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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Table of Contents



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 : | 3rd | 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

| Module | Module Content | Teaching Hours | Module Concepts | Blooms 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.<br>**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.<br>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 | 10 | Characteristics and operation Winding connection | L3, L5 |
| 2 | **Parallel Operation of Transformers:** 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 | 10 | Load sharing Copper saving in transformer | L3,L4 |
| 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,L5 |
| 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 | L3,L4,L5 |
| 5 | **Synchronous generators** (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,L5 |

| | | | | |
|---|---|---|---|---|
| | reactance. Voltage regulation by EMF, MMF, ZPF methods.Performance of synchronous generators: Capability curve for large turbo generators and salient pole generators. Starting, synchronizing and control. Hunting and dampers | | generators | |

## 3. Course Material

| Module | Details | Available |
|---|---|---|
| **1** | **Text books** | |
| | I J nagaranth khothari | In Lib |
| | M G Say**Synchronous generators** | |
| **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 | Concept | Instr Method | Assessment Method | Blooms' Level |
|---|---|---|---|---|---|---|
| 18EE33.1 | Ideal,On load, No load Characteristics,regulation of transformer all day efficiency | 10 | Characteristics and operation | Lecture | Slip Test | L2 Understand |
| 18EE33.2 | Three phase transformer different winding connection star-Delta Delta-star Y-Y | 05 | Winding connection | Lecture | Assignment | L2 Understanding |
| 18EE33.3 | Conditions for load sharing,Load sharing In similar and dissimilar transformer | 06 | Load sharing | Lecture | Assignment and Slip Test | L4 Analysis |
| 18EE33.4 | Equivalent circuit of auto transformer,derivation of copper saving, efficiency and voltage regulationArticulation Matrix | 06 | Copper saving in transformer | Lecture / | Assignment | L3 Apply |
| 18EE33.5 | Necessity of tertiary winding equivalent circuit and connection | 07 | Working of Tertiary winding | Lecture | Slip test | L5 Evaluate |
| 18EE33.6 | Armature reaction of AC and DC and Commutation of generation numerical on generators | 06 | Characteristics of DC generator | Lecture | Assignment | L3 Apply |
| 18EE33.7 | Harmonics of Synchronous generator Equivalent circuit | 06 | Operation of AC generator | Lecture | Assignment and Slip Test | L5 Evaluate |

| | | | | | | |
|---|---|---|---|---|---|---|
| 18EE33.8 | Load and No load characteristics Excitation for generator,load sharing | 07 | Characteristics of AC generator | Lecture | Assignment | L2 Understanding |
| 18EE33.9 | Open circuit and short circuit test, V curves and inverted V curves , Voltage regulation | 07 | Test on Synchronous generator | Lecture | Assignment | L4 Analyze |
| 18EE33.10 | 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 optimal solution | CO4 | L3 |
| 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 | Program Outcomes | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Level |
| 18EE33.1 | Ideal,On load, No load Characteristics,regulation of transformer all day efficiency | X | X | | | X | | | X | | | | | L2 |
| 18EE33.2 | Three phase transformer different winding connection star-Delta Delta-star Y-Y | X | X | X | X | | | | | | | | | L2 |
| 18EE33.3 | Conditions for load sharing,Load sharing In similar and dissimilar transformer | X | X | | X | | | | | | | | | L2 |
| 18EE33.4 | Equivalent circuit of auto transformer,derivation of copper saving, efficiency and voltage regulation | X | X | | | | | | | | | | | L3 |
| 18EE33.5 | Necessity of tertiary winding equivalent circuit and connection | X | | X | | | | | | | | | | L2 |
| 18EE33.6 | Armature reaction of AC and DC and Commutation of generation numerical on generators | X | X | | X | | | | | | | | | L2 |
| 18EE33.7 | Harmonics of Synchronous generator Equivalent circuit | | X | X | X | | | | | | | | | L3 |
| 18EE33.8 | Load and No load characteristics Excitation for generator,load sharing | X | X | | X | | | | | | | | | L2 |
| 18EE33.9 | Open circuit and short circuit test, V curves and inverted V curves , Voltage regulation | X | X | | X | | | | | | | | | L2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **18EE33.10** | Capability curve of generators, Hunting and different methods to minimize hunting | | **X** | | **X** | | | | | | | | | **L2** |
| **Note: Mention the mapping strength as 1, 2, or 3** | | | | | | | | | | | | | | |

## 4. Mapping Justification

| Mapping | | Justification | Mapping Level |
|---|---|---|---|
| **CO** | **PO** | **-** | **-** |
| 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 associated with load sharing | L2 |
| 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 |
| CO9 | 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 | Resources Person | PO Mapping |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| | | | | | |
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Note: Anything not covered above is included here.

