DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SUBJECT CODE & NAME: U23EET35 DC MACHINES AND TRANSFORMERS

YEAR/SEC/SEM: II//III

QUESTION BANK

UNIT I – ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES

PART – A

1. State the principle of electromechanical energy conversion. (Nov - 2017)

The mechanical energy is converted in to electrical energy which takes place through either by magnetic field or electric field.

2. Predominant energy storage occurs in the air gap of an electromechanical energy conversion device. Is this statement correct? (Nov - 2017)

Yes, this statement is correct, because the magnetic circuits have air gaps between the stationary and moving members in which considerable energy is stored in the magnetic field. This field acts as the energy-conversion medium, and its energy is the reservoir between the electric and mechanical system. In most such cases the reluctance of the air gap is much larger than that of the magnetic material. Thus the predominant energy storage occurs in the air gap, and the properties of the magnetic circuit are determined by the dimensions of the air gap.

3. Define the synchronous speed. Write the expression also. (May - 2017)

The speed of the synchronous machine for which it produces alternating emf at a specified rated frequency for a fixed number of poles is called its synchronous speed. It is denoted as N_s.

$N_s=120f/P$

4. Define the term pole pitch and coil pitch. (May – 2017)

It is centre to centre distance between the two adjacent poles. 1 pole is responsible for 180^0 electrical of induced emf. So 180^0 electrical is also called one pole pitch.

The factor by which there is a reduction in the emf due to short pitching of the coils is called coil pitch.

5. What is magnetic saturation? (Nov - 2016)

The unit beyond which Magnetic Flux density in a magnetic area does not increase sharply further with increase of MMF.

6. What is meant by distributed winding? (Nov -2016)

If Number of Slot is more than number of Pole means, Winding is Distributed in many slot under a Pole. All the winding turns are arranged in several full pitch or fractional pitch coils. These coils are then housed in the slots spread around the air-gap periphery to form phase or commutator winding.

7. What is meant by winding inductance? (May - 2016)

Mutual inductance is where the magnetic flux of two or more inductors is “linked” so that voltage is

induced in one coil proportional to the rate-of-change of current in another. A transformer is a device made of two or more inductors, one of which is powered by AC, inducing an AC voltage across the second inductor.

8. Compare lap and wave winding. (May - 2016)

Lap	Wave
A=P	A=2
Number of brush sets required is equal to number of poles	Number of brush sets required is always equal to two
Normally used for generators of capacity more than 500A	Preferred for generators of capacity less than 500A

9. Give examples for multiple excitation systems? (May -2013)

Alternator, Electro-Mechanical Transducer and Synchronous motors

10. Define field energy. (Nov - 2014)

In both Motor and Generator the field energy is converted either into electric or mechanical energy. In permanent magnet machine the magnetic flux is generated by the magnet and in case of electromagnet the magnetic field is generated by the current.

11. What is multiply excited magnetic field system? (May - 2003)

A magnetic field system in which more than one windings are excited by an external source to produce magnetic fields is called multiply excited system.

12. What are the requirements of excitation system? (Nov - 2015)

- Very quick response
- High sensitivity
- Its power requirement must be low
- It should be able to operate with any kind of regulator

13. What is meant by mechanical angle? (Nov - 2012)

. The angle through which the rotor or conductors of the machine rotates physically is called mechanical angle.

14. State the assumptions made while obtaining mmf space wave. (May - 2010)

- It is cylindrical rotor machine
- The armature and rotor are made up of high grade magnetic material

15. What is the function of an exciter? (May - 2004)

The exciter is used to excite the field winding of synchronous machine by a dc supply.

16. What are the causes for irrecoverable energy loss when the flux in the magnetic circuit undergoes a cycle? (Nov - 2004)

Hysteresis loss occurs due to the saturation property of the magnetic material. Eddy current loss occurs due to circulating currents developed in all possible directions where the magnetic flux flows.

