Subject: - Industrial AC Machines (22523)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Three Phase Induction Motor	25
2	25 2 Single Phase Induction Motor 20 3 25 4 18 5 14	20
3	Three Phase Alternator	25
4	Synchronous Motor	18
5	Fractional Horse Power Motor	14
	Total Marks: -	**102**

BOARD THEORY PAPER PATTERN FOR IAM (22523)

Q.1		**Attempt any FIVE**	**5*2=10**
	a)	State the function of following parts in Induction motor. (i) Stator (ii) Slipring	
	b)	State suitable single phase motor for following applications: (i) Table fan (ii) Mixers and Grinders	
	c)	State advantages of short pitch winding over full pitch winding in alternators	
	d)	List different torques in synchronous motor.	
	e)	State advantages of rotating field type alternators. (any four)	
	f)	List applications of stepper motor.	
	g)	List applications of servomotor.	
Q.2		**Attempt any THREE**	**3*4=12**
	a)	Derive the condition for maximum torque under running condition of a 3 phase induction motor.	
	b)	A 16 pole, 3 phase star connected alternator armature has 12 slots with 24 conductors per slot and flux per pole is 0.1 wb. sinusoidally distributed. Calculate line emf generated at 50 Hz	
	c)	Explain the effect of variable excitation on the behaviour of synchronous motor under constant load condition	
	d)	Prove that for a 3z induction motor. Rotor copper loss = S. Rotor input.	
Q.3		**Attempt any THREE**	**3*4=12**

	a)	The power input to a 500V 50Hz 6Pole 3z induction motor running at 975 rpm is 40 kW. The stator losses are 1kW and friction and windage losses are 2kW. Calculate : (i) Slip (ii) Rotor copper loss (iii) Shaft power (iv) Efficiency
	b)	Derive equation for K_d
	c)	Explain working of resistance split phase single phase induction motor with vector diagram
	d)	A 400V, 50Hz seipring type three phase induction motor is star connected and has per phase rotor resistance and standstill reactance of 0.5 and 1.5 ohm respectively. Calculate resistance to be added per phase to achieve maximum torque at starting.
Q.4		**Attempt any FOUR 3*4=12**
	a)	Explain working of autotransformer starter for a 3 phase induction motor with neat diagram
	b)	Explain phase shifting (production of rotating magnetic field) in shaded pole induction motor with neat diagram
	c)	Explain the construction and working of permanent magnet stepper motor
	d)	Describe with neat sketch working of hystersis motor.
	e)	Explain construction and working of AC servomotor.
Q.5		**Attempt any TWO 2*6=12**
	a)	Explain the activities carried out during weekly maintenance of 3 ph. Induction motor.
	b)	Define voltage regulation of an alternator. Explain synchronous impedance method for finding regulation of alternator
	c)	State the modifications to be done in dc series motor to work satisfactorily as ac series motor. State applications of ac series motor.
Q.6		**Attempt any TWO 2*6=12**
	a)	Define armature reaction in an alternator. Explain the effect of armature reaction at various P.F. of loads of alternator
	b)	Draw and explain ‘V’ and ‘inverted V curves’ for synchronous motor
	c)	List different starting methods of three phase synchronous motor. Explain any one of them

CLASS TEST - I
PAPER PATTERN

COURSE: - Industrial AC Machines (22523)
PROGRAMME: - Electrical Engineering
Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
1	Induction motor	CO.523.1
2	Single Phase induction motor	CO.523.2

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Three Phase Induction motor	CO.523.1
b)	Three Phase Induction motor	CO.523.1
c)	Three Phase Induction motor	CO.523.1
d)	Three Phase Induction motor	CO.523.1
e)	Single Phase Induction Motor	CO.523.2
f)	Single Phase Induction Motor	CO.523.2
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Three Phase Induction motor	CO.523.1
b)	Three Phase Induction motor	CO.523.1
c)	Three Phase Induction motor	CO.523.1
d)	Single Phase Induction Motor	CO.523.2
e)	Single Phase Induction Motor	CO.523.2

CLASS TEST - II

PAPER PATTERN

COURSE: - Industrial AC Machines (22523)
PROGRAMME: - Electrical Engineering
Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
3	Three Phase Alternator	CO523.3
4	synchronous motors	CO523.4
5	Fractional horse power motors	CO523.5

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Three Phase Alternator	CO523.3
b)	Three Phase Alternator	CO523.3
c)	Three Phase Alternator	CO523.3
d)	synchronous motors	CO523.4
e)	synchronous motors	CO523.4
f)	Give one application each for AC and DC servo motor.	CO523.5
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Three Phase Alternator	CO523.3
b)	Three Phase Alternator	CO523.3
c)	synchronous motors	CO523.4
d)	synchronous motors	CO523.4
e)	Fractional horse power motors	CO523.5

COURSE OUTCOME (CO)

COURSE: - Industrial AC Machines (22523)

PROGRAMME: - Electrical Engineering

CO.NO	Course Outcome
CO.523.1	Use the relevant Three Phase Induction motor for different application
CO.523.2	Use the relevant Single Phase Induction motor for different application
CO.523.3	Use the relevant Three Phase alternator for different load condition
CO.523.4	Use suitable synchronous motor in different application
CO.523.5	Use suitable Fractional Horse Power motor for different application

1. Three Phase Induction Motor

Position in Question Paper **Total Marks-22**

Q.1. a) 2-Marks.
Q.1. b) 2-Marks.
Q.2. a) 4-Marks.
Q.3. a) 4-Marks.
Q.3. d) 4-Marks.
Q.4. a) 6-Marks.

Descriptive Question

1. Compare squirrel cage induction motor and slip ring induction motor on any four points.
2. Explain the working principle of 3 phase induction motor.
3. Explain with diagram how star delta starters are used for reducing the starting current of 3 phase induction motors.
4. Explain speed control method of 3 phase induction motor by the following methods
   a. Frequency control
   b. Stator voltage control
   c. Rotor resistance control.
5. Explain the effect of resistance of rotor winding on starting torque of 3 phase IM.
6. Explain effect of voltage on torque speed characteristics of 3 phase IM.
7. Derive the condition for T_{max} of a 3 phase induction motor.
8. Explain how each of the following can reduce starting current of 3 phase IM :
9. By inserting resistance in rotor winding
10. By connecting autotransformer in stator winding.
11. Draw a block diagram showing power stages of a 3 phase induction motor
12. Derive the ratio of full load torque (TFL) and maximum torque (TMax) of a 3 phase induction motor.
13. State the effects of change in supply voltage on torque-slip characteristics of 3-phase induction motor.
14. State the function of different parts of an induction motor
15. State the necessity of starter for three-phase induction motor
16. Draw and explain torque-slip characteristics of three phase induction motor.
17. Prove that rotor copper loss in induction motor is slip times rotor input.
18. Derive the condition for maximum torque at running condition of a 3φ induction motor.
19. How speed of 3φ induction motor is controlled by using pole changing method
20. State construction and working of shaded pole single phase induction motor.

21. With neat sketch state the working principle of star-delta starter
22. State why three phase induction motor never runs on synchronous speed.
23. Draw and explain Auto transformer starter

MCQ Question

(Total number of Question=Marks*3=22*3=66)

Note: Correct answer is marked with **bold.**

1. Which of the following component is usually fabricated out of silicon steel?
a. Bearings
b. Shaft
c. Stator core
d. None of the above

2. The frame of an induction motor is usually made of
a. silicon steel
b. cast iron
c. aluminum
d. bronze

3. The shaft of an induction motor is made of
a. stiff
b. flexible
c. hollow
d. any of the above

4. The shaft of an induction motor is made of
a. high speed steel
b. stainless steel
c. carbon steel
d. cast iron

5. In an induction motor, no-load the slip is generally
a. less than 1%
b. 1.5%
c. 2%
d. (d) 4

6. In medium sized induction motors, the slip is generally around
a. 0.04%
b. 0.4%
c. 4%
d. (d) 14

7. In squirrel cage induction motors, the rotor slots are usually given slight skew in order to
a. reduce windage losses
b. reduce eddy currents
c. reduce accumulation of dirt and dust
d. reduce magnetic hum

8. In case the air gap in an induction motor is increased
a. the magnetising current of the rotor will decrease
b. the power factor will decrease
c. speed of motor will increase
d. the windage losses will increase

9. Slip rings are usually made of
a. copper
b. carbon

c. phosphor bronze d. aluminum

10. A 3-phase 440V,50 Hz induction motor has 4% slip.The frequency of rotor emf will be
a. 200 Hz **c. 2 Hz**
b. 50 Hz d. 0.2 Hz

11. In Ns is the synchronous speed and s the slip, then actual running speed of an induction motor will be
a. Ns **c. (l-s)Ns**
b. s.N, d. (Ns-l)s

12. The efficiency of an induction motor can be expected to be nearly
a. 60 to 90% c. 95 to 98%
b. 80 to 90% d. 99%

13. The number of slip rings on a squirrel cage induction motor is usually
a. two c. four
b. three **d. none**

14. The starting torque of a squirrel-cage induction motor is
a. low
b. negligible
c. same as full-load torque
d. slightly more than full-load torque

15. A double squirrel-cage induction motor has
a. two rotors moving in oppsite direction
b. two parallel windings in stator
c. two parallel windings in rotor
d. two series windings in
e. stator

16. Star-delta starting of motors is not possible in case of
a. single phase motors c. low horse power motors
b. variable speed motors d. high speed motors

17. The term 'cogging' is associated with
a. three phase transformers c. D.C. series motors
b. compound generators **d. induction motors**

18. In case of the induction motors the torque is
a. inversely proportional to (Vslip)
b. directly proportional to (slip)2
c. inversely proportional to slip
d. directly proportional to slip

