Synchronous Machines MCQ

1. The zero power factor characteristic for the Potier diagram can be obtained by loading the alternator using

(a) lamp load.

(b) synchronous motor.

(c) water load.

(d) dc motor. [U.P.S.C. I.E.S. 1999]

Answer: (b) synchronous motor.

2. Modern alternators are designed to have poor regulation as it

(a) increases the value of short-circuit current.

(b) limits the value of short-circuit current.

(c) increases the efficiency of operation.

(d) both (a) and (c).

Answer: (b) limits the value of short-circuit current.

3. The phasor diagram by ASA method gives

(a) reliable results for both regulation and power angle of a salient pole synchronous generator.

(b) reliable result for power angle but erroneous result for regulation.

(c) reliable result for regulation but erroneous result for power angle.

(d) erroneous results for both regulation and power angle of a salient-pole synchronous generator.

Answer: (c) reliable result for regulation but erroneous result for power angle.

4. Armature reaction mmf and leakage reactance of a synchronous machine are determined by

(a) open-circuit and short-circuit tests.

(b) open-circuit and zero pf tests.

(c) open-circuit test only.

(d) zero pf test only.

Answer: (b) open-circuit and zero pf tests.

5. Consider the following:

1. EMF

2. Reversal

3. MMF

4. Direct

Which methods among these are for the determination of voltage regulation of an alternator?

(a) 1, 2, 3 and 4.

(b) 1 and 2 only.

(c) 2 and 3 only.

(d) 1 and 3 only. [U.P.S.C. I.E.S. E.E.-II, 2010]

Answer: (d) 1 and 3 only.

6. Consider the following:

1. LPF method.

2. EMF method.

3. ZPF method.

4. MMF method.

Which of the above methods are correct for determination of voltage regulation of an alternator?

(a) 1, 2 and 3.

(b) 2, 3 and 4.

(c) 2 and 3 only.

(d) 3 and 4 only. [U.P.S.C. I.E.S. E.E.-II, 2009]

Answer: (b) 2, 3 and 4.

7. Which one of the following methods would give higher than actual value of regulation of an alternator?

(a) ZPF method.

(b) MMF method.

(c) EMF method.

(d) ASA method. [U.P.S.C. I.E.S. E.E.-II, 1998]

Answer: (c) EMF method.

8. Which one of the following methods gives more accurate result for determination of voltage regulation of an alternator?

(a) MMF method.

(b) Synchronous impedance method.

(c) Potier triangle method.

(d) American Institution Standard method. [U.P.S.C. I.E.S. E.E.-11, 2004]

Answer: (c) Potier triangle method.

9. The four methods of calculation of voltage regulation of a 3-phase alternator are

1. EMF method.

2. Saturated synchronous reactance method.

3. New ASA method.

4. MMF method.

The correct sequence of the ascending order of the values of regulation obtained by these methods is

(a) 3, 4, 2, 1

(b) 4, 3, 1, 2

(c) 3, 4, 1, 2

(d) 4, 3, 2, 1 [U.P.S.C. I.E.S. 1993]

Answer: (d) 4, 3, 2, 1

10. By slip test on a 3-phase synchronous generator the maximum and minimum impressed voltages per phase are found to be V_{max} and V_{min} respectively whereas the maximum and minimum phase currents are found to be I_{max} and I_{min} respectively. The values of the direct axis synchronous reactance X_d and quadrature axis synchronous reactance X_q are given as

(a) $X_d = V_{max}/I_{min}$; $X_q = V_{min}/I_{max}$

(b) $X_d = V_{max}/I_{min}$; $X_q = V_{min}/I_{min}$

(c) $X_d = V_{max}/I_{min}$; $X_q = V_{max}/I_{max}$

(d) $X_d = V_{min}/I_{max}$; $X_q = V_{max}/I_{min}$

Answer: (a) $X_d = V_{max}/I_{min}$; $X_q = V_{min}/I_{max}$

11. Which one of the following statements is not correct in respect of synchronous machines?

(a) In salient pole machines, the direct-axis synchronous reactance, is greater than the quadrature axis synchronous reactance.