17. What is rotating magnetic field? (Nov - 2008)

Thus a magnetic field having constant amplitude but whose axis continuously rotates in a plane with a certain speed is called rotating magnetic field.

18. Why the relationship between current and coil flux linkages of electro mechanical energy conversion devices are linear? (May - 2006)

The air gap length once designed is to be constant throughout working. The flux setup and hence the inductance are functions of air gap length and hence the relation between flux and the current is linear if the air gap is smooth.

19. State the advantages of short pitched coils. (May - 2012)

- Harmonics are reduced in induced voltage
- Saving of copper
- End connection is shorter

20. Write down the expression for the torque developed in a round rotor machine. (May - 2013)

$$T = -\frac{\pi}{2}\frac{\mu_0 Dl}{g} F_1 F_2 \sin\alpha$$

$$T = -\frac{\pi}{2}(p/2)^2 \phi F_2 \sin\delta$$

PART – B

1. Prove that a rotating magnetic field is produced when three phase supply is supplied to a three phase winding. (NOV/DEC-14)
2. Derive the force and torque expressions for attracted type armature relay system. (NOV/DEC-19)
3. Derive the torque equation of a round rotor machine. Also clearly state the assumption made. (NOV/DEC-18)
4. Discuss in detail the production of mechanical force for an attracted armature relay excited by an electric source. (MAY-17)
5. With an example explain the multiple excited magnetic field system (NOV/DEC-15)
6. Two coupled coils have self and mutual inductance of $L_{11}=3+0.5x$; $L_{22}=2+0.5x$; $L_{12}=L_{21}=0.3x$. Over a certain range of linear displacement X. The first coil is excited by a constant current of 15A and the second by a constant current of -8A, Determine: (i) Mechanical work done if X changes from 0.6m to 1m. (ii) Energy supplied by each electrical source. (NOV/DEC-18)
7. Explain in detailed MMF distribution in AC synchronous machine and derive the expression for the fundamental MMF. (NOV/DEC-15)
8. With neat sketch explain the multiple excited magnetic field system in electromechanical energy conversion systems. Also obtain the expression for the field energy in the system. (APR/MAY-15)
9. Explain the concept of electromechanical energy conversion with neat diagram. (NOV/DEC-18)
10. Derive Force and Torque from Energy and Co-energy for the following electromechanical conversion systems. (MAY-17)
    i) Singly excited linear actuator and
    ii) Singly excited rotating actuator.

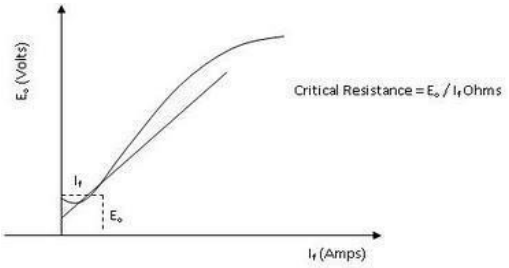
UNIT II – DC GENERATORS

PART – A

1. Why the armature core in dc machine is constructed with laminated steel sheets instead of solid steel sheets? (May - 2018)

Lamination highly reduces the eddy current loss and steel sheets provide low reluctance path to magnetic field ie., decreases the hysteresis loss.

2. Draw the magnetising characteristics of dc shunt generator. (May -2018)



3. What is the purpose of yoke in a dc machine? (Nov - 2017)

- It serves the purpose of outermost cover of the dc machine. So that the insulating materials get protected from harmful atmospheric elements like moisture, dust and various gases.
- It provides mechanical support to the poles.
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4. What is critical resistance of a dc shunt generator? (Nov - 2017)

Critical field resistance is defined as the resistance of the field circuit which will cause the shunt generator just to build up its emf at a specified field.

5. What is meant by armature reaction? (May - 2017)

The interaction between the main flux and armature flux cause disturbance called as armature reaction.