19. An induction motor with 1000 r.p.m. speed will have
a. 8 poles c. 4 poles
b. 6 poles d. 2 poles

20. The good power factor of an induction motor can be achieved if the average flux density in the air gap is

a. absent
b. small
c. large
d. (d) infinite

21. An induction motor is identical to

a. D.C. compound motor
b. D.C. series motor
c. synchronous motor
d. asynchronous motor

22. The injected e.m.f. in the rotor of induction motor must have

a. zero frequency
b. the same frequency as the slip frequency
c. the same phase as the rotor e.m.f.
d. high value for the satisfactory speed control

23. Which of the following methods is easily applicable to control the speed of the squirrel-cage induction motor ?

a. By changing the number of stator poles
b. Rotor rheostat control
c. By operating two motors in cascade
d. By injecting e.m.f. in the rotor circuit

24. The crawling in the induction motor is caused by

a. low voltage supply
b. high loads
c. harmonics develped in the motor
d. improper design of the machine

25. The auto-starters (using three auto transformers) can be used to start cage induction motor of the following type

a. star connected only
b. delta connected only
c. none of the above
d. both a and (b)

26. The torque developed in the cage induction motor with autostarter is

a. k/torque with direct switching
b. (6) K x torque with direct switching
c. K2 x torque with direct switching
d. (d) k2/torque with direct switching

27. When the equivalent circuit diagram of double squirrel-cage induction motor is Constructed the two cages can be considered

a. in series
b. in parallel
c. in series-parallel
d. in parallel with stator

28. It is advisable to avoid line-starting of induction motor and use starter because

a. Motor takes five to seven times its full load current
b. It will pick-up very high speed and may go out of step
c. It will run in reverse direction

d. Starting torque is very high

29. Steeples speed control of induction motor is possible by which of the following methods?

a. e.m.f. injection in rotor eueuit
b. Changing the number of poles
c. Cascade operation
d. None of the above

30. Rotor rheostat control method of speed control is used for

a. squirrel-cage induction motors only
b. slip ring induction motors only
c. both (a) and (b)
d. none of the above

31. In the circle diagram for induction motor, the diameter of the circle represents

a. slip
b. rotor current
c. running torque
d. line voltage

32. For which motor the speed can be controlled from rotor side ?

a. Squirrel-cage induction motor
b. Slip-ring induction motor
c. Both (a) and (b)
d. None of the above

33. If any two phases for an induction motor are interchanged

a. the motor will run in reverse direction
b. the motor will run at reduced speed
c. the motor will not run
d. the motor will burn

34. An induction motor is

a. self-starting with zero torque
b. self-starting with high torque
c. self-starting with low torque
d. non-self starting

35. The maximum torque in an induction motor depends on

a. frequency
b. rotor inductive reactance
c. square of supply voltage
d. all of the above

36. In three-phase squirrel-cage induction motors

a. rotor conductor ends are short-circuited through slip rings
b. rotor conductors are short-circuited through end rings
c. rotor conductors are kept open
d. rotor conductors are connected to insulation

37. In a three-phase induction motor, the number of poles in the rotor winding is always

a. zero
b. more than the number of poles in stator
c. less than number of poles in stator
d. equal to number of poles in stator

38.DOL starting of induction motors is usually restricted to

a. low horsepower motors
b. variable speed motors

c. high horsepower motors
d. high speed motors

39. The speed of a squirrel-cage induction motor can be controlled by all of the following Except

a. changing supply frequency
c. changing winding resistance
b. changing number of poles
d. reducing supply voltage

40. The 'crawling" in an induction motor is caused by

a. high loads
b. (6) low voltage supply
c. improper design of machine
d. harmonics developed in the motor

41. The power factor of an induction motor under no-load conditions will be closer to

a. **0.2 lagging**
c. 0.5 leading
b. 0.2 leading
d. unity

42. The 'cogging' of an induction motor can be avoided by

a. using DOL starter
b. auto-transformer starter
c. having number of rotor slots more or less than the number of stator slots (not equal)
d. None

43. If an induction motor with certain ratio of rotor to stator slots, runs at 1/7 of the normal speed, the phenomenon will be termed as

a. humming
c. crawling
b. hunting
d. cogging

44. Slip of an induction motor is negative when

a. magnetic field and rotor rotate in opposite direction
b. rotor speed is less than the syn-chronous speed of the field and are in the same direction
c. rotor speed is more than the syn-chronous speed of the field and are in the same Direction.
d. none of the above

45. Size of a high speed motor as compared to low speed motorfor the same H.P. will be

a. bigger
c. same
b. **smaller**
d. any of the above

46.A 3-phase induction motor stator delta connected, is carrying full load and one of its fuses blows out. Then the motor

a. **will continue running burning its one phase**
b. will continue running burning its two phases
c. will stop and carry heavy current causing permanent damage to its winding
d. will continue running without any harm to the winding

47.A 3-phase induction motor delta connected is carrying too heavy load and one of its

fuses blows out. Then the motor

a. will continue running burning its one phase
b. will continue running burning its two phase
c. **will stop and carry heavy current causing permanent damage to its winding**
d. will continue running without any harm to the winding

48. Low voltage at motor terminals is due to

a. inadequate motor wiring
b. poorely regulated power supply
c. **any one of the above**
d. none of the above

49. In an induction motor the relationship between stator slots and rotor slots is that

a. stator slots are equal to rotor slots
b. stator slots are exact multiple of rotor slots
c. stator slots are not exact multiple of rotor slots
d. (d) none of the above

50. Slip ring motor is recommended where

a. speed control is required
b. (6) frequent starting, stopping and reversing is required
c. high starting torque is needed
d. (d) all above features are requir

51. As load on an induction motor goes on increasing

a. its power factor goes on decreasing
b. its power factor remains constant
c. its power factor goes on increasing even after full load
d. **its power factor goes on increasing upto full load and then it falls again**

52. If a 3-phase supply is given to the stator and rotor is short circuited rotor will move

a. in the opposite direction as the direction of the rotating field
b. in the same direction as the direction of the field
c. in any direction depending upon phase squence of supply
d. None

53. It is advisable to avoid line starting of induction motor and use starter because

a. it will run in reverse direction
b. it will pick up very high speed and may go out of step
c. motor takes five to seven times its full load current
d. Starting torque is very high

54. The speed characteristics of an induction motor closely resemble the speed load characteristics of which of the following machines

a. D.C. series motor
b. D.C. shunt motor
c. universal motor
d. none of the above

55. Which type of bearing is provided in small induction motors to support the rotor shaft

a. **Ball bearings**
b. Cast iron bearings
c. Bush bearings
d. None of the above

56.A pump induction motor is switched on to a supply 30% lower than its rated voltage. The pump runs. What will eventually happen ? It will
a. stall after sometime
b. stall immediately
c. continue to run at lower speed without damage
d. **get heated and subsequently get damaged**

57.5 H.P., 50-Hz, 3-phase, 440 V, induction motors are available for the following r.p.m. Which motor will be the costliest ?
a. **730 r.p.m.**
b. 960 r.p.m.
c. 1440 r.p.m.
d. 2880 r.p.m.

58.A 3-phase slip ring motor has
a. double cage rotor
b. **(6) wound rotor**
c. short-circuited rotor
d. any of the above

59. The starting torque of a 3-phase squirrel cage induction motor is
a. twice the full load torque
b. **1.5 times the full load torque**
c. equal to full load torque

60. Short-circuit test on an induction motor cannot be used to determine
a. **windage losses**
b. copper losses
c. transformation ratio
d. power scale of circle diagram

61. In a three-phase induction motor
a. iron losses in stator will be negligible as compared to that in rotor
b. (6) iron losses in motor will be neg¬ligible as compared to that in rotor
c. iron losses in stator will be less than that in rotor
d. **iron losses in stator will be more than that in rotor**

62. In case of 3-phase induction motors, plugging means
a. pulling the motor directly on line without a starter
b. locking of rotor due to harmonics
c. starting the motor on load which is more than the rated load
d. **interchanging two supply phases for quick stopping**

63. Which is of the following data is required to draw the circle diagram for an induction motor ?
a. Block rotor test only
b. No load test only
c. Block rotor test and no-load test
d. **Block rotor test, no-load test and stator resistance test**

64. In three-phase induction motors sometimes copper bars are placed deep in the rotor to
a. **improve starting torque**
b. reduce copper losses
c. improve efficiency
d. improve power factor

65. In a three-phase induction motor
a. power factor at starting is high as compared to that while running

b. **power factor at starting is low as compared to that while running**
c. power factor at starting in the same as that while running

66. The vafcie of transformation ratio of an induction motor can be found by
a. open-circuit test only
b. **short-circuit test only**
c. stator resistance test
d. none of the above

67. The power scale of circle diagram of an induction motor can be found from
a. stator resistance test
b. (6) no-load test only
c. **short-circuit test only**
d. noue of the above

68. The shape of the torque/slip curve of induction motor is
a. parabola
b. hyperbola
c. **rectangular parabola**
d. straight line

69. A change of 4% of supply voltage to an induction motor will produce a change of approximately
a. 4% in the rotor torque
b. 8% in the rotor torque
c. 12% in the rotor torque
d. **16% in the rotor torque**

70. The stating torque of the slip ring induction motor can be increased by adding
a. external inductance to the rotor
b. **external resistance to the rotor**
c. external capacitance to the rotor
d. both resistance and inductance to rotor

71. A 500 kW, 3-phase, 440 volts, 50 Hz, A.C. induction motor has a speed of 960 r.p.m. on full load. The machine has 6 poles. The slip of the machine will be
a. 0.01
b. 0.02
c. 0.03
d. **0.04**

72. The complete circle diagram of induetion motor can be drawn with the help of data found from
a. noload test
b. (6) blocked rotor test
c. stator resistance test
d. **all of the above**