(b) The damper bars help the motor to self start.

(c) Short-circuit ratio is the ratio of field current required to produce the rated voltage on open circuit to the rated armature current.

(d) The V-curve of a synchronous motor represents the variation in armature current with field excitation at a given output power. [GATE E.E. 2005]

Answer: (c) Short-circuit ratio is the ratio of field current required to produce the rated voltage on open circuit to the rated armature current.

12. Slip test is performed to determine

(a) slip.

(b) direct-axis reactance and quadrature axis reactance.

(c) positive-sequence reactance and negative-sequence reactance.

(d) sub-transient reactance. [U.P.S.C. I.E.S. E.E.-11, 1999]

Answer: (b) direct-axis reactance and quadrature axis reactance.

13. For maximum current during slip test on a synchronous machine, the armature mmf aligns along

(a) d-axis.

(b) q-axis.

(c) 45° to d-axis.

(d) 45° to q-axis. [U.P.S.C. I.E.S. E.E.-II, 2002]

Answer: (b) q-axis.

14. While conducting a "slip" test for determination of direct- and quadrature-axis synchronous reactance X_d and X_q of salient pole synchronous machine, the rotor

of the machine is run with a slip ‘s' and stator supply frequency ‘f’ . The frequency of

1. voltage induced across open-field terminals

2. envelope of armature terminal voltage

3. envelope of armature current and

4. armature current will be respectively

(a) sf, sf, sf and f.

(b) sf, f sf and f

(c) f, sf, f and sf.

(d) f, (1 — s) f, (2 — s) f and sf. [U.P.S.C. I.E.S. E.E.-II, 1997]

Answer: (a) sf, sf, sf and f.

15. In which one of the following is reluctance power developed?

(a) Salient pole alternator.

(b) Non-salient pole alternator.

(c) Squirrel cage induction motor.

(d) Transformer. [U.P.S.C. I.E.S. E.E.-II, 2006]

Answer: (a) Salient pole alternator.

16. Which is the value of load angle when the power output of a salient pole synchronous generator is maximum?

(a) 0°

(b) 45°

(c) 90°

(d) none of the above. [U.P.S.C. I.E.S. 2006]

Answer: (b) 45°

17. Higher synchronous reactance is preferred in the present day alternators, because one can have

(a) reduced subtransient current.

(b) reduced harmonic currents.

(c) reduced transient currents.

(d) higher voltage regulation with load. [GATE E.E. 1999]

Answer: (c) reduced transient currents.

18. When a 3-phase alternator is suddenly short-circuited at its terminals, the initial value of short-circuit current is limited by which one of the following:

(a) Subtransient reactance X''_d.

(b) Transient reactance X'_d.

(c) Synchronous reactance X_s.

(d) Sum of X''_d , X'_d and X_s. [U.P.S.C. I.E.S. E.E.-11, 2004]

Answer: (a) Subtransient reactance X''_d.

19. X_d, X'_d and X''_d are steady-state d-axis synchronous reactance, transient d-axis reactance and subtransient d-axis reactance of a synchronous machine respectively. Which of the following statements is true?

(a) $X_d > X'_d > X''_d$

(b) $X''_d > X'_d > X_d$

(c) $X'_d > X''_d > X_d$

(d) $X_d > X''_d > X'_d$ [GATE E.E. 2001]

Answer: (b) $X''_d > X'_d > X_d$

20. An alternator with higher value of SCR has

(a) poor voltage regulation and lower stability limit.

(b) better voltage regulation and higher stability limit.

(c) poor voltage regulation and higher stability limit.

(d) better voltage regulation and low stability limit. [A.M.I.E. Sec B. Winter 1994]

Answer: (b) better voltage regulation and higher stability limit.

