UNIT II ELECTRICAL MACHINES important questions

1. What is an electric generator?

An electrical machine, which converts mechanical energy into electrical Energy, is called as electric generator.

2. What is an electric motor?

An electrical machine, which converts electrical energy into mechanical Energy, is called as electric motor.

3. What is meant by magnetic flux?

The magnetic lines of force existing around a magnet is called magnetic flux. It's unit is

Weber.

4. State faraday's law of electromagnetic induction.

Whenever a conductor cuts the magnetic lines of force an emf is induced in it.

5. State Fleming's Right hand rule.

If three fingers of right hand, namely thumb, index finger and middle finger are outstretched so that everyone of them is at right angles with the remaining two, and the index finger is made to point in the direction of lines of flux, thumb in the direction of the relative motion of the conductor and the middle finger gives the direction of the induced emf in the conductor.

6.What is the use of commutator?

A device is used in a dc generator to convert the alternating emf into unidirectional emf is called commutator.

7.What is the function yoke?

It serves the purpose of outermost cover of the dc machine. So that

the insulating material get protected from harmful atmospheric elements like moisture, dust and various gases like SO2, acidic fumes etc.

It provides mechanical support to the poles.

8.What is the choice of material for the following?

1.Yoke 2.pole 3.Field winding 4.Armature winding

1.Yoke:

It is prepared by using cast iron because it is cheapest.

2.Pole:

It is made up of cast iron or cast steel.

3.Field winding:

It is made up of aluminium or copper.

4.Armatuer winding:

It is made up of cast iron or cast steel.

9.What is the function of brush?

To collect current from commutator and make it available to the stationary external

circuit.

10.Write down the emf equation for d.c generator.

$$E = (\phi NZ / 60)(P/A) \quad V$$

Where

P = number of poles

Z = Total number of conductors

A = number of parallel paths

Φ = flux per pole

N = speed in rpm

11.What are all the two types of excitation? i. Separate excitation

When the field winding is supplied from external, separate dc supply i.e. Excitation of field winding is separate then the generator is called separately excited generator.

ii. Self excitation

When the field winding is supplied from the armature of the generator itself then it is called as self-excitation.

12.What is meant by residual magnetism?

Practically though the generator is not working, without any current through field winding, the field poles posses some magnetic flux. This is called as residual magnetism.

13.Give the types of DC generator.

1.Self excited generator

Series Generator

Shunt Generator Compound Generator

Long shunt compound generator Short shunt compound generator

Cumulative and differential compound Generator 2. Separately excited generator

14.List out the applications of various types of generators.

Separately excited generator

As a separate supply is required to excite the field, the use is restricted to some special applications like electroplating, electro refining of materials etc

Shunt generator

Commonly used in battery charging and ordinary lighting purposes.

Series Generators

Commonly used as boosters on dc feeders, as a constant current generators for welding generator and arc lamps.

Cumulatively compound generators

These are used for domestic lighting purposes and to transmit energy over long distance.

Differential compound generator

The use of this type of generators is very rare and it is used for special application like electric arc welding.

15.what is the principle of DC motor?

Whenever a current carrying conductor placed in a magnetic field, it experiences a mechanical force.

16.State that the Fleming's left hand rule.

The rules states that outstretch the three fingers of the left hand namely the first finger, middle finger and thumb such that they are mutually perpendicular to each other. Now point the first finger in the direction of magnetic field and the middle finger in the direction of the current then the thumb gives the direction of the force experienced by the conductor.

17.What is Lenz's law?

Lenz's law states the direction of induced emf is always so as to oppose the cause producing it.

18.Give the torque equation of a DC motor. Ta=0.159fIa.PZ/A N-m

Ia - Armature current

P - Number of poles

Z - Total number of conductors

A -Number of parallel paths

19.List the different types of DC motor.