73. In the squirrel-cage induction motor the rotor slots are usually given slight skew
a. **to reduce the magnetic hum and locking tendency of the rotor**
b. to increase the tensile strength of the rotor bars
c. to ensure easy fabrication
d. none of the above

74. The torque of a rotor in an induction motor under running condition is maximum
a. at the unit value of slip
b. at the zero value of slip
c. **at the value of the slip which makes rotor reactance per phase equal to the resistance per phase**
d. at the value of the slip which makes the rotor reactance half of the rotor

75. What will happen if the relative speed between the rotating flux of stator and rotor of the induction motor is zero ?
a. The slip of the motor will be 5%
b. **The rotor will not run**
c. The rotor will run at very high speed
d. The torque produced will be very large

76. The circle diagram for an induction motor cannot be used to determine
a. **efficiency**
b. power factor
c. frequency
d. output

77. Blocked rotor test on induction motors is used to find out
a. leakage reactance
b. power factor on short circuit
c. short-circuit current under rated voltage
d. **all of the above**

78. Lubricant used for ball bearing is usually
a. graphite
b. **grease**
c. mineral oil
d. molasses

79. An induction motor can run at synchronous speed when
a. it is run on load
b. it is run in reverse direction
c. it is run on voltage higher than the rated voltage
d. **e.m.f. is injected in the rotor circuit**

80. Which motor is preferred for use in mines where explosive gases exist ?
a. **Air**
b. D.C. shunt motor
c. Synchronous motor
d. Induction motor

81. The torque developed by a 3-phase induction motor least depends on
a. rotor current
b. rotor power factor
c. rotor e.m.f.
d. **shaft diameter**

82. 82. In an induction motor if air-gap is increased
a. **the power factor will be low**
b. windage losses will be more
c. bearing friction will reduce
d. copper loss will reduce In an induction motor

83. In induction motor, percentage slip depends on
a. supply frequency
b. supply voltage
c. **copper losses in motor**
d. none of the above

84. When /?2 is tne rotor resistance, .X2 the rotor reactance at supply frequency and s the slip, then the condition for maximum torque under running conditions will be
a. sR2X2 = 1
b. sR2 = X2
c. **R2 = sX2**
d. R2 = s2X2

85. In case of a double cage induction motor, the inner cage has
a. **high inductance arid low resistance**
b. low inductance and high resistance
c. low inductance and low resistance
d. high inductance and high resis¬tance

86. The low power factor of induction motor is due to
a. rotor leakage reactance motor
b. stator reactance
c. all of the above
d. **reactive lagging magnetizing current necessary to generate the magnetic flux.**

87. Insertion of reactance in the rotor circuit
a. **reduces starting torque as well as maximum torque**
b. increases starting torque as well as maximum torque
c. increases starting torque but maxi-mum torque remains unchanged
d. (d) increases starting torque but maxi-mum torque decreases

88. Insertion of resistance in the rotcir of an induction motor to develop a given torque
a. decreases the rotor current
b. increases the rotor current
c. rotor current becomes zero
d. rotor current refrains same

89. For driving high inertia loods best type of induction motor suggested is
a. slip ring type
b. squirrel cage type
c. any of the above
d. none of the above

90. Temperature of the stator winding of a three phase induction motor is obtained by
a. resistance rise method
b. thermometer method
c. embedded temperature method
d. all above methods

91. The purpose of using short-circuit gear is
a. to short circuit the rotor at slip rings
b. to short circuit the starting resis¬tances in the starter
c. to short circuit the stator phase of motor to form star
d. none of the above

92. A squirrel cage induction motor is not selected when
a. initial cost is the main consideration
b. maintenance cost is to be kept low
c. higher starting torque is the main consideration
d. all above considerations are involved

93. Reduced voltage starter can be used with
a. slip ring motor only but not with squirrel cage induction motor
b. squirrel cage induction motor only but not with slip ring motor
c. squirrel cage as well as slip ring induction motor
d. (d) none of the above

94. Slip ring motor is preferred over squirrel cage induction motor where

a. **high starting torque is required**
b. load torque is heavy
c. heavy pull out torque is required
d. all of the above

95. In a star-delta starter of an induction motor
a. resistance is inserted in the stator
b. reduced voltage is applied to the stator
c. resistance is inserted in the rotor
d. **applied voltage per1 stator phase is 57.7% of the line voltage**

96. The torque of an induction motor is
a. **directly proportional to slip**
b. inversely proportional to slip
c. proportional to the square of the slip
d. none of the above

97. The rotor of an induction motor runs at
a. synchronous speed
b. **below synchronous speed**
c. above synchronous speed
d. any of the above

98. The starting torque of a three phase induction motor can be increased by
a. increasing slip
b. increasing current
c. **both (a) and (b)**
d. none of the above

99. Insertion of resistance in the stator of an induction motor
a. increases the load torque
c. increases the starting torque
b. decreases the starting torque
d. none of the above

2. Single Phase Induction Motor

Position in Question Paper **Total Marks-10**

Q.1 .b) 2-Marks.
Q.3 c) 4-Marks.
Q.5 b&c. 4 -Marks.

Descriptive Question

1. Explain working principle of AC series motor. Draw speed-torque characteristics of AC series motor.
2. Write applications of each of the following :
    a) Shaded pole IM
    b) Capacitor start induction run
    c) Resistance start induction run
    d) Capacitors start capacitor run.
3. Explain why single phase induction motors are not self-starting.
4. Explain working of shaded pole induction motor with suitable sketches.
5. Practically if D.C. series motor has to be supplied with single phase A.C., what modification and refinements will have to be done on D.C. series motor
6. Compare resistance split phase motor with capacitor split phase motor
7. How the direction of rotation of capacitor start capacitor run motor can be reversed
8. State the double field revolving theory of single phase induction motor.
9. Explain working principle of AC series motor. Draw speed-torque Characteristics of AC series motor.
10. Explain with diagram the working principle of following motors and also draw speed-torque Characteristics.
    a) Universal motor.
    b) Repulsion Motors
    c) Hysteresis Motors
    d) Resistance split phase
    e) Capacitor start capacitor run
11. Compare 1 Phase and 3 Phase Induction Motors

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1. In a split phase motor, the running winding should have
   a. high resistance and low inductance
   b. **low resistance and high inductance**
   c. high resistance as well as high inductance
   d. low resistance as well as low inductiance

2. If the capacitor of a single-phase motor is short-circuited
   a. **the motor will not start**
   b. the motor will run
   c. the motor will run in reverse direction
   d. (d) the motor will run in the same direction at reduced r.p.m

3. In capacitor start single-phase motors
   a. **current in the starting winding leads the voltage**
   b. current in the starting winding lags the voltage
   c. current in the starting winding is in phase with voltage in running winding
   d. none of the above

4. In a capacitor start and run motors the function of the running capacitor in series with the auxiliary winding is to
   a. **improve power factor**
   b. increase overload capacity
   c. reduce fluctuations in torque
   d. to improve torque

5. In a capacitor start motor, the phase displacement between starting and running winding can be nearly
   a. 10°
   b. 30°
   c. 60°
   d. **90°**

6. In a split phase motor
   a. **The starting winding is connected through a centrifugal switch**
   b. The running winding is connected through a centrifugal switch
   c. Both starting and running windings are connected through a centrifugal switch
   d. Centrifugal switch is used to control supply voltage

7. The rotor developed by a single-phase motor at starting is
   a. more than i.he rated torque
   b. rated torque
   c. less than the rated torque
   d. **zero**

8. Which of the following motor will give relatively high starting torque ?
   a. **Capacitor start motor**
   b. Capacitor run motor
   c. Split phase motor
   d. Shaded pole motor

9. Which of the following motor will have relatively higher power factor ?
a. **Capacitor run motor**
b. Shaded pole motor
c. Capacitor start motor
d. Split phase motor

10. In a shaded pole motor, the shading coil usually consist of
a. single turn of heavy wire which is in parallel with running winding
b. **a single turn of heavy copper wire which is short-circuited and carries only induced current**
c. a multilayer fine gauge copper wire in parallel with running winding
d. none of the above

11. In a shaded pole single-phase motor, the revolving field is produced by the use of
a. inductor
b. capacitor
c. resistor
d. **shading coils**

12.A centrifugal switch is used to dis- connect 'starting winding when motor has
a. run for about 1 minute
b. run for about 5 minutes
c. **picked up about 50 to 70 per cent of rated speed**
d. picked up about 10 to 25 per cent of rated speed

13. If a particular application needs high speed and high starting torque, then which of the following motor will be preferred ?
a. **Universal motor**
b. Shaded pole type motor
c. Capacitor start motor
d. Capacitor start and run motor

14. The value of starting capacitor of a fractional horse power motor will be
a. 100 uF
b. **300 uF**
c. 400 uF
d. 200 uF

15. In repulsion motor direction of rotation of motor
a. is opposite to that of brush shift
b. **is the same as that of brush shift**
c. is independent of brush shift

16. In a single phase motor the centrifugal switch
a. **disconnects auxiliary winding of the motor**
b. disconnects main winding of the motor
c. reconnects the main winding the motor
d. reconnects the auxiliary winding of the motor

17. The running winding of a single phase motor on testing with meggar is found to be ground. Most probable location of the ground will be
a. at the end connections
b. at the end terminals
c. anywhere on the winding inside a slot
d. **at the slot edge where coil enters or comes out of the slot**

18.A capacitor-start single phase induction motor is switched on to supply with its capacitor replaced by an inductor of equivalent reactance value. It will

a. start and then stop
b. start and run slowly
c. start and run at rated speed
d. **not start at all**

19. Which of the following motors is used in mixies ?
a. Repulsion motor
b. Reluctance motor
c. Hysteresis motor
d. **Universal motor**

