EC2201- ELECTRICAL ENGINEERING

2 - mark Questions & Answers

UNIT -I
DC MACHINES

1. State the basic parts of a DC machine.

- Stationary Parts: Frame, Main pole, field coils, interpoles, interpole winding.
- Rotating Parts: Armature core, Armature winding, Commutator, Shaft.

2. Name the various parts of a DC machine that control the magnetic circuit.
Poles, Air-gap, Armature core, Yoke.

3. What is prime mover?
The basic source of mechanical power which drives the armature of the generator is called prime mover.

4. 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.

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

$E = (\Phi PZN / 60A)$ in Volts.

Where,

P= number of poles
Z= Total number of conductors
A= number of parallel paths
Φ= flux per pole
N= speed in rpm

6. Why is Commutator employed in d.c machines? (Or) what is the function of a commutator in a DC generator?

- Conduct electricity between armature and fixed brushes
- Converts alternating emf into unidirectional emf and vice versa

7. How will you change the direction of rotation of a d.c motor?
Either the direction of the main field or the direction of current through the armature conductors is to be reserved.

8. 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 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.

9. Under what condition the mechanical power developed in a dc motor will be maximum?

Condition for mechanical power developed to be maximum is

$$E_b = V_a/2$$

or

$$I_a = V_a / 2R_a$$

10. What is the function of a no-voltage release coil provided in a dc motor starter?

As long as the supply voltage is on healthy condition the current through the NVR coil produce enough magnetic force of attraction and retain the starter handle in the ON position against spring force. When the supply voltage fails or becomes lower than a prescribed value the electromagnet may not have enough force and the handle will come back to OFF position due to spring force automatically. Thus a no-voltage or under voltage protections given to the motor.

11. Define critical field resistance in dc shunt generator

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.

12. Why is the emf not zero when the field current is reduced to zero in a dc generator?

Even after the field current/magnetizing force is reduced to zero the machine is left out with some flux as residue. Emf due to this residual flux is available when field current is zero.

13. Define the term "critical speed" in dc shunt generator.

Critical sped is defined as the speed at which the generator is to be driven to cause self-excited generator to Build up its emf for the given field circuit resistance.

14. On what occasions dc generators may not have residual flux?

- The generator may be put for its first operation after its construction.
- In previous operation the generator would have been fully demagnetized.

15. What are the conditions to be fulfilled for a dc shunt generator to build up emf?

- The generator should have residual flux
- The field winding should be connected in such a manner that the flux set up by the field winding should be in the same direction as that of residual flux
- The field circuit resistance should be less than critical field resistance
- Load circuit resistance should be above its critical load resistance

16. What are the types of D.C-starters?

1. Two point starters
2. Three point starters
3. Four point starters

17. What are the major categories of losses in a DC machine?
Magnetic losses, Electrical losses, Mechanical losses

18. Name the different types of DC motors.
Shunt motor, Series motor, cumulative compound motor, differential compound Motor.

19. Name any four applications of DC series motors.
* Electric traction
* Food mixies
* Hoist work
* Drilling machine

20. **Why starters are used for DC motors? Or Why a starter is necessary for a DC motor?**
Starters are used in DC motors to limit the starting current within about 2 to 3 times the rated current by adding resistance in series with the armature circuit. Apart from starting resistances starters are invariably fitted with protective devices such as No-voltage protection.

21. Why are carbon brushes preferred for dc machines?
The high contact resistance carbon brushes help the current in the coil undergoing commutation to attain its full value in the reverse direction at the end of commutation. The carbon brushes also lubricate and give less wear and tear on commutator surface.

22. Name any two applications of DC series generator.
Booster, electric welding, Constant current source, Constant illumination

23. What is the basic principle of a dc generator?
Basic principle of a dc generator is Faraday's law of electromagnetic induction. i.e. whenever a conductor is moved in a magnetic field, dynamically induced emf is produced in that conductor.

24. What is the purpose of yoke in a dc machine? Or The outer frame of a DC machine serves double purpose. What are they?
- It acts as a protecting cover for the whole machine and provides mechanical support for the machine.
- It carries the magnetic flux produced by the poles. The flux per pole divides at the yoke so that; the yoke carries only half the flux produced by each pole.

