# BE8255 Basic Electrical, Electronics and Measurement Engineering

## Unit – II

## Electrical Machines

## Part-A

**1. What is an electrical generator?**

**[OR]**

**Define electrical generator?**

An electrical generator is a machine which converts mechanical energy to electrical energy.

**2. What is the basic principle of a DC generator?**

**[OR]**

**Write the 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.

**3.What are the essential parts of a DC generator? [AU]**

**[OR]**

**List the parts of a DC generator.**

- Magnetic Frame or yoke
- Armature
- Poles, pole shoe, Interposes
- Commutator
- Brushes, Bearings and shaft.

**4.What is the purpose of yoke in a DC machine?**

**[OR]**

**What is the use of yoke in a DC machine/generator?**

**[OR]**

**List the use of yoke in a DC motor?**

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

- It carries the magnetic flux produced by the poles.

**5.What is the purpose of yoke in a DC machine?**

**[OR]**

**What is the use of interpoles in a DC machine?**

In modern DC machines commutating poles or interpoles are provided to improve commutation.

**6.The core of the armature in laminated in DC machines. Justify**

**[OR]**

**How do you reduce the eddy current losses?**

**[OR]**

**Why down need stamp mgs in armature core?**

The armature core is made of laminations, in order to reduce the eddy current losses, lamination is often known as stampings.

**7.How do you reduce the hysteresis loss in armature? [AU]**

**[OR]**

**The core of the armature is made up of silicon. Justify**

The hysteresis losses can be reduced by using low hysteresis steel containing a few percentages of silicon.

**8.What are the types of armature windings available in D.C machine?**

**[OR]**

**List the types of armature winding in DC machine.**

1. Lap winding
2. Wave winding

**9.What is the purpose of commutator in a DC generator?**

**[OR]**

**What is the use of commutator in a DC machine?**

- It converts the alternating emf into unidirectional or direct emf.

**10.What is the main use of brush in a DC generator?**

**[OR]**

**What is the purpose of brush in a DC machine?**

The brushes are mainly used to collect current from the commutator.

**11.Write down the emf equation of a DC generator. [AU]**

$$E_g = \frac{P\emptyset ZN}{60\,A} \text{ Volts}$$

Where,    $E_g$ – Induced emf in generator

P - Number of poles.

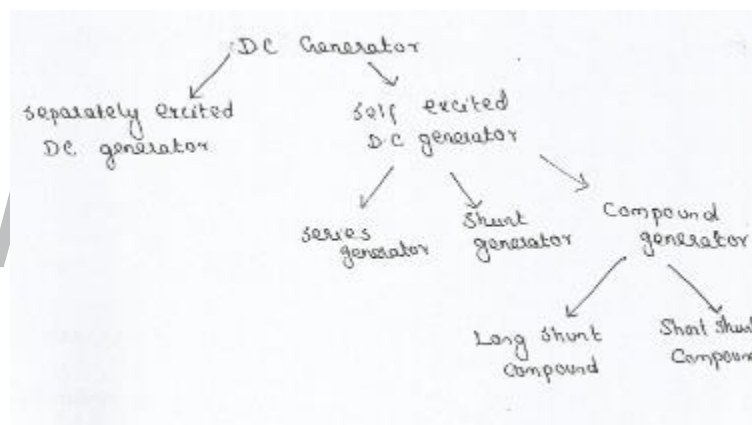Z – Total number of conductors in armature

N – Speed in rpm

A – Number of parallel path

$\emptyset - Flux\ per\ pole\ in\ wb$.

**12.What are the different types of DC generator?**

**[OR]**

 **List the types of DC generator**



**13.What is a separately excited DC generator?**

**[OR]**

 **What is a separately excited DC Motor?**

**[OR]**

 **What is a separately excited DC Machine?**

        If the field winding of a generator/Motor/Machine is excited by a separate dc supply, then the generator/Motor/Machine is called separately excited DC generator/ Motor Machine.

**14.What is a self-excited DC machine?**

**[OR]**

 **What is a self-excited DC generator?**

SSLC, HSE, DIPLOMA, B.E/B.TECH, M.E/M.TECH, MBA, MCA

*Notes*                                                    *Available @*
*Syllabus*
*Question Papers*                                     www.Binils.com
*Results and Many more…*

**[OR]**

If the field winding of a dc machine/ generator/ Motor is supplied from the armature of the DC machine/ generator/ motor itself then it is called a self-excited dc machine/ generator/ motor.

**15. What are the conditions for build-up of voltage in a shunt generator?**

**[OR]**

**What are the conditions to excite the d.c shunt generator?**

1. The residual magnetism should be present in the poles.
2. The field winding should be properly connected with armature.
3. Under no load condition, the shunt field resistance should be less than the critical resistance.
4. Under loaded condition, the shunt field resistance should be more than the critical resistance.

**16. Why the air gap is made as small as possible between the armature and the poles in a dc machine?**

**[OR]**

**What is the use of pole shoes in DC machine?**

The air gap is made as small as possible between the armature and the poles in a DC machine in order to reduce the reluctance of the magnetic path.

