V.50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of z5A       CO2       L2         20       1KT17EE005       Explain role of damping winding       CO3       L2         21       1KT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         22       1KT17EE007       Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance       CO3       L2         23       1KT17EE008       List the advantages and disadvantages of synchronous co3       CO3       L1         25       1KT17EE009       Define short circuit ratio       CO4       L4         26       1KT17EE000       What is the relation between short circuit ratio and co2       CO2       L3         26       1KT17EE000       What is the relation between short circuit ratio and co2       CO4       L4	16	1KT17EE004			CO1	L1
18       1KT17EE006       Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail       CO2       L2         19       1KT17EE007       A 2300V.50HZ 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A       CO2       L4         20       1KT17EE002       Wright short note on capability of synchronous generator       CO3       L2         21       1KT17EE005       Explain role of damping winding       CO3       L2         23       1KT17EE006       With neat sketch explain OCC and SCC characteristics of synchronous generator       CO2       L3         24       1KT17EE007       Differentiate between synchronous reactance, adjusted impedance of computing the regulation       CO3       L1         25       1KT17EE009       Define short circuit ratio       CO4       L4         27       1KT17EE009       Define short circuit ratio       CO4       L4         26       1KT17EE009       Define short circuit ratio       CO4       L4         25       1KT17EE009       Define short circuit ratio       CO4       L4         26       1KT17EE000       What is the relation between short circuit ratio and s			What is the relation between short circuit ratio and			L3
effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L2201KT17EE002Wright short note on capability of synchronous generatorCO3L2211KT17EE004What is hunting in synchronous generatorCO4L5221KT17EE005Explain role of damping windingCO3L2231KT17EE006With neat sketch explain OCC and SCC characteristics of synchronous generatorCO2L3241KT17EE007Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactanceCO4L4251KT17EE008List the advantages and disadvantages of synchronous impedance of computing the regulationCO3L1261KT17EE000What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO3L1291KT17EE012A 2300V,50HZ 3 phase star connected alternator has an produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pfCO3L1291KT17EE012A 2300V,50HZ 3 phase star connected alternator has an produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pfCO3L1	18	1KT17EE006	Name the various method for determining of voltage regulation for 3 phase alternator and describe any one		CO2	L2
201KT17EE002Wright short note on capability of synchronous generatorCO3L2211KT17EE004What is hunting in synchronous generatorCO4L5221KT17EE005Explain role of damping windingCO3L2231KT17EE006With neat sketch explain OCC and SCC characteristics of synchronous generatorCO2L3241KT17EE007Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactanceCO4L4251KT17EE008List the advantages and disadvantages of synchronous impedance of computing the regulationCO3L1261KT17EE009Define short circuit ratioCO4L4271KT17EE010What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO3L1291KT17EE012A 2300V.50Hz 3 phase star connected alternator has an effective armature resistance 0.2ohm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	19	1KT17EE007	effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf		CO2	L4
21IKT17EE004What is hunting in synchronous generatorCO4L522IKT17EE005Explain role of damping windingCO3L223IKT17EE006With neat sketch explain OCC and SCC characteristics of synchronous generatorCO2L324IKT17EE007Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactanceCO4L425IKT17EE008List the advantages and disadvantages of synchronous impedance of computing the regulationCO3L126IKT17EE009Define short circuit ratioCO4L427IKT17EE010What is the relation between short circuit ratio and synchronous reactanceCO2L328IKT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO3L129IKT17EE012A 2300V,50Hz 3 phase star connected alternator has an 	20	1KT17EE002	Wright short note on capability of synchronous generator		CO3	L2
22IKT17EE005Explain role of damping windingCO3L223IKT17E006With neat sketch explain OCC and SCC characteristics of synchronous generatorCO2L324IKT17E007Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactanceCO4L425IKT17E008List the advantages and disadvantages of synchronous impedance of computing the regulationCO3L126IKT17E009Define short circuit ratioCO4L427IKT17E010What is the relation between short circuit ratio and synchronous reactanceCO2L328IKT17E011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO3L129IKT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	21	1KT17EE004	What is hunting in synchronous generator		CO4	L5
231KT17EE006With neat sketch explain OCC and SCC characteristics of synchronous generatorCO2L3241KT17EE007Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactanceCO4L4251KT17EE008List the advantages and disadvantages of synchronous impedance of computing the regulationCO3L1261KT17EE009Define short circuit ratioCO4L4271KT17EE010What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO3L1291KT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	22				CO3	L2
241KT17EE007Differentiate synchronous reactance and Potier reactanceCO4L4251KT17EE008List the advantages and disadvantages of synchronous impedance of computing the regulationCO3L1261KT17EE009Define short circuit ratioCO4L4271KT17EE010What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO3L1291KT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	23	1	With neat sketch explain OCC and SCC characteristics of			L3
impedance of computing the regulation261KT17EE009Define short circuit ratioCO4L4271KT17EE0010What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO4L4291KT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	24	1KT17EE007	Differentiate between synchronous reactance, adjusted		CO4	L4
271KT17EE0010What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO4L4291KT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	25	1KT17EE008			CO3	L1
271KT17EE010What is the relation between short circuit ratio and synchronous reactanceCO2L3281KT17EE011Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detailCO4L4291KT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25ACO3L1	26	1KT17EE009			CO4	L4
regulation for 3 phase alternator and describe any one method in detail 29 1KT17EE012 A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A					-	L3
291KT17EE012A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pfCO3L1L1L1L1L1L1L1L1L1L2L2L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1L1L1L1L3L1L1L1L1 <tdl1< td=""><t< td=""><td>28</td><td>1KT17EE011</td><td>regulation for 3 phase alternator and describe any one</td><td></td><td>CO4</td><td>L4</td></t<></tdl1<>	28	1KT17EE011	regulation for 3 phase alternator and describe any one		CO4	L4
	29	1KT17EE012	A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf		CO3	L1
	30	1KT17EE013	Wright short note on capability of synchronous generator		CO4	L4

