UNIT I
SYNCHRONOUS GENERATOR
PART A

1. Two reaction theories are applied only to salient pole machines. State the reason ***(Nov 2014)***

In cylindrical rotor machine air gap is uniform and therefore, its reactance remains the same, irrespective of the spatial position of rotor. But in case of salient pole machines, the air gap is not uniform and its reactance varies with the rotor position therefore the mmf of the armature is divided into two components (i) direct axis component (ii) quadrature axis component. These facts form the basis of the two reaction theory applied to salient pole machines.

2. What is meant by armature reaction in alternator?

The effect of armature flux (stator flux) on main flux (rotor flux) under loaded condition is known as armature reaction.The armature flux reacts with the main flux. Due to this reaction the resultant flux in the air gap becomes either less or more than the field flux.

3. Define the term voltage regulation of alternator.

The total change in terminal voltage of an alternator from no load to full load at constant speed and field excitation is termed as voltage regulation.

4. State the cause for voltage drop in rotor.

Due to resistance of the winding.
Due to leakage reactance.
Due to armature reaction.

5. What are the conditions for parallel operation of an alternator?

The following conditions must be fulfilled before an incoming alternator can be put in parallel with the bus bars.
1) The terminal voltage of the incoming alternator must be same as that of bus bar voltage.
1) The frequency of incoming alternator must be same as that of bus bars.
2) The phase of the incoming machine voltage must be same as that of bus bar voltage relative to the load.
3) The phase sequence of the voltage of incoming alternator must be same as that of bus-bar voltage.

6. Why almost all large size Synchronous machines are constructed with rotating field system type?

1) Better insulation. 3) Lesser number of slip rings.
2) Ease of current collection. 4) Lesser rotor weight.

7. What is synchronizing power of Alternator?

Power supplied by already existing Alternator is called the synchronizing power and is given by the expression.

$P_s = E_1 I_s \cos\Phi_1$

8. Mention the various methods to determine voltage regulation.
1) Synchronous Impedance Method (EMF method) 3)ZPF method
2) MMF method 4)ASA method

9. Why a 3-phase synchronous motor will always run at synchronous speed?
Because of the magnetic coupling between the stator poles and rotor poles the motor runs exactly at synchronous speed.

10. What are the types of synchronous machines with respect to its rotor construction?
The types of synchronous machines are:
i. Cylindrical rotor type
ii. Salient pole rotor type

11. What are the essential features of synchronous machine?
i. The rotor speed is synchronous with stator rotating field.
ii. Varying its field current can easily vary the speed.
iii. It is used for constant speed operation.

12. Mention the methods of starting of 3-phase synchronous motor.
a. A D.C motor coupled to the synchronous motor shaft.
b. A small induction motor coupled to its shaft.(pony method)
c. Using damper windings –started as a squirrel cage induction motor.

13. Write down the equation for frequency of emf induced in an alternator.
F = PN / 120 Hertz
Where P = No. of poles
N = Speed in rpm.

14. What are the advantages of salient pole type of construction used for synchronous machines?

The pole faces are so shaped radial air gap length increases from the pole center to the pole tips so that flux distribution in the air gap is sinusoidal in shape which will help to generate sinusoidal emf.

Due the variable reluctance, the machine develops additional reluctance power, which is independent of excitation.

They allow better ventilation.

15. What is the relation between electrical degree and mechanical degree?
Electrical degree θ_e and mechanical degree are related to one another by the number of poles P, the electrical machine has, as given by the following equation.
$\theta_e = (P/2)\ \theta_m$

16. Why short-pitch winding is preferred over full pitch winding?
Advantages: -
- Waveform of the emf can be approximately made to a sine wave and distorting harmonics can be reduced or totally eliminated.
- Conductor material, copper is saved in the back and front-end connections due to less coil span.

- Fractional slot winding with fractional number of slots/phase can be used which in turn reduces the tooth ripples.
- Mechanical strength of the coil is increased.

