SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

III SEMESTER

EE3362 -ELECTRICAL MACHINES - I

Regulation – 2023

Academic Year 2025-2026 (Odd)

Prepared by

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SUBJECT : EE3362 -ELECTRICAL MACHINES - I

SEM / YEAR : II / III

UNIT-I - ELECTROMECHANICAL ENERGY CONVERSION

Fundamentals of Magnetic circuits- Statically and dynamically induced EMF - Principle of electromechanical energy conversion forces and torque in magnetic field systems- energy balance in magnetic circuits- magnetic force- co-energy in singly excited and multi excited magnetic field system- mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines- magnetic saturation and leakage fluxes. Introduction to Indian Standard Specifications (ISS) - Role and significance in testing.

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	Explain Statically induced EMF?	BTL5	Evaluate	CO1
2.	Define magnetic flux density.	BTL1	Remember	CO1
3.	Define magnetic reluctance.	BTL1	Remember	CO1
4.	Distinguish statically and dynamically induced EMF.	BTL2	Understanding	CO1
5.	Describe co energy?	BTL2	Understand	CO1
6.	Why do all practical energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field? Explain.	BTL4	Analyze	CO1
7.	Compose the advantages of analyzing energy conversion devices by field energy concept.	BTL4	Analyze	CO1
8.	Give example for continuous energy conversion equipment and force producing devices.	BTL2	Understand	CO1
9.	Formulate synchronous speed. Also Write the expression.	BTL6	Create	CO1
10.	Differentiate the pitch factor and distribution factor.	BTL2	Understand	CO1
11.	Generalize example for singly and multiply excitation systems.	BTL6	Create	CO1
12.	Explain reactance voltage.	BTL4	Analyze	CO1
13.	List the basic requirements of the excitation systems?	BTL1	Remember	CO1
14.	Tell why fractional pitched winding is preferred over full.	BTL1	Remember	CO1
15.	Why the relationship between current and coil flux			CO1

	linkages of electromechanical energy conversion devices are linear?		BTL1	Remember	
16.	Show the equation, which relates rotor speed in electrical and mechanical radian/second.		BTL1	Remember	CO1
17.	State the principle of conservation of energy.		BTL3	Apply	CO1
18.	Define winding factor?		BTL1	Remember	CO1
19.	In a linear system Show that field energy and co energy are equal.		BTL3	Apply	CO1
20.	What are the cusses for irrecoverable energy loss when the flux in the magnetic circuits undergoes a cycle?		BTL2	Understand	CO1
21.	Deduce the assumptions made to determine the distribution of coil mmf.		BTL5	Evaluate	CO1
22.	Define the term pole pitch.		BTL1	Remember	CO1
23.	Why synchronous machine does not produce torque at any other speed? Justify.		BTL5	Evaluate	CO1
24.	Why field in rotating machines should be quasi static in nature.		BTL2	Understand	CO1
PART-B					
1.	Draw and explain statically induced emf and dynamically induced emf.	(16)	BTL3	Analyze	CO1
2.	Draw and explain the typical magnetic circuit with air-gap and its equivalent electric circuit. Hence derive the expression for air gap flux.	(16)	BTL2	Understanding	CO1
3.	(i) Compare the difference between electric circuit and magnetic circuit. (8) (ii) What is meant by induced emf? Explain the following types of induced emf (a) Statically Induced emf. (b) Dynamically Induced emf. (4+4)	(16)	BTL3	Applying	CO1
4.	Explain the following Magnetic field properties (i) Magnetic Field (ii) Magnetic Flux (iii) Magnetic Flux Density (iv) Magnetic Intensity or Force (v) Absolute and Relative Permeability (vi) Reluctance (vii) Permeance (viii)Magneto Motive Force.	(16)	BTL6	Creating	CO1
5.	Derive torque developed in singly excitation system also identify singly excited systems.	(16)	BTL6	Create	CO1
6.	Explain the concepts of rotating MMF waves in AC Machines.	(16)	BTL5	Evaluate	CO1
7.	With neat sketch explain multiple excited magnetic field system in electromechanical energy conversion systems. Also obtain the expression for field energy in the system.	(16)	BTL6	Create	CO1
8.	Explain in detailed MMF distribution in AC synchronous machine and derive the	(16)	BTL5	Evaluate	CO1