6. State the conditions under which a DC shunt generator fails to excite. (May - 2017)

Absence of residual flux, initial flux setup by field may be opposite in direction to residual flux, shunt field circuit resistance may be higher than its critical field resistance; load circuit resistance may be less than its critical load resistance.

7. Write emf equation of dc generator. (Nov - 2016)

E= (ΦNZP/60A

P --------no of poles

Z -------- Total no of conductor

Φ ------- flux per pole

N-------- speed in rpm.

8. What is the use of inter pole in dc machine? (Nov - 2016)

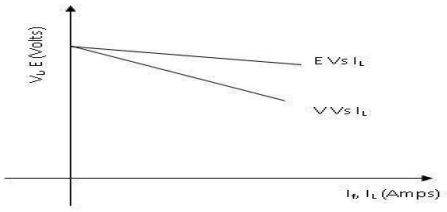
In modern dc machines commutating poles or inter poles are provided to improve commutation.

9. Compare lap and wave windings. (May - 2016)

Lap	**Wave**
A=P	A=2
Number of brush sets required is equal to number of poles	Number of brush sets required is always equal to two

Normally used for generators of capacity more than 500A	Preferred for generators of capacity less than 500A

10. Draw various characteristics of dc shunt generator.(May - 2016)



11. Why the external characteristics of a dc shunt generator is more drooping than that of a separately excited generator? (May - 2014)

In separately excited generator $I_a=I_L$ and I_{sh} is not supplied by armature. In dc shunt generator $I_a=I_L+I_{sh}$ hence the drop I_aR_a is more than in separately excited generator. Hence the external characteristic of dc shunt generator is more drooping than that of a separately excited generator.

12. What are the conditions for parallel operation of dc generators? (May - 07)

- The voltage of both the generators must be equal
- The polarities of the generators must be same or the connections must be interchanged till they become same.
- The change of voltage with change of load should be of same character

13. Define a pole pitch. (Nov - 2005)

It may be defined as the distance between the two adjacent poles ie., the periphery of the armature divided by the number of poles. It may also be defined as the number of armature conductors or number of armature slots per pole.

14. Define commutation and commutation period. (May - 2012)

A process by which current in the short circuited coil is reversed while it crosses the MNA is called commutation. The time during which the coil remains short circuited is known as commutation period.

15. How to reduce the effects of the armature reaction? (Nov-2005)

The effect of armature reaction can be neutralized by use of compensating winding. It is always placed in series with armature winding. The armature reaction causes the distortion in main field flux. This can be reduced if the reluctance of the path of the cross magnetizing field is increased. Thus by increasing length of air gap, the armature reaction effect is reduced.

16. State the methods of improving commutation. (May - 2006)

- Resistance commutation
- Giving a brush shift
- Use of inter poles

17. State the applications of various types of generators. (Nov - 2007)

Shunt Generator : Battery charging and ordinary lighting purpose

Series Generator : DC feeders, Welding generator and Arc lamps

18. What is meant by reactance voltage? (May - 2012)

An armature coil has certain self inductance. When coil undergoes commutation there is change in

current in that coil and the commutation takes certain time. Thus there is self induced emf in a coil undergoing commutation given by L(di/dt). This emf induced in the coil undergoing commutation is called reactance voltage.

19. What is meant by residual emf in dc generator? (May - 2015)

When supply to the field winding in generators is removed, the field current becomes zero. But still there exists some magnetic flux associated with the poles. This is called residual flux. The emf induced in the generators by cutting the residual flux by armature is called residual of emf.