17. Define distribution factor. [Nov 2006]

The factor by which there is a reduction in the emf due to distribution of coils is called distribution factor.

K_d = Sin (mβ/2)

msin(β/2)

Where

m - number of slots/pole/phase

β - angle between adjacent slots in electrical degree

n- order of harmonics.

18. Define the term pitch factor. [May-2005, Nov-2009]

The pitch or coil span factor is defined as the ratio of actual coil voltage to the coil voltage for a full-pitch coil.

Hence, pitch factor, K_P = Vector sum of induced emf per coil/ Arithmetic sum of induced emf per coil.

K_p= cosα / 2

Where α = Angle of short pitch

19. Define winding factor.

The winding factor K_w is defined as the ratio of phasor addition of emf induced in all the coils belonging to each phase winding of their arithmetic addition.

20.Why are alternators rated in kVA and not in kW?

The continuous power rating of any machine is generally defined as the power the machine or apparatus can deliver for a continuous period so that the losses incurred in the machine gives rise to a steady temperature rise not exceeding the limit prescribed by the insulation class.

Apart from the constant loss the variable loss incurred in alternators is the copper loss, occurring in the 3-phase winding, which depends on I_2R, the square of the current delivered by the generator. is directly related to apparent power delivered by the generator,Thus the alternators have only their apparent power in VA/kVA/MVA as their power rating.

21. State the causes of voltage drop in an alternator when loaded? [Nov-2012]

- Voltage variation due to the resistance of the winding R.
- Voltage variation due to the leakage reactance of the winding X_1.
- Voltage variation due to the armature reaction.

22. What is meant by armature reaction in alternators? [Nov-2015, 2013, 2012]

The interaction between flux set up by the current carrying armature conductors and the main field flux is defined as the armature reaction.

23. What do you mean by synchronous reactance?

It is the sum of the leakage reactance X_1 and armature reactance X_a

$X_s = X_1 + X_a$

24. Define the term voltage regulation of alternator.
[May-2017, 2016, 2011, Nov-2015, 2013]
It is defined as the change in terminal voltage from no load-to-load condition expressed as a function or terminal voltage at load condition, the speed and excitation conditions remaining same.
% Regulation = (E_o-V)/V x 100

25. What do you mean by single layer and double layer winding? [May-2017, Nov-2011]
If a slot consists of only one coil side, it means a coil occupies two complete slots, then the winding is said to be single layer winding. Slot contains even number of coil sides in two layer. The number of coils is equal to the number of slots in the stator and armature, then the winding is said to be double layer winding.

26. Distinguish between full pitch coil and short pitch coil. [Nov-2016]
If the coil span is equal to the pole pitch, then the armature winding is said to be full pitch coil. If the coil span is less than the pole pitch, then the winding is referred as short pitch coil.

27. What are the conditions of parallel operation of alternators?
[Nov-2016, 2010, 2009, May-2013]
There are some conditions to be satisfied for parallel operation of the alternator which are as follows.

The process of connecting two alternators or an alternator and an infinite bus bar system in parallel is known as synchronizing.

Running machine is the machine which carries the load.

Incoming machine is the alternator or machine which has to be connected in parallel with the system.

The phase sequence of the incoming machine voltage and the bus bar voltage should be identical.

The RMS line voltage (terminal voltage) of the bus bar or already running machine and the incoming machine should be the same.

The phase angle of the two systems should be equal.

28. How can you distinguish between the two types of large synchronous generator from their appearance? [May-2016, 2014]
The two types of large synchronous generator are
i. Non- salient pole rotor type
ii. Salient pole rotor type
Non-salient pole rotors are cylindrical in shape having parallel slots on it to place rotor windings. They are smaller in diameter but having longer axial length.
In salient pole type of rotor consist of large number of projected poles (salient poles) mounted on a magnetic wheel. Salient pole rotors have large diameter and shorter axial length.

