# ET SHORT QUESTION AND ANSWERS (2 MARKS)

## UNIT-1 (DC MACHINES)

**1. What is the dc generator and dc motor** ?

Ans. **Generator:** Generator converts mechanical energy into electrical energy.

Principle: It works on the principle of dynamically induced EMF i.e., Faradays laws of electromagnetic induction. (When flux linking with the conductor or coil changes, EMF is induced.

**Motor**: Motor converts electrical energy into mechanical energy.

Principle: When the current carrying conductor is placed in the magnetic field, the coil experiences the mechanical force.

But there is no constructional difference between the two.

2. **Write down the emf equation for d.c generator.**

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

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

3. **Why the armature core in d.c machines is constructed with laminated steel sheets instead of solid steel steel?**

Ans. Steel sheets offer low relutance path for the magnetic field , laminated sheets reduce eddy current loss.

4**. Why is commutator employed in d.c machines?**

Ans. Conduct electricity between armature and fixed brushes

 Converts altenating emf into unidirectional emf and vice versa

Material Used: Commutator consists of No. of copper segments separated by the insulating material like mica.

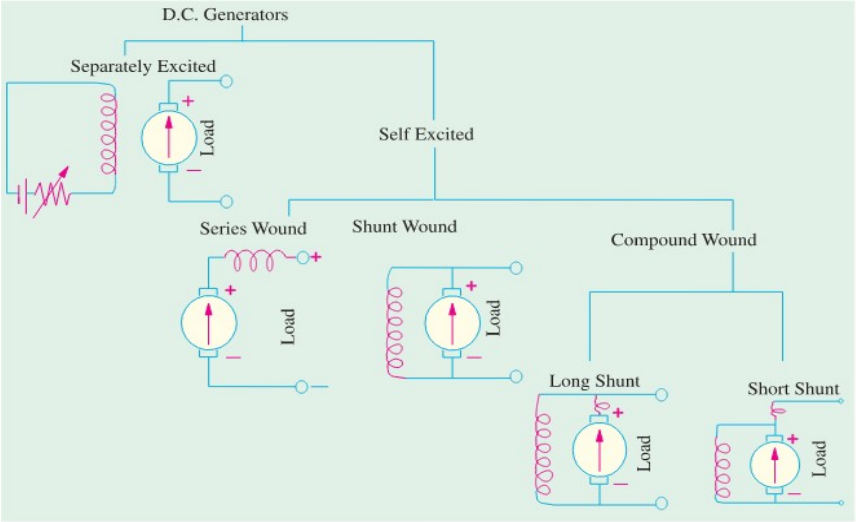
1. What are the types of winding in a DC machine?

Ans. There are two types of windings in a DC machine. They are Lap winding and wave winding.

| Lap winding | Wave winding |
|---|---|
| 1. No of parallel paths(A)= No. of poles(P) | 1. No of parallel paths(A)= 2 |
| 2. No. of brush sets= No. of poles(P) | 2. No. of brush sets= 2 |
| 3. Overlapping of windings | 3. No Overlapping of windings |
| 4. High current, low voltage applications | 4. Low current, high voltage applications |
| 5. No. of conductors in each parallel path = Z/P | 5. No. of conductors in each parallel path = Z/2 |

**6. What are the types of DC generators?**

**Ans.** DC generators are classified based on the connection between the armature windings and the field winding.




8. **Distinguish between shunt and series field coil constructions.**

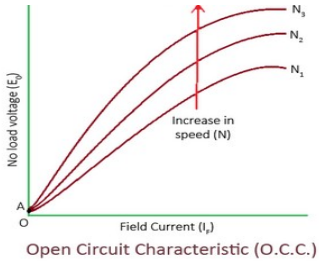
Ans. Shunt field coils are wound with wires of small cross section and have more number of turns. Series field coils are wound with wires of larger cross section and have less number of turns.

**7. What are the characteristics of a DC generator?**

Ans. Characteristics of a DC generator are

(i) Magnetisation characteristics (Open circuit characteristics or no load Characteristics):

This characteristic shows the relation between generated emf at no load ($E_0$) and the field current ($I_f$) at a given fixed speed.



Open Circuit Characteristic (O.C.C.)

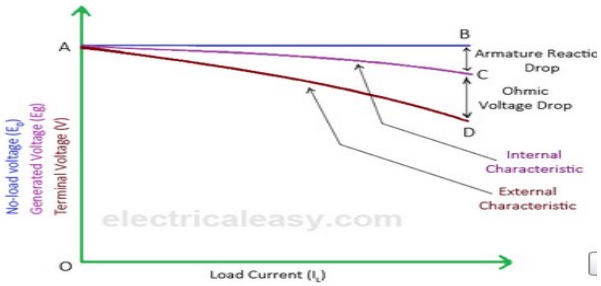
(ii) Load characteristics:

a. Internal Characteristics: An internal characteristic curve shows the relation between the on-load generated emf (Eg) and the armature current ($I_a$).

b. External Characteristics: An external characteristic curve shows the relation between terminal voltage (V) and the load current ($I_L$).