	expression for fundamental MMF.				
9.	Briefly explain multiply excited magnetic field systems.	(16)	BTL6	Create	CO1
10.	Explain in detail flow of energy in electro-mechanical device.	(16)	BTL5	Evaluate	CO1
11.	Explain briefly the production of rotating magnetic field. What are the speed and direction of rotation of the field? Is the speed uniform?	(16)	BTL4	Analyze	CO1
12.	Obtain an expression for the mechanical force of field origin in a typical Attracted armature relay.	(16)	BTL1	Remember	CO1
13.	Formulate the torque equation of a round rotor machine. Also clearly state the assumptions made.	(16)	BTL6	Create	CO1
14.	Describe the torque in doubly excited magnetic system and show that is equal to the rate of increase of field energy with respect to displacement at constant current.	(16)	BTL2	Understand	CO1
15.	Describe the m.m.f space wave of one phase of distributed a.c. winding.	(16)	BTL1	Remember	CO1
16.	Derive an expression for the magnetic energy stored in a singly excited electromagnetic relay.	(16)	BTL4	Analyze	CO1
17.	Derive an expression for magnetic torque developed in A doubly excited magnetic system.	(16)	BTL4	Analyze	CO1
18.	The magnetic flux density on the surface of an iron face is 1.6 T which is a typical saturation level value for ferromagnetic material. Identify the force density on the iron face.	(16)	BTL1	Remember	CO1

UNIT-II - DC GENERATORS

Principle of operation, constructional details, armature windings and its types, EMF equation, wave shape of induced emf, armature reaction, demagnetizing and cross magnetizing Ampere turns, compensating winding, commutation, methods of improving commutation, interpoles, OCC and load characteristics of different types of DC Generators. Parallel operation of DC Generators, equalizing connections- applications of DC Generators.

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	List the factors involved in the voltage buildup of a Shunt Generator.	BTL1	Remember	CO2
2.	Why the armature core in a DC machine is constructed with laminated steel sheets instead of solid steel sheets?	BTL1	Remember	CO2
3.	Define residual EMF in DC Generator?	BTL1	Remember	CO2
4.	Define back pitch and front pitch.	BTL1	Remember	CO2

5.	Define winding pitch and commutator pitch.		BTL1	Remember	CO2
6.	Define Commutation and Commutation period.		BTL1	Remember	CO2
7.	Differentiate Lap winding and Wave Winding of a DC machine armature.		BTL2	Understand	CO2
8.	Discuss why the external characteristics of a DC Shunt Generator is more drooping than that of a separately excited.		BTL2	Understand	CO2
9.	Discuss the detail under which conditions a dc shunt generator fails to excite.		BTL2	Understand	CO2
10.	Discuss the purpose of yoke in dc machine.		BTL2	Understand	CO2
11.	Classify the different types of DC Generators based on method of excitation?		BTL3	Apply	CO2
12.	Demonstrate the armature reaction in DC Generators? What are its effects?		BTL3	Apply	CO2
13.	Why load voltage across DC shunt generator is decreasing with increase in load current?		BTL3	Apply	CO2
14.	Explain in short the role of inter poles in DC Machines.		BTL4	Analyze	CO2
15.	Point out why the air gap between the pole pieces and the armature is kept very small?		BTL4	Analyze	CO2
16.	What are the methods to improve commutation?		BTL4	Analyze	CO2
17.	Integrate the Characteristics of all DC Generators in single graph.		BTL5	Evaluate	CO2
18.	Summarize the application of various types of Generators.		BTL5	Evaluate	CO2
19.	Generalize the requirements of the excitation systems?		BTL6	Create	CO2
20.	Develop critical resistance of a dc shunt generator.		BTL6	Create	CO2
21.	Explain characteristics of long shunt generator.		BTL4	Analyze	CO2
22.	Write down emf equation in relation with flux for dc generator.		BTL2	Understand	CO2
23.	Name various methods of decreasing effects of armature reaction.		BTL1	Remember	CO2
24.	Draw external characteristics of cumulative compound Generator		BTL2	Understand	CO2
	PART-B				
1.	Draw and explain the Internal and external characteristics of different types of DC Generators and also derive emf equation.	(16)	BTL1	Remember	CO2
2.	Explain under commutation in DC machines.	(16)	BTL4	Analyze	CO2
3.	Explain the armature reaction and commutation in detail for a DC Machine.	(16)	BTL2	Understand	CO2
4.	An 8-pole DC shunt generator with 778 wave connected armature conductors and running at 500 rpm supplies a load of 12.5 Ω	(16)	BTL4	Analyze	CO2