# F. EXAM PREPARATION

### 1. University Model Question Paper

Cou Crs (	Code:	Transformer and generatorsMonth18EE33Sem:3Marks:100Time:		01/08 180 m	
-	1	18EE33     Sem:     3     Marks:     100     Time:       Answer all FIVE full questions. All questions carry equal marks.	Marks		Leve
1		Derive an equation for a single phase transformer.	16 /	CO1	Leve
		berve arrequation for a single phase transformer.	20		
	b	Draw and explain vector diagram of transformer loaded with Inductive	è		
		and capacitive load			
		Explain open-delta connection with the help of neat diagram. Show that		CO2	
		open-delta connection has a KVA rating of 58% of the rating of the normal delta-delta connection.			
		Show the terminal connections of a three-phase transformer with phaso			
		diagram and corresponding clock method representation 1)Dd0 2) Yy6	õ		
		3) Dy1 4) Yd11			
	-	OR	10 (	<u> </u>	
1	a	What are the conditions to operate two transformers in parallel?	16 /	CO1	
	b	Derive an expression for the copper savings in an autotransformer as	20	CO2	
		compared with 2 winding transformer.		002	
		A 400/100V, 10 KVA, 2 winding transformer is to be employed as ar			
		autotransformer to supply a 400volts circuit from 500volts source. When			
		tested as 2 winding transformer at rated load of 0.85 p.f lagging, its			
		efficiency is 97%. Determine its KVA rating and efficiency as ar	n		
		autotransformer			
		Explain the reason for tap changing in transformer. State on which	า		
		winding the taps are provided & why?			
2	2	Evoluin the reason for tan changing in transformer. State on which	16/	Co3	
2		Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?	20	03	
		Explain current inrush phenomenon in transformer.	20		
		Derive an equation for the emf induced in an alternator.		CO4	
		What is armature reaction? With neat figure explain armature reaction ir	1		
		DC machines under normal working condition.			
		ÖR			
-	а	Explain the reason for tap changing in transformer. State on which	n 16 /	CO3	
		winding the taps are provided & why?	20		
	b	Explain with neat sketch the construction of three phase core type and shell type transformer.	l	CO4	
		Derive an equation for a single phase transformer.			
		Draw and explain vector diagram of transformer loaded with Inductive	è		
		and capacitive load			
3		Write a brief note on parallel operation of two-single phase transformers		CO5	
		with unequal voltage ratio. Derive the necessary relation.	20		
	b	List the advantages and disadvantages of an autotransformer		000	
		Two 250KVA transformers supplying a network are connected in paralle on both primary and secondary sides. Their voltage ratios are the same		CO6	
		The resistance drops are 1.5% & 0.9% and the reactance drops are 3.33% 8			
		4% respectively. Calculate the KVA loading on each transformer and its			
		power factor when the total load on the transformers is 500KVA & a			
		0.707 lagging p.f.			
		What are the conditions to operate two transformers in parallel?			
-	a	Derive an expression for the copper savings in an autotransformer as	5 16 /	CO5	
		compared with 2 winding transformer.	20		
		A 400/100V, 10 KVA, 2 winding transformer is to be employed as ar			
		autotransformer to supply a 400volts circuit from 500volts source. Wher			
		tested as 2 winding transformer at rated load of 0.85 p.f lagging, its			
		efficiency is 97%. Determine its KVA rating and efficiency as ar	l		

