UNIT-IV

1.What are the types of starters?

Stator rheostat, Autotransformer Star to Delta starter and rotor resistance starter.

2. List out the methods of speed control of cage type 3-phase induction motor?

a) By changing supply frequency

b) By changing the number of poles

c) By operating two motors in cascade

3.Mention different types of speed control of slip ring induction motor?

e) By changing supply frequency

f) By changing the number of stator poles g) By rotor rheostat control

h) By operating two motors in cascade

4.State the advantages of capacitor start run motor over capacitor start motor. Running torque is more; Power factor during running is more.

5.What is Universal motor?

A Universal motor is defined as a motor, which may be operated either on direct current or single-phase ac supply.

6.state some application of universal motor.

Used for sewing machines, table fans, Vaccum cleaners, hair driers, blowers etc

7.Explain why single-phase induction motor is not self-starting one.

When the motor is fed from a single phase supply its stator winding produces an alternating or pulsating flux, which develops no torque which is explained in Double revolving field theory..

8.What type of motor is used for ceiling fan?

Capacitor start and capacitor run single-phase motor is used for ceiling fans.

9.what is the type of induction motor used in wet grinders?

Capacitor start capacitor run single-phase induction motor.

10.what kind of motor is used in mixie?

Single-phase ac series motor is used in mixie.

11.what is the application of shaded pole induction motor?

Because of its small starting torque, it is generally used for small fans, toys, instruments, hair driers, ventilators, electric clock etc.

12. In which direction does a shaded pole motor run?

The rotor starts rotation in the direction from unshaded part to the shaded part.

13.why single-phase induction motor has low power factor?

The current through the running winding lags behind the supply voltage by a very large angle. Therefore power factor is very low.

14.Diffrentiate between “capacitor start “and “capacitor start capacitor run “induction motor?

In capacitor start motor, capacitor is connected in series with the starting winding. But it will be disconnected fro m the supply, when the motor picks up its speed. But in capacitor start

capacitor run motor the above starting winding and capacitor are not disconnected, but always connected in the supply .so it has high starting and running torque.

15. State the application of an induction generator?

v Used in windmill for generating electric power.

v Used in regenerative breaking places like traction.

16.What do you mean by residual EMF in a generator.

The EMF induced in the armature conductor only due to the residual flux in the field poles is known as residual EMF

17.State the effect of rotor resistance on starting torque?

Starting torque increases with increase in value of rotor resistance.

18.How can varying supply frequency control speed?

We know that

$N_s = \frac{120f}{}$

P

From the equation it is clear that by varying frequency speed can be varied it is vary rarely.

19.How is speed control achieved by changing the number of stator poles?

Here change in stator poles is achieved by having two or more independent stator windings in the same slot. Each winding gives different number of poles and different speeds. At a time only one winding is used and other is closed.

20.What are the main disadvantages of rotor rheostatic control?

Ø The speed can be decreased by increasing the rotor resistance, but increases I2R loss and hence decreases efficiency.

Ø Speed depends on load also and so used for small periods only.

21.What are the methods of speed control preferred for large motors?

Ø Kramer system

Ø Scherbius system

22.What is an induction regulator?

An induction regulator is used to obtain the constant voltage at the feeder end. Varying the range between the magnetic axes of the primary and secondary windings controls the voltage; it

may be a single phase. Rotor is moved usually by a maximum of 180 degree.

23.Define-Slip frequency.

The relation motion of the stator flux and the rotor conductors induces the voltage of frequency Sf called slip frequency.

24.Define- Asynchronous torque.

When stator and rotor fields are stationary with respect to each other, a steady torque is produced and rotation is maintained. Such a torque existing at any mechanical speed other than

synchronous speed is called as an asynchronous torque.

25.What is the main use of squirrel cage winding in synchronous motor starting?

When a squirrel cage winding called the amortissuer or damper winding is inserted in the rotor pole faces, the rotor comes up to the synchronous speed by induction motor action with the field winding unexcited.

26.What is breakdown torque?

From the torque verses slip charactertics, we can infer that as the torque increases, slip increases upto a maximum torque developed is called a breakdown torque.

27.What is the function of rotary converter? Where it is used?

Rotary converter converts low slip ac power. It is used in Kramer system, which is for the speed control of three-phase induction motor.

28.What are the advantages of Kramer system of speed control?