20. State the causes of failure to excite self excited generator and remedies for it. (May – 2014)

S.No	Causes	Remedy
1	Absence of residual magnetism due to ageing	Operate the generator as separately excited first and then as a self excited
2	Field resistance is more than the critical resistance	Reduce the resistance of field circuit using proper field divertor
3	Generator is driven in opposite direction	Drive the generator in proper direction

PART – B

1. Explain the construction and operation of DC. Generator. And Derive the EMF equation. (APR/MAY-19)
2. Explain in detail about commutation and list out the various methods of improving commutation in detail with a neat sketch. (APR/MAY-17)
3. Two shunt generators are connected in parallel to supply a load of 5000A each machine has a armature resistance of 0.03Ω and field resistance of 60Ω. EMF on one machine is 600V and in other machine is 640V. What power does each machine supply? (NOV/DEC-17)
4. Explain the effect of armature reaction in a DC generator. How are its demagnetizing and cross magnetizing amperes turns calculated? (MAY-16)
5. A 4-pole, 50KW, 250V wave wound shunt generator has 400 armature conductors. Brushes are given lead of 4 commutator segments. Calculate the demagnetization ampere-turns per pole if shunt field resistance is 50 Ohm. Also calculate extra shunt field turns per pole to neutralize the demagnetization. (NOV/DEC-16)
6. A Series generator having a combined armature and field resistance of 0.4 Ω is running at 1000 rpm and delivering 5.5 KW at a terminal voltage of 110V. If the speed is raised to 1500rpm and the load adjusted to 10KW, find the new current and terminal voltage. Assume the machine is working on the straight line portion of the magnetization characteristics. (NOV/DEC-15)
7. i) Draw and explain the load characteristics of differently and cumulatively compound DC generator. ii) A 4 pole DC shunt generator with lap connected armature supplies kw at 230Volts. The armature and field copper losses are 360Watts and 200 Watts respectively. Calculate the armature current and generated EMF? (APR/MAY-14)
8. With a circuit, explain how to obtain efficiency of D.C generator by conducting swinburne's test. (MAY-16)
9. Two separately excited shunt generators are connected in parallel.Discuss in detail how they share the load.(MAY/JUNE-07)
10. Draw the performance characteristics of different types of dc generator and explain in detail. (NOV/DEC-16)

UNIT III – DC MOTORS

PART – A

1. How will you change the direction of rotation of dc motor? (May - 2018)

By changing the field wires or by changing the armature wires

2. Why commutator is employed in dc machines? (May - 2018)

- To facilitate the collection of current from the armature conductors
- To convert internally developed alternating emf to unidirectional emf
- To produce unidirectional torque in case of motors

3. What will happen to the speed of a dc motor when its flux approaches zero? (Nov - 2017)

In fact physically the rotor is moving because of field flux interacting with armature current flux. So physically if reduce flux the speed must be reduce, since reduced the cause of motion.

4. Mention the effects of differential compounding and cumulatively compound on the performance of dc compound motor. (Nov - 2017)

In cumulative compound motor the two field winding fluxes aid each other i.e., flux due to the series field winding strengthens the flux due to the shunt field winding. In differential compound motor the two field winding fluxes oppose each other. Flux due to series field winding weakness the field due to shunt field winding.

5. Why a starter is necessary for a dc motor? (May - 2017)

When a dc motor is directly switched on, at the time of starting the motor back emf is zero, Due to this the armature current is very high nearly 25times the rated current. Due to the very high current the motor gets damaged. To reduce the starting current of the motor a starter is used.

6. What are the applications of dc motor? (May - 2017)

Shunt Motors : Driving centrifugal pumps, Wood working machines, lathes

Series Motors : Cranes, Hoist, Lifts, Blowers, Conveyors

Compound Motors: Driving heavy machine tools, Punches machines

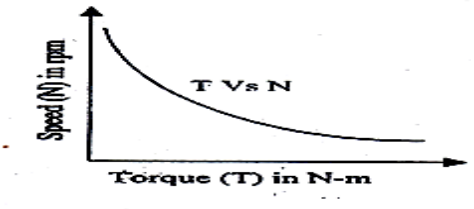
7. What are the different types of testing of dc machines?

Brake Test, Swinburne's Test, Retardation Test and Hopkinson's Test

8. What is meant by dynamic braking in dc motor? (Nov - 2016)

When an electric motor rotates a kinetic energy is stored in its rotating mass. During dynamic braking the kinetic energy of the motor is converted in to electric energy. This energy is dissipated in resistive elements.