20. Which of the following motors is inherently self-starting ?
a. Split motor
b. **Shaded-pole motor**
c. Reluctance motor
d. None of these

21. The direction of rotation of an hysteresis motor is determined by
a. interchanging the supply leads
b. **position of shaded pole with respect to main pole**
c. retentivity of the rotor material
d. none of these

22. Burning out of windings is due to
a. **short circuited capacitor**
b. capacitor value hiving changed
c. open circuiting of capacitor
d. none of the above

23. Direction of rotation of a split phase motor can be reversed by reversing the connection of
a. running winding only
b. starting winding only
c. **either (a) or (b)**
d. both (a) and (b)

24. Short-circuited is used in
a. repulsion induction motor
b. repulsion motor
c. **repulsion start induction run motor**
d. none of the above

25. The range of efficiency for shaded pole motors is
a. 95% to 99%
b. 80% to 90%
c. 50% to 75%
d. **5% to 35%**

26. In a capacitor start single-phase motor, when capacitor is replaced by a resistance
a. torque will increase
b. the motor will consume less power
c. motor will run in reverse direction
d. **motor will continue to run in same direction**

27. The power factor of a single-phase induction motor is usually
a. **lagging**
b. always leading
c. unity
d. unity to 0.8 leading

28. A shaded pole motor can be used for
a. toys
b. hair dryers
c. circulators
d. **any of the above**

29. A hysteresis motor works on the principle of
a. **hysteresis loss**
b. magnetization of rotor

c. eddy current loss
d. electromagnetic induction

30. Which of the following motor will give the highest starting torque ?
a. D.C. shunt motor
b. **Schrage motor**
c. Repulsion start and induction run motor
d. Universal motor

31. For which of the applications a reluctance motor is preferred ?
a. Electric shavers
b. Refrigerators
c. **Signaling and timing devices**
d. Lifts and hoists

32. The motor used on small lathes is usually
a. universal motor
b. D.C. shunt motor
c. **single-phase capacitor run motor**
d. 3-phase synchronous motor

33. Which of the following motors is preferred for tape-recorders ?
a. Shaded pole motor
b. **Hysteresis motor**
c. Two value capacitor motor
d. Universal motor

34. A single-phase induction motor is
a. inherently self-starting with high torque
b. inherently self-starting with low torque
c. **inherently non-self-starting with low torque**
d. (d) inherently non-self-starting with high torque

35. A Schrage motor can run on
a. zero slip
b. negative slip
c. positive slip
d. **all of the above**

36. A universal motor can run on
a. A.C. only
b. (6) D.C. only
c. **either A.C. or D.C.**
d. none of the above

37. Which of the following single-phase motors is suitable for timing and control purposes ?
a. **Reluctance motor**
b. Series motor
c. Repulsion motor
d. Universal motor

38. Single phase induction motor usually operates on
a. **0.6 power factor lagging**
b. 0.8 power factor lagging
c. 0.8 power factor leading
d. unity power factor

39. In split-phase motor iauxiliary winding is of
a. thick wire placed at the top of the slots
b. **thin wire placed at the top of the slots**
c. thin wire placed at the bottom of the slots
d. thick wire placed at the bottom of the slots

40. Which of the following motors will operate at high power factor ?

a. Shaped pole motor
b. Split phase motor
c. Capacitor start motor
d. **Capacitor run motor**

41. In a two value capacitor motor, the capacitor used for running purposes is
a. air capacitor
b. **paper spaced oil filled type**
c. ceramic type
d. a.c. electrolytic type

42. Which of the following motors can be run on AC. as well as D.C. supply ?
a. **Universal motor**
b. Repulsion motor
c. Synchronous motor
d. Reluctance motor

43. In A.C. series motor compensating winding is employed to
a. reduce the effects of armature reaction
b. increase the torque
c. **reduce sparking at the brushes**
d. none of the above

44. Which of the following single-phase induction motors is generally used in time phonographs?
a. Resistance start
b. Capacitor start capacitor run
c. **Shaded pole**
d. Universal

45. Which of the following motors has highest starting torque ?
a. Repulsion motor
b. Shaped pole motor
c. **Capacitor-start motor**
d. Split-phase motor

46. The repulsion-start induction-run motor is used because of
a. good power factor
b. high efficiency
c. minimum cost
d. **high starting torque**

47. In case of a shaded pole motor the direction of rotation of the motor is
a. **from main pole to shaded pole**
b. from shaded pole to main pole
c. either of the above depending on voltage
d. either of the above depending on power factor

48. In case of high speed universal motor which of the following needs more attention ?
a. End play
b. Air gap
c. Insulation in rotor
d. **Balancing of rotor**

49. The wattage rating for a ceiling fan motor will be in the range
a. 200 to 250 W
b. 250 to 500 W
c. **50 to 150 W**
d. 10 to 20 W

50. The wattage of motor for driving domestic sewing machine will be around
a. **100 to 150 W**
b. 40 to 75 W
c. 10 to 30 W
d. 5 to 10 W

51. Which of the following single-phase motors has relatively poor starting torque ?
a. Universal motor
b. Repulsion motor
c. **Capacitor motor**

d. All single phase motors have zero starting torque

52. Which type of load is offered by cranes and hoists ?

a. Gradually varying load
b. Non-reversing, no-load start
c. Reversing, light start
d. **Reversing, heavy start**

53. The speed of a universal motor is generally reduced by using

a. **gear trains**
b. V-belts
c. brakes
d. chains

54. Which of the following motors can be used for unity power factor ?

a. Capacitor run motor
b. Shaded pole motor
c. Hysteresis motor
d. **Schrage motor**

55. When a D.C. series motor is connected to A.C. supply, the power factor will be low because of

a. **high inductance of field and armature circuits**
b. induced current in rotor due to variations of flux
c. fine copper wire winding
(d) none of the above

56. The direction of rotation of universal motor can be reversed the by reversing the flow of current through

a. armature winding
b. field winding
c. **either armature winding or field winding**
d. none of the above

57. In which single-phase motor, the rotor has no teeth or winding ?

a. Split phase motor
b. Reluctance motor
c. **Hysteresis motor**
d. Universal motor

58. Which motor is normally free from mechanical and magnetic vibrations ?

a. Split phase motor
b. Universal motor
c. **Hysteresis motor**
d. Shaded pole motor

59.. As hysteresis motors are free from mechanical and magnetic vibrations therefore these are considered as suitable for

a. fans
b. blowers
c. **sound equipment**
d. mixer grinders

60.A reluctance motor

a. is self-starting
b. is constant speed motor
c. needs no D.C. excitation
d. **all of the above**

3. Three Phase Alternator

Position in Question Paper **Total Marks-20**

Q.1 .c,b) 2+2=4-Marks.
Q.2 d) 4-Marks.
Q.3 c) 4-Marks.
Q.5 b&c. 8 -Marks.

Descriptive Question

1. Derive the relationship between Ns and f of alternator.
2. Explain why armature winding of an alternator is short pitched and distributed.
3. Compare salient pole and cylindrical rotor alternator
4. Define each of following terms of alternator :
   a. Leakage reactance
   b. Synchronous impedance
   c. Distribution factor
   d. Pitch factor.
5. Explain armature reaction in alternators for a)unity pf, b)zero pf leading,
a. c) zero pf lagging load. Draw suitable waveforms showing the effect of armature flux.
6. Derive the emf equation of an alternator.
7. Explain the method of finding regulation of alternator by ampere turn method.
8. Define the following terms and write their mathematical expression :
a. Pitch Factor and
b. Distribution Factor related to the winding of alternators
9. Draw the phasor diagram of loaded alternator when load is capacitive.
10. List out the advantages of having a stationary armature and rotating field of 3φ alternator.
11. Describe the factors affecting the regulation of three phase alternator and draw the phasor diagrams of loaded alternator when operating power factor is lagging and leading .
12. State and explain different methods of finding Voltage regulation of alternator
13. Explain OC and SC test performed on alternator
14. .Derive expression for winding and distribution factor of alternator and also explain them
15. Explain different types of armature winding
16. Explain synchronous reactance and synchronous impedance
17. State the factors affecting A) turn emf B) coil emf C) phase emf D) Line emf

MCQ Question

(Total number of Question=Marks*3=20*3=60)

Note: Correct answer is marked with **bold**

1. The magnitude of various voltage drops that occur in an alternator, depends on
   a. power factor of the load
   b. **load current**
   c. power factor x load current
   d. power factor x (load current)2

2. In an alternator, at lagging power factor, the generated voltage per phase, as compared to that at unity power factor
   a. must be same as terminal voltage
   b. must be less than the terminal voltage
   c. **must be more than the terminal voltage**
   d. must be 1.41 time the terminal voltage.

3. The power factor of an alternator depends on
   a. **Load**
   b. Speed of rotor
   c. Core losses
   d. Armature losses.

4. Which kind of rotor is most suitable for turbo alternators which arc designed to run at high speed ?
   a. Salient pole type
   b. **Non-salient pole type**
   c. Both (A) and (B) above
   d. None of the above.

5. Salient poles are generally used on
   a. high speed prime movers only
   b. medium speed prime movers only
   c. low speed prime movers only
   d. **low and medium speed prime movers**

6. The frequency of voltage generated in an alternator depends on
   a. number of poles
   b. rotative speed
   c. **number of poles and rotative speed**
   d. number of poles, rotative speed and type of winding

7. The frequency of voltage generated by an alternator having 8 poles and rotating at 250 rpm is
   a. 60 Hz
   b. 50 Hz
   c. 25 Hz
   d. **16 2/3 Hz.**

8. An alternator is generating power at 210 V per phase while running at 1500 rpm. If the need of the alternator drops to 1000 rpm, the generatedvoltage per phase will be
   a. 180 V
   b. 150 V
   c. 140 V
   d. 105 V.