21. A 3-ϕ alternator has negligible stator resistance. A short-circuit test is conducted on this alternator. At a particular speed a field current of I_{f1} is required to drive the rated armature current. If the speed of the alternator is reduced to half, the field current required to maintain rated armature current

(a) would be equal to I_{fi}.

(b) would be equal to $2I_{f1}$.

(c) would be equal to $I_{f1}/2$.

(d) cannot be predicted due to insufficient data. [GATE 1993]

Answer: (d) cannot be predicted due to insufficient data.

22. Which one of the following is the correct statement?

(a) The armature current upon symmetrical 3-phase, short-circuit of a synchronous machine (armature resistance is negligible) constitutes q-axis current only.

(b) The armature current upon symmetrical 3-phase short-circuit of a synchronous machine (armature resistance is negligible) constitutes d-axis current only.

(c) The armature current upon symmetrical 3-phase short-circuit of a synchronous machine (armature resistance is negligible) has both d-axis and q-axis component.

(d) Short circuit current cannot be divided into d- and q-axes components. [U.P.S.C. I.E.S. E.E.-II, 2007]

Answer: (b) The armature current upon symmetrical 3-phase short-circuit of a synchronous machine (armature resistance is negligible) constitutes d-axis current only.

23. If the excitation of a 3-phase alternator operating on infinite bus bars is changed, which one of the following shall alter?

(a) Active power of machine.

(b) Reactive power of machine.

(c) Terminal voltage of machine.

(d) Frequency of machine. [U.P.S.C. I.E.S. 2008]

Answer: (b) Reactive power of machine.

24. A 3-phase synchronous generator with constant steam input supplies power to an infinite bus at a lagging power factor. If the excitation is increased

(a) both power angle and power factor decrease.

(b) both power angle and power factor increase.

(c) the power angle decreases while power factor increases.

(d) the power angle increases while power factor decreases. [U.P.S.C. IES. 2005]

Answer: (a) both power angle and power factor decrease.

25. A turbo-alternator set feeds power to a 3-phase constant voltage, constant frequency bus. If the steam supply to the set is cut off, then the set will

(a) continue to run at rated speed in the same direction.

(b) continue to run at a reduced speed in the same direction.

(c) run at rated speed in the reverse direction.

(d) come to stop. [U.P.S.C. I.E.S. E.E.-II 1998]

Answer: (a) continue to run at rated speed in the same direction.

26. A stand alone engine driven synchronous generator is feeding a partly inductive load. A capacitor is now connected across the load to completely nulify the inductive current. For this operating condition

(a) the field current and fuel input have to be reduced.

(b) the field current and fuel input have to be increased.

(c) the field current has to be increased and fuel input left unaltered. (d) the field current has to be reduced and fuel input left unaltered. [GATE. E.E. 2003]

Answer: (d) the field current has to be reduced and fuel input left unaltered.

27. The mmf produced by single phase winding is

(a) pulsating and rotating with constant speed.

(b) pulsating and stationary.

(c) constant in amplitude and stationary.

(d) constant in amplitude and rotating.

Answer: (b) pulsating and stationary.

28. A polyphase field is

(a) pulsating and stationary.

(b) pulsating and rotating.

(c) constant in amplitude and rotating at synchronous speed.

(d) constant in amplitude and stationary in space.

Answer: (c) constant in amplitude and rotating at synchronous speed.

29. When a balanced 3-phase distributed type armature winding is carrying 3-phase, balanced currents, the strength of the resultant rotating magnetic field is

(a) three times the amplitude of each constituent pulsating magnetic field.

(b) equal to the amplitude of each constituent pulsating magnetic field. (c) half the amplitude of each constituent pulsating magnetic field.

(d) one and half times the amplitude of each constituent of pulsating magnetic field. [U.P.S.C. I.E.S. 1994]

Answer: (d) one and half times the amplitude of each constituent of pulsating magnetic field.

30. Synchronous motors generally have

(a) salient pole rotor.

(b) smooth cylindrical rotor.

(c) either salient pole or smooth cylindrical rotor.

(d) none of the above.