29. Why the stator core is laminated? [May-2011]
The stator core is laminated to avoid short circuit between iron pieces and to reduce the hysteresis and eddy current losses in the stator core of the machine.

30. What are the various functions of damper winding provided with alternator? [Nov-2011]

It is used to prevent hunting. It is used to damp out the oscillation when generator starts hunting.

It is used to suppress the negative sequence field.

31. Why is the field system of an alternator made as a rotor? [May-2012]

Relatively small amount of power about 2% required for field system.

Air gap dimension is more available in the stator part of the machine for providing more insulation to the system of conductors.

Easy to provide cooling arrangement for a stationary system

32. What is synchronizing power of an alternator? [May-2012]

The power supplied by machine 1 = power received by machine 2 + copper losses.

$$\mathbf{E_1 I_S \cos\Phi_1 = E_2 I_2 \cos\Phi_2 + \text{copper losses}}$$

The power supplied by machine 1 is called synchronizing power and is given by

$P_S = \alpha E_2 / X_S$

33. What is meant by alternator on Infinite bus-bars? [May-2014]

Many alternators and loads are connected into a grid and all the alternators in grid are having output voltage and frequency. It is said to be alternator is connected on infinite bus-bar.

UNIT-II
SYNCHRONOUS MOTOR
PART-A

1. Name any two important characteristics of a 3 phase synchronous motor not found in 3 phase induction motor. [May 2014]

a) The rotor speed is synchronous with stator rotating field.
b) The power factor can be easily varied by its field current.
c) It is used for constant speed operation.

2. Give any two methods of starting a synchronous motor. [May-2014]

Starting with the help of damper winding.

Starting with help of separate small induction motor.

Starting by using an ac motor coupled to the synchronous motor.

3. What is meant by hunting of a synchronous motor? [Nov-2013, May-2012]

When a synchronous motor is used for driving a fluctuating load, the rotor starts oscillating about its new position of equilibrium corresponding to the new load. This is called hunting.

4. What are the uses of damper winding in synchronous motor? [Nov- 2013]

To prevent hunting, dampers or damping grids are employed. Damper windings or short circuited copper loss are embedded in the faces of the field poles of the motor.

5. What is meant by 'Torque Angle '? [May- 2011]
The angular displacement between the rotor and stator pole is called torque angle or load angle or coupling angle (δ).

6. What is meant by hunting in synchronous motor? [May-2011, Nov-2013, 2012]
When a synchronous motor is used for driving a fluctuation load, the rotor starts oscillating about its new position equilibrium corresponding to the new load called hunting or phase swinging.

7. What are the main parts of synchronous motor? [May-2010]
a) Stator
b) Rotor

8. Mention the need for starters in synchronous motors. [May-2010]
When a 3 phase supply is given to the stator with rotor excited , no steady staring torque will be developed instead a sinusoidally time varying torque is developed .The average value of which is zero and hence synchronous motor need starters .

9. List the inherent disadvantages of synchronous motor. [Nov-2010]
a) High cost
b) Necessity of a dc excitation source
c) Greater initial cost
d) High maintenance cost

10. When is a synchronous motor said to receive 100 % excitation? [Nov-2010]
When $E_b = V$, synchronous motor receives 100% excitation.

11. Define pull-out torque in synchronous motor. [May-2009]
The maximum torque at which the motor can be developing without pulling out to step or synchronism is called pull Out Torque.

12. What s synchronous condenser? [Nov-2012, May-2017]
An over-excited synchronous motor is called synchronous capacitor, because like a capacitor, it takes a leading current.

13. Why synchronous motor is not self starting motor? [May-2012, 2008]
Rotor is magnetically locked into position with stator i.e., the rotor poles are engaged with the stator poles and the both run synchronously in the same direction. It is because of this interlocking of stator and rotor poles that the motor has either to run synchronously of not at all.

14. What are the causes of hunting? [Nov-2008]
1) Varying load on synchronous motor produce hunting.
2) When the supply frequency is pulsating (as in the case of generator driven by reciprocating internal combustion engines).