25. What are the causes of failure of dc shunt generator to exite?
- The residual magnetism may not be present in the poles.
- The field winding may not be properly connected with armature.
- Under no load condition, the shunt field resistance should be greater than the critical field resistance.
- Under loaded condition, the shunt field resistance should be less than the critical field resistance.

26. Why a dc shunt motor is also called a constant flux motor or constant speed motor?

In shunt motor, flux produced by field winding is directly proportional to the field current i.e. ($\Phi \alpha I_{sh}$). Here, the input voltage is constant and so the flux is also constant. Therefore, DC shunt motor is also called a constant flux motor or constant speed motor.

27. Why series motor cannot be started without any load?

In dc series motor, flux is directly proportional to armature current. i.e. ($\Phi \alpha I_a$). Under no load condition, the armature current is very low and flux also be less. By using the formula $N \alpha (1/\Phi)$, here Φ is less; the motor speed will be very high. Due to this motor will be damaged. Hence dc series motor should always be started with some load on the shaft.

28. What is the function of starters in DC motor?

- To limit the starting current.
- To protect against low voltage and over load condition.

29. List the important parts of a DC starter.

Starting resistance, Handle, over load relay, No voltage relay

30. What are the drawbacks of brake test on DC machines?

- The brake test can be used for small motors only, because in case of large motors, it is difficult to dissipate the large amount of heat generated at the brake.
- This method cannot be used for determining internal losses.
- The output of the motor cannot be measured directly.

Unit-II
TRANSFORMERS

1. What is the function of a transformer?

Transformers are energy converting devices, converting AC electrical energy with one level of voltage and current, to AC electrical energy with another level of voltage and current

2. 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.

3. What is the purpose of laminating the core in transformers?

To reduce eddy current loss.

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

- Emf induced in primary coil E1 = 4.44 fF_mN_1 volt
- Emf induced in secondary coil E2 = 4.44fF_mN_2 volt

Where,

- f is the frequency of AC input
- F_m is the maximum value of flux in the core
- N_1, N_2 are the number of primary and secondary turns.

5. Does the transformer draw any current when secondary is open? Why?
Yes, it (primary) will draw the current from the main supply in order to magnetize the core and to supply iron and copper losses on no load. There will not be any current in the secondary since secondary is open.

6. Define voltage regulation of a transformer
The change in secondary terminal voltage from no load to full load expressed as a percentage of no load or full load voltage is termed as regulation.

$$\% \text{ regulation } = ((E_2 - V_2)/ V_2) \times 100$$

7. Full load copper loss in a transformer is 1600 watts. What will be the loss at half load?
If x is the ratio of actual load to full load then copper loss = x2(full load copper loss).Here Wc = (0.5)2 x 1600 = 400 watts

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

9. 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.

10. 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. Also to avoid sledging of oil i.e. decomposition of oil. Addition of 8 parts of water in 1000000 reduces the insulations quantity of oil. Normally silica gel is filled in the breather having pink color. This color will be changed to white due to continuous use, which is an indication of bad silica gel, it is normally heated and reused.

11. A 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.

12. 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.

13. Can the voltage regulation of a transformer go to negative? If so under what condition?
Yes. If the load has leading power factor.

14. What is meant by turns ratio in transformer?
Turns ratio in transformers,K is the ratio of number of turns in the secondary winding N_2 to number of turns in the primary winding N_1

$K = N_2/N_1$

15. Why are cooling tubes provided in transformer tanks?
By providing cooling tubes, oil circulation and hence heat dissipation can further be improved by providing cooling tubes in two or all four walls of the transformer tanks

16. 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.

17. List out general application of transformers.

1) Stepping-up of voltage
2) Stepping-down of voltage
3) Instrument extension
4) Electrical isolation
5) Impedance matching
7) Link between AC and DC systems

18. What is the purpose of conducting open circuit and short circuit tests in transformers?
Open circuit Test :

(i) To find out the equivalent circuit parameters R_0 & X_0 or no load resistance and reactance
ii) To find out the Iron loss of the transformer
Short circuit Test :

(i) To find out the equivalent circuit parameters R_{01} & X_{01} or resistance and reactance of the transformer referred to primary or secondary
ii) To find out the copper loss of the transformer
By using these two tests we can find out the efficiency and regulation of the transformer.