Answer: (a) salient pole rotor.

31. Number of slip-rings in a 3-phase synchronous motor will be

(a) 0

(b) 1

(c) 2

(d) 3 or 4. [A.M.I.E. Sec B. Electrical Machines Summer 1996]

Answer: (c) 2

32. Electromagnetic force or torque developed in any physical system tends to

(a) increase both the field energy and co-energy at constant current.

(b) reduce both the field energy and co-energy at constant current.

(c) reduce reluctance.

(d) reduce inductance.

(e) reduce permanence.

(f) both (a) and (c).

Answer: (f) both (a) and (c).

33. An ideal synchronous motor has no starting torque because the

(a) rotor is made up of salient poles.

(b) relative velocity between the stator and the rotor mmfs is zero.

(c) relative velocity between the stator and rotor mmfs is not zero.

(d) rotor winding is highly reactive. [I.E.S. 1998]

Answer: (b) relative velocity between the stator and the rotor mmfs is zero.

34. In a synchronous motor

(a) the rotor mmf and stator mmf are stationary with respect to each other.

(b) rotor mmf rotates slightly faster in comparison to stator mmf.

(c) stator minf rotates slightly faster than rotor mmf.

(d) none of the above.

Answer: (a) the rotor mmf and stator mmf are stationary with respect to each other.

35. A synchronous niacinne is revolving armature and stationary field type. Under steady running conditions, the air gap field

(a) rotates at synchronous speed with respect to stator.

(b) rotates at synchronous speed in the direction of rotation of rotor.

(c) remains stationary with respect to stator.

(d) remains stationary with respect to rotor.

Answer: (c) remains stationary with respect to stator.

36. In a synchronous machine if the axis of the field flux coincides with that of armature flux, the machine

(a) will operate smoothly without any vibration.

(b) is said to be floating.

(c) is operating as a synchronous generator.

(d) is operating as a synchronous motor.

Answer: (b) is said to be floating.

37. In a 3-phase synchronous motor the magnitude of field flux

(a) remains constant at all loads.

(b) varies with load.

(c) varies with speed.

(d) varies with power factor.

Answer: (a) remains constant at all loads.

38. In a 3-phase synchronous motor

(a) the field mmf leads the air gap flux and air-gap flux leads the armature mmf.

(b) the armature mmf leads the air-gap flux and air-gap flux leads the field mmf.

(c) the armature mmf leads the air-gap flux and air-gap flux lags behind the field mnif.

(d) none of the above.

Answer: (b) the armature mmf leads the air-gap flux and air-gap flux leads the field mmf.

39. What is the angle between the induced voltage and supply voltage of a synchronous motor under running condition?

(a) Zero.

(h) Greater than zero but less than or equal to 90^0.

(c) Between 90° and 180°.

(d) > 180^o. [U.P.S.C. I.E.S. 2007]

Answer: (c) Between 90° and 180°.

40. The flux per pole in a synchronous motor with the field circuit ON and the stator disconnected from the supply is found to be 25 m Wb. When the stator is connected to the rated supply with the field excitation unchanged, the flux per pole in the machine is found to be 20 m Wb while the motor is running on no load. Assuming no-load losses to be zero, the no-load current by the motor from the supply

(a) lags behind the supply voltage.

(b) leads the supply voltage.

(c) is in phase with the supply voltage. [GATE E.E. 2002; A.M.I.E. 2002]

Answer: (b) leads the supply voltage.

41. The relative speed between the magnetic fields of stator and rotor under steady state operation is zero for

(a) a dc machine.

(b) an induction machine.

(c) a synchronous machine.

(d) all the above machines. [A.M.I.E. Electrical Science Summer 1994]

Answer: (d) all the above machines.

42. A 3-phase synchronous motor has

(a) high starting torque.

(b) no starting torque.

(c) low starting current.

(d) low starting torque. [I.E.S. E.E.-II, 2003]

Answer: (b) no starting torque.