Any speed with in the working range can be obtained

When rotary converter is overexcited, it will take leading current, compensates with the lagging current drawn by the motor, thus improving power factor.

29.Write the expression for concatenated speed of the set.

Cumulative mode (Nsc) = $\frac{120f}{Pa + Pb}$

Differential mode (Nsc) = $\frac{120f}{Pa - Pb}$

Pa – no of poles of motor A Pb – no of poles of motor B

UNIT - 4

1) with neat diagrams, explain working of any two types of starter used for 3ϕ squirrel cage IM.

1) DOL starter 2) primary resistance starter
3) Auto transformer starter. 4) star-delta starter
5) Rotor resistance starter

(Diagram, explanation, operation)

1) DOL → Direct on line starter

A motor of small capacity & which gathers normal speed quickly can be started with this starter. A small capacity motor (below 2kW) draws only small amount of current.

No voltage protection
over load protection

$$\frac{T_{st}}{T_{fl}} = \left(\frac{I_{sc}}{I_{fl}}\right)^2 s_f$$

2) primary resistor (or) Reactor starter:-

A variable resistor is connected in series with the supply terminals of the motor. The purpose of this resistance is to reduce the supply voltage.

$$\frac{T_{st}}{T_{fl}} = x^2 \left(\frac{I_{sc}}{I_{fl}}\right)^2 s_f$$

3) Auto transformer starter

This starter is used to give a reduced voltage to the 3φ IM.

(diagram, explanation)

$$I_{st} = x I_{sc}$$

$$T = \frac{3 I_2^2 R_2}{s}$$

$$T_{fl} = \frac{3 I_{fl}^2 R_2}{s_f}$$

$$\frac{T_{st}}{T_{fl}} = \left(\frac{x I_{sc}}{I_{fl}}\right)^2 s_f$$

$$= x^2 \left(\frac{I_{sc}}{I_{fl}}\right)^2 s_f$$

4) Star - Delta starter :-

This method is used in motors which are means to run normally with a delta connected stator winding.

(diagram, explanation)

$$I_{st} = \frac{1}{\sqrt{3}} I_{sc}$$

$$\frac{T_{st}}{T_{fl}} = \frac{1}{3}\left(\frac{I_{sc}}{I_{fl}}\right)^2 s_f$$

5) Rotor Resistance starter

external or starting resistance is connected in the rotor terminals.

(diagram & explanation)

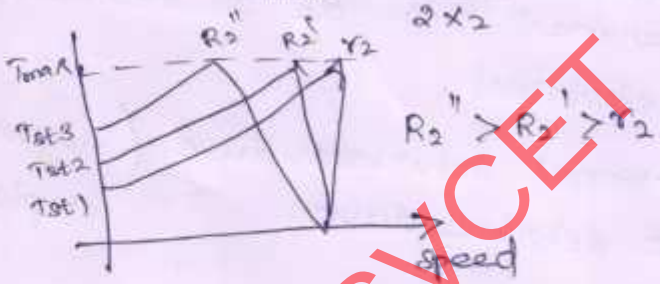
2) Explain the speed control of 3ϕ wound rotor IM by rotor resistance method.

External resistance can be added in the rotor circuit. (diagram, explanation)

$$T \propto \frac{s E_2^2 R_2}{R_2^2 + (s X_2)^2}$$

$$s_m = \frac{R_2}{X_2}, \quad s_m \propto R_2$$

$$T_{max} \propto \frac{E_2^2}{2 X_2}$$



$R_2'' > R_2' > R_2$

$$T_{st} \propto \frac{E_2^2 R_2}{R_2^2 + X_2^2}$$

3) Explain the slip power recovery scheme.

slip power can be returned to the supply source & can be used to supply an additional motor which is mechanically coupled to the main motor. This type of drive is known as slip power recovery system & improves the overall efficiency of the system.

- Kramer system
- Scherbius system

(diagram, explanation)

- Conventional method
- Static method

Kramer system

It is applicable only for sub-syn. speed operation. The classification of Kramer system is

a) conventional Kramer system. (diagram, Explanation)

b) static Kramer system.

Scherbius system :-

Scherbius system is similar to Kramer system but only difference is that, in the Kramer s/m the feedback is mechanical & in the scherbius system the return power is electrical.

→ conventional scherbius drive (diagram, explanation)

→ static scherbius drive