Unit-III
INDUCTION MOTORS

1. State the condition for maximum torque of a three phase induction motor. What is the maximum torque equal to?

When the slip is maximum, the torque of a three phase IM is maximum.

$$\text{The maximum torque} = \frac{s_m E_2^2 R_2}{R_2^2 + s_m^2 X_2^2}$$

2. A 3 ph, 4 pole, 50 Hz induction motor is running at 1440 rpm. Determine the slip speed and slip.

- Slip speed = $N_s - N$;
- % slip = $\frac{Ns-N}{Ns} * 100.$

$N_s = 120f / p = (120)(50) / 4 = 1500$ rpm.

Slip speed = $N_s - N = 1500 - 1440 = 60$ rpm.
%Slip = (60/1500) *100 = 4%

3. **Give the relationship between the following in a 3 phase induction motor:**
   - **Rotor input and rotor output**
   - **Starting torque and applied voltage**

   $P_m = P_2 (1-s)$ which indicates the relationship between the rotor input and rotor output where P_m denotes the gross mechanical power developed and P_2 denotes the rotor input.

   $T_{st} = 3 V_2^2 R_2 / (2\pi N_s (R_2^2 + X_2^2))$ which indicates the relation-ship between the starting torque and applied voltage.

4. **What are the purposes that could be served by external resistors connected in the rotor circuit of phase would induction motor.**
   - To limit the starting current
   - To increase the starting torque
   - To control the speed.

5. **How can the reversal of rotation of poly phase induction motor be attained?**

The reversal of rotation of poly phase induction motor is obtained by interchanging any two terminals of the three phase windings when connecting to the supply.

6. **A 3 ph, 50 Hz induction motor runs at 960 rpm on full load. Find the number of poles and slip speed.**

Induction motor always runs nearer to synchronous speed. So, assume

$N_s = 1000$rpm.

$N_s = 120f / p = 1000$ $\quad p = (120) (50) / 1000 = 4.$

Slip speed $= N_s - N = 1000 - 960 = 40$ rpm.

7. **Mention the losses occur in induction motor.**
   - Constant loss which includes hysterisis, eddy current loss and mechanical losses.
   - Variable loss which includes the losses in the stator and rotor winding due to the current flowing in the winding.

8. **Enlist four application of wound rotor induction motor**.
   - Cranes
   - Hoists
   - Pumps
   - Fans and blowers
   - Chippers
   - Conveyors
   - Banbury mixers
   - Ball and sag mill

9. Point out the disadvantages of rotor rheostat control to obtain variable speed of induction motor.

- Large power loss due to the increase in resistance value.
- Due to large power loss efficiency is low.
- The speed above normal speed can not be obtained.
- Bulky and expensive
- Wide speed range is not possible. Because it needs large resistance which will be the cause to increase the losses.

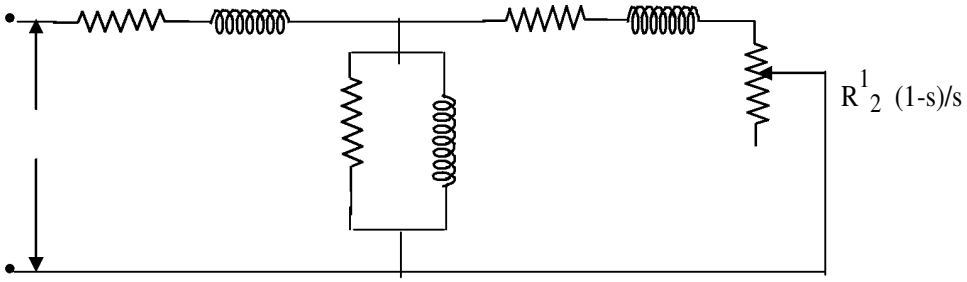
10. What is the function of slip ring in 3 phase induction motor?

The function of slip ring is used to connect the external stationary circuit to the rotor circuit of the induction motor. Here it is used to connect the external rheostat to the rotor of IM.

11. Write the advantages of slip ring induction motor.

- External resistance can be added in to the rotor circuit.
- High starting torque can be obtained
- Speed control by the rotor rheostat is possible.
- Rotor resistance starter can be used.