		autotransformer			
	С	Derive an equation for the emf induced in an alternator.		CO6	
	d	What is armature reaction? With neat figure explain armature reaction in			
		DC machines under normal working condition.			
4	а	Draw and explain the characteristics of DC series generator.	16 / 20	CO7	
	b	Explain Parallel operation of generators and load sharing			
	С	Draw Power angle characteristic of generator and explain		C08	
	d	Write short note on Voltage regulation of generator			
		OR			
-	а	Wright short note on capability of synchronous generator	16 / 20	CO7	
	b	What is hunting in synchronous generator		CO8	
	С	Explain role of damping winding			
	d	With neat sketch explain OCC and SCC characteristics of synchronous generator			
		Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance			
5	а	List the advantages and disadvantages of synchronous impedance of computing the regulation	16 / 20	CO9	
	b	Define short circuit ratio		CO10	
	С	What is the relation between short circuit ratio and synchronous reactance			
	d	Explain role of damping winding			
		OR			
	а	Define short circuit ratio	16 / 20	CO9	
	b	What is the relation between short circuit ratio and synchronous reactance			
	С	Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail		C010	
	d	A 2300V,50Hz 3 phase star connected alternator has an effective armature resistance 0.20hm a field current of 35A is produced a current of 150A on short circuit and open circuit emf 780V(line) calculate the voltage regulation of 0.8 pf lagging for the full load current of 25A			

# 2. SEE Important Questions

Cour	rse:	Transformer and generators Month .	/ Year	01/08	/19
Crs (	Code:	18EE33 Sem: 3 Marks: 100 Time:		180 mi	inutes
	Note	Answer all FIVE full questions. All questions carry equal marks.	-	-	
Мо	Qno.	Important Question	Marks	со	Year
dul					
е					
1	1	Explain the reason for tap changing in transformer. State on which	16 /		2014
		winding the taps are provided & why?	20		
	2	Explain with neat sketch the construction of three phase core type and			2015
		shell type transformer.			
	3	Derive an equation for a single phase transformer.			2016
	4	Draw and explain vector diagram of transformer loaded with Inductive and capacitive load			2017
		Explain open-delta connection with the help of neat diagram. Show that open-delta connection has a KVA rating of 58% of the rating of the normal delta-delta connection.			2018
		Show the terminal connections of a three-phase transformer with phasor diagram and corresponding clock method representation 1)Dd0 2) Yy6 3) Dy1 4) Yd11			
2	1	Draw and explain equivalent circuit of tertiary transformer.	16 /		2014
			20		

	2	Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?		2015
	3	Explain current inrush phenomenon in transformer.		2016
	4	Derive an equation for the emf induced in an alternator.		2010
	5	What is armature reaction? With neat figure explain armature reaction in DC machines under normal working condition.		2018
3	1	Draw and explain equivalent circuit of tertiary transformer.	16 / 20	2014
	2	Explain the reason for tap changing in transformer. State on which winding the taps are provided & why?		2015
	3	Explain current inrush phenomenon in transformer.		2016
	4	Derive an equation for the emf induced in an alternator.		2017
	5	What is armature reaction? With neat figure explain armature reaction in DC machines under normal working condition.		2018
		What are the sources of noise in transformer? How to reduce the noise problem in transformer?		
4	1	Explain Parallel operation of generators and load sharing	16 / 20	2014
	2	Draw Power angle characteristic of generator and explain		2015
	3	Write short note on Voltage regulation of generator		2016
	4	With a phasor diagram explain the concept the two reaction theory in a salient pole machine		2017
	5	Write short note on V-curves of synchronous generator		2018
5	1	Wright short note on capability of synchronous generator	16 / 20	2014
	2	What is hunting in synchronous generator		2015
	3	Explain role of damping winding		2016
	4	With neat sketch explain OCC and SCC characteristics of synchronous generator		2017
	5	Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance		2018
		List the advantages and disadvantages of synchronous impedance of computing the regulation		
		Define short circuit ratio		
		What is the relation between short circuit ratio and synchronous reactance		