	resistance at a terminal voltage of 250V. The armature resistance is 0.24Ω and field resistance is 250Ω. Find the armature current, the induced emf and the flux per pole.				
5.	A 10-pole dc shunt generator with 800 wave connected conductors and running at 600 rpm supplies a load of 15Ω resistance at a terminal voltage of 240V. The armature resistance is 0.3Ω and field resistance is 250Ω Determine the armature current, induced emf and flux per pole.	(16)	BTL2	Understand	CO2
6.	Explain demagnetizing and cross-magnetizing ampere turns calculated.	(16)	BTL3	Apply	CO2
7.	Show the condition for maximum efficiency of the DC Generator.	(16)	BTL2	Understand	CO2
8.	Explain the following: (a) Self and separately excited DC generators. (8) (b) Commutation. (8)	(16)	BTL1	Remember	CO2
9.	Explain in detail about commutation and list out the various methods of improving commutation in detail with a neat sketch.	(16)	BTL1	Remember	CO2
10.	Derive an expression for the EMF Equation of DC Generator.	(16)	BTL4	Analyze	CO2
11.	Explain in details of dc compound generator and its characteristics. List the advantages and limitations of compound generator.	(16)	BTL5	Evaluate	CO2
12.	Explain the different methods of excitation and characteristics of DC Generators with suitable diagram.	(16)	BTL4	Analyze	CO2
13.	With neat sketch explain the following constructional components of DC Machine and its principle (i) Magnetic Frame or Yoke (ii) Pole Core (iii) Field Coils (iv) Armature (v) Armature Winding (vi) Commutator (vii)Brushes and Bearings. (3+3+2+2+2+2+2)	(16)	BTL3	Apply	CO2
14.	Explain the effect of armature reaction in a dc generator. How are its demagnetizing and cross magnetizing calculated.	(16)	BTL4	Analyze	CO2
15.	Explain in details various methods of decreasing the effects of armature reaction.	(16)	BTL5	Evaluate	CO2
16.	In Armature Reaction Explain the following terms (i) Main field of DC Machine (ii) Armature Field of DC Machine (iii) Interaction between a	(16)	BTL5	Evaluate	CO2

	main field and armature mmf (iv) Armature conductor and Ampere Turns.				
17.	In commutation explain the following terms (i) Mechanical Cause of Commutation (ii) Electrical cause Of commutation (iii) Process of commutation (iv) Methods to improve commutation. (4+4+4+4)	(16)	BTL5	Evaluate	CO2
18.	Explain the following terms in DC Generator (a) Lap and Wave Winding (b) Compensation Winding. (8+8)	(16)	BTL6	Apply	CO2

UNIT-III - DC MOTORS

Principle of operation, significance of back emf, torque equations and power developed by armature, speed control of DC motors, starting methods of DC motors, load characteristics of DC motors, losses and efficiency in DC machine, condition for maximum efficiency. Testing of DC Machines: Brake test, Swinburne's test, Hopkinson's test, Field test, Retardation test, Separation of core losses-applications of DC motors.