**17. What is an electric motor?**

**[OR]**

**Define DC motor.**

Electric motor/ DC Motor converts electrical energy into mechanical energy.

**18. What is the basic principle of operation of a DC motor?**

**[OR]**

**Write the principle of DC Motor.**

The basic principle of operation of a dc motor is that, a current carrying conductor placed in a magnetic field experiences a force tending to move it.

**19. Define Back Emf.**

**[OR]**

**What is Back Emf. [OR] What is counter emf.**

When a motor rotates, the conductors housed in the armature also rotate and out the magnetic lines of force. So, an emf is induced in the armature conductors and this induced

SSLC, HSE, DIPLOMA, B.E/B.TECH, M.E/M.TECH, MBA, MCA

*Notes*                                    *Available @*
*Syllabus*
*Question Papers*                          [www.Binils.com](www.Binils.com)
*Results and Many more…*

emf opposes the supply voltage as pen Lenz's Law. This induced emf is called back emf (or) counter emf.

$$E_b = \frac{\emptyset ZN}{60} \ x \ \frac{P}{A} \ volts$$

**20.What is a DC series motor?**

**[OR]**

**What is a DC series generator?**

In a DC series motor/ generator, field winding is connected in series with the armature. The field winding should have less number of turns of thick wire.

**21.What is a DC shunt motor?**

**[OR]**

**What is a DC shunt generator?**

In a DC shunt motor, the field winding is connected across the armature. The shunt field winding has more number of turns with less cross sectional area.

**22.Why series motor cannot be started without any load? [AU]**

**[OR]**

**What are the causes of series motor cannot be started without any load?**

- In DC series motor, flux is directly proportional to armature current i.e., $\emptyset \propto I_s$
- Under no load condition the armature current is very low and flux also be less. By using the formula $N \propto \frac{1}{\emptyset}$, here $\emptyset$ 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.

**23.Write down the torque equation of a DC motor.**

**[OR]**

**Derive the torque equation of a DC motor.**

$$T_a = 0.159 \ \emptyset \ I_a \ \frac{PZ}{A} \ N - m$$

Where,        $T_a$ – Torque in N-m

$\emptyset - Flux \ per \ pole \ in \ wb.$

$I_a$ – Armature current in A.

P – Number of poles

Z – Total number of armature conductors.

A – Number of parallel paths.

**24. What is the relation between torque, flux and armature current?**

**[OR]**

**Write the torque equation.**

Torque is directly proportional to the product of the armature current and flux.

$$T \propto \emptyset I_a$$

**25. What is stepper motor? [AU]**

**[OR]**

**Define stepper motor?**

A stepper motor is a digital actuator whose input is in the form of programmed energization of the stator windings and whose output is in the form of discrete angular rotation.

**26. Define the term step angle. [AU]**

**[OR]**

**What is step angle.**

Step angle is defined as the angle through which the stepper motor shaft rotate for each command pulse. It is denoted as $\beta$.

$$\beta = \frac{N_s \sim N_r}{N_s . N_r} \ x \ 360$$

$$\beta = \frac{360}{mN_r}$$

Where,       $N_s$ – Number of stator poles or stator teeth.

               $N_r$ – Number of rotor poles or rotor teeth.

               m – Number of stator phases.

**27. What is meant by a transformer?**

**[OR]**

**Define Transformer.**

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

**28. What is meant by step up transformer?**

**[OR]**

**Define transformer.**

In a step up transformer the number of turns in the primary is than that in secondary ($N_1 < N_2$) step up transformer is used to step up the voltage.

## 29. What is meant by step-down transformer?

### [OR]

### Define step down transformer.

In a step down transformer, the number of turns in the primary is greater than that in secondary ( $N_1 > N_2$). It is used to step down high voltage to low voltage.

## 30. What are the important parts of a transformer?

### [OR]

### List the main parts of a transformer.

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

## 31. Define transformation ratio?

### [OR]

### What is transformation ratio.

The ratio of secondary induced emf to primary induced emf is called voltage transformation ratio denoted by K.

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

## 32. State some application of stepper motor.

### [OR]

### What are the application of stepper motor?

1. Floppy disk drives
2. Guartz watches
3. Camera shutter operation
4. Dot matrix and line printers
5. Machine tool applications.
6. Robotics

## 33. What are the advantages and disadvantages of VR stepper motor?

### [OR]

### What are the merits and demerits of variable Reluctance stepper motor?

## Advantages:

1. Low rotor inertia.
2. High torque to inertia ratio.
3. Light weight.
4. Capable of high stepping rate.
5. Ability to free wheel.

## Disadvantages:

1. Normally available 1m $3.6^0$ to $30^0$ step angles.
2. **No detent torque available with windings de-energized.**

**34. What is all-day efficiency of a Transformer? [AU]**

**[OR]**

**Define all-day efficiency of a Transformer?**

All day efficiency is the ratio of energy [in (KWH)] delivered in 24-hour period to the energy [in (KWH)] input for the same interval of time.

$$all\ day = \frac{Output\ in\ KWH}{Input\ in\ KWh}\ (for\ 24\ hours)$$