12. Draw the equivalent circuit of induction motor.

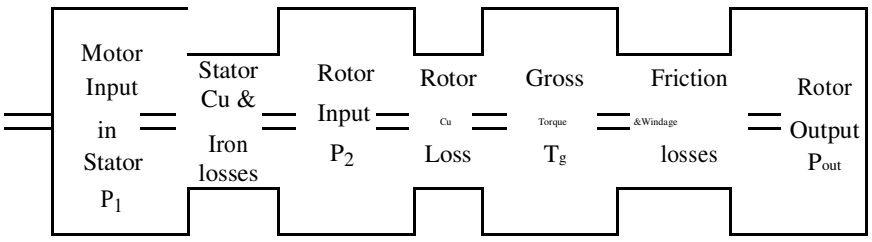


13. Explain the conditions for maximum torque under running condition.

The torque depends on slip at which motor is running. So the only parameter which controls the torque is slip. So by differentiating the torque equation with respect to slip the condition for maximum torque can be achieved. That is slip is equal to the ratio between the rotor resistance and reactance.

$R_2 = SX_2$.

14. Draw the power stages of an induction motor.



15. Define slip.

The ratio between difference in synchronous speed N_S and the actual speed N of the rotor to the synchronous speed N_S is known as slip.

$$S = N_S - N / N_S.$$

$$\% \text{ slip} = \frac{Ns-N}{Ns} * 100.$$

16. Why the squirrel cage rotor is named so?

The rotor bars are brazed or electrically welded to two heavy and short circuiting end rings which give the pictorial representation of the squirrel's cage. That's why this motor is called as squirrel cage motor.

17. What are the principles involved in the starting of the rotor to rotate?

- Faraday's laws of electromagnetic induction.- By this principle an emf will be induced in the rotor conductors .
- Lenz's law – By this law the rotor current is produced since the rotor conductors are short circuited.

18. Why the induction motor is called as rotating transformer.

The induction motor is same as transformer in the principle of operation, i.e. mutual induction principle except the rotation. Similar to primary and secondary here stator and rotor parts are available which involve in that principle of operation. That's why IM is called as rotating transformer.

19. Compare the squirrel cage and wound rotor IM.

S.No	Characteristics	Slip Ring IM	Squirrel Cage IM
1.	Stator winding	Three phase winding	Three phase winding
2.	Construction	Complicated	Very simple
3.	Rotor	Three phase winding	Bars shorted with end rings
4.	External resistance	Can be added	Can not be added
5.	Slip rings and brushes	Present	Absent
6.	Cost	High	Low
7.	Starting torque	High	Moderate
8.	Speed control	By rotor resistance	By rotor res. Not possible
9.	Losses	High	Low
10.	Efficiency	Low	High
11.	Applications	Lifts, hoists, cranes	Laths, blowers, pumps
12.	Usage	Only 5%	95%

20. Why the IM is called as asynchronous motor?

The speed of the rotor is not same as the speed of the synchronously revolving flux of the stator. That's why it is called as asynchronous motor.

21. Define synchronous speed.

The speed of rotating magnetic field in the stator is called as synchronous speed. It is denoted as N_S .

$N_S = 120f / p$

where f- denotes the supply frequency and p-denotes the number of poles.

22. List the types of starters used for an IM.

- DOL starter

For SCIM:

- Primary resistor started
- Auto transformer starter
- Star delta starter

For SRIM:

- Rotor rheostat starter.

23. What is the necessity of starter?

If normal supply voltage is applied to the stationary motor, then as in the case of transformer very large initial current is taken atleast for a short while which is 5 to 7 times of their full load current. Hence to avoid this high value of initial current the starters are needed.

24. List the methods adopted to control the speed of an IM. From stator side:

- By changing the supply voltage
- By changing the supply frequency
- By changing the number of stator poles

From rotor side:

- Rotor rheostat control
- Cascade operation
- By injecting an emf in the rotor circuit.

25. What are the merits and demerits of injecting emf method of speed control?

Advantages:

- Wide speed range is possible
- Improved power factor.

Demerit:

- It can be only applied for slip ring induction motors.