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	Define Back emf in a D.C. Motor.	BTL1	Remember	CO3
2.	List the application of various types of DC Motor.	BTL1	Remember	CO3
3.	List the merits and demerits of Swinburne's test.	BTL1	Remember	CO3
4.	Define Speed regulation of DC Motor.	BTL1	Remember	CO3
5.	Why commutator is employed in d.c.machines?	BTL1	Remember	CO3
6.	When you will say the motor is running at base speed?	BTL1	Remember	CO3
7.	Summarize the different techniques used to control the speed of DC Shunt motor.	BTL2	Understand	CO3
8.	Describe the torque equation of a DC Motor.	BTL2	Understand	CO3
9.	Give the advantages and disadvantages of Flux control method?	BTL2	Understand	CO3
10.	Which method is preferred for controlling the speed of DC shunt motor above the rated speed? Justify.	BTL2	Understand	CO3
11.	Demonstrate How to reverse the direction of rotation of DC Motor?	BTL3	Apply	CO3
12.	Show at what load does the efficiency is maximum in DC Shunt Machines.	BTL3	Apply	CO3
13.	Why series motor should not started at no-load?	BTL3	Apply	CO3
14.	Point out why the Starters necessary for starting DC Motors?	BTL4	Analyze	CO3
15.	What will happen to the speed of a dc motor when its flux approaches to zero?	BTL4	Analyze	CO3
16.	Explain why Swinburne's test cannot be performed on DC Series Motor.	BTL4	Analyze	CO3

17.	Criticize “belt drive not suitable for DC Series Motor why?”		BTL5	Evaluate	CO3
18.	Explain the significance of back emf in a DC Motor?		BTL5	Evaluate	CO3
19.	Explain the function of no-volt release in a Three-point starter?		BTL6	Create	CO3
20.	Mention the effects of differential compounding and cumulatively compound on the performance of DC Compound motor.		BTL6	Create	CO3
21.	Mention speed torque characteristics of dc series motor.		BTL6	Create	CO3
22.	Explain the necessity of dc starters.		BTL2	Understand	CO3
23.	Give out merits of 3-point starter.		BTL3	Apply	CO3
24.	Why OLR used in 3-point starter.		BTL2	Understand	CO3
PART-B					
1.	With neat diagram explain the principle, construction and working of DC Motor and its characteristics.	(16)	BTL1	Remember	CO3
2.	Describe briefly the various methods of controlling the speed of a DC Shunt Motor and bring out their merits and demerits. Also, state the situations where each method is suitable.	(16)	BTL1	Remember	CO3
3.	Describe Plugging, dynamic and regenerative braking in DC Motor.	(16)	BTL1	Remember	CO3
4.	Explain four-point starter with neat diagram.	(16)	BTL3	Apply	CO3
5.	Discuss why starting current is high at the moment of starting a DC Motor? Explain the method of limiting the starting current in DC Motors and also various methods of speed control.	(16)	BTL2	Understand	CO3
6.	With neat sketch explain three point starter to start the DC Shunt Motor.	(16)	BTL4	Analyze	CO3
7.	A 460VDC Series Motor runs at 1000 rpm calculate the speed and percentage change in torque if the load is reduced so that the motor is taking 30A. Total resistances of armature and field circuits is 0.8Ω. Assume flux is proportional to field current.	(16)	BTL3	Apply	CO3
8.	Explain briefly hopkinson’s test as well merits and demerits of test.	(16)	BTL4	Analyze	CO3
9.	Explain the different methods of excitation and characteristics of a DC Motors with suitable diagrams.	(16)	BTL4	Analyze	CO3
10.	A 400 Volts DC Shunt Motor has a no load speed of 1450 RPM, the line current being 9 Amperes. At full loaded condition, the line	(16)	BTL5	Evaluate	CO3

	current is 75 Amperes. If the shunt field resistance is 200 Ohms and armature resistance is 0.5Ohm. Evaluate the full load speed.				
11.	With the help of neat circuit diagram, explain Swinburne's test and Hopkinson's Test. derive the relations for efficiency (Both for generator and Motor).	(16)	BTL1	Remember	CO3
12.	List the condition for maximum power developed in armature what are the disadvantages.	(16)	BTL2	Understand	CO3
13.	Explain the construction, principle, working and equivalent circuit of PMDC Motor.	(16)	BTL2	Understand	CO3
14.	Enumerate advantages and disadvantages of electric braking over mechanical breaking.	(16)	BTL4	Analyze	CO3
15.	Compare conventional dc motor and PMDC motor.	(16)	BTL3	Apply	CO3
16.	Evaluate in detail losses in a DC machines.	(16)	BTL5	Evaluate	CO3
17.	Explain long and short compound motors in details with necessary equations.	(16)	BTL4	Analyze	CO3