9. A 10 pole AC generator rotates at 1200 rpm. The frequency of AC voltage in cycles per second will be
a. 110
b. **100**
c. 50.
d. 0

10. The number of electrical degrees passed through in one revolution of a six pole synchronous alternator is
a. 360:
b. 720
c. 1080
d. 2160 .

11. Fleming's left hand rule may be applied to an electric generator to find out
a. direction of rotor rotation
b. polarity of induced emf
c. **direction of induced emf**
d. direction of magnetic field.

12. If the input to the prime mover of an alternator is kept constant but the excitation is changed, then the
a. **reactive component of the output is changed**
b. active component of the output is changed
c. power factor of the load remains constant
d. power factor of the load reduces.

13. An alternator is said to be over excited when it is operating at
a. A unity power factor
b. **leading power factor**
c. lagging power factor
d. lagging to leading power factor

14. When an alternator is running on no load the power supplied by the prime mover is mainly consumed
a. to meet iron losses
b. to meet copper losses
c. **to meet all no load losses**
d. to produce induced emf in armature winding.

15. As the speed of an alternator increases
a. **the frequency increases**
b. the frequency decreases
c. the frequency remains constant but power factor decreases
d. none of the above.

16. For an alternator when the power factor of the load is unity
a. the armature flux will have square waveform
b. the armature flux will be demagnetising
c. **the armature flux will be cross-magnetising**
d. the armature flux will reduce to zero

17. The driving power from the prime mover driving the alternator is lost but the alternator remains connected to the supply network and the field supply also remains on.
a. The alternator will get burnt
b. behave as an induction motor but will rotate in the opposite direction

c. **behave as a synchronous motor and will rotate in the same direction**
d. behave as a synchronous motor but will rotate in a reverse direction to that corresponding to generator action

18. If the input of the prime mover of an alternator is kept constant but the excitation is changed, then
a. the active component of the output is changed
b. **the reactive component of the output is changed**
c. power factor of the load remains constant
d. power factor of the load changes from lagging to leading.

19. For 50 Hz system the maximum speed of an alternator can be
a. approximately 3600 rpm
b. approximately 3000 rpm
c. 3600 rpm
d. **3000 rpm.**

20. The armature reaction of an alternator influences
a. windage losses
b. operting speed
c. **generated voltage per phase**
d. waveform of voltage generated.

21. For the same power rating, a lower voltage alternator will be
a. more efficient
b. **larger in size**
c. operating at high rpm
d. more costly

22. An alternator is supplying 10A to an inductive load at 220 V, whil running at 1000 rpm. Now if the speed of the alternator is reduced to 750 rpm but the field current remains unchanged, the load current will become
a. 18 A
b. 13.3 A
c. **10 A**
d. 7.5 A.

23. Dampers in a large generator
a. **increase stability**
b. reduce voltage fluctuations
c. reduce frequency fluctuations.
d. None

24. An alternator is rated for 75 kW at 0.8 power factor. It means that
a. alternator has 4 poles
b. **alternator can supply 75 kW at 0.8 power factor**
c. alternator can supply power only to loads having power factor 0.8 only
d. the peak efficiency of alternator occurs only at 75 kW load having 0.8 lagging power factor.

25. The regulation of an alternator is
a. the reduction in terminal voltage when alternator is loaded
b. the variation of terminal voltage under the conditions of maximum and minimum excitation
c. **the increase in terminal voltage when load is thrown off**
d. the change in terminal voltage from lagging power factor to leading power factor.

26. A magnetisation curve represents the relationship between
a. reactive and non-reactive components of voltage
b. **exciting currents and terminal voltage**

c. power factor and terminal voltage
d. magnetic flux and armature current.

27. In an alternator if the armature reaction produces demagnetisation of the main field, the power factor should be
a. **Zero, lagging load**
b. Zero, leading load
c. Unity.

28. In an alternator if the armature reaction produces magnetisation of the main field the power factor should be
a. **Zero, lagging load**
b. Zero, leading load
c. Unity.

29. When an alternator is supplying unity power factor load, the armature reaction will produce
a. magnetisation of the main field
b. demagnetisation of the main field
c. **distortion of the main field**.

30. An alternator has full load regulation of 4% when the power factor of the load is 0.8 lagging while alternator runs at 1500 rpm. The full load regulation of 1400 rpm for 0.8 pf lagging load will be
a. 15/14 x 4 percent
b. 14/15 x 4 percent
c. **4 percent**
d. Depends on other factors also.

31. The Potier's triangle separates the
a. iron losses and copper losses
b. field mmf and armature mmf
c. stator voltage and rotor voltage
d. **armature leakage reactance and armature reaction mm**

32. In the Potier's triangle, the Potier reactance drop per phase is 22 volts per phase at 88 amperes per phase. The Potier's reactance per phase is
a. 0.22
b. **0.25**
c. 0.30
d. 0.44.

33. Two alternators are running in parallel. The excitation of one of the alternator is increased. The result will be
a. machine with excess excitation will burn
b. both machines will start vibrating
c. power output will decrease
d. **wattless component will change**

34. The power output of an alternators is 100 kW. In order that the tangent of pf angle may be 0.8 lagging, the KVAR rating must be
a. 80 cosφ KVAR
b. 80 sin φ KVAR
c. 80 KVAR
d. **-80 KVA**

35. The power output of an alternator is 40 kW and KVAR component is - 25. What will be the value of tanφ (φ being the power factor angle) ?

a. 0.625 lagging
b. **0.625 leading**
c. 0.375 lagging
d. 0.375 leading.

36. When short pitch coils of 160 are used in an alternator, which harmonic component will not be present in the output emf ?
a. third
b. fifth
c. seventh
d. **ninth.**

37. A 120 MW turbo alternator is supplying power to 80 MW load at p.f. lagging. Suddenly the steam supply to the turbine is cut off and the alternator remains connected to the supply network and the field supply also remains on. What will happen to the alternator ?
a. The stator winding of the alternator will get burnt
b. The rotor winding of the alternator will get burnt
c. **The alternator will continue to run as a synchronous motor rotating in the same direction**
d. The alternator will continue to run as a synchronous motor rotating in the opposite direction.

38. Two alternators A and B are sharing an inductive load equally. If the excitation of alternator A is increased
a. alternator B will deliver more current and alternator A will deliver less current
b. **alternator B will deliver less current and alternator A will deliver more current**
c. both will continue to share load equally
d. both will deliver more current.

39. Desirable feature for the parallel operation of two alternators is
a. both should have same resistance
b. both should have same reactance
c. **both should have less of resistance as compared to synchronous reactance**
d. both should have more of resistance as compared to synchronous reactance.

40. Alternators used in aircraft systems usually have frequency of
a. 25 Hz
b. 50 Hz
c. 100 Hz
d. **400 Hz.**

41. High frequency on aircraft alternators is selected in order to
a. free the systems from external disturbance
b. compensate for high speeds
c. compensate for high altitudes
d. reduce the bulk.

42. A 20 pole ac generator rotates at 600 rpm. The periodic time of current in seconds per cycle is
a. 0.009
b. 0.004
c. 0.008
d. **(D) 0.01**

43. What kind of rotor is most suitable for turbo alternators ?

a. salient pole type
b. **non-salient pole type**
c. both (A) and (B) above
d. none of the above

44. The synchronizing power developed in one of the alternators, when two alternators are running in parallel, will load the same alternator in which it is developed and reduce its speed
a. **True**
b. False

45. If the input to the prime mover of an alternator is kept constant but the excitation is changed then the
a. **reactive component of the output is changed**
b. active component of the output is changed
c. power factor of load remains constant.

46. If two machines are running in synchronism and the voltage of one machine is suddenly increased
a. the machines will burn
b. both machines will stop
c. synchronising torque will be produced to restore further synchronism.

47. In an alternator, at 0.8 lagging power factor, the generated voltage per phase is 240 V to give a rated terminated voltage ' V '. If the power factor of load increases to unity, the generated voltage per phase must be
a. 260 V
b. 250 V
c. 240 V
d. 225 V.

48. The advantage of salient poles in an alternator is
a. reduce noise
b. reduced windage loss
c. **adoptability to low and medium speed operation**
d. reduce bearing loads and noise.

49. Two alternators A and B are sharing a resistive load (p.f. = 1) equally. Now if the excitation of alternator A is increased
a. alternator A will become lagging and alternator B will become leading
b. alternator A will become leading and alternator B will become lagging
c. both alternators will continue to operate on unity power factor
d. both alternators will operate on lagging power factor

50. The advantage of providing damper winding in alternators is
a. elimination of harmonic effects
b. provide a low resistance path for the currents due to unbalancing of voltage
c. oscillations are provided when two alternators operate in parallel
d. **all of the above.**

51. When two alternators are running in exactly synchronism, the synchronizing power wil be
a. **zero**
b. sum of the output of two
c. unity
d. 0.707.

52. In synchronous alternator, which of the following coils will have emf closer to sine waveform ?
a. concentrated winding in full pitch coils
b. concentrated winding in short pitch coils
c. distributed winding in full pitch coils
d. **distributed winding in short pitch coils.**

53. An alternator has rated field current of 4 A. The alternator develops 180 V while drawing a field current of 2 A at 750 rpm. If the field current is made 4 A at 750 rpm generated voltage could be
a. 400 V
b. 380 V
c. 60V
d. **330 V.**

54. The armature reaction of an alternator will be completely magnetizing in case the load power factor is
a. unity
b. 0.707
c. zero lagging
d. **zero loading.**

55. Which of the following is not an integral part of synchronous generator system ?
a. prime mover
b. **distribution transformer**
c. excitation system
d. protection system.

56. For turbo generators the range of excitation voltage is
a. 10 to 20 V
b. 30 to 100 V
c. **100 to 800 V**
d. 1000 to 1800 V.