15. Write down the application of synchronous motor. [Nov-2007]
a) Machines tools, Motor generator set, Blowers, Centrifugal pumps, Vacuum pumps, Pulp grinders.

16. Why a synchronous motor is a constant speed motor? [May-2012]
Due to the interlocking between the stator and rotor poles, the motor runs only at one speed, i.e., synchronous speed. Therefore the synchronous motor is a constant speed motor.

17. What is a Synchronous Capacitor? [Nov-2011]
When the synchronous motor operates on no-load, it acts as a static capacitor and hence under this condition motor is called as synchronous condenser or synchronous capacitor. It is mainly used for power factor correction.

18. What are V Curves? [Nov- 2013, 2011, 2009, May-2017]
The V-curves show the relation that exists between the armature current and field current for different constant power input.

19. What are the starting methods of synchronous motor? [May-2013]
The various methods to start the synchronous motor are,
Using pony motors.
Using damper winding.
As a slip ring induction motor.
Using small dc machine coupled to it.

20. What is meant by hunting? [Nov-2015]
When a synchronous motor is used to drive a fluctuating load, the rotor starts oscillating about its new position of equilibrium corresponding to the new load. This causes hunting.

UNIT-III
THREE PHASE INDUCTION MOTOR
PART-A

1. List the main parts of three phase induction motor? [Nov-2009]
1) Stator 2) Rotor

2. How can the direction of rotation of three phase induction motor can be reversed?
The direction can be changed by interchanged by interchanging any two terminals of the input supply. The direction of the synchronous rotating field reverses and hence the direction of rotor reverses.

3. At what value of slip does the torque developed is maximum? [May-2010]
The torque at which the motor produces at slip $S=S_m$ is called maximum torque. S_m is slip at which maximum torque occurs and alsosaid to be breakdown torque or pull out torque.

4.Why the stator core of induction motor made of silicon content steel stamping?
i) Since induction motor is subject to alternate changes in polarity of the magnetic field, the hysteresis and eddy current losses takes place.
ii)To reduce 3-7% of silicon is added to high grade steel to reduce the latter.

5. Under what condition, the slip in an induction motor is a) Negative b) Greater than one.

a) Slip is negative=generator condition.

b)Slip is greater than one=braking operating condition.

6. What are the two fundamentals characteristics of a rotating magnetic field? [Nov-2010]

i) The resultant of 3 alternating flows separated from each other by 120_0 has constant amplitude of 1.5.

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

7. Why the rotor slots are slightly skewed in squirrel cage IM?

i) To make the motor run quickly by reducing the magnetic form.

ii) To reduce the locking tendency of the rotor.

8. Why are the rotor slots of a 3phase induction motor skewed?

Rotor slots are skewed in the three phase induction motor are;

i) To make the motor run quietly by reducing magnetic form.

ii) To reduce locking tendency of rotor.

9. Define slip of induction motor?

10. It is the difference between the synchronous speed (N_s) and the actual speed (N) of the rotor. %Slip(S) = $(N_s - N/N_{s)} \times 100$

Where, slip speed =$N_s - N$.

10. What is an induction generator? [May-2012]

If the rotor of the induction motor is to be driven by another machine at above the synchronous speed ,the induction motor runs as generator and this arrangement is called induction generator.

11. What are the advantages of double squirrel cage induction motor?

i) Good starting torque.

ii) Excellent running performance.

iii) Maintains high efficiency.

iv) Good speed regulation under normal operating conditions.

12. **State the conditions of maximum torque developed in three phase induction motor?**

The conditions for maximum torque $T_{max} = (KE_{22}/2X_2)$ is obtained when slip $s=(R_2/X_2)$ which is the ratio of standstill per phase values of resistance and reactance of rotor.