UNIT-IV - SINGLE PHASE TRANSFORMER

Construction and principle of operation, equivalent circuit, phasor diagrams, testing - polarity test, open circuit and short circuit tests, voltage regulation, losses and efficiency, all day efficiency, back-to-back test, separation of core losses, parallel operation of single phase transformers, excitation phenomenon in transformers, applications of single-phase transformer.

PART-A

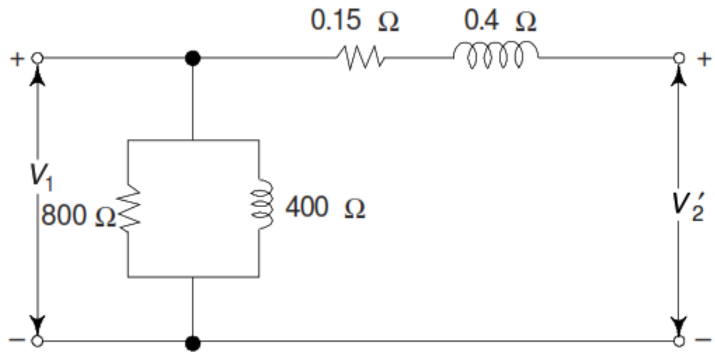
Q. No	Questions	BT Level	Competence	CO
1.	List out the merits and demerits of core and shell type transformer.	BTL1	Remember	CO4
2.	How do you reduce leakage flux in a transformer?	BTL2	Understand	CO4
3.	What is the condition for maximum efficiency of transformer?	BTL1	Remember	CO4
4.	What happens if DC supply is applied to the transformer?	BTL3	Apply	CO4
5.	Give the principle of transformer.	BTL2	Understand	CO4
6.	List the losses in a transformer?	BTL1	Remember	CO4
7.	The emf per turn for a single-phase 2200/220 V, 50 Hz transformer is 11 V. Calculate the number of primary and secondary turns.	BTL3	Apply	CO4
8.	Describe turns ratio of transformer.	BTL4	Analyze	CO4
9.	Why is transformer rated in KVA? Justify	BTL1	Remember	CO4

10.	Explain ideal transformer and draw its phasor diagram.	BTL1	Remember	CO4
11.	Full load copper loss in a transformer is 1600 W, What will be the loss at half load?	BTL1	Remember	CO4
12.	Deduce the voltage regulation of a transformer.	BTL5	Evaluate	CO4
13.	Predict the causes of stray losses.	BTL2	Understand	CO4
14.	Show the condition for parallel operation of a transformer?	BTL2	Understand	CO4
15.	Compose the purpose of conducting open circuit test.	BTL6	Create	CO4
16.	Define all day efficiency. Explain why all day efficiency is lower than commercial efficiency.	BTL2	Understand	CO4
17.	Interpret the Inrush current in a transformer	BTL6	Create	CO4
18.	Draw the phasor diagram of a transformer for lagging power factor load.	BTL2	Understanding	CO4
19.	Mention the important information's obtained in Sumpner's test.	BTL4	Analyze	CO4
20.	Mention the important information's obtained in Open circuit and short circuit test on transformers.	BTL4	Analyze	CO4
21.	How the transformer manufacturer find their transformer efficiency?	BTL6	Create	CO4
22.	Show the condition for maximum voltage regulation of single phase transformer.	BTL2	Understanding	CO4
23.	Show the condition for zero voltage regulation of single phase transformer.	BTL2	Understanding	CO4
24.	List the applications of single phase transformers.	BTL1	Remember	CO4