DC series motor

DC Shunt motor

DC Compound motor

Long shunt compound motor

Short shunt compound motor

20.List out the characteristics of DC motor.

i. Torque-Armature current characteristics (T VS Ia)

ii. Speed-Armature current characteristics (N VS Ia)

21.What are all the applications of DC motor? DC Shunt motor:

Blowers and fans

Centrifugal and reciprocating pumps

Lathe machines

Machine tools

Milling machines

Drilling machines

DC Series motor:

Cranes

Hoists, Elevators

Trolleys,Conveyors,Electric locomotives

DC Cumulative compound motor:

Rolling mills

Punches

Shears

Heavy planers

Elevators

22. How is voltage generated in rotating machines?

In rotating machines voltage is generated in windings or group of coils by rotating them through a magnetic field or by mechanically rotating a magnetic field past the winding or by designing the magnetic circuit so that the reluctance varies with rotation of the rotor.

23.What is the basic principle of dc motor?

A machine that converts dc power into mechanical power is known as a dc motor its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. The direction of force is given by Fleming's left hand rule and magnitude is given by

F= BIL netwons.

Basically there is no constructional difference between a dc motor and dc generator. The same dc machine can be run as a generator (or) motor.

24. What is back emf in d.c motors?

As the motor armature rotates, the system of conductor come across alternate North and South pole magnetic fields causing an emf induced in the conductors. The direction of the emf induced in the conductors. The direction of the emf induced is in the direction opposite to the current .As this emf always opposes the flow of current in motor operation it is called back emf.

25. Mention the different parts of a d.c generator.

The different parts of dc generator are

(i) Magnetic frame (or) yoke.

(ii) pole core and pole shoes

(iii) pole coil or field coils

(iv)armature windings or conductors

(v) armature coils

(vi)commutator

(vii)Brushes and bearing.

26.What are the characteristics of DC generator?

The characteristics of DC generator are

i) no load or saturation characteristics(Ea/ If)

ii) internal characteristics(E/If)

iii) external characteristics(V/If)

27.Write the various losses occurring in DC generator

Copper loss

Iron loss

Mechanical loss

28. Mention the difference between core and shell type transformers.

In core type, the windings surround the core considerably and in shell type the core surround the winding.

29. What is the purpose of laminating the core in a transformer?

The purpose of laminating the core in a transformer is to reduce eddy current loss.

30. Give the emf equation of a transformer and define each term

Emf induced in primary coil E1 = 4.44 fΦ mN1 volt

Emf induced in secondary coil E2 = 4.44fΦ mN2 volt

Where f is the frequency of AC input Φ m is the maximum value of flux in the core N1, N2 are the number of primary and secondary turns.

31.Define voltage regulation of a transformer

When a transformer is loaded with a constant primary voltage, the secondary voltage decreases for lagging Power factor 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 down = (0V2 -V2) x 100/0V2

% regulation up = (0V2 -V2) x 100/V2

32. Why transformers are rated in kVA?

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

33. What are the typical uses of auto transformer?

(i) To give small boost to a distribution cable to correct for the voltage drop.

(ii) As induction motor starters.

(iii) As furnace transformers

(iv) As interconnecting transformers

(v) In control equipment for single phase and 3 phase elective locomotives.

34. When will a Bucholz relay operate in a transformer?

Bucholz rely is a protective device in a transformer.

If the temperature of the coil exceeds its limit, Bucholz relay operates and gives an alarm.

35. Why are breathers used in transformers?

Breathers are used to entrap the atmospheric moisture and thereby not allowing it to pass on to the transformer oil.

Also to permit the oil inside the tank to expand and contract as its temperature increases and decreases.

36. What is the function of transformer oil in a transformer?

Nowadays instead of natural mineral oil, synthetic oils known as ASKRELS (trade name) are used. They are Noninflammable; under an electric arc do not decompose to produce inflammable gases. PYROCOLOR oil possesses high dielectric strength.

Hence it can be said that transformer oil provides,

(i) good insulation and

(ii) cooling.

37. An 1100/400 V, 50 Hz single phase transformer has 100 turns on the secondary winding. Calculate the number of turns on its primary.

We know V1 / V2 = k = N2 / N1 Substituting 400/1100 = 100/N1 N1 = 100/400 x 1100 = 275 turns.

38. What are the functions of no-load current in a transformer?

No-load current produces flux and supplies iron loss and copper loss on no-load.