13. How do change in supply voltage and frequency affect the performance of a 3 phase induction motor? [May-2014, Nov-2015]

i) Torque at any speed is proportional to the square of the supply voltage.($T \alpha v_2$)

ii) If input voltage decreases by 10% the torque decreases by 20% so changing the supply voltage, affects the starting torque , maximum torque and torque under running conditions.

iii) The stator speed $N_{S=}(120f / P)$, if we change frequency the stator speed also changes correspondingly.

14. The starting torque of a squirrel cage induction motor cannot be altered when the altered when the applied voltage is constant. Why?

The stator supply voltage (V) is constant so that flux per pole ϕ set up by the stator is also fixed. This in turns that E_2 induced in the rotor will be constant.

15. What are the merits and demerits of double squirrel cage induction motor?

Merits:

High starting torque.
Low starting current.
Improved starting torque.

Demerits:

Maximum torque developed.

16. Define the term crawling.

The tendency of the motor to run stably at speed as low as one seventh of its synchronous speed with a low pitched howling sound is called crawling

17. Define the term cogging.

Sometimes, the rotor of a squirrel cage induction motor refuses to start at all, particularly if the supply voltage is low. This happens especially when number of rotor teeth is equal to number of stator teeth, because of magnetic locking between the stator teeth and the rotor teeth. When the rotor teeth and stator teeth face each other, the reluctance of the magnetic path is minimum, that is why the rotor tends to remain fixed. This phenomenon is called cogging or magnetic locking of induction motor.

18. State the important distinguish factor of induction generator and alternator.

Induction generator does not require DC excitation.
It does not hunt or drop out of synchronous

19. What is the effect of change in supply voltage on starting torque of induction motor?

- There will be large reduction in starting torque because starting torque at any speed is proportional to the square of the supply voltage.($T \alpha v_2$).
- By applying half the input voltage, supply frequency remaining unchanged, the starting torque reduced to one-fourth of the rated value.

20. Draw the torque slip characteristics of three phase induction motor.

UNIT-IV
SINGLE PHASE INDUCTION MOTOR
PART-A

1. What are the starting methods used in three phase induction motor? (Or) Name the type of starters used in 3 phase induction motors.

Direct on line starter.
Primary resistance starter.
Autotransformer starter.
Star-delta starter.
Rotor resistance starter.

2. What is the effect of change in input voltage on starting torque of induction motor?

Large reduction in starting torque because the starting torque varies as the square of voltage applied to the stator.

3. Why the starters are necessary for the induction motor?

An induction motor when directly switched ON, takes five to seven times its full load current and it develops only 1.5 to 2.5 times full load torque. This inrush current produce large line voltage drop and affect the operation of the other equipment. This can be overcome by using starters.

4. What is meant by plugging?

Plugging is a type of braking , in this method the terminals of supply are reversed as a result the generator torque also reverses which resists the normal rotation of the motor and as a result the speed decreases.

5. How the direction of rotation of a single phase induction motor reversed?

The direction of rotation of the motor can be changed by changing the connections of one of the two stator windings.

6. What is the effect of increasing the rotor resistance on starting current and torque?

By adding external resistance in rotor circuit the power factor and starting torque can be improved. After certain point effect of increases impedance predominant effect of improved power factor and so torque starts decreasing.

7. What is the rotation between frequency of stator current and rotor current of an induction motor?

Where f = frequency of stator current, f_r = frequency of rotor current, s= slip

8. What is meant by slip power recovery scheme?

Slip power can be returned to the supply source and 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 scheme and improves the overall efficiency of the system.

9. While controlling the speed of an induction motor, how is super-synchronous speed achieved?

Super-synchronous speed can be achieve, while controlling the speed of an induction motor, by injecting a slip frequency emf in phase opposition with emf induced in the rotor circuit.

10. List out the methods of speed control of three phase induction motor.

Stator voltage control
Stator frequency control
Pole changing method

11. Name the method of speed control used only for slip ring induction motor.
(Or)
Write down the methods to control the speed of 3 phase induction motor from its rotor side.