43. A 10 pole, 25 Hz alternator is directly coupled to and is driven by 60 Hz synchronous motor. What is the number of poles for the synchronous motor?

(a) 48

(b) 12

(c) 24

(d) 16 [I.E.S. E.E.-II, 2007]

Answer: (c) 24

44. The coupling magnetic field reaction with system(s) is essential for extracting ………. energy from an electrical system.

(a) mechanical

(b) electrical

(c) both electrical and mechanical

Answer: (b) electrical

45. The armature current of a synchronous motor on no load

(a) leads the applied voltage by 90°.

(b) lags behind the applied voltage by 90°.

(c) is in phase will applied voltage.

(d) zero.

Answer: (a) leads the applied voltage by 90°.

46. The synchronous motor meets increase in load by taking more armature current as

(a) the rotor pole falls back relative to the stator pole causing an increase in motor current.

(b) the back emf decreases causing an increase in motor current.

(c) rotating field is strengthened causing an increase in motor current.

(d) none of the above.

Answer: (a) the rotor pole falls back relative to the stator pole causing an increase in motor current.

47. A synchronous motor is operating with normal excitation. With the increase in load the armature current drawn from the supply main increases due to

(a) increase in back emf.

(b) fall in motor speed.

(c) increase in resultant voltage across the armature.

(d) increase in power factor.

Answer: (c) increase in resultant voltage across the armature.

48. The resultant voltage acting across the armature circuit of a synchronous motor (E_r) is the ……….. of induced emf in the armature circuit (E_b) and supply voltage V.

(a) arithmetic sum.

(b) arithmetic difference.

(c) phasor difference.

(d) phasor sum.

Answer: (c) phasor difference.

49. The magnitude of emf induced in the armature of a synchronous motor (E_b) depends upon

(a) supply voltage.

(b) rotor excitation.

(c) rotor speed.

(d) flux density.

(e) all of the above.

Answer: (b) rotor excitation.

50. The phase of emf induced in the armature of a synchronous motor (E_b) depends upon

(a) rotor speed.

(b) load.

(c) both load and speed.

(d) none of the above.

Answer: (b) load.

51. In a synchronous motor, the synchronizing power comes into action when

(a) rotor speed either exceeds or falls below the synchronous speed.

(b) rotor speed is equal to synchronous speed.

(c) rotor speed falls below the synchronous speed.

(d) rotor speed exceeds the synchronous speed.

Answer: (a) rotor speed either exceeds or falls below the synchronous speed.

52. Synchronizing power of a synchronous motor varies

(a) directly as synchronous reactance, X_s.

(b) directly as the square of the synchronous reactance, X_s^2.

(c) inversely as the synchronous reactance, $1/X_s$.

(d) none of the above.

Answer: (c) inversely as the synchronous reactance, $1/X_s$.

53. The coupling angle or load angle of a synchronous motor is defined as the space angle between the

(a) rotor and stator poles of the same polarity.

(b) rotor and stator poles of opposite polarity.

(c) rotor and stator teeth.

(d) none of the above.

Answer: (b) rotor and stator poles of opposite polarity.

54. The torque angle **δ** is defined as the space angle between

(a) stator field axis and resultant field axis.

(b) rotor field axis and resultant field axis.

(c) stator field axis and rotor field axis.

(d) stator field axis and mutual field axis.

Answer: (c) stator field axis and rotor field axis.

55. The value of load angle for a synchronous motor depends mainly upon its

(a) excitation.

(b) load.

(c) speed.

(d) supply voltage.

Answer: (b) load.

56. The total steady state torque to drive the synchronous motor and the load at synchronous speed is known as …….. torque.

(a) reluctance

(b) pull-out

(c) synchronous

(d) average

Answer: (c) synchronous

57. Electromagnetic torque is present in rotating machines when

(a) stator winding carries current.

(b) rotor winding carries current.

(c) both stator and rotor windings carry current.

(d) none of the above.

Answer: (c) both stator and rotor windings carry current.

58. In a synchronous motor electromagnetic power varies

(a) directly as applied voltage.

