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NETTUR TECHNICAL TRAINING FOUNDATION

DIPLOMA IN ELECTRICAL & ELECTRONICS-CP23

III SEMESTER REGULAR & SUPPLEMENTARY EXAMINATION-JAN 2023

Subject: Electrical Machines-1 **Total Time: 2 Hr.**
Subject Code: CP23303T **Total Marks: 50 Marks**

ANSWER KEY

1.0 ANSWER ANY EIGHT OF THE FOLLOWING **2*8=16**

1.1What do you mean by the term Generator?

1.2 Name the different types of self-excited generators.

Series wound, shunt wound and compound wound are names of self-excited generators.

1.3 Write the formula of speed control of dc motor.

1.4 What is the purpose of commutator in DC generator?

Commutator is simply a mechanical rectifier

Commutation in DC generator is the process in which generated alternating current in the armature winding of a dc machine is converted into direct current after going through the commutator and the stationary brushes.Again in DC Motor, the input DC is to be converted in alternating form in armature and that is also done through commutation. This transformation of current from the rotating armature of a DC machine to the stationary brushes needs to maintain continuously moving contact between the commutator segments and the brushes.

1.5 Write down the EMF equation of a DC Generator

So

$$E = \frac{\phi P N Z}{60 A} \quad \text{e.m.f. equation}$$

$$E = \frac{\phi N Z}{60} \quad \text{for lap type as } A = P$$

$$E = \frac{\phi P N Z}{120} \quad \text{for wave type as } A = 2$$

1.6 Name the different types of speed control methods in DC motor.

1.7 What do you understand by efficiency of DC machine?

This test is an indirect method of testing DC shunt and compound wound machines which have constant flux.In this test,the efficiency of dc machine is pre-determined. In this method,no-load losses are measured separately and efficiency is determined.

1.8 Write the applications of DC generators

When a current carrying conductor is placed in a magnetic field,it experiences a torque and has a tendency to move.This is known as motoring action.When magnetic field and electric field interact they produce mechanical force.

1.9 In which condition regenerative braking is used?

In practice, regenerative braking is used in the condition when load has overhauling characteristics.

1.10What do you understand by lap and wave winding?

Refer master file

2.0 ANSWER ANY SIX OF THE FOLLOWING 3*6=18

2.1 What do you mean by static and dynamic emf?

The emf induced when conductor is stationary and field rotates is called statically induced. When conductor rotates and field stationary then emf induced is called dynamically induced.

2.2 Explain field control method of DC shunt motor.

This method is used when speeds below the the no-load speed are required.As the supply voltage is constant, the voltage across armature is varied by inserting rheostat in series with armature.It is also known as controller resistance.As this resistance is increased, p.d across armature is decreased, there by decreasing the speed.

2.3 Explain the various types of losses in DC motor.

(A) Copper Loss:- Armarure cu loss,Field cu loss and Loss due to Brush Contact Resistance. (B) Iron Loss:- Hysteresis Loss and Eddy Current Loss.(C) Mechanical Loss:- Friction Loss and Wintage Loss.

2.4 Write any four differences between 3 point and 4 point starter.

Refer master file

2.5 Define Torque, Armature Torque and Shaft Torque of a motor.

Types of DC motor:-Shunt wound motor,Series wound motor and compound wound motor.Torque vs. armature current (Ta-Ia)

Before magnetic saturation of the field, flux ϕ is directly proportional to Ia. Hence, before magnetic saturation Ta α Ia2. Therefore, the Ta-Ia curve is parabola for smaller values of Ia.

After magnetic saturation of the field poles, flux ϕ is independent of armature current Ia. Therefore, the torque varies proportionally to Ia only, T $\propto$ Ia.Therefore, after magnetic saturation, Ta-Ia curve becomes a straight line..

Speed vs. armature current (N-Ia)

We know the relation, N $\propto$ Eb/ϕ

For small load current (and hence for small armature current) change in back emf Eb is small and it may be neglected. Hence, for small currents speed is inversely proportional to ϕ. As we know, flux is directly proportional to Ia, speed is inversely proportional to Ia.

Speed vs. torque (N-Ta)

This characteristic is also called as mechanical characteristic. From the above two characteristics of DC series motor, it can be found that when speed is high, torque is low and vice versa

2.6 Write down types of DC motor and explain series motor characteristics

Following are the types of characteristic of DC motors:-

(a) Torque and Armature current(Ta/Ia) characteristic. It is also known as electrical characteristic.

(b) Speed and Armature Current (N/Ia) characteristic &

(c) Speed and Armature Torque(N/Ta) characteristic. It is also known as mechanical characteristic.

2.7 Explain the various characteristic of DC generators.

There are three types of characteristic-

(i) Open circuit characteristic

(ii) Internal characteristic &

(iii) External characteristic.

2.8 Explain the working principle of DC generator with neat diagram.

According to Faraday's laws of electromagnetic induction, whenever a conductor is placed in a varying magnetic field (OR a conductor is moved in a magnetic field), an emf (electromotive force) gets induced in the conductor. The magnitude of induced emf can be calculated from the emf equation of dc generator. If the conductor is provided with a closed path, the induced current will circulate within the path. In a DC generator, field coils produce an electromagnetic field and the armature conductors are rotated into the field. Thus, an electromagnetically induced emf is generated in the armature conductors. The direction of induced current is given by Fleming's right hand rule.

3.0 ANSWER ANY FOUR OF THE FOLLOWING 4*4=16

3.1 Explain the commutation process of DC generator with diagram.

The ratio of applied voltage and measured current through armature winding is called armature resistance.A voltage drop is the reduction in voltage in an electrical circuit that occurs when current passes through the wire.Following are the causes of excess voltage drop:- (a) Too much resistance in the wire, (b) poor splicing,(c) loose or intermittent connection,or (d) corroded connection in the circuit.

3.2 Explain the construction of DC motor with neat diagram.

The voltage V applied across the motor armature has to (i) overcome the back emf Eb and (ii) supply the armature ohmic drop IaRa. Therefore,V=Eb+IaRa.This is known as voltage equation of a motor.

3.3 Explain the different braking methods in DC motors.

Refer master file

3.4 Explain armature control method of shunt motor.

This method is used when speeds below the the no-load speed are required.As the supply voltage is constant, the voltage across armature is varied by inserting rheostat in series with armature.It is also known as controller resistance.As this resistance is increased, p.d across armature is decreased, there by decreasing the speed.

3.5 With neat diagram briefly explain working of 3 point starter.

Why 3-point starter necessary is to limit starting current.

3.6 Define Armature Reaction. What are the ill effects of it?

By increasing length of air gap, the armature reaction effect is reduced, The effect of armature reaction can be neutralized by use of compensating winding, The armature reaction causes shifting the magnetic neutral axis.