26. What is the name of the starter used for starting the slip ring IM?

Rotor resistance starter is used for the starting of slip ring IM. There is a provision to change the value of rotor resistance in slip ring IM alone. This type of starter also improves the starting torque.

27. Why capacitor start and run induction motors advantageous?

- Improvement of over load capacity of the motor
- Higher power factor
- High efficiency
- Quite running.

28. Is single phase induction motor is self starting? Why?

- No. It is not self starting.
- This is explained by double revolving field theory. It states that, when single phase ac supply is given to the stator will produce pulsating (forward & backward toque which cancel each other) torque and hence continuous rotation is not achieved.

29. List the types of single phase IM.

- Split phase
- Shaded pole
- Capacitor start and run induction motor
- Capacitor start induction motor

UNIT-IV
SYNCHRONOUS AND SPECIAL MACHINES.

1. What are the two fundamental characteristics of a rotating magnetic field?

The two fundamental factors of rotating magnetic field are,

1) The resultant of the three alternating fluxes separated from each other by 120° has a constant amplitude of 1.5 Φ_m where Φ_m is the maximum amplitude of an individual flux due to any phase.

2) The resultant always keeps on rotating with a certain speed in space.

2. Define the pitch factor.

It is defined as a ratio of resultant emf when coil is short pitch to the resultant emf when the coil is full pitched. It is always less than unity.

It is also called as coil span factor. It is denoted by Kp or Kc.

- Kp = cos(α/2).

Where α = angle of short pitch

3. Define the distribution factor

It is defined as a ratio of resultant emf when coils are distributed to the resultant emf when the coils are concentrated. It is always less than unity.

It is also called as coil breadth factor. It is denoted by Kd.

- Kd= sin(mβ/2) / msin(β/2).

Where β =slot angle = 180°/ n; m= slots per pole per phase; n= slots per pole.

4. What are the requirements to be met with for paralleling of alternators?

The conditions to be satisfied for parallel operation of alternators are,

- The terminal voltage of the incoming machine must be same as that of bus bar voltage.
- The frequency must be same as that of the incoming machine as well as that of bus bar.
- With respect to the external load, the phase of alternator voltage must be identical with that of the bus bar voltage.

5. Why the parallel operation is necessary?

- To avoid the power shut down during maintenance or inspection by sharing the load to other units.
- To have the optimum utility of the alternators
- To have the good reliability of the supply
- To achieve the better efficiency by operating the alternators with full load.

6. List the types of rotors of the synchronous generator. State their features.

There are two types of synchronous generator namely salient type and cylindrical type rotor. In salient pole structure, the air gap is non uniform. These poles are mechanically weak and hence preferred for low speed alternators. Separate damper winding is provided. In cylindrical type structure, the air gap is uniform. It is mechanically robust and hence preferred for high speed turbo alternators. Separate damper winding is not necessary.

7. What are the functions of damping winding provided with alternator?

The uses of damper windings are,

- To reduce hunting or phase swinging
- To develop necessary starting torque.

8. Why the field system of an alternator made as a rotor? (Or) Why the armature is made stationary in alternator?

- The field system of an alternator is made rotating to avoid interaction of mechanical and electrical stresses.
- Also with rotating field system, it is easier to collect currents at very high voltages from stationary member.
- Due to low voltage on field side, the insulation required is less.
- The problem of sparking is avoided.
- The construction with rotating field is simple and only two slip rings are required to provide external dc supply.

9. Why is EMF method called Pessimistic method?

The value of voltage regulation obtained by EMF method is always more than the actual value, therefore it is called Pessimistic method**.**

10. Why is MMF method called Optimistic method?

The value of voltage regulation obtained by MMF method is less than the actual value, therefore it is called Optimistic method.

11. Compare salient pole rotor r& smooth cylindrical rotor.

Salient Pole Rotor	Cylindrical Rotor
1. Large diameter and short axial length	Small diameter and long axial length
2. Used for low speed alternators	Used for high - speed turboalternators
3.Has projecting poles	No projecting poles
4. Needs damper windings	Does not need damper windings.
5.Windage loss is more	Windage loss is less

12. What are the reasons for drop in voltage from no load to full load?
The reasons for drop in voltage from no load to full load are,
1. Drop in armature resistance
2. Armature leakage reactance
3. Reaction corresponding to armature reaction.