9. Draw the speed – torque characteristics of dc series motor. (May - 2016)



10. What is meant by plugging? (May - 2016)

The plugging operation can be obtained by changing the polarity of the motor. For ac machines the phase sequence of the stator windings and dc machines the polarities of the field or armature terminals.

11. State Fleming's left hand rule? (Nov - 2015)

The thumb, forefinger & middle finger of left hand are held so that these fingers are mutually perpendicular to each other, then forefinger gives the direction of magnetic field, middle finger gives the direction of the current and thumb gives the direction of the force experienced by the conductor.Why DC series motor is called as variable speed motor? (Nov - 2015)

The speed of a DC motor can be controlled by changing the voltage applied to the armature. The introduction of variable resistance in the armature circuit or field circuit allowed speed control.

12. List the different methods of speed control of dc shunt motor. (May - 2010)

Flux control method, Voltage control method, Rheostatic control

13. Why dc series motor is suited for traction applications? (May - 2015)

The series motor has characteristics that it produces high starting torque and it cannot be started on no load. It has capability of handling overloads. Its speed control is easy. All these features are well suited for the electric traction hence series motor is used for traction applications.

14. Specify the techniques used to control the speed of dc shunt motor for below and above the rated speed? (May - 2015)

For speed control of dc shunt motor below rated speed, rheostatic control method is used in which voltage across the armature is controlled. While for the speed control above the rated speed, the flux control method is used in which current through field winding is controlled.

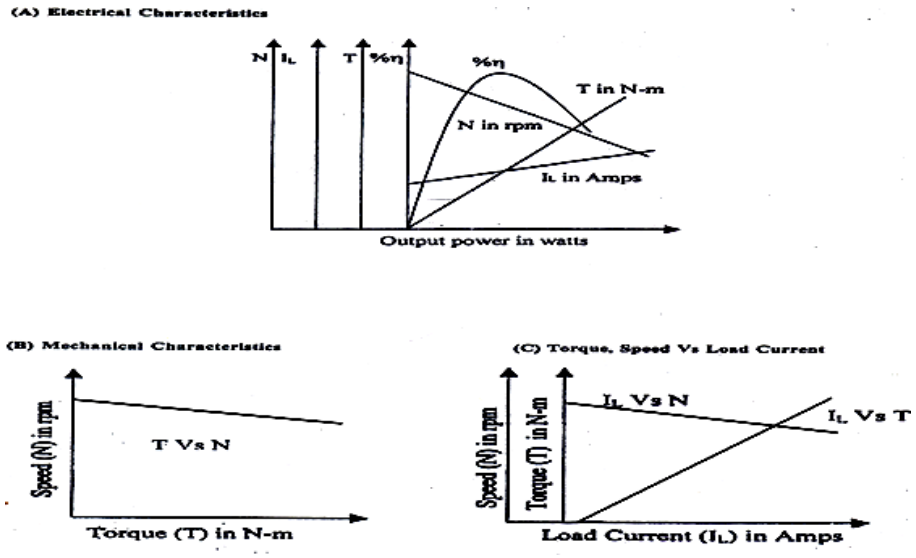
15. Explain why Swinburne's test cannot be performed in dc series motor. (Nov - 2014)

The Swinburne's test is a no load test. On no load dc series motor runs at dangerously high speed and may get damaged. Hence no load condition cannot be achieved on dc series motor for testing purpose.

16. What are the losses occurring in a dc machine? (May - 2009)

Copper loss, Iron or Core loss and Mechanical loss

17. Draw the characteristics of dc compound motor. (Nov- 2009)



18. Write the power balance equation of a dc motor. (Nov – 2003)

$V I_a = E_b I_a + I_a^2 R_a$

$V I_a$ =Net electrical power input

$I_a^2 R_a$= Power loss due to the resistance of the armature.