**8. Draw the characteristics of DC separately excited and self excited generators.**

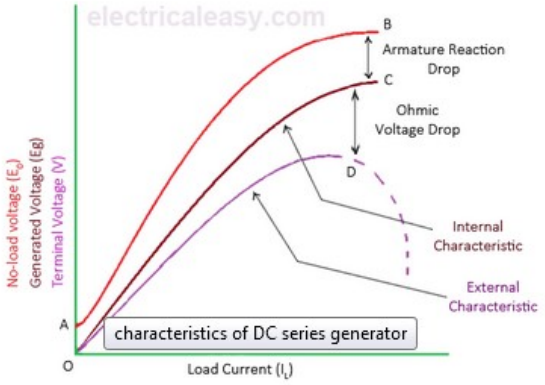
Ans. a. Separately excited DC generator characteristics:




Characteristics of separately excited DC generator

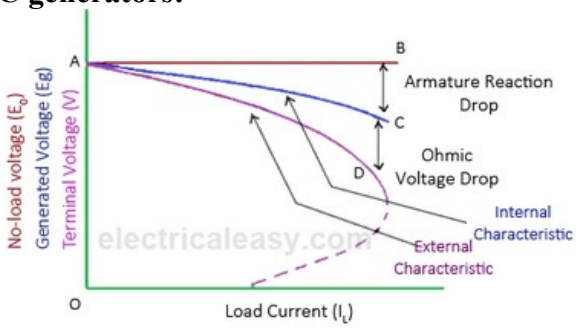
**b.Self excited DC generators:**

**(i) Series generator:**



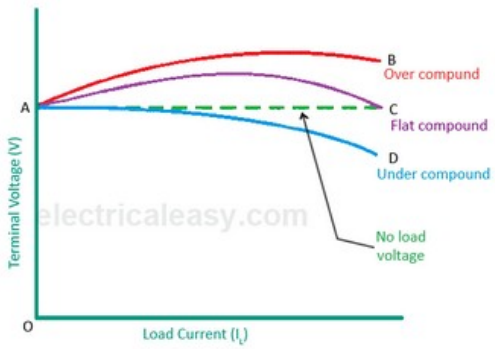

Characteristics of DC series generator

**(ii)Shunt excited DC generators:**




Characteristics of DC shunt generator

**(iii)DC compound Generator:**




**9. How will you change the direction of rotation of a d.c motor?**
Ans. The direction of rotation of a d.c motor can be changed by either reversing direction of the main field or reversing the direction of current through the armature conductors.

**10. What is back emf in d.c motors ?**
Ans. 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.

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

14. **Enumerate the factors on which the speed of a dc motor depends**.
Ans. $N = (V-IaRa)/\phi$
The speed of dc motor depends on three factors.
- Flux in the air gap
- Resistance of the armature circuit
- Voltage applied to the armature

**15. How the critical field resistance of a dc shunt generator is estimated from its OCC?**
Ans. Critical field resistance can be obtained from OCC by drawing a straight line passing through the origin and tangent to the initial straight line portion of OCC. The slope of this line gives the value of critical field resistance for the given speed at which OCC is obtained.

**16. Define the term armature reaction in dc machines.**
Ans. The interaction between the flux set up by the current carrying armature conductors with the main field flux is defined as armature reaction.

17. **What are the two unwanted effects of armature reaction?**

Ans. □ Cross magnetizing effect / Distorting effect
□ Demagnetizing effect

18. **Define critical field resistance in dc shunt generator**
Ans. 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.

**19. What is the function of carbon brush used in D.C generator?**
Ans. The function of carbon brush is to collect current from the commutator and supply to the external load circuit and to the field circuit.