PART-B

1.	Analyze in detail about open circuit test and short circuit test of a transformer.	(16)	BTL6	Create	CO4
2.	Explain sumpners test in detail and its advantages.	(16)	BTL5	Evaluate	CO4
3.	Derive the condition for maximum efficiency in a transformer.	(16)	BTL6	Create	CO4
4.	Explain parallel operation of a 3-phase transformer and write down the advantages of parallel operation.	(16)	BTL5	Evaluate	CO4
5.	Explain the construction, working principle and operation of a transformer also derive the emf equation.	(16)	BTL4	Analyze	CO4
6.	Obtain the generalized conditions for parallel operation.	(16)	BTL5	Evaluate	CO4
7.	Develop the equivalent circuit of a single-phase transformer referred to primary.	(16)	BTL6	Create	CO4
8.	Draw and explain the phasor diagram of transformer when it is operating under load.	(16)	BTL3	Apply	CO4
9.	Obtain the generalized conditions for parallel operation of Transformer. Also explain the	(16)	BTL4	Analyze	CO4

	effect of load sharing due to impedance variation between transformers during parallel operation.				
10.	Explain the polarity test on transformer and also give its importances.	(16)	BTL4	Analyzing	CO4
11.	Explain in detail per unit representation of transformer.	(16)	BTL4	Analyze	CO4
12.	A 50 kVA, 2200/110 V transformer when tested gave the following results: OC test, measurements on the LV side: 400 W, 10 A, 110 V SC test, measurements on the HV side: 808 W, 20.5 A, 90 V Compute all the parameters of the equivalent circuit referred to the HV and LV sides of the transformer.	(16)	BTL5	Evaluating	CO4
13.	A single-phase load is fed through a 66 kV feeder whose impedance is 120 + j 400 W and a 66/6.6 kV transformer of equivalent impedance (referred to LV) 0.4 + j 1.5 W. The load is 250 kW at 0.8 leading power factor and 6 kV. (a) Compute the voltage at the sending end of the feeder. (b) Compute the voltage at the primary terminals of the transformer. (c) Compute the complex power input at the sending end of the feeder.	(16)	BTL5	Evaluating	CO4
14.	The approximate equivalent circuit of a 4 kVA, 200/400 V single-phase transformer, referred to the LV side is shown in Fig. below. (a) An open-circuit test is conducted by applying 200 V to the LV side, keeping the HV side open. Calculate the power input, power factor and current drawn by the transformer. (b) A short-circuit test is conducted by passing full-load current from the HV side keeping the LV side shorted. Calculate the voltage to be applied to the transformer and the power input and power factor.	(16)	BTL5	Evaluating	CO4



15.	In a 25 kVA, 2000/200 V transformer, the iron and copper losses are 350 and 400 W respectively. (a) Calculate the efficiency on upf at (i) full load (ii) half load. (b) Determine the load for maximum efficiency and the iron and the copper loss in this case.	(16)	BTL5	Evaluating	CO4
16.	The efficiency of a 1000 kVA, 110/220 V, 50 Hz, single-phase transformer is 98.5% at half full-load at 0.8 pf leading and 98.8% at full-load upf. Determine: (a) iron loss, (b) full-load copper loss and (c) maximum efficiency at upf.	(16)	BTL5	Evaluating	CO4
17.	A transformer has its maximum efficiency of 0.98 at 20 kVA at upf. During the day it is loaded as follows: 12 hours : 2 kW at pf 0.6 6 hours : 10 kW at pf 0.8 6 hours : 20 kW at pf 0.9 Find the 'all day' efficiency of the transformer.	(16)	BTL5	Evaluating	CO4