## C. COURSE ASSESSMENT

### 1. Course Coverage

| Module # | Title | Teaching Hours | No. of question in Exam | | | | | | CO | Levels |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CIA-1 | CIA-2 | CIA-3 | Asg | Extra Asg | SEE | | |
| 1 | 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, Co8 | L2, L3 |
| 5 | 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 | CO | Levels |
|---|---|---|---|
| CIA Exam – 1 | 30 | CO1, CO2, CO3, CO4 | L2, l3, l4, l2 |
| CIA Exam – 2 | 30 | CO5, CO6, CO7, Co8 | 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 – Slip test | | CO1 to Co9 | L2, L3, L4 . .. |
| **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 Time: | 16 Hrs |
|---|---|---|---|
| **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*** | - | - |
| **Class No** | **Module Content Covered** | **CO** | **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 efficiency- commercial and all-day | | |
| 3 | Voltage regulation and its significance.Three-phase Transformers | | |
| 4 | Introduction, Constructional features of three-phase transformers. | | |
| 5 | Choice between single unit three-phase transformer and a bank of three single-phase transformers. | | |
| 6 | 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 | | |
| | | | |
| | | | |
| **c** | **Application Areas** | **CO** | **Level** |
| 1 | Use to find characteristics of transformers | CO1 | L3 |
| 2 | Efficiency of transformer in industrial applications | CO2 | 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)Dd0 2) Yy6 3) Dy1 4) Yd11 | CO2 | L5 |
| 7 | A 50KVA, 4400/220V, transformer has $R_1$=3.45Ω,$R_2$=0.009Ω, The Values of reactance's are $X_1$=5.2Ω,$X_2$=0.015Ω, calculate for 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. | 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 |
| | | | |

| | | | |
|---|---|---|---|
| **e** | **Experiences** | - | - |
| 1 | | CO1 | L2 |
| 2 | | | |
| 3 | | | |
| 4 | | CO3 | L3 |
| 5 | | | |

## Module – 2

| 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** | **Module Content Covered** | **CO** | **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 | | |
| | | | |
| **c** | **Application Areas** | **CO** | **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 with unequal voltage ratio. Derive the necessary relation. | CO3 | L1 |
| 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 |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | CO1 | L2 |
| 2 | | | |
| 3 | | | |
| 4 | | CO3 | L3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | |

## E1. CIA EXAM – 1

### a. Model Question Paper - 1

| Crs Code: | 18EE33 | Sem: | 3 | Marks: | 30 | Time: | 75 minutes | | |
|---|---|---|---|---|---|---|---|---|---|
| Course: | Transformer and generators | | | | | | | | |
| **-** | **-** | **Note: Answer any 3 questions, each carry equal marks.** | | | | | **Marks** | **CO** | **Level** |
| 1 | a | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | | | | 8 | CO1 | L1 |
| | b | Explain on load tap changing with neat diagram. | | | | | 6 | | L2 |
| | c | 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. | | | | | 8 | CO2 | L3 |
| | | | | | | | | | |
| 2 | a | Write a brief note on parallel operation of two-single phase transformers with unequal voltage ratio. Derive the necessary relation. | | | | | 6 | | L2 |
| | b | List the advantages and disadvantages of an autotransformer | | | | | 8 | | L4 |
| | c | 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. | | | | | 4 | | L3 |
| | d | What are the conditions to operate two transformers in parallel? | | | | | 4 | | L2 |
| | | | | | | | | | |
| 3 | a | Derive an expression for the copper savings in an autotransformer as compared with 2 winding transformer. | | | | | 8 | CO3 | L1 |
| | b | 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 | | | | | 6 | CO4 | L2 |
| | c | Explain with neat sketch the construction of three phase core type and shell type transformer. | | | | | 8 | | L1 |
| | | | | | | | | | |
| 4 | a | With connection diagrams and equivalent circuits , Explain the theory behind the O.C and S.C tests conducted to find the constants of a transformer. | | | | | 8 | | L2 |
| | b | A 50KVA, 4400/220V, transformer has $R_1$=3.45Ω, $R_2$=0.009Ω, The Values of reactance's are $X_1$=5.2Ω,$X_2$=0.015Ω, calculate for 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 | | | | | 6 | | L2 |
| | c | 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 | | | | | 8 | | L1 |