**20. What are the losses in a DC machine.**
**Ans. 1. Copper losses:** These losses occur in armature and field copper windings. Copper losses consist of Armature copper loss, Field copper loss and loss due to brush contact resistance.
**Armature copper loss** = $I_a^2R_a$ (where, $I_a$ = Armature curren, $R_a$ = Armature resistance)
**Field copper loss** = $I_f^2R_f$ (where, $I_f$ = field current, $R_f$ = field resistance)

2. **Iron Losses**: As the armature core is made of iron and it rotates in a magnetic field, a small current gets induced in the core itself too. Due to this current, eddy current loss and hysteresis loss occur in the armature iron core. Iron losses are also called as **Core losses or magnetic losses.**

   (i) Hysteresis loss is due to the reversal of magnetization of the armature core. When the core passes under one pair of poles, it undergoes one complete cycle of magnetic reversal. The loss depends upon the volume and grade of the iron, frequency of magnetic reversals and value of flux density. **Hysteresis loss** is given by, Steinmetz formula:

   $W_h=\eta B_{max}^{1.6}fV$ (watts)
   where, $\eta$ = Steinmetz hysteresis constant
   V = volume of the core in $m^3$

   (ii) **Eddy current loss**: When the armature core rotates in the magnetic field, an emf is also induced in the core (just like it induces in armature conductors), according to the Faraday's law of electromagnetic induction. Though this induced emf is small, it causes a large current to flow in the body due to the low resistance of the core. This current is known as eddy current. The power loss due to this current is known as eddy current loss. **Eddy current loss** is given by, Steinmetz formula:

   $W_e=\eta B_{max}^2f^2t^2V$(watts) where, $\eta$ = Steinmetz hysteresis constant
   V = volume of the core in $m^3$, t= thickness of the core, f= frequency

3. **Mechanical losses:** Mechanical losses consist of the losses due to friction in bearings and commutator. Air friction loss of rotating armature also contributes to these.
   These losses are about 10 to 20% of full load losses.

**21. How will you find the direction of emf using Fleming□s Right Hand Rule?**

Ans. The thumb, the forefinger and the middle finger of the right hand are held so that these fingers are mutually perpendicular, then Forefinger - Field Thumb - Motion Middle finger- I, current.

22. **How will you find the direction of force produced using Fleming□s Left Hand Rule?**

Ans. The thumb , forefinger and middle finger of the left hand are held so that those fingers are mutually perpendicular then Forefinger - Field Thumb - Motion(due to force) Middle finger - I, current

## UNIT-2: TRANSFORMERS AND THEIR PERFORMANCE

**1. What is a transformer?**

Ans. A transformer is a static device which transfers energy from one circuit to another without change in the frequency and with a desired change in the voltages and currents without any electrical connection.

2**. What is the principle of a transformer?**
Ans. Transformer works on the principle of mutual induction. Mutual induction states that when the current is passed in one coil then it induces an voltage in an adjacent coil.

**3. Mention the difference between core and shell type transformers.**
Ans.

| Core type transformer | Shell type transformer |
|---|---|
| 1. Consists of one magnetic core. | 1. Consists of double magnetic core. |
| 2. Consists of two limbs | 2. Consists of three limbs. |
| 3. Core is surrounded by the windings | 3. Windings are surrounded by the core. |
| 4. Concentric cylindrical coils are used. | 4. Sandwich coils are used. |
| 5. Maintainence is very easy. | 5. Maintainence is difficult. |
| 6. Natural cooling is very efficient. | 6. Natural cooling does not exist. |
| 7. Low voltage applications | 7. High voltage applications. |

**4. What is the purpose of laminating the core in a transformers ?**
Ans. To reduce eddy current loss.

**5. Give the emf equation of a transformer and define each term**
Ans. 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.

**6. Does the transformer draw any current when secondary is open ? Why ?**
Ans. 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.

**7. Define voltage regulation of a transformer**
Ans. 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 load or full load voltage is termed as regulation .
% regulation down = (0V2-V2) x 100/0V2 % regulation up = (0V2-V2) x 100/V2

8**. Full load copper loss in a transformer is 1600 watts. What will be the loss at half load ?**
Ans. 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

**9. Define efficiency of a transformer .**
Ans. Transformer efficiency may be defined as the ratio between Output and Input.

Efficiency = Output/Input
Efficiency = η= Output / (Output + Losses) ..... (As Input = Output +Losses)
Efficiency = η= Output / (Output +Cupper Losses + Iron Losses)
Efficiency = η = (Input – Losses) / Input ..... (As Output = Input – Losses)
Efficiency = $\eta = (V_1 I_1 \cos\theta_1 - I_1^2 . R_1 - W_I) / V_1 I_1 \cos\theta_1$

**10. What is the condition for the maximum efficiency to be occurred in a transformer?**
Ans. Iron Loss = Copper Loss

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

12**. What are the typical uses of auto transformer ?**
Ans. (i)To give small boost to a distribution cable to correct for the voltage drop.
(ii)As induction motor starters.

13**. What are the applications of a step-up and step-down transformers ?**
Ans. Step-up transformers are used in generating stations. Normally the generated voltage will be either 11 kV . This voltage(11 KV) is stepped up to 110 kV or 220 kV or 400 kV and transmitted through transmission lines. (In short it may Be called as sending end).