13. List the advantages of rotating field then rotating armature.

- It is easier to collect larger currents at very high voltages from stationary member than from the slip ring and brush assembly.
- The ventilation arrangement for high voltage side can be improved if it is kept stationary.
- The problem of sparking at the slip rings can be avoided by keeping field rotating which is low voltage circuit and high voltage armature as stationary.
- To excite the field an external dc supply with two slip ring are enough.

14. What is brushless excitation?
It consists of silicon diode rectifiers which are mounted on the same shaft of alternator and will directly provide necessary excitation to the field. The problem of sparking is avoided in this type system.

15. Mention the advantages of short pitched coil.
Because of short pitching the effective length of copper is reduced which leads to reduction of cost.

16.Define harmonics.
The high frequency components are merged with the fundamental Components of the wave. This is called Harmonics.

17. What are the methods to find the regulation of an alternator?
There are four methods to find the regulation of an alternator.
1. Direct loading method
2. EMF method
3. MMF method
4. ZPF method
5. ASA method

18. What do you mean by Synchronization of an Alternator?
The process of connecting or switching of one alternator to the other alternator or to the infinite bus bar without any interruption is called synchronization.

19. What are the methods of Synchronizing Alternator?

- Dark lamp method
- Bright lamp method
- Synchroscope method

20. What is infinite bus bar?
The bus bar whose frequency and phase emf remain unaffected by the changes in the condition of any one machine connected to it is called as infinite bus bar.

21. How it is identified that the phase sequence of an incoming Alternator is same as that of the bus bar?
If the lamps are glowing with the same dark period or bright period, then the it can be considered as same phase sequence. If the lamps becoming dark and bright simultaneously it indicates the incorrect phase sequence.

22. Explain the term "Alternator floating on bus bar".
If the alternator is once connected in parallel with the bus bar after satisfying the condition then it is said to be in floating condition.

23. Mention four applications of synchronous motor.
i) Synthetic fiber drawing
ii) Constant speed applications
iii) Synchronous condenser

24. What is synchronous reactance?
The leakage reactance XL and the armature reactance Xa may be combined to give the synchronous reactance Xs. Xs = XL + Xa.

25. What is hunting?
When synchronous motor is on no load, the stator and rotor pole axes coincide with each other. When motor is loaded, the rotor pole axis falls back with respect to stator. If the load connected to motor is suddenly changed by a large amount, then rotor tries to retard to take its new equilibrium position. But due to inertia of rotor, it cannot achieve equilibrium instantaneously. While achieving new position, it passes beyond its final position corresponding to new load. This will produce more torque than demanded. So, the load angle is reduced and rotor swings in other direction. Such oscillations of the rotor about its new equilibrium position due to sudden application or removal of load is called hunting.

26. Enlist the advantages and disadvantages of synchronous motor.
Main disadvantage is it needs external starting arrangements. Regarding the advantage, it mainly improves the power factor by simply adjusting the excitation.

27. Why synchronous motor is not self starting?
When a three phase supply is given to the stator, rotating magnetic field is produced. At one instant, due to unlike poles trying to attract each other, the rotor will be subjected to a torque in clockwise direction. At another instant, the like poles trying to repel each other, the rotor will be subjected to a torque in anticlockwise direction. As a result, the average torque exerted on the reotr is zero. And hence the synchronous motor is non self starting.

28. List the starting methods of synchronous motor.
The starting methods are,

- Using pony motors
- Using damper winding
- As a slip ring induction motor
- Using small dc machine coupled to it.

29. Define synchronous motor.
The motor which rotates with always synchronous speed otherwise zero speed is known as synchronous motor.

30. Compare synchronous motor and induction motor

Synchronous motor is non self starting motor. By changing the field Excitation, the power factor can be varied. It can be used for power factor correction. Induction motor is a self starting motor. The field excitation cannot be changed. It cannot be used for power factor correction.

31. Discuss why the starting torque of a synchronous motor is zero?

Due to inertia of the rotor it is not able to lock with the stator poles which are alternatively changing for the positive and negative half cycle. During that time the rotor rotates CW for some time and CCW for some time. So the average torque is zero.