## b. Assignment -1

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

| Model Assignment Questions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Crs Code: | 18EE33 | Sem: | 3 | Marks: | 5 / 10 | Time: | 90 – 120 minutes |
| Course: | Transformer and Generators | | | | | | |
| Note: Each student to answer 2-3 assignments. Each assignment carries equal mark. | | | | | | | |

| SNo | USN | Assignment Description | Marks | CO | Level |
|---|---|---|---|---|---|
| 1 | 1KT17EE002 | Write a brief note on parallel operation of two-single phase transformers with unequal voltage ratio. Derive the necessary relation. | 5 | CO1 | L2 |
| 2 | 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 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. | | CO2 | L4 |
| 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 autotransformer as compared with 2 winding transformer. | | CO1 | L2 |
| 6 | 1KT17EE008 | 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 | | CO2 | L3 |
| 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 |
| 9 | 1KT17EE011 | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | CO1 | L2 |
| 10 | 1KT17EE012 | Explain with neat sketch the construction of three phase core type and shell type transformer. | | CO2 | L3 |
| 11 | 1KT17EE013 | Derive an equation for a single phase transformer. | | CO2 | L4 |
| 12 | 1KT18EE400 | Draw and explain vector diagram of transformer loaded with Inductive and capacitive load | | CO1 | L3 |
| 13 | 1KT17EE401 | 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. | | CO1 | L2 |
| 14 | 1KT17EE002 | 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 | | CO2 | L3 |
| 15 | 1KT17EE003 | A 50KVA, 4400/220V, transformer has $R_1$=3.45Ω,$R_2$=0.009Ω, The Values of reactance's are $X_1$=5.2Ω,$X_2$=0.015Ω, calculate for 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. | | CO2 | L4 |
| 16 | 1KT17EE004 | 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 | L3 |
| 17 | 1KT17EE005 | Derive an equation for a single phase transformer .Draw and explain vector diagram of transformer loaded with Inductive and capacitive load. | | CO2 | L4 |

| | | | | | |
|---|---|---|---|---|---|
| 18 | 1KT17EE006 | 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 | L3 |

## D2. TEACHING PLAN - 2

### Module – 3

| Title: | Divide and Conquer | Appr Time: | 16 Hrs |
|---|---|---|---|
| **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*** | | |
| **Class No** | **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 | | |
| | | | |
| **c** | **Application Areas** | **CO** | **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. | | |

| | | | |
|---|---|---|---|
| **e** | **Experiences** | - | - |
| 1 | | CO1 | L2 |
| 2 | | | |
| 3 | | | |
| 4 | | CO3 | L3 |
| 5 | | | |

Module – 4

| Title: | | Appr Time: | 16 Hrs |
|---|---|---|---|
| **a** | ***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 | | | |
| | | | |
| **c** | **Application Areas** | **CO** | **Level** |
| 1 | Used in distribution system | CO8 | L3 |
| 2 | Used in industrial application for sharing | CO7 | 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 | CO7 | 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 |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | CO7 | L2 |
| 2 | | | |
| 3 | | | |
| 4 | | CO8 | L3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | |

## E2. CIA EXAM – 2

### a. Model Question Paper - 2

| Crs Code: | 18EE33 | Sem: | I | Marks: | 30 | Time: | 75 minutes | | |
|---|---|---|---|---|---|---|---|---|---|
| Course: | Transformer and Generators | | | | | | | | |
| **-** | **-** | **Note: Answer any 2 questions, each carry equal marks.** | | | | | **Marks** | **CO** | **Level** |
| 1 | a | 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 | | | | | 20 | CO5 | L1 |
| | b | What is armature reaction? With neat figure explain armature reaction in DC machines under normal working condition. | | | | | | | L2 |
| | c | 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 | | | | | | CO6 | L3 |
| | d | Derive an equation for the emf induced in an alternator. | | | | | | | L1 |
| | | | | | | | | | |
| 2 | a | 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 |
| | c | With a phasor diagram explain the concept the two reaction theory in a salient pole machine | | | | | | | L3 |
| | d | Explain Parallel operation of generators and load sharing | | | | | | | L2 |
| | | | | | | | | | |
| 3 | a | What is synchronization of alternator | | | | | 20 | CO8 | L1 |
| | b | What are the conditions for proper synchronization of alternator | | | | | | CO8 | L2 |
| | c | What are the sources of noise in transformer? How to reduce the noise problem in transformer? | | | | | | | L1 |
| | d | Derive the necessary expression for cross magnetizing effect and de-magnetizing effect. | | | | | | | L2 |
| | | | | | | | | | |
| 4 | a | What are the conditions for proper synchronization of alternator | | | | | 20 | | L2 |
| | b | With neat diagram explain the process of commutation in DC machines. | | | | | | | L2 |
| | c | Draw and explain the characteristics of DC series generator. | | | | | | | L1 |
| | d | State the possible causes of failure of excitation of self excited generator. | | | | | | | L3 |

### b. Assignment – 2

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

| Model Assignment Questions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Crs Code: | 18EE33 | Sem: | 3 | Marks: | 5 / 10 | Time: | 90 – 120 minutes | | |
| Course: | Transformers and generators | | | | | | | | |
| Note: Each student to answer 2-3 assignments. Each assignment carries equal mark. | | | | | | | | | |
| **SNo** | **USN** | **Assignment Description** | | | | | **Marks** | **CO** | **Level** |
| 1 | 1KT17EE002 | 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 | | | | | 5 | CO8 | L2 |
| 2 | 1KT17EE004 | Draw and explain equivalent circuit of tertiary transformer. | | | | | 5 | CO9 | L3 |
| 3 | 1KT17EE005 | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | | | | | CO10 | L4 |
| 4 | 1KT17EE006 | Explain current inrush phenomenon in transformer. | | | | | 5 | CO9 | L3 |
| 5 | 1KT17EE007 | Derive an equation for the emf induced in an alternator. | | | | | | CO1 | L1 |
| 6 | 1KT17EE008 | What is armature reaction? With neat figure explain armature reaction in DC machines under normal working condition. | | | | | | CO1 | L3 |
| 7 | 1KT17EE009 | What are the sources of noise in transformer? How to reduce the noise problem in transformer? | | | | | | CO2 | L2 |
| 8 | 1KT17EE0010 | Derive the necessary expression for cross magnetizing effect | | | | | | 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

### Module – 5

| Title: | Synchronous generator | Appr Time: | 16 Hrs |
|---|---|---|---|
| **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** | **CO** | **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 | | |
| | | | |
| **c** | **Application Areas** | **CO** | **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 0.2ohm 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 25A | | L1 |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | CO10 | L2 |
| 2 | | | |
| 3 | | | |
| 4 | | CO9 | L3 |
| 5 | | | |

## E3. CIA EXAM – 3

### a. Model Question Paper - 3

| Crs Code: | 18EE33 | Sem: | 3 | Marks: | 30 | Time: | 75 minutes |
|---|---|---|---|---|---|---|---|
| Course: | Transformer and generators | | | | | | |