57. In case of low speed hydrogenerators, the short circuit ratio is usually
a. to 0.5
b. 0.5 to 0.6
c. 0.6 to 1.0
d. **to 1.5.**

58. The permissible duration for which a generator of rated frequency 50Hz can run at 46 Hz is
a. zero
b. one cycle
c. one second
d. one minute

59. The permissible duration in supply . frequency is
a. ± 2 %
b. ± 5 %
c. ± 10 %
d. ± 25 %.

60. The regulation of an alternator is likely to be negative in case of
a. high speed alternators
b. slow speed alternators
c. lagging power factor of the load
d. **leading power factor of the load.**

61. 61 A phase, 50 Hz, 6600 V, alternator is rated at 6600 kW at 0.8 power factor and a full load efficiency of 90%.85 kVA is rating of the alternator is
a. 750 kVA
b. **7500 kVA**
c. 75000 kVA
d. 750000 kVA.

62. The current rating of the alternator is

a. 65.63 A
b. 656.3 A
c. **6563 A**
d. 65630 A.

63. The input to the alternator is
a. 666.6 kW
b. **6666 kW**
c. 66660 kW
d. 666,600 kW.

64. If the input. to an alternator remains unaltered, but excitation is changed then which of the following will not change ?
a. kVA output
b. **kW output**
c. power factor
d. all of the above.

65. 65. Which of the following method is likely to give the voltage regulation more than the actual value ?
a. **Synchronous reactance method**
b. MMF method
c. Zero power factor method
d. None of the above.

66. The effect of cross magnetization in an alternator field is to make the output
a. true sinusoidal
b. **non-sinusoidal**
c. harmonic free
d. none of the above.

67. 67. In order to reduce the harmonics in the emf generated in an alternator
a. slots are skewed
b. salient pole tips are chamfered
c. winding is well distributed
d. all of the above.

68. 68. The maximum power in a synchronous machine is obtained when the load angle is
a. 0°
b. 85°
c. 120°
d. 135°.

69. 69. The emf generated due to nth harmonic component of flux in an alternator will be
a. n times the fundamental emf
b. same as fundamental emf
c. less than the value of fundamental emf.

70. 70. Synchronizing torque comes into operation under all of the following cases EXCEPT
a. phase difference between two voltages
b. frequency difference between two voltages
c. voltage difference between two voltages
d. reduction in exciting current in one of the alternators.

71. 71. Unbalanced 3-phase stator currents cause
a. double frequency currents in the rotor
b. healing of rotor
c. vibrations
d. **all of the above**

72. In large generators protection provided against external faults is
a. biased differential protection
b. sensitive earth fault protection
c. inter-turn fault protection
d. **all of the above**

73. Pitch factor is the ratio of the emfs of
a. **short pitch coil to full pitch coil**
b. full pitch winding to concentrated winding
c. full pitch winding to short pitch winding
d. distributed winding to full pitch winding.

73. The Potier's triangle separates
a. stator losses and rotor losses
b. fixed losses and variable losses
c. armature voltage and field voltage
d. **armature leakage reactance and armature reaction mmf.**

74. If a single phase alternator has 8 slots per pole uniformly speed, but the winding is arranged with the middle two left empty, the breadth coefficient will be
a. 0.99
b. 0.88
c. 0.67
d. **0.53.**

75. Two alternators are running in parallel. If the field of one of the alternator is adjusted, it will
a. reduce its speed
b. change its load
c. **change its power factor**
d. change its frequency.

76. A generator is operating by itself supplying the system loads. The reactive power supplied by the generator will
a. depend on prime mover rpm
b. depend on type of insulation used
c. **depend on the amount demanded by the load**
d. depend on inter-coil inductance.

77. Which of the following part plays important role in over speed protection of a generator
a. Over current relay
b. Alarm
c. Differential protection
d. **Governor**.

78. Which type of protection is provided on a generator to protect againststator insulation failure ?
a. Differential protection
b. Thermocouple actuated alarm
c. Over current relay
d. Reverse power relay.

79. Which relays comes into operation in the event of the failure of prime mover connected to ihe generator ?
a. **Reverse power relay**
b. Differential relay
c. Buchholz relay
d. None of the above.

80. In alternators, the distribution factor is defined as the ratio of emfs of
a. **distributed winding to connected winding**

b. full pitch winding to distributed winding
c. distributed winding to full pitch winding
d. concentrated winding to distributed winding.

81. One of the advantages of distributing the winding in alternator is to
a. reduce noise
b. save on copper
c. **improve voltage waveform**
d. reduce harmonics.

82. In case of a uniformly distributed winding, the value of distribution factor is
a. **0.995**
b. 0.80
c. 0.75
d. 0.50.

83. The advantage of a short pitch winding is
a. low noise
b. increased inductance
c. **suppression of harmonics**
d. reduced eddy currents.

84. Two alternators are connected in parallel. Their kVA and kW load share can be changed by changing respectively their
a. driving torque and excitation
b. excitation and driving torque
c. excitations only
d. driving torques only

85. In case of alternators, the dark and bright lamp method is used for
a. phase sequence
b. load balancing
c. **synchronizing**
d. load transfer.

86. The advantage of using short pitched windings in an alternator is that it
a. suppresses the harmonics in generated emf
b. **reduces the total voltage around the armature coils**
c. saves copper used in windings
d. improves cooling by better circulation of air.

87. For the same power rating, an alternator operating at lower voltage will be
a. less noisy
b. costlier
c. **larger in size**
d. more efficient.

88. Which of the following is the common synchronous speed in rpm between 60 Hz and 50 Hz alternators ?
a. 900
b. **600**
c. 375
d. 225.

89. All of the following losses for a synchronous machine are fixed EXCEPT
a. Bearing friction loss
b. Copper loss
c. Windage loss
d. Core loss.

90. Salient pole type rotors as compared to cylindrical pole type are
a. smaller in diameter and larger in axial length
b. **larger in diameter and smaller in axial length**
c. larger in diameter as well as axial length
d. small in diameter as well as axial length.

91. In a synchronous machine, the field flux axis is ahead of the armature field axis in the direction of rotation, the machine is working as

a. asynchronous alternator
b. asynchronous motor
c. synchronous motor
d. **synchronous alternator**

92. Which of the following is not a common synchronous speed in rpm between a 50 Hz and 25 Hz alternator ?

a. 750
b. 375
c. 250
d. **200.**

93. The effective voltage in one phase of an alternator having 240 turns per phase, frequency of 60 Hz and flux per pole of 2.08 x 106lines will be

a. 332.5 V
b. 665 V
c. **1330 V**
d. 2660 V.

94. The maximum current that can be supplied by an alternator depends on

a. speed of the exciter
b. number of poles
c. exciter current
d. **strength of the magnetic field.**

4. Synchronous motors

Position in Question Paper **Total Marks-20**

Q.1 .c,b) 2+2=4-Marks.
Q.2 d) 4-Marks.
Q.3 c) 4-Marks.
Q.5 b&c. 8 -Marks.

Descriptive Question

1. Explain with the neat sketch the construction and working of reluctance type 1 phase synchronous motor
2. Explain why synchronous motor is not self-staring?
3. Explain phenomenon of hunting in synchronous motor
4. Explain V curve and Inverted V curve of synchronous motor
5. Explain the term load angle Pull in torque, pull out torque
6. What are the different methods used to make synchronous motor self starting
7. What is effect of variation of load on synchronous motor
8. Explain synchronous motor on load and No Load condition
9. Draw power flow diagram of synchronous motor
10. Compare synchronous motor and induction motor
11. Give the application of synchronous motor
12. State and explain the effect of change of excitation on synchronous motor at constant load
13. State the effect of variation of load on synchronous motor

MCQ Question

(Total number of Question=Marks*3=20*3=60)

Note: Correct answer is marked with **bold**

1. Synchronous motors are generally not self-starting because
   a. the direction of rotation is not fixed
   b. **the direction of instantaneous torque reverses after half cycle**
   c. startes cannot be used on these machines
   d. starting winding is not provided on the machines

2. In case one phase of a three-phase synchronous motor is short-circuited the motor will
a. **not start**
b. run at 2/3 of synchronous speed
c. run with excessive vibrations
d. take less than the rated load

3. A pony motor is basically a
a. small induction motor
b. D.C. series motor
c. D.C. shunt motor
d. double winding A.C./D.C. motor

4. A synchronous motor can develop synchronous torque
a. when under loaded
b. while over-excited
c. only at synchronous speed
d. below or above synchronous speed

5. A synchronous motor can be started by
a. pony motor
b. D.C. compound motor
c. providing damper winding
d. any of the above

6. A three-phase synchronous motor will have
a. no slip-rings
b. one slip-ring
c. two slip-rings
d. three slip-rings

7. Under which of the following conditions hunting of synchronous motor is likely to occur?
a. Periodic variation of load
b. Over-excitation
c. Over-loading for long periods
d. Small and constant load

8. When the excitation of an unloaded salient pole synchronous motor suddenly gets disconnected
a. the motor stops
b. it runs as a reluctance motor at the same speed
c. it runs as a reluctance motor at a lower speed
d. none of the above

9. When V is the applied voltage, then the breakdown torque of a synchronous motor varies as
a. V
b. V312
c. V2
d. 1/V

10. The power developed by a synchronous motor will be maximum when the load angle is
a. zero
b. 45°
c. 90°
d. 120°

11.A synchronous motor can be used as a synchronous capacitor when it is
a. under-loaded
b. over-loaded
c. under-excited
d. over-excited

12.A synchronous motor is running on a load with normal excitation. Now if the load on
a. the motor is increased

b. power factor as well as armature current will decrease
c. power factor as well as armature current will increase
d. power factor will increase but armature current will decrease
e. power factor will decrease and armature current will increase