19. What are the advantages and disadvantages of Swinburne's test? (Nov - 2013)

Advantages

- Since constant losses are known the efficiency can be estimated at any load
- The method is convenient and less power is required
- The motor is not required to be loaded

Disadvantages

- The only test which is carried out is the no load test. Hence it is difficult to know whether there will be satisfactory commutation at full load.
- It cannot be performed on a series motor

PART B

1. A 230V DC shunt motor has an armature circuit resistance of 0.4 Ω and field resistance of 115 Ω. The motor drives a constant torque load and takes an armature current of 20A at 800 rpm. If motor speed is to be raised from 800 to 1000rpm, find the resistance that must be inserted in the shunt field circuit. (NOV/DEC-14)

2. Explain the various characteristics of dc shunt motor with necessary graphs (APR/MAY-18)

3. A 440V dc shunt motor takes 4A at no load. Its armature and field resistances are 0.4 Ω and 220 Ω respectively. Estimate the KW output and efficiency when the motor takes 60A on full load. (APR/MAY-17)

4. Explain the different methods of speed control of dc shunt motor with neat circuit diagrams. (NOV/DEC-15)

5. A 220 V, 22 A, 1000 rpm DC shunt motor has armature circuit resistance of 0.1Ω and field resistance of 100 Ω. Calculate the value of additional resistance to be inserted in the armature circuit in order to reduce the speed to 800 rpm. Assume the load torque to be (i) proportional to the speed and (ii) proportional to s

6.

7. quare of the speed. (APR/MAY-16)

8. Why starting current is high at the moment of starting a dc motor? Explain the method of limiting the starting current in dc motors. (NOV/DEC-15)

9. Draw the neat sketch of 3 point starter and explain its working. (APR/MAY-18)

10. Explain the different methods of speed control techniques of dc motors. (APR/MAY-16)

11. Explain the method to obtain efficiency at full load by conducting Hopkinson's test. (May - 2016)

12. Why starter are necessary? Explain in detail the construction and working of 4 point starter. (May - 2015)

UNIT IV – TRANSFORMERS

PART –A

1. List out the merits and demerits of core and shell type transformer. (Nov - 2017)

ore type Transformer:Merits:

- Easy Construction
- Better Cooling
- Easy Insulation

Demerits:

- Less Coupling
- Less Mechanical Protection
- Less Efficient
- Shell type Transformer:Merits:
  - More Coupling
  - More MechanicalProtection
  - More Efficient

Demerits:

- Construction is not Easy
- Less Cooling
- Require more Insulation

2. How do you reduce leakage flux in a transformer? (Nov - 2017)

The combined effect of the leakage flux and the electric field around the windings is what transfers energy from the primary to the secondary. In some applications increased leakage is desired, and long magnetic paths, air gaps, or magnetic bypass shunts may deliberately be introduced in a transformer design to limit the leakage flux.

3. Why transformer rating is expressed in KVA? (May – 2017/ Nov - 2015)

Copper loss of a transformer depends on current & iron loss on voltage. Hence total losses depend on Volt-Ampere and not on PF. That is why the rating of transformers is in kVA and not in kW.

4. Why wattmeter in OC test on transformer reads core loss and that in SC test reads copper loss at full load? (May - 2017)

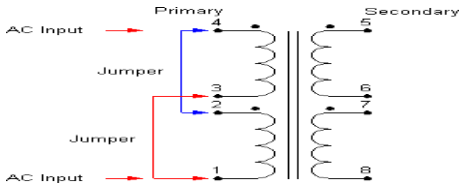
In an open circuit test, current is very low because the circuit is incomplete on the secondary side hence the only losses are those due to inductance of the core. For this reason, we can neglect the variable copper losses and whatever power is injected that may
be considered as core losses.So in OC test, we are getting the approximate rated voltage core losses. In short circuit test, voltage is low but the current is standard. So the only losses are due to resistance of conductor. Since the core loss occurring here is negligible as compared to rated voltage core losses, so the losses incurred here are approximated to rated copper losses.