| - | - | **Note: Answer any 2 questions, each carry equal marks.** | **Marks** | **CO** | **Level** |
|---|---|---|---|---|---|
| 1 | a | Wright short note on capability of synchronous generator | 20 | CO9 | L1 |
| | b | What is hunting in synchronous generator | | | L2 |
| | c | Explain role of damping winding | | CO9 | L3 |
| | d | With neat sketch explain OCC and SCC characteristics of synchronous generator | | | L1 |
| | | Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance | | | |
| 2 | a | List the advantages and disadvantages of synchronous impedance of computing the regulation | 20 | CO10 | L2 |
| | b | Define short circuit ratio | | | L4 |
| | c | What is the relation between short circuit ratio and synchronous reactance | | | L3 |
| | d | Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail | | | L2 |
| | | A 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 25A | | | |
| 3 | a | Draw and explain the characteristics of DC series generator. | 20 | CO10 | L1 |
| | b | Explain Parallel operation of generators and load sharing | | CO10 | L2 |
| | c | Draw Power angle characteristic of generator and explain | | | L1 |
| | d | Write short note on Voltage regulation of generator | | | L2 |
| | | With a phasor diagram explain the concept the two reaction theory in a salient pole machine | | | |
| 4 | a | Write short note on V-curves of synchronous generator | 20 | | L2 |
| | b | With a neat diagram, Explain the slip lest on salient pole synchronous machine | | | L2 |
| | c | What is synchronization of alternator | | | L1 |
| | d | What are the conditions for proper synchronization of alternator | | | L3 |

### b. Assignment – 3

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

| Model Assignment Questions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Crs Code: | 18EE33 | Sem: | 3 | Marks: | 5 / 10 | Time: | 90 – 120 minutes |

| Course: | Transformer and generators | | | | |
|---|---|---|---|---|---|
| Note: Each student to answer 2-3 assignments. Each assignment carries equal mark. | | | | | |
| **SNo** | **USN** | **Assignment Description** | **Marks** | **CO** | **Level** |
| 1 | 1KT17EE002 | Draw and explain the characteristics of DC series generator. | 5 | CO9 | L2 |
| 2 | 1KT17EE004 | Explain Parallel operation of generators and load sharing | 5 | CO9 | L3 |
| 3 | 1KT17EE005 | Draw Power angle characteristic of generator and explain | | CO10 | L4 |
| 4 | 1KT17EE006 | Write short note on Voltage regulation of generator | 5 | CO10 | L3 |
| 5 | 1KT17EE007 | With a phasor diagram explain the concept the two reaction theory in a salient pole machine | | CO1 | L1 |
| 6 | 1KT17EE008 | Write short note on V-curves of synchronous generator | | CO1 | L3 |
| 7 | 1KT17EE009 | With a neat diagram, Explain the slip lest on salient pole synchronous machine | | CO2 | L2 |
| 8 | 1KT17EE0010 | What is synchronization of alternator | | CO2 | L4 |
| 9 | 1KT17EE011 | What are the conditions for proper synchronization of alternator | | CO2 | L2 |
| 10 | 1KT17EE012 | Wright short note on capability of synchronous generator | | CO2 | L5 |
| 11 | 1KT17EE013 | What is hunting in synchronous generator | | CO2 | L2 |
| 12 | 1KT18EE400 | Explain role of damping winding | | CO2 | L3 |
| 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 | | 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 0.2ohm 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 25A | | CO2 | L4 |
| 20 | 1KT17EE002 | Wright short note on capability of synchronous generator | | CO3 | L2 |
| 21 | 1KT17EE004 | What is hunting in synchronous generator | | CO4 | L5 |
| 22 | 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 synchronous reactance and Potier reactance | | CO4 | L4 |
| 25 | 1KT17EE008 | List the advantages and disadvantages of synchronous impedance of computing the regulation | | CO3 | L1 |
| 26 | 1KT17EE009 | Define short circuit ratio | | CO4 | L4 |
| 27 | 1KT17EE0010 | What is the relation between short circuit ratio and synchronous reactance | | CO2 | L3 |
| 28 | 1KT17EE011 | Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail | | CO4 | L4 |
| 29 | 1KT17EE012 | A 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 25A | | CO3 | L1 |
| 30 | 1KT17EE013 | Wright short note on capability of synchronous generator | | CO4 | L4 |
| 31 | 1KT18EE400 | What is hunting in synchronous generator | | | |