Adding external resistance in the rotor circuit.
Cascade control.
Slip power recovery scheme.

12. What are the various methods of speed control of 3 phase induction motor?

The various methods of speed control of 3 phase induction motor are;

Changing applied voltage
Changing applied frequency
Changing number of stator poles.
Rotor rheostat control.
Injecting an emf in rotor circuit.

13. What is the disadvantage of rotor rheostat speed control method?

Large power losses due to I_2R losses.
Efficiency is very low.
Cannot be used for squirrel cage motor.
Large speed changes not possible.

$f_r = s \cdot f$

14. Give the functions performed by induction motor starter.

Apart from limiting the high starting current, starter in an induction motor also serves the functions like single phase prevention, prevention of low voltage operation, thermal shutdown, prevention from overloading etc.

15. **State two advantages of speed control of induction motor by injecting an e.m.f in the rotor circuit?**

Any speed within the working range can be obtained.
If the rotary converter is such excited , it will take a leading current which compensates for the lagging current drawn by SRIM.

16. Which is the cheapest method of starting a three phase induction motor?

The star-delta starter is the cheapest method of starting a three phase induction motor.

17. Define regenerative braking.
If the rotor speed is increased greater than the synchronous speed with the help of external device, it acts as an induction generator. It converts the input mechanical energy to an electrical energy which is given back to supply. It delivers active power to the 3 phase line. The flux becomes greater than 90 degree. The power flow reverses hence rotor induced emf and rotor current also reverse. So rotor produces torque in opposite direction to achieve the braking. As the electrical energy is given back to the lines while braking, it is called regenerative braking.

18. Define dynamic braking.
A quick stopping of an induction motor and its high inertia load can be achieved by connecting stator terminals to a d.c. supply. Any two stator terminals can be connected to a d.c. supply and third terminal may be kept open or may be connected directly to other stator terminal. This is called dynamic braking.

UNIT–V
SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES
PART-A

1. Name the methods of starting a single-phase induction motor.
i) Resistance-Start (Split phase) induction motor
ii) Capacitor-start induction motor
iii) Capacitor-run induction motor
iv) Capacitor-start Capacitor-run induction motor
v) Shaded pole induction motor

2. Why single phase induction motor is not a self-starting?
When a single phase supply is fed to the stator winding, it produces only an alternating flux only. Due to this starting torque will be zero. Hence the motor does not rotate.

3. What is the function of capacitor in single phase induction motor?
To make phase difference between starting and running winding, to improve PF and to get more torque.

4. List the applications of single phase induction motor.
Fans
Blowers
Centrifugal pumps
Washing machines
Compressors

5. What kind of motors used in ceiling fan and wet grinders?
Capacitor start and capacitor run single phase induction motor are used for ceiling fan and wet grinders.

6. State the applications of shaded pole single phase induction motor.
Hair driers, Fans, Blowers, Turn tables

7. State the double revolving field theory.
Any alternating quantity can be resolved into two quantities which rotate in opposite directions and have half of the magnitude.

8. Why single phase induction motors have low PF?
The current through the running winding lags behind the supply voltage by large angle so only single phase induction motors have low PF.

9. Define the term step angle in a stepper motor.
Step angle is defined as the angle through which th the stepper motor shaft rotates for each command pulse.
Step angle $\beta = 360_0/_m N_r$

10. What are the inherent characteristics of plain single phase induction motor?
The starting torque is 100% to 250% of the rated value.
The breakdown torque is upto 300%
The power factor of this motor is 0.5 to 0.65

11. Why an induction motor never runs at its synchronous speed?
If it runs at synchronous speed then there would be no relative speed between the two, hence no rotor emf, so no rotor current, then no rotor torque to maintain rotation.

12. What will be the direction of rotation of a shaded pole single phase induction motor?
When the exciting winding is connected to an A.C Source of supply, the magnetic axis will shift from the unshaded part of the pole to the shaded part of the pole. This shift in the magnetic axis is in effect equivalent to an actual physical motion of the pole; the result is that the squirrel cage each rotor will rotate in a direction from the unshaded part to the shaded part.