39. What is meant by a transformer?

The transformer is a static piece of apparatus by means of which electrical power is transformed from one alternating current circuit to another with desired change in voltage and current. Without any change in the frequency. It works on the principle of mutual induction .

40. What are the advantages of a transformer?

i) Less I2R loss in the transmission line

ii) Less voltage drop in the line

iii) Efficiency of the transmission line is increased

iv) Volume of the conductor required is less.

41. What are the properties of ideal transformer?

i) It has no loss

ii) Its winding have zero resistance.

iii) Leakage flux is zero i.e 100% flux produced by primary links with the secondary

iv) Permeability of core is so high that negligible current is required to establish the flues

is it.

40. What are the important parts of a transformer?

Transformer consists of winding and magnetic core. The core is square or rectangle shape. It consists of limb and yoke core is made up of lamination which is used to reduce eddy current losses.

43. Define voltage transformation ratio?

The ratio of secondary induced emf to primary induced emf is called as voltage regulation ratio devoted by K.

$$\frac{E_2}{E_1} = \frac{N_2}{N_1} = K$$

44. Write the expression for equivalent resistance and reactance of transformer referred to primary.

Equivalent resistance Ro1 = R1 + R21 = R1 + R2/K2

Equivalent reactance Xo1 = X1 + X11 = X1 + X2/K2

45. Define voltage regulations of a transformer.

The decrease in secondary terminal voltage expressed as a fraction of the no load secondary terminal voltage is called voltage regulation of a transformer.

46. What are the losses occurring in a transformer?

i) Core losses

ii) Copper losses

47. What is meant by core or iron losses?

Core or iron losses are caused as the core gets subjected to an alternating flux.

48. What is meant by hysteresis losses?

Due to alternating flux set up in the magnetic core of the transformer, it undergoes a cycle of magnetization and demagnetization.

Due to hysteresis effect there is loss of energy in this process which is called hysteresis

loss.

49. What is meant by copper loss?

The copper losses are due to the power wasted in the form of I2R due to the resistances of the primary and secondary windings.

50. What is meant by eddy current loss?

The induced emf in the core tries to set up eddy currents in the core and hence responsible for the eddy current losses.

51.Define all day efficiency?

All day efficiency is the ratio energy (in kwh) delivered in a 24 hours period to the energy (in kwh) input for the same length of time.

$$\text{All day Efficiency} = \frac{\text{Output in kwh}}{\text{Input in kwh}} \quad \text{(for 24 hrs)}$$

52. Define efficiency of a transformer?

The efficiency of a transformer is defined as the ratio of the output power to the input power.

$$\eta = \frac{\text{power output}}{\text{power input}}$$

53. What is the function of capacitor in a single phase induction motor?

Capacitor is used to improve the power factor of the motor. Due to the capacitor connected in series with the auxiliary winding, the capacitive circuit draws a leading current which increases the split phase angle α between two phase currents Im and Ist.

54. What is the use of shading coil in the shaded pole motor?

In shaded pole motors, the necessary phase-splitting is produced by induction. These motors have salient poles on stator and a squirrel cage type rotor. The poles are shaded i.e.; each pole carries a copper band one of its unequally divided part called shading band.

When single phase A.C. supply is given to the stator winding, due to shading provided to the poles, a rotating magnetic field is generated.

55. Why capacitor-start induction motors advantageous?

In capacitor-start induction motors, capacitor is connected in series with the auxiliary winding. When speed of the motor approaches to 75 to 80% of the synchronous speed, the starting winding gets disconnected due to the operation of the centrifugal switch. The capacitor remains in the circuit only at start. The starting torque is proportional to phase angle α and hence such motors produce very high starting torque.

56. List out four applications of shaded pole induction motor?

Shaded pole motors have very low starting torque, low power factor and low efficiency. These motors are commonly used for small fans, toy motors, advertising displays, film projectors, record players, gramophones, hair dryers, photo copying machines etc.

57. What are the types of single phase induction motors?

The types of single phase induction motors are:

1. Split phase induction motor.

2. Capacitor start induction motor.

3. Capacitor start and capacitor run motor.

4. Shaded pole induction motor.