Step-down transformers are used in receiving stations. The voltage are again stepped down to 11 kV or 22 kV and transmitted through feeders.(In short it may be called as receiving end). Further these 11 kV or 22kV are stepped down to 3 phase 400 V by means of a distribution transformer and made available at consumer premises. The transformers used at generating stations and receiving stations are called power transformers.

**14. How transformers are classified according to their construction ?**
Or Mention the difference between □CORE□ and □SHELL□ type transformers.
Or What are the two types of cores used ? Compare them.
Ans. Transformers are classified according to their construction as , (i)Core type (ii)Shell type. In □core□ type, the windings(primary and secondary)surround the core and in □shell□ type, the core surround the windings.

**15. Explain on the material used for core construction.**
Ans. The core is constructed of transformer sheet steel laminations assembled to provide a continuous magnetic path with a minimum of air gap included. The steel used is of high silicon content sometimes heat treated to produce a high permeability and a low hysteresis loss at the usual operating flux densities. the eddy current loss is minimized by laminating the core, the laminations being insulated from each other by light coat of core-plate vanish or by an oxide layer on the surface .the thickness of laminations varies from 0.35 mm for a frequency of 50 Hz and 0.5 mm for a frequency of 25 Hz.

**16. What is the angle by which no-load current will lag the ideal applied voltage?**

Ans. In an ideal transformer, there are no copper loss and no core loss, (i.e. loss free core). The no load current is only magnetizing current. Therefore the no-load current lags behind by an angle of 90˚. However the windings possess resistance and leakage reactance and therefore the no-load current lags the applied voltage slightly less than 90˚.

**17. What is the function of transformer oil in a transformer ?**

Ans. Nowadays instead of natural mineral oil, synthetic oils are used. They are non inflammable, under an electric arc do not decompose to produce inflammable gases. PYROCOLOR oil possess high dielectric strength. Hence it can be said that transformer oil provides , (i)good insulation and (ii)cooling .

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

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

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

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

**20. Give the materials used in machine manufacturing**

Ans. Three materials are used in machine manufacturing. (i)steel  to conduct magnetic flux (ii)copper  to conduct electric current (iii)Insulation

**21. What are the factors on which hysteresis loss depends ?**

Ans. The hysteresis loss depends on the magnetic flux density , frequency f and the volume of the material V.

**22. What is core loss? What is its significance in electric machines?**

Ans. When a magnetic material undergoes cyclic magnetization, two kinds of power losses occur on it  hysteresis and eddy current loss which together are known as core loss. It is important in determining heating, temperature rise, rating and efficiency of transformers, machines and other a.c run magnetic devices.

**23. What is eddy current loss?**

Ans. When a magnetic core carries a time varying flux voltages are induced in all possible paths enclosing flux. Result is the production of circulating current in core. These induced currents do no useful work are known as eddy current and have power loss known as eddy current loss.

**24. How are hysteresis and eddy current losses minimized?**

Ans. Hysteresis loss can be minimized by selecting materials for core such as silicon steel & steel alloys with low hysteresis coefficient and electrical resistivity. Eddy current losses are minimized by laminating the core and their moving parts.

**UNIT-5: (MEASURING INSTRUMENTS)**

**Q1. Classify instruments based on their functions.**
Ans. Indicating instruments, integrating instruments, Recording instruments.

**Q2. Give the applications of measurement systems.**
Ans. The instruments and measurement systems are sued for · Monitoring of processes and operations. · Control of processes and operations. · Experimental engineering analysis.

**Q3. Name the different essential torques in indicating instruments.**
Ans. Deflecting torque, Controlling torque, Damping torque.

**Q4. Name the types of instruments used for making voltmeter and ammeter.**
Ans. PMMC type, Moving iron type, Dynamometer type, Hot wire type, Electrostatic type, Induction type.

**Q5. State the advantages of PMMC instruments Uniform scale.**
Ans. No hysterisis loss, Very accurate, High effuiciency.

**Q6.. State the disadvantages of PMMC instruments.**
Ans. Cannot be used for ac m/s Some errors are caused by temperature variations.

**Q7. State the applications of PMMC instruments m/s of dc voltage and current**

Ans. Used in dc galvanometer.

**Q7. How the range of instrument can be extended in PMMC instruments**.
Ans. In ammeter by connecting a shunt resister In voltmeter by connecting a series resister

**Q8. State the advantages of Moving iron type instruments.**
Ans. The advantages of moving iron type instruments are:
Less expensive
Can be used for both DC and AC
Reasonably accurate.

**Q9. Define Instrument.**
Ans. Instrument is defined as a device for determining the value or magnitude of a quantity or variable.