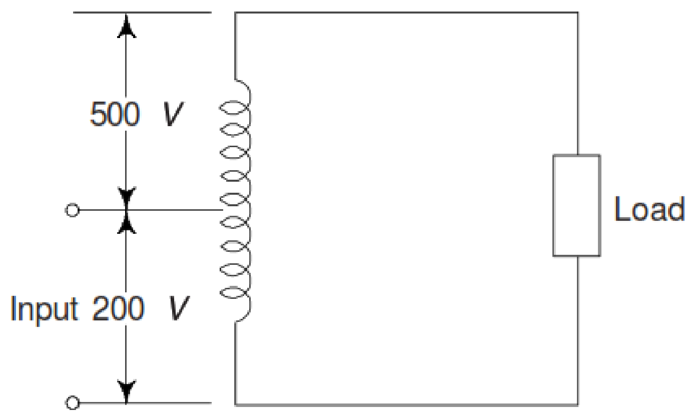
UNIT-V - AUTOTRANSFORMER AND THREE PHASE TRANSFORMER

Construction and working of auto transformer, comparison with two winding transformers, applications of autotransformer. Three Phase Transformer- Construction, types of connections and their comparative features, Scott connection, applications of Scott connection tap changing transformers.

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	Compose the advantages of auto transformer.	BTL1	Remember	CO5
2.	Differentiate two winding transformer and auto transformer.	BTL1	Remember	CO5
3.	List the disadvantages of auto transformer.	BTL2	Understanding	CO5
4.	List the practical applications of 3 phase autotransformer.	BTL2	Understanding	CO5
5.	How a two-winding transformer can be converted to an autotransformer?	BTL3	Applying	CO5
6.	Where is an autotransformer employed in a power	BTL4	Analyzing	CO5

	system? Why?				
7.	List the essential parts of an auto transformer.		BTL2	Understanding	CO5
8.	List the practical applications of an autotransformer.		BTL1	Remembering	CO5
9.	Describe the role of tertiary winding in Transformer.		BTL2	Understanding	CO5
10.	Which type of winding connection is preferred for three-phase transformers used in power systems?		BTL4	Analyzing	CO5
11.	In a transmission system the star side of a star/delta transformer is HV side, while in a distribution system the star side is the LV side. Explain.		BTL4	Analyzing	CO5
12.	List the advantages of three phase transformer over a Bank of Three Single-phase Transformers.		BTL1	Remembering	CO5
13.	Give Positions of the hour-hand of the clock used to represent the phase displacement between HV and LV side voltages in three phase transformer.		BTL2	Understanding	CO5
14.	Compare the delta – delta and V-V connection of three phase transformer.		BTL4	Analyzing	CO5
15.	Draw the V-V connection of three phase transformer and give its VA rating.		BTL3	Applying	CO5
16.	List the harmonics generated when three phase transformer is operated in no-load		BTL4	Analyzing	CO5
17.	List the essential parts of three phase transformer.		BTL1	Remembering	CO5
18.	Describe which winding is near to the core in three phase transformer.		BTL4	Analyzing	CO5
19.	State the different forms of connections used in three-phase transformers.		BTL1	Remembering	CO5
20.	List the uses of tertiary winding.		BTL1	Remembering	CO5
21.	Where is the Scott connection applied?		BTL1	Remembering	CO5
22.	What do you mean by phasing out of a three-phase transformer?		BTL2	Understanding	CO5
23.	Where is the open-delta connection applied?		BTL3	Applying	CO5
24.	Draw the Scott connection.		BTL4	Analyzing	CO5
	PART-B				
1.	Explain in detail the principle and operation of 1 phase autotransformer.	(16)	BTL4	Analyze	CO5
2.	A 200/400 V, 20 kVA, and 50 Hz transformer is connected as an auto transformer to transform 600 V to 200 V. (a) Determine the auto transformer ratio a. (b) Determine the kVA rating of the auto transformer. (c) With a load of 20 kVA, 0.8 pf lagging connected to 200 V terminals, determine the currents in the load and the two transformer windings.	(16)	BTL5	Evaluating	CO5
3.	Interpret in detail about the autotransformer,	(16)			CO5