13. Mostly, synchronous motors are of
a. alternator type machines
b. induction type machines
c. salient pole type machines
d. smooth cylindrical type machines

14. The synchronous motor is not inherently self-starting because
a. the force required to accelerate the rotor to the synchronous speed in an instant is absent
b. the starting device to accelerate the rotor to near synchronous speed is absent
c. a rotating magnetic field does not have enough poles
d. the rotating magnetic field is produced by only 50 Hz frequency currents

15. As the load is applied to a synchronous motor, the motor takes more armature current
a. because
b. the increased load has to take more current
c. the rotor by shifting its phase backward causes motor to take more current
d. the back e.m.f. decreases causing an increase in motor current
e. the rotor strengthens the rotating field casuing more motor current

16. Synchronous motor always runs at
a. the synchronous speed
b. less than synchronous speed
c. more than synchronous speed
d. none of the above

17. An over-excited synchronous motor takes
a. leading current
b. lagging current
c. both (a) and (b)
d. none of the above

18. The working of a synchronous motor is similar to
a. gear train arrangement
b. transmission of mechancial power by shaft
c. distribution transformer
d. turbine

19. The minimum armature current of the synchronous motor corresponds to operation at
a. zero power factor leading
b. unity power factor
c. 0.707 power factor lagging
d. 0.707 power factor leading

20. In a synchronous motor, the magnitude of stator back e.m.f. £& depends on
a. d.c. excitation only
b. speed of the motor
c. load on the motor
d. both the speed and rotor flux

21. If load (or torque) angle of a 4-pole synchronous motor is 6° electrical, its value in mechanical degrees is
a. 2
b. 3
c. 4
d. 6

22. For V-curves for a synchronous motor the graph is drawn between
- **a. field current and armature current**
- b. terminal voltage and load factor
- c. power factor and field current
- d. armature current and power factor

23. The back e.m.f. of a synchronous motor depends on
- a. speed
- b. load
- **c. load angle**
- d. all of the above

24. A synchronous motor can operate at
- a. lagging power factor only
- b. leading power factor only
- c. unity power factor only
- d. **lagging, leading and unity power factors**

25. In a synchronous motor which loss varies with load ?
- a. Windage loss
- b. Bearing friction loss
- c. **Copper loss**
- d. Core loss

26. A synchronous motor can be made self-starting by providing
- a. damper winding on rotor poles
- b. damper winding on stator
- c. damper winding on stator as well as rotor poles
- d. **none of the above**

27. The oscillations in a synchronous motor can be damped out by
- a. maintaining constant excitation
- b. running the motor on leading power factors
- c. **providing damper bars in the rotor pole faces**
- d. oscillations cannot be damped

28. The shaft of synchronous motor is made of
- a. **mild steel**
- b. chrome steel
- c. alnico
- d. stainless steel

29. When the field of a synchronous motor is under-excited, the power factor will be
- a. leading
- b. **lagging**
- c. unity
- d. zero

30. The speed regulation of a synchronous motor is always
- a. 1%
- b. 0.5%
- c. positive
- d. **zero**

31. The percentage slip in case of a synchronous motor is
- a. 1%
- b. 100%
- c. 0.5%
- d. **(d) zero**

32. The operating speed of a synchronous motor can be changed to new fixed value by
- a. changing the load
- b. changing the supply voltage
- c. **changing frequency**
- d. using brakes

33.A synchronous motor will always stop when
a. supply voltage fluctuates
b. load in motor varies
c. **excitation winding gets disconnected**
d. supply voltage frequency changes

34.ruining in a synchronous motor takes place
a. when supply voltage fluctuates
b. **when load varies**
c. when power factor is unity
d. motor is under loaded

35. When load on an over-excited or under excited synchronous*motor is increased, rate of change of its armature current as compared with that of power factor is
a. more
b. **less**
c. equal
d. twice

36. The rotor copper losses, in a synchronous motor, are met by
a. **d.c. source**
b. armature input
c. motor input
d. supply lines

37. The maximum power developed in a synchronous motor occurs at a coupling angle of
a. 30°
b. 60°
c. **90°**
d. 180°

38. When the stator windings are connected in such a fashion that the number of poles are made half, the speed of the rotor of a synchronous motor
a. remains same as the original value
b. decreases to half the original value
c. tends to becomes zero
d. **increases to two times the original value**

39. In which of the following motors the stator and rotor magnetic field rotate at the same speed ?
a. Universal motor
b. **Synchronous motor**
c. Induction motor
d. Reluctance motor

40. Synchronizing power of a synchronous machine is
a. directly proportional to the synchronous reactance
b. **inversely proportional to the synchronous reactance**
c. equal to the synchronous reactance
d. none of the above

41. Synchronous motors are
a. **not-self starting**
b. self-starting
c. essentially self-starting
d. none of the above

42. The standard full-load power factor ratings for synchronous motors are
a. zero or 0.8 leading
b. unity or 0.8 lagging
c. **unity or 0.8 leading**
d. unity or zero

43.A synchronous motor running with normal excitation adjusts to load increases essentially by increase in

a. back e.m.f.
b. **armature current**
c. power factor
d. torque angle

44. A synchronous motor has better power factor as compared to that of an equivalent induction motor. This is mainly because
a. synchronous motor has no slip
b. **stator supply is not required to produce magnetic field**
c. mechanical load on the rotor remains constant
d. synchronous motor has large air gap

45. A synchronous motor working at leading power factor can be used as
a. voltage booster
b. **phase advancer**
c. noise generator
d. mechanical synchronizer

46. Slip rings are usually made of
a. carbon or graphite
b. **brass or steel**
c. silver or gold
d. copper or aluminium

47. An over excited synchronous motor is used for
a. fluctuating loads
b. variable speed loads
c. low torque loads
d. **power factor corrections**

48. When the voltage applied to a synchronous motor is increased, which of the following will reduce ?
a. Stator flux
b. Pull in torque
c. Both (a) and (b)
d. **None of the above**

49. The efficiency of a properly designed synchronous motor will usually fall in range
a. 60 to 70%
b. 75 to 80%
c. **85 to 95%**
d. 99 to 99.5%

50. To limit the operating temperature an electrical machine should have proper
a. voltage rating
b. **current rating**
c. power factor
d. speed

51. Slip-rings in a synchronous motor carry
a. alternating current
b. no current
c. all of the above
d. direct current

52. A synchronous machine with large air gap has
a. a higher value of stability limit
b. a small value of inherent regulation
c. a higher synchronizing power which makes the machine less sensitive to load variations
d. all of the above

53. The armature current of the synchronous motor has higher values for
a. high excitation only
b. low excitation only
c. **both (a) and (b)**
d. none of the above

54. In a synchronous motor running with fixed excitation, when the load is increased

three times, its torque angle becomes approximately
a. one-third
b. twice
c. **thrice**
d. six times

55. The angle between the rotating stator flux and rotor poles is called _____ angle.
a. **torque**
b. obtuse
c. synchronizing
d. power factor

56. Which of the following methods is used to start a synchronous motor ?
a. Damper winding
b. Star-delta starter
c. **Damper winding in conjunction with star-delta starter**
d. Resistance starter in the armature circuit

57. When the rotor speed, in a synchronous machine, becomes more than the synchronous speed during hunting, the damper bars develop
a. inductor motor torque
b. **induction generator torque**
c. synchronous motor torque
d. d.c. motor toque

58. An important advantage of a synchronous motor over wound round induction motor is that
a. **its power factor may be varied at will**
b. its speed is independent of supply frequency
c. its speed may be controlled more easily
d. none of the above

59. The mechanical displacement of the rotor with respect to the stator, in polyphase multipolar synchronous motorsrunning at full load, is of the order of
a. zero degree
b. two degrees
c. **five degrees**
d. ten degrees

60. Power factor of a synchronous motor is unity when
a. the armature current is maximum
b. **the armature current is minimum**
c. the armature current is zero
d. none of the above

5. Fractional horse power motors

Position in Question Paper **Total Marks-20**

Q.1 .f,g) 2+2=4-Marks.
Q.2 d) 4-Marks.
Q.3 c) 4-Marks.
Q.5 b&c. 8 -Marks.

Descriptive Question

1. With the help of neat diagram explain the construction and working of following motor and also draw Torque-speed characteristics
2. synchronous reluctance motor
3. Switched reluctance motor
4. Explain the construction and working of BLDC also gives advantage and disadvantage
5. Explain the construction and working of variable reluctance stepper motor
6. Explain the construction and working of permanent magnet stepper motor
7. Explain important terms related with stepper motor
8. Explain the construction and working of AC servo motor
9. Explain the construction and working of DC servo motor

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1. The electric motor used in portable drills is
   a. capacitor run motor
   b. hysteresis motor
   c. **universal motor**
   d. repulsion motor

2. Which of the following applications always have some load whenever switched on ?
   a. Vacuum cleaners
   b. Fan motors
   c. **Pistol drills**
   d. All of the above

3. The speed control of universal motor used for sewing machines is by
   a. friction
   b. **varying the resistance**
   c. tapping the field
   d. centrifugal mechanism

4. Torque developed by a single phase induction motor at starting is
   a. pulsating
   b. uniform
   c. none of the above
   d. **nil**

5. In split phase motor main winding is of
   a. thin wire placed at the top of the slots

b. thin wire placed at the bottom of the slots
c. **thick wire placed at the bottom of the slots**
d. thick wire placed at the top of the" slots

6. In repulsion motor, maximum torque is developed when
a. **brush axis is at 45° electrical to the field axis**
b. brush axis coincides with the field axis
c. brush axis is at 90° electrical to the field axis
d. none of the above

7. If the centrifugal switch does not open at 70 to 80 percent of synchronous speed of motor, it would result in
a. **damage to the starting winding**
b. damage to the centrifugal switch
c. overloading of running winding
d. none of the above