## F. EXAM PREPARATION

### 1. University Model Question Paper

| Course: | | Transformer and generators | | | | | | Month / Year | 01/08/19 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crs Code: | | 18EE33 | Sem: | 3 | Marks: | 100 | | Time: | 180 minutes | |
| - | **Note** | Answer all FIVE full questions. All questions carry equal marks. | | | | | | **Marks** | **CO** | **Level** |
| 1 | a | Derive an equation for a single phase transformer. | | | | | | 16 / 20 | CO1 | |
| | b | Draw and explain vector diagram of transformer loaded with Inductive and capacitive load | | | | | | | | |
| | c | 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 | |
| | d | 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 | | | | | | | | |
| | | **OR** | | | | | | | | |
| 1 | a | What are the conditions to operate two transformers in parallel? | | | | | | 16 / 20 | CO1 | |
| | b | Derive an expression for the copper savings in an autotransformer as compared with 2 winding transformer. | | | | | | | CO2 | |
| | c | 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 | | | | | | | | |
| | d | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | | | | | | | |
| | | | | | | | | | | |
| 2 | a | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | | | | | 16 / 20 | CO3 | |
| | b | Explain current inrush phenomenon in transformer. | | | | | | | | |
| | c | Derive an equation for the emf induced in an alternator. | | | | | | | CO4 | |
| | d | What is armature reaction? With neat figure explain armature reaction in DC machines under normal working condition. | | | | | | | | |
| | | **OR** | | | | | | | | |
| - | a | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | | | | | 16 / 20 | CO3 | |
| | b | Explain with neat sketch the construction of three phase core type and shell type transformer. | | | | | | | CO4 | |
| | c | Derive an equation for a single phase transformer. | | | | | | | | |
| | d | Draw and explain vector diagram of transformer loaded with Inductive and capacitive load | | | | | | | | |
| | | | | | | | | | | |
| 3 | a | Write a brief note on parallel operation of two-single phase transformers with unequal voltage ratio. Derive the necessary relation. | | | | | | 16 / 20 | CO5 | |
| | b | List the advantages and disadvantages of an autotransformer | | | | | | | | |
| | c | 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. | | | | | | | CO6 | |
| | d | What are the conditions to operate two transformers in parallel? | | | | | | | | |
| - | a | Derive an expression for the copper savings in an autotransformer as compared with 2 winding transformer. | | | | | | 16 / 20 | CO5 | |
| | b | 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 | | | |
| | c | 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 | a | Draw and explain the characteristics of DC series generator. | 16 / 20 | CO7 | |
| | b | Explain Parallel operation of generators and load sharing | | | |
| | c | Draw Power angle characteristic of generator and explain | | CO8 | |
| | d | Write short note on Voltage regulation of generator | | | |
| | | **OR** | | | |
| - | a | Wright short note on capability of synchronous generator | 16 / 20 | CO7 | |
| | b | What is hunting in synchronous generator | | CO8 | |
| | c | 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 | a | List the advantages and disadvantages of synchronous impedance of computing the regulation | 16 / 20 | CO9 | |
| | b | Define short circuit ratio | | CO10 | |
| | c | What is the relation between short circuit ratio and synchronous reactance | | | |
| | d | Explain role of damping winding | | | |
| | | **OR** | | | |
| | a | Define short circuit ratio | 16 / 20 | CO9 | |
| | b | What is the relation between short circuit ratio and synchronous reactance | | | |
| | c | Name the various method for determining of voltage regulation for 3 phase alternator and describe any one method in detail | | CO10 | |
| | d | A 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 25A | | | |

## 2. SEE Important Questions

| Course: | | Transformer and generators | | | | | | Month / Year | 01/08/19 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crs Code: | | 18EE33 | Sem: | 3 | Marks: | 100 | | Time: | 180 minutes | |
| | **Note** | Answer all FIVE full questions. All questions carry equal marks. | | | | | | - | - | |
| Module | Qno. | Important Question | | | | | | **Marks** | **CO** | **Year** |
| 1 | 1 | Explain the reason for tap changing in transformer. State on which winding the taps are provided & why? | | | | | | 16 / 20 | | 2014 |
| | 2 | Explain with neat sketch the construction of three phase core type and shell type transformer. | | | | | | | | 2015 |
| | 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 |
| | 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. | | | | | | | | 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 / 20 | | 2014 |

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|---|---|---|---|---|---|
| | 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 |
| | | | | | |
| 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 | | | |