	their principle. Arrive at the expression for saving of copper.		BTL4	Analyze	
4.	Derive the expression for reduction in volume of copper material compared with two winding transformer.	(16)	BTL3	Applying	CO5
5.	A 20 kVA, 200/500 V, 50 Hz, single-phase transformer is connected as an auto transformer, as shown in Fig. below. Determine its voltage-ratio and the kVA rating. Mark on the diagram, the magnitudes and relative directions of the currents in the winding as well as in the input and output lines when delivering the rated kVA to load. 	(16)	BTL5	Evaluating	CO5
6.	A 400/100 V, 10 kVA, 2-winding transformer is to be employed as an auto transformer to supply a 400 V circuit from a 500 V source. When tested as a 2-winding transformer at rated load, 0.85 pf lagging, its efficiency is 0.97. (a) Determine its kVA rating as an auto transformer. (b) Find its efficiency as an auto transformer.	(16)	BTL5	Evaluating	CO5
7.	A 240V/120V, 12 kVA transformer has full-load unity pf efficiency of 96.2%. It is connected as an auto-transformer to feed a load at 360 V. What is its rating and full-load efficiency at 0.85 pf lagging?	(16)	BTL5	Evaluating	CO5
8.	A small industrial unit draws an average load of 100 A at 0.8 lagging pf from the secondaries of its 2000/200 V, 60 kVA star/delta transformer bank. Find: (a) the power consumed by the unit in kW (b) the total kVA used (c) the rated line currents available from the transformer bank (d) the rated transformer phase currents of the D-secondaries	(16)	BTL5	Evaluating	CO5

	(e) per cent of rated load on transformers (f) primary line and phase currents (g) the kVA rating of each individual transformer				
9.	Describe the various three phase transformer connections, also draw the necessary phasor diagrams.	(16)	BTL3	Applying	CO5
10.	Describe the parallel operation of three phase transformer.	(16)	BTL3	Applying	CO5
11.	An ideal 3-phase step-down transformer, connected delta/star delivers power to a balanced 3-phase load of 120 kVA at 0.8 power factor. The input line voltage is 11 kV and the turns ratio of the transformer, phase-to-phase is 10. Determine the line voltage, line currents, phase voltages and phase currents on both the primary and the secondary sides.	(16)	BTL5	Evaluating	
12.	A 3-phase transformer bank consisting of three 1-phase transformers is used to stepdown the voltage of a 3-phase, 6600 V transmission line. If The primary line current is 10 A, calculate the secondary line voltage, line current and output kVA for the following connections: a) Star/delta and b) delta/star. The turns ratio is 12. Neglect losses.	(16)	BTL5	Evaluating	CO5
13.	Explain the different types of three phase transformer connection and their comparative features.	(16)	BTL3	Applying	CO5
14.	A delta / star connected bank of three identical 60 kVA 2000/100 V, 50 Hz transformers is fed with power through a feeder whose impedance is 0.75 + j 0.25 W per phase. The voltage at the sending end of the feeder is held fixed at 2 kV line-to-line. The short circuit test when conducted on one of the transformers with its LV terminals short-circuited gave the following results: $V_{HV} = 40$ V, $f = 50$ Hz, $I_{HV} = 35$ A, $P = 800$ W (a) Find the secondary line-to-line voltage when the bank delivers rated current to a balanced 3phase upf load. (b) Calculate the currents in the transformer primary and secondary windings and in the feeder wires on the occurrence of a solid 3-phase short-circuit at the secondary line terminals.	(16)	BTL5	Evaluating	CO5
15.	Explain three phase to two phase conversion of 3	(16)	BTL3	Applying	CO5

	phase transformer and its load analysis.				
16.	Explain the Scott connection and its applications.	(16)	BTL4	Analyzing	CO5
17.	Explain about the tap changing transformers and its applications.	(16)	BTL3	Applying	CO5

Course Outcome:

Upon the successful completion of the course, students will have the ability to:

- Apply the laws governing the electromechanical energy conversion for singly and multiple excited systems.
- Explain the construction and working principle and various characteristics of DC generator.
- Compute various performance parameters of the machine, by conducting suitable tests.
- Draw the equivalent circuit of transformer and predetermine the efficiency and regulation.
- Describe the working principle of auto transformer, three phase transformer with different types of connections.