5. Define voltage regulation of a transformer. (Nov -2016)

When a transformer is loaded with a constant primary voltage, the secondary voltage decreases for lagging PF load, and increases for leading PF load because of its internal resistance and leakage reactance. The change in secondary terminal voltage from no load to full load expressed as a percentage of no loads or full load voltage is termed as regulation.

%regulation =E2-V2/E2*100

6. Draw Scott connection of a transformer. (Nov - 2016)



7. Define all day efficiency of a transformer. (May - 2015)

It is computed on the basis of energy consumed during a certain period, usually a day of 24 hrs. All day efficiency=output in kWh/input in kWh for 24 hrs.

8. What is inrush current in a transformer? (May - 2015)

Inrush Current, Input surge current or switch on surge is the maximum, instantaneous input current drawn by an electrical device when first is turned on. Alternating current of Transformers may draw several times their normal full-load current when first energized, for a few cycles of the input waveform.

9. What happen when a DC supply is applied to a transformer? (Nov - 2015)

If dc supply is given the current will not change due to constant supply hence mutual induction is not possible and transformer will not work. The resistance of primary winding is very small and inductive reactance is zero for dc. Hence primary will draw very high current for dc supply which cause damage to the transformer due to extra heat generated. This may cause saturation of the core. Hence dc supply is not applied to the transformers.

10. Specify the applications of autotransformer. (May - 2015)

- Autotransformers are used for starting induction motors and synchronous motors
- Used as boosters to increase the voltage in AC feeder.
- Electrical testing laboratories.
-

11. State the different connections of three phase transformer. (May - 2013)

Star- Star , Star-Delta, Delta-Star and Delta-Delta

12. Which equivalent circuit parameters can be determined from the open circuit test on a transformer? (May - 2011)

From the open circuit test the exciting branch parameters can be obtained which includes resistance R_0 indicating core loss component and no load inductance X_0 indicating magnetising reactance.

13. Why all day efficiency is lower than commercial efficiency? (May - 2012)

All day efficiency is calculated for those transformers which are used to supply power continuously to the consumer for 24 hrs a day. The primary of such transformers is energized for 24 hrs a day hence core losses takes place for 24 hrs a day whether the load is connected to it or not. Due to these losses the all day efficiency is lower than the commercial efficiency.

14. Mention the rule of tertiary winding in transformer. (May - 2015)

- It can be used as a voltage coil in a testing transformer
- Three supply systems operating at different voltages can be interconnected using three winding transformer.
- It permits the flow of third harmonic current to reduce third harmonic voltage
-

15. What is an ideal transformer? (May - 2004)

A transformer is said to be ideal if it satisfies following properties: It has no losses. Its winding has zero resistance. Leakage flux is zero.

16. State the different losses which occur in transformer. (May - 2013)

Hysteresis loss, Eddy current loss and Copper loss

17. What is the application of equivalent circuit of a single phase transformer? (Nov-2005)

It is the electrical model of the transformer. Once the equivalent circuit parameters are obtained then the transformer regulation and efficiency at any power factor and load conditions can be obtained without actually loading the transformer.

18. What are the conditions of parallel operation of transformers? (May / Dec - 2010)

- The transformers that are connected must have same polarity.
- Voltage ratio same.
- If the transformers have the different KVA ratings, the equivalent impedances should be inversely proportional to individual KVA rating to avoid circulating current.

19. Why is the efficiency of transformers more than that of other rotating machines? (May - 2003)

There are no moving parts in transformers hence the friction and mechanical losses are absent in transformer. Hence efficiency of the transformer is more than of other rotating machines.