13. Why an induction motor is called as rotating transformer?
The rotor receives same electrical power in exactly the same way as the secondary of a two winding transformer receiving its power from primary. That is why induction motor is called as rotating transformer.

14. State the limitations of shaded pole motors.
Starting torque is poor.
Power factor is very low
Due to copper losses in the shading ring the efficiency is very low.
Speed reversal is very difficult.

15. What are the advantage of capacitor start induction motor over split phase induction motor?
Starting torque is improved
Power factor is improved
Efficiency is high

16. What are the drawbacks of the presence of backward rotating magnetic field in a single phase induction motor?
i) Net flux will be zero. ii) No starting torque in the motor.

17. How can the direction of a capacitor run motor be reversed?
The direction of rotation of the motor can be changed by changing the connections of one of the two stator windings.

18. Give two advantages and two applications of stepper motor.
Advantages:
These motors are compatible with digital equipment and are flexible in operation. The dynamic response is fast.
Applications:
Stepper motors are widely used in computer peripherals such as serial printers tape drives, floppy disk drivers. They are also used in control of machine tools and robotics.

19. List some applications of linear induction motor?
They are used in machine tool industry and in robotics .They are used in trains operated on magnetic levitation, reciprocating compressors can also be driven by linear motors.

20. What is the principle of reluctance motor?
A reluctance motor is a type of electric motor that induces non-permanent magnetic poles on the ferromagnetic rotor. The rotor does not have any windings. Torque is generated through the phenomenon of magnetic reluctance.

21. Discuss the characteristics of single phase series motor.
To reduce the eddy current losses, yoke and pole core construction is laminated
The power factor can be improved by reducing the number of turns. But this reduces the field flux
But this reduction in flux increases the speed and reducing the torque. To keep the torque same it is necessary to increase the armature turns proportionately. This increases the armature inductance.

22. What are the demerits of repulsion motor?
It is very expensive
Its speed changes with load
On no load speed is very high causing sparking at brushes
Low power factor on no load

23. List four applications of reluctance motors.
This motor is used in signaling devices, control apparatus, automatic regulators, recording instruments, clocks and all kinds of timing devices, teleprinters, gramophones.

24. Why centrifugal switches provided in many single phase induction motors?
The centrifugal switches are provided on many single phase induction motors, because when motor is running at 75 percent of the synchronous speed, the centrifugal switch connected in the auxiliary circuit operates and disconnects the auxiliary winding from the supply.

26. What is meant by single phasing? [Nov-2012]
Single phase refers to the fact that the circuit powered by a single AC voltage source.

26. What is meant by single phasing? [Nov-2012]

Single phase refers to the fact that the circuit powered by a single AC voltage source.

UNIT-I
SYNCHRONOUS GENERATOR
PART-B

1. Describe with neat sketches the constructional details of a salient pole type alternator.
2. Describe construction and working principle of an alternator.
3. Explain clearly the ZPF (potier triangle) method of determining the regulation of an alternator.
4. Explain dark lamp method of synchronizing an alternator with the bus bar.
5. Describe a method of synchronizing the three phase alternator to the infinite bus giving the relevant circuit diagram.
6. What is synchronizing power of an alternator? Derive an expression for the synchronizing power between the two alternators connected in parallel.
7. Explain the two-reaction theory of salient pole synchronous machine.
8. Explain the determination of direct and quadrature axis synchronous reactance using slip test.
9. Sketch and explain the open circuit and short circuit test characteristics of synchronous machines.
10. Define armature reaction and explain the effect of armature reaction on different power factor loads of synchronous generators.
11. Explain the EMF method of determining the regulation of an alternator.
12. List the methods used to predetermine the voltage regulation of synchronous machine and explain the MMF method.
13. For a salient pole synchronous machine, derive an expression for power developed as a function of load angle.
14. List the methods used to predetermine the voltage regulation of synchronous machine and explain the mmf method.
15. Derive the emf equation of an alternator.
16. State and explain the condition for parallel operation of alternators.