32. Why is the hysterisis motor free from mechanical and magnetic vibrations?

- Due to magnetic retentivity property there is continuous magnetic locking between stator and rotor which avoids the vibrations.
- As there is no rotor teeth and winding there are no mechanical vibrations.

33. Define stepper motor.

It is an electro mechanical device which produces step movement of the rotor in response to the train of input pulses.

34. Define the step angle of a stepper motor and write the expression for the same.

The angle through which the stepper motor rotates for the train of pulses is called step angle. $\beta = 360 / mNr$ where m denotes the number of phases and Nr denotes the number of rotor teeth.

35. List the types of stepper motors.

- Variable reluctance stepper motor.
- Permanent magnet stepper motor
- Hybrid stepper motor.

36. Give the applications of stepper motor.

- Printers and plotters
- Paper tape drives
- Quartz watch
- Synchronizing clock
- Positioning control

Unit-V - TRANSMISSION AND DISTRIBUTION

1. What are the advantages of hydro electric power plant?

i. Water is the cheapest and reliable source of generation of electric power.
ii. No fuel transportation problem.
iii. Maintenance problem.
iv. No ash disposal problems and no smoke is produced.
v. Running cost is low.

2. What are the disadvantages of hydro electric power plant?

- The power produced by the plant depends upon quantity of water which in turn is dependent upon the rainfall.
- Capital cost of the plant is high.
- The hydro electric power plants are generally situated away from the load centres. This requires long transmission lines to deliver power. Therefore the cost of transmission lines and losses will be more.
- iv. It takes long time for the erection.

3. What are the advantages of steam power plant?

- Fuel is cheaper.
- Less space is required compared with hydroelectric plant.
- Capital cost is low.
- It can be located at any place, located near the load centre.
- Response quickly to change in load.

4. What are the disadvantages of steam power plant?

i. Maintenance and operating costs are high.
ii. Atmosphere is polluted.
iii. Large quantity of water is required.
iv. Handling of ash is difficult.
v. Time required for erection and put into operation is more.

5. What are the advantages of Nuclear power plant?

i. The amount of fuel required is very small.
ii. There is no problem of transportation and storage.
iii. Less space is required.
iv. Can be located near the load centre.
v. Most economical.

6. What are the disadvantages of Nuclear power plant?

i. Capital cost is very high.
ii. Erection and commissioning of the plant requires greater technical know-how.
iii. The by products are generally radioactive and may cause a large amount of radioactive pollution.
iv. The fuel is expensive and difficult to recover.
v. Maintenance costs are high.
vi. The disposal of radioactive waste is a big problem.

7. Write the main components of tidal power plant?

i. The power house
ii. The dam to form basin
iii. Sluice- ways from the basins to the sea and from the sea to the basins.

8. What are the classifications of wind energy conversion system?

i. Horizontal axis wind mill
ii. Vertical axis wind mill

9. What are the advantages of wind energy conversion system?

i. It is renewable source of energy.
ii. Non polluting
iii. No problem of transportation

iv. It is cheaper if produced in large amount of power.

10. What are the disadvantages of wind energy conversion system?
i. Wind energy available is fluctuating in nature
ii. Noisy in operation
iii. The overall weight of the plant is very high.
iv. The system is not reliable.

11. What are the advantages of MHD generator?
i. Conversion efficiency is around 50%.
ii. Capital cost is less compared with conventional steam plants.
iii. Overall generation cost is less.
iv. Large amount of power is generated.
v. It has no moving parts, so more reliable.

12. Write down the classification of geothermal sources.
i. Hydro-thermal convective systems.
ii. Geo pressure resources
iii. Petro-thermal or hot dry rocks
iv. Magma resources
v. Valcanoes

13. What are the advantages of geothermal energy?
i. Geothermal energy is versatile in its use.
ii. It is cheaper.
iii. Geothermal power plants have highest annual load factor
iv. Pollution is less.

14. What are the disadvantages of geothermal energy?
i. Overall efficiency for power production is low; approximately 15%.
ii. Drilling operation is noisy.
iii. Large areas are needed for exploitation of geothermal energy.