(b) directly as square of the applied voltage.

(c) inversely as applied voltage.

(d) none of the above.

Answer: (a) directly as applied voltage.

59. The interaction torque in a synchronous motor depends upon

(a) stator field strength alone.

(b) rotor field strength alone.

(c) torque angle alone

(d) all of the above i.e. on stator field and rotor field strengths and torque angle.

Answer: (d) all of the above i.e. on stator field and rotor field strengths and torque angle.

60. The breakdown torque of a synchronous motor varies as

(a) applied voltage V

(b) V^2

(c) 1/V

(d) √V

Answer: (a) applied voltage V

61. Higher the applied voltage

(a) higher will be the stator flux.

(b) higher will be the pull-in torque.

(c) lower will be the stator flux.

(d) lower will be pull-in torque.

(e) both (a) and (b).

(f) both (a) and (d).

Answer: (f) both (a) and (d).

62. The operation of a 3-phase synchronous motor operating on constant excitation across infinite bus will not be stable if power angle δ

(a) exceeds intemal angle θ.

(b) is less than θ.

(c) exceeds θ/2.

(d) is less than θ/2.

Answer: (a) exceeds intemal angle θ.

63. A 3-phase synchronous motor will operate on lagging power factor till

(a) open-circuit voltage per phase E_o exceeds V sinθ.

(b) $E_o < V \sin\theta$

(c) $E_o < V$

(d) $E_o \sin\theta < V$

Answer: (b) $E_o < V \sin\theta$

64. A 3-phase synchronous motor connected to an infinite bus-bar, with constant excitation, is driving a certain load and operating at leading power factor. If the shaft load is reduced,

(a) the load angle will increase.

(b) the load angle will decrease.

(c) power factor will increase.

(d) power factor will decrease.

(e) both load angle and power factor will decrease.

Answer: (e) both load angle and power factor will decrease.

65. A synchronous motor is supplying a load at unity pf. If the load on the motor is increased keeping its excitation and terminal voltage

constant, the power factor

(a) will remain the same.

(c) will become lagging.

(b) will become leading.

(d) none of the above. [A.M.I.E. Sec B. 1994]

Answer: (c) will become lagging.

66. When does a synchronous motor operate with leading power factor current?

(a) While it is underexcited.

(b) While it is critically excited.

(c) While it is overexcited.

(d) While it is heavily loaded. [I.E.S. E.E.-II, 2007]

Answer: (c) While it is overexcited.

67. A threes-phase synchronous motor connected to ac mains is running at full load and unity power factor. If its shaft load is reduced by half, with field current held constant, its new power factor will be

(a) unity.

(b) leading.

(c) lagging.

(d) dependent on machine parameters. [GATE E E. 2007]

Answer: (b) leading.

68. A 3-phase synchronous motor connected to an infinite bus is operating at half-full load with normal excitation. When the load on the synchronous motor is suddenly increased

(a) its speed will first decrease and then become synchronous.

(b) its speed will first increase and then become synchronous.

(c) its speed will fluctuate around synchronous speed and then become synchronous.

(d) its speed will remain unchanged. [I.E.S. E.E-II, 1994]

Answer: (c) its speed will fluctuate around synchronous speed and then become synchronous.

69. A synchronous generator connected to an infinite bus is over-excited. Considering only the reactive power, from the point of view of the system, the machine acts as

(a) capacitor.

(b) inductor.

(c) resistor.

(d) none of the above. [GATE E.E. 1998]

Answer: (a) capacitor.

70. A synchronous machine connected to a power system grid bus-bar is operating as a generator. To make the machine operate as a motor, the

(a) direction of rotation is to be reversed.

(b) phase-sequence is to be changed.

(c) field excitation is to be decreased.

(d) mechanical input is to be less than the losses at the shaft. [I.E.S. E.E.-II, 1993]

Answer: (d) mechanical input is to be less than the losses at the shaft.