8. Speed torque characteristic of a repulsion induction motor is similar to that of a D.C.
a. shunt motor
b. series motor
c. **compound motor**
d. separately excited motor

9. In a ceiling fan employing capacitor run motor
a. **secondary winding surrounds the primary winding**
b. primary winding surrounds the secondary winding
c. both are usual arrangements
d. none of the above

10. The shaded pole motor is used for
a. high starting torque
b. **low starting torque**
c. medium starting torque
d. very high starting torque

11.. The rotor slots, in an induction motor, are usually not quite parallel to the shaft because it
a. improves the efficiency
b. helps the rotor teeth to remain under the stator teeth
c. **helps in reducing the tendency of the rotor teeth to remain under the stator teeth**
d. improves the power factor

12. The speed/load characteristics of a universal motor is same as that of
a. A.C. motor
b. D.C. shunt motor
c. **D.C. series motor**
d. none of the above

13. The purpose of stator winding in the compensated repulsion motor is to
a. provide mechanical balance
b. **improve power factor and provide better speed regulation**
c. prevent hunting in the motor
d. eliminate armature reaction

14. Which of the following motors is used for unity power factor ?
a. Hysteresis motor
b. **Schrage motor**

c. Universal motor
d. Reluctance motor

15.. The motor used for the compressors is
a. d.c. series motor
b. shaded pole motor
c. **capacitor-start capacitor-run motor**
d. reluctance motor

16. Which of the following motors is used in a situation where load increases with speed ?
a. Induction motor
b. **Three-phase series motor**
c. Schrage motor
d. Hysteresis motor

17. In repulsion motor, zero torque is developed when
a. brush axis is 45° electrical to field axis
b. brush axis coincides with the field axis
c. brush axis is 90° electrical to field axis
d. **both (b) and (c)**

18. Centrifugal switch disconnects the auxiliary winding of the motor at about ____ percent of synchronous speed
a. 30 to 40
b. **70 to 80**
c. 80 to 90
d. 100

19. Starting winding of a single phase motor of a refrigerator is disconnected from the circuit by means of a
a. **magnetic relay**
b. thermal relay
c. centrifugal switch
d. none of the above

20. If a single phase induction motor runs slower than normal, the most likely defect is
a. **worn bearings**
b. short-circuit in the winding
c. open-circuit in the winding
d. none of the above

21.. Which of the following motors is used in tape-recorders ?
a. Hysteresis motor
b. Reluctance motor
c. Capacitor-run motor
d. Universal motor

22. Which of the following statements regarding two value capacitor motor is incorrect
a. It is a reversing motor
b. **It is preferred to permanent-split single-value capacitor motor where frequent reversals are required**
c. It has low starting as well as rushing currents
d. It has high starting torque

23.. Two-value capacitor motor finds increased application as compressor motor in small home air-conditioners because
a. it is comparatively cheaper
b. it has almost non-destructible capacitor
c. **it has low starting as well as running currents at relatively high power factor**
d. it is quiet in operation

24.. If the centrifugal switch of a two-value capacitor motor using two capacitors fails to open then
a. motor will not come upto speed
b. motor will not carry the load
c. current drawn by the motor will be excessively high
d. **electrolytic capacitor will, in all probability, suffer break down**

25. In a universal motor, the most common cause of brush sparking is
a. open armature winding
b. shorted armature winding
c. shorted field winding"
d. **all of the above**

26. If starting winding of a single-phase induction motor is left in the circuit, it will
a. run faster
b. spark at light loads
c. **draw excessive current and overheat**
d. run slower

27. Most of the fractional horsepower motors have either
a. hard and annealed bearings
b. ball or roller bearings
c. soft and porous bearings
d. **plain or sleeve bearings**

28. Which of the following statements regarding reluctance-start motor is incorrect ?
a. **It is similar to reluctance motor**
b. It is basically an induction motor and not a synchronous one
c. So far as its basic working principle is concerned, it is similar to shaded pole motor
d. the air-gap between rotor and salient poles is non- uniform

29. To reverse the direction of rotation of acapacitor start motor while it is running we should
a. **disconnect motor from the supply till it stops then reconnect it to supply with**
b. reversed connection of main or auxiliary winding
c. disconnect motor from supply and immediately reconnect it to supply with reversed
d. connections of the main winding

30.synchronous speed the motor will
a. become unstable
b. draw excessive armature current and may burn out
c. fall out of synchronism and come to stand still
d. **run as induction motor**

31. Which of the following motors has two separate windings on the motor ?
a. Repulsion motor
b. **Repulsion induction motor**
c. Repulsion start induction run motor
d. None of the above

32.shaded pole motor does not possess
a. centrifugal switch
b. capacitor
c. commutator
d. **all of the above**

33. In a A.C. series motor armature coils are usually connected to commutator
a. **through resistance**
b. through reactances
c. through capacitors
d. solidly

34. Which of the following statements regarding a reluctance motor is incorrect ?
a. **It cannot be reversed, ordinarily**
b. It requires no D.C. field excitation for its operation
c. It is nothing else but a single-phase, salient pole synchronous-induction motor
d. Its squirrel cage-rotor is of un symmetrical magnetic construction in order to vary
e. reluctance path between stator and rotor

35. A universal motor is one which
a. **can be operated either on D.C. or A.C. supply at approximately the same speed and**
b. **output**
c. can be marketed internationally
d. runs at dangerously high speed on no-load

36. A repulsion motor is equipped with
a. slip rings
b. **commentator**
c. both (a) and (b)
d. none of the above

37. The capacitors used in single-phase capacitor motors have no
a. voltage rating
b. dielectric medium
c. **polarity marking**
d. definite value

38. If a D.C. series motor is operated on A.C. supply, it will
a. spark excessively
b. have poor efficiency
c. have poor power factor
d. **all of the above**

39. After the starting winding of a single phase induction motor is disconnected from supply, it continues to run only on
a. **running winding**
b. rotor winding
c. field winding
d. compensating winding

40. Which of the following statements regarding repulsion-start induction motor is incorrect ?
a. It requires more maintenance of commutator and other mechanical devices
b. It makes quite a bit of noise on starting
c. **In fractional horse power motors, it has replaced the capacitor motors**
d. It is not easily reversed

41. A.C. series motor as compared to D.C. series motor has
a. smaller brush width
b. less number of field turns
c. more number of armature turns
d. **all of the above**

42. Locked rotor current of a shaded pole motor is
a. equal to full load current
b. less than full load current

c. **slightly more than full load current**
d. several times the full load current

43. Speed control of a universal motor is achieved by
a. varying field flux with tapped field windings
b. connecting rheostat in series
c. applying variable voltage by means of silicon controlled rectifier
d. **all of the above methods**

44. Hysteresis motor is particularly useful for high-quality record players and tape-recorders because
a. it revolves synchronously
b. it is not subject to any magnetic or mechanical vibrations
c. it can be easily manufactured in extremely small sizes of upto 1 W output
d. **it develops hysteresis torque which is extremely steady both in amplitude and phase**

45. Which of the following statements regarding hysteresis motor is in incorrect ?
a. **It is extremely sensitive to fluctuations in supply voltage**
b. Its high starting torque is due to its high rotor hysteresis loss
c. It is extremely quiet in operation
d. It accelerates from rest to full-speed almost instantaneously

46. Which of the following statements regarding single-phase induction motoris correct
a. It requires only one winding
b. It can rotate in one direction only
c. It is self-starting
d. **It is not self-starting**

47. The starting winding of a single-phase motor is placed in
a. armature
b. field
c. rotor
d. **stator**

48. The speed of a universal motor is usually reduced by using
a. **gearing**
b. belts
c. brakes
d. chains

49. A capacitor start single phase induction motor will usually have a power factor of
a. unity
b. 0.8 leading
c. 0.6 leading
d. **0.6 lagging**

50. A capacitor start, capacitor run single phase induction motor is basically a
a. ac series motor
b. dc series motor
c. **2 phase induction motor**
d. 3 phase induction motor.

51. The torque developed by a split phase motor is proportional to
a. Sine of angle between lm and ls
b. Cosine of angle between lm and Is
c. Main winding current, Im
d. Auxiliary winding current,Is

52. The starting capacitor of a single phase motor is

a. **Electrolytic capacitor**
b. Ceramic capacitor
c. Paper capacitor
d. None of the above

53. Which of the following is the most economical method of starting a single phase motor
a. Resistance start method
b. Inductance start method
c. **Capacitance start method**
d. Split-phase method

54. The number of turns in the starting winding of a capacitor start motor as compared to that for split phase motor is
a. same
b. **more**
c. less
d. none of the above.

55. In a split phase motor, the ratio of number of turns for starting winding to that for running winding is
a. 2.0
b. more than 1
c. 1.0
d. less than 1

56. A single phase motor generally used for small air compressor is
a. **capacitor start capacitor run motor**
b. reluctance motor
c. universal motor
d. shaded pole motor.

57. Out of the following motors, which will give the highest starting torque ?
a. Universal motor
b. **Capacitor start motor**
c. Shaded pole motor
d. All have zero starting torque.

58. Which single phase ac motor will you select for record players and tape recorders ?
a. **Hysteresis motor**
b. Shaded pole motor
c. Reluctance motor
d. Two value capacitor motor

59. A universal motor is one
a. which can run on any value of supply voltage
b. which has infinitely varying speed
c. **which can operate on ac as well as dc voltage**
d. which can work as single phase or three phase motor.

60. Under normal operating conditions which motor can run at 5000 rpm ?
a. Synchronous motor
b. Induction motor
c. **Universal motor**
d. No motor can give 5000 rpm.

61. The motor used in household refrigerators is
a. dc series motor
b. dc shunt motor
c. universal motor
d. **single phase induction motor**