UNIT-II
SYNCHRONOUS MOTOR
PART-B

1. Explain how synchronous motor can be operated as a synchronous condenser.
2. Show that the synchronous motor is a variable power factor motor.
3. Explain what is meant by V-curves. Draw the V-curves of a synchronous motor.
4. State the characteristic features of synchronous motor.
5. Draw the equivalent circuit and phasor diagram of a synchronous motor.
6. Explain briefly about the V and Inverted V curves and mention its significance.
7. Explain the effect of changing field current excitation at constant load.
8. Derive the expression for the maximum torque developed per phase of a synchronous motor.
9. Describe in detail about the effect of load change on load angle and power factor of a 3 phase synchronous motor operating an infinite bus bar and constant excitation.
10. Describe the various methods of starting the synchronous motor.

11. Draw and explain the current loci of synchronous motor for (i)constant power input and (ii) constant excitation. Also obtain the minimum and maximum excitation for given mechanical power.
12.Derive the expression for power developed in a synchronous motor. Also fine the condition for maximum power developed.

UNIT-III
THREE PHASE INDUCTION MOTOR
PART-B

1.Draw the power flow diagram of a 3 phase induction motor and explain each stage?
2. Explain the construction of double cage rotor?
3. Explain the equivalent circuit of double cage induction motor.
4. Discuss the different power stages of an induction motor with losses.
5 Write a brief note on double cage rotor induction motors.
6. Explain the principle of operation of 3-phase induction motor and explain how the rotating magnetic field is produced by 3-phase currents.
7. Derive an expression for the torque of an induction motor and obtain the condition for maximum torque.
8. Explain the torque slip characteristic of 3 phase induction motor.
9. Sketch the equivalent circuit, Derive the various power equation of an induction motor.
10.Explain the tests required to be performed to obtain the data for the circle diagram.
11. Describe the construction and principle of operation of a 3-phase induction motor with neat sketch.
12. Explain in detail the construction of circle diagram of an induction motor.
13. Illustrate the phenomenon of cogging and crawling in induction motor.
14. Explain the operation of induction machine as a generator with neat diagram.

UNIT-IV
SINGLE PHASE INDUCTION MOTOR
PART-B

1. Explain the methods of starting of induction motor with neat sketches.
2. Explain the speed control of induction motor from stator side.
3. Why starters are necessary for starting induction motors? What are the various types of starters? Explain star-delta type starter in detail.
4. With neat diagram explain the slip power recovery scheme.
5. Explain the speed control methods of three phase induction motor.
6. Explain the cascaded operation of three phase induction motor.
7. Explain the static scherbius system of slip power recovery scheme.
8. Explain the various methods of braking in induction motor.

UNIT–V
SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES
PART - B

1.What is stepper motor? How does it work? What are their applications?
2.Draw the equivalent circuit of single phase induction motor and discuss the experimental procedure to obtain its parameters.
3.Explain the operation of single phase induction motor using double field revolving theory.

4.Explain the operation of shaded pole induction motor with diagram.
5.Explain the constructional features and principle of operation of AC series motor.
6.Explain the principle and operation of reluctance motor and state its applications.
7.Explain the working principle of single phase induction motor.
8.Explain the construction and working principle of linear reluctance motor and Hysteresis motor.
9.Explain with a neat diagram the following types of single phase induction motor.
i) Split phase induction motor
ii) Capacitor start and capacitor run induction motor, and also draw the slip-torque characteristics.
10. Describe the constructional features and principle of operation of hysteresis motor.
11. Explain the operation of shaded pole induction motor with diagram and capacitor start induction motor.
12. Describe the constructional features and principle of operation of linear reluctance motor and repulsion motor.
13. Derive the equivalent circuit of a single phase induction motor with the help of double field revolving theory.

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