15. What are the transmission system voltages used in India?
33kV, 66 kV For medium high voltage 132 kV, 220 kV For high voltage 400 kV For extra high voltage 765 kV For Ultra high voltage

16. What are the parts of the transmission system network?
i. Transmission system
ii. Sub transmission system
iii. Primary distribution system
iv. Secondary distribution system

17. What are the types of HVDC links?
i. Monopolar link
ii. Bipolar link
iii. Homopolar link

18. List the advantages and disadvantages of HVDC transmission system?
Advantages:
i. Asynchronous operation is possible
ii. Less corona loss and radio interference
iii. No compensation problem
iv. Cheaper for long distance transmission
v. No charging current

vi. No technical limit for power transfer except thermal limit
vii. Power control is possible
viii. No reactive power loss
ix. Ground can be used as return conductor
x. No skin and Ferranti effect
xi. No transmission of short circuit power in case of fault
xii. Low short circuit current
xiii. No stability problem
xiv. No switching transient
xv. Require less space compared to ac for same voltage rating and size
xvi. Fast fault clearing time.

Disadvantages:

i) Point to point transmission not possible
ii) Introduction of harmonics
iii) Blocking of reactive power
iv) High cost of terminal equipment

19. What are the main components of HVDC transmission system?

i. Converters
ii. Converter transformers
iii. Smoothing reactors
iv. Reactive power source
v. Harmonic filters
vi. Overhead lines
vii. Earth electrodes

20. What are the applications of HVDC transmission system?

i. Long distance bulk power transmission
ii. Underground or submarine cables
iii. Asynchronous connection of ac system with different frequencies
iv. Control and stabilize the power system with power flow control.

22. What are the characteristics of an ideal insulator?

i) There should not be any pores or air spaces
ii) There should not be any impurities
iii) There should be perfectly homogeneous material
iv) Leakage current through insulators should be minimum
v) Insulators should be able to withstand over voltage and normal working voltage.

21. Define working voltage, flashover voltage and puncture voltage

Working voltage :

It is the voltage at which an insulator is designed to bear the steady state voltage stress.

Flashover voltage:

It is the voltage at which flashover occurs through air surrounding the insulator.

Puncture voltage:

It is the voltage at which the insulator breaks through between conductor and pin. It destroys the insulator.

22. Define safety factor

A safety factor is defined relating the flashover and working voltages.
Mathematically, Safety factor = Flashover voltage / Working voltage

23. What are the types of insulators used in overhead transmission lines

i. Sackle type (230-440 V lines)

ii. Pin type

iii. Suspension type

iv. Strain type

24. What are the advantages of suspension type insulators?

i. Economical for voltage above 33 kV

ii. Each insulator is designed for 11 kV and hence for any operating voltage, a string can be made.

iii. Failure of any unit can be replaced without changing the whole string

iv. Since it is allowed to swing in the air, mechanical stress at a point of attachment is reduced

v. Flexible in extension of voltage rating by adding more units

vi. Since the conductors lay below the cross arm, the line outages due to lightening strokes are reduced.

25. Give various insulating materials used for cable

i. Vulcanized rubber

ii. Varnished cambric

iii. Polyvinyl chloride

iv. Impregnated paper

v. Polythene

26. What do you mean by grading of cables?

Grading means distribution of dielectric material such that the difference between Emax and Emin is reduced. Thereby a cable of same size can be operated for high voltage or for the same operation voltage, the size can be reduced.

27. What are the grading methods available for a cable?

i) Capacitance grading(more than one dielectric materials are used)

ii) Intersheath grading(the same dielectric material is used but potentials at certain radius are held constant by using sheaths)

28. What are the difficulties in practical system grading of cables?

i) Non availability of varying permittivity of insulating materials

ii) Change in the permittivity with time, which changes the distribution of stress that lead to rapture of insulating material at normal working voltage.

iii) Damage of Intersheath during laying or due to aging may lead to severe stress

iv) Charging current flows through the Intersheath which may damage the cable due to overheating

v) There may be resonance problem in Intersheath grading due to inductance of transformer and capacitance of cable

vi) Grading may not be economical in low voltage cables

29. Give the reasons of high capacitance in cables than the overhead transmission lines?

i) High value of permittivity of insulating materials

ii) Distance between the core and the earthed sheath is small

iii) Small distances between the cores (phases) itself.