20. Mention the properties of oil used in transformer. (Nov-2005)

- Good conductor of heat
- High coefficient of volume expansion
- High insulating strength
- Free from moisture content

PART – B

1. The following data were obtained on a 20KVA, 50Hz, 2000/20V distribution transformer: (APR/MAY-15)

	Voltage(V)	Current(A)	Power(W)
OC Test(HV)	200	4	120
SC Test(LV)	60	10	300

Draw the approximate equivalent circuit of the transformer referred to the HV and LV sides respectively.

2. With a circuit diagram how to obtain equivalent circuit by conducting O.C and S.C test in a single phase transformer.(NOV/DEC-17)

3. Explain the following (APR/MAY-17)
   i) Derive the expression for saving of copper in auto transformer.
   ii) Calculate the efficiency for half and full load of a 100KVA transformer for the p.f. of unity & 0.8 p.f for the copper loss at full load is 1000W.

4. Explain the various three phase transformer connection and parallel operation of three phase transformer. (NOV/DEC-16)

5. Draw the equivalent circuit of a single phase 1100/220V transformer on which the following results were obtained.(NOV/DEC-18)
   i) 1100V, 0.5A, 55W on primary side, secondary being open circuited.
   ii) 10V, 80A, 400W on LV side, high voltage side being short circuited

UNIT V – TESTING OF DC MACHINES AND TRANSFROMERS

PART A

1. What are the essential parts of DC machine?

1. Magnetic frame or yoke
2. Poles
3. Armature
4. Commutator
5. Pole shoes
6. Armature windings
7. Interpoles
8. Brushes
9. Bearings
10. Shaft

2. **What is the purpose of yoke in D.C machine?**

It acts as a protecting cover for the whole machine and provides mechanical support for the poles.

It carries magnetic flux produced by the poles

3. What is the purpose of Field pole in D.C machine?

To produce flux with the help of field winding

4. What is the purpose of Field winding in D.C machine?

To produce flux

5. **What is the purpose of pole shoes in D.C machine?**

1. They support field coil
2. Decrease reluctance
3. Increase cross section area of magnetic circuit

6. **What is the purpose of Armature core in D.C machine?**

To store armature windings and provide the path for main flux

7. What is the purpose of Armature winding in D.C machine?

To develop main electrical power

8. Why the armature core in D.C machines is constructed with laminated steel sheets instead of solid steel sheets?

Lamination highly reduces the eddy current loss and steel sheets provide low reluctance path to magnetic field i.e decreases hysteresis loss

9. What is the purpose of brushes?

Its function is to collect current from commutator and supply to external load circuit

10. **What are the materials used for brushes in DC machines?**

1. Natural graphite
2. Electro graphite
3. Hard carbon
4. Metal graphite

11. **Why the brushes are made of carbon?**

1. To some extent carbon brush can act as a self-lubricating brush;
2. On moment, polishes the commutator segments;
3. Damage to the commutators is less then when copper brushes are used on Occurrence of spark over.

11. What is the function of bearings?

To reduce friction and thereby help in smooth and easy rotation.

12. What is meant by self-excited and separately excited DC generator?

- Self-excited generator are those whose field magnets are energized by the current produced by the generator themselves.
- Separately excited generator are those whose field magnets are energized from an independent external source of dc current.

PART B

1. With a neat sketch, explain the different parts of a D.C. Machine.
2. Explain the construction of a DC Machine with a neat diagram.
3. Explain the construction and working principle of a DC Generator.
4. Explain the principle of operation of a DC Generator and explain about mechanical rectifier.
5. Draw a neat sketch of the cross-sectional view of a DC Machine and explain the function and material used for each part.
6. Four terminals of a D.C Shunt machine are available, but they are unmarked. How will you identify the field and armature terminals?
7. Explain why all field coils placed on field poles have the same no. of turns / pole and are always connected in series.
8. Name the main parts of a D.C. Machine and state material used.
9. What does pigtail mean? What is its significance?
10. What is the difference between Lap winding & Wave winding?
11. Give the materials and functions of the following parts of a D.C. Machine:-

(i) Field Poles (ii) Commutator (iii) Armature