71. A salient pole synchronous motor is running on no load. If its excitation is made off, it will

(a) continue running at synchronous speed.

(b) continue running but at a speed slightly less than synchronous one.

(c) stop.

(d) none of these.

Answer: (b) continue running but at a speed slightly less than synchronous one.

72. What is the effect of the field failure of salient pole synchronous motor connected with infinite bus?

(a) Reduce motor torque and speed.

(b) Not change motor torque and speed.

(c) Stop the motor.

(d) Reduce motor torque but motor will continue to run at synchronous speed. [IES. E.E.-II, 2009]

Answer: (d) Reduce motor torque but motor will continue to run at synchronous speed.

73. A salient pole synchronous motor continues running even if its excitation current is reduced to zero. This is due to

(a) rotating magnetic field of stator.

(b) rotating magnetic field of rotor.

(c) magnetization of rotor salient poles by stator magnetic field.

(d) interlocking action between stator and rotor rotating magnetic fields.

Answer: (c) magnetization of rotor salient poles by stator magnetic field.

74. When the excitation of normally operating unloaded salient-pole synchronous motor suddenly gets disconnected, it continues to run as a

(a) Scharge motor.

(b) Spherical motor.

(c) Switched-reluctance motor.

(d) Variable-reluctance motor. [I.E.S. E.E.-II, 2002]

Answer: (d) Variable-reluctance motor.

75. A smooth cylindrical synchronous motor will always stop when

(a) excitation winding gets disconnected.

(b) load varies.

(c) supply voltage fluctuates.

(d) supply frequency varies.

Answer: (a) excitation winding gets disconnected.

76. The speed of a synchronous motor can be varied by varying its

(a) excitation.

(b) supply voltage.

(c) supply frequency.

(d) load.

Answer: (c) supply frequency.

77. For a 3-phase, 4-pole, 50 Hz synchronous motor the frequency, pole number and the load torque are all halved. The motor speed will be

(a) 375 rpm.

(b) 75 rpm.

(c) 1,500 rpm.

(d) 3,000 rpm. [A.M.I.E. Electrical Science Winter 1993]

Answer: (c) 1,500 rpm.

78. A synchronous motor with comparatively large air gap gives

(a) higher stability limit.

(b) high synchronizing power making the machine less sensitive to load variations.

(c) both (a) and (b).

(d) none of these.

Answer: (c) both (a) and (b).

79. In a 3-phase synchronous motor, the magnitude of back emf set up in the stator depends on

(a) rotor excitation.

(b) supply voltage.

(c) rotor speed.

(d) load on motor.

Answer: (a) rotor excitation.

80. The magnitude of counter or back emf in a synchronous motor

(a) is always less than supply voltage.

(b) is always more than supply voltage.

(c) is always equal to supply voltage.

(d) may be either equal to or less than or more than supply voltage.

Answer: (d) may be either equal to or less than or more than supply voltage.

81. In a synchronous motor, the excitation voltage on no load is approximately equal to the applied voltage. This will happen

(a) when developed torque is maximum.

(b) with zero excitation.

(c) with 100% excitation.

(d) none of the above.

Answer: (c) with 100% excitation.

82. Which motor can conveniently operate at lagging as well as leading power factor ?

(a) Squirrel cage induction motor.

(b) Wound rotor induction motor.

(c) Synchronous motor.

(d) DC shunt motor. [A.M.I.E. Electrical Science Summer 1995]

Answer: (c) Synchronous motor.

83. At constant load, the magnitude of armature current drawn by a synchronous motor is large for

(a) low excitation.

(b) high excitation.

(c) both low and high values of field excitation.

(d) 100% excitation.

Answer: (c) both low and high values of field excitation.

84. Variation in dc excitation of a synchronous motor causes variation in

(b) power factor.

(a) speed of motor.

(c) armature current.

(d) both armature current and power factor.

Answer: (d) both armature current and power factor.

85. A synchronous motor, connected to an infinite bus, is working at a leading power factor. Its excitation emf E_f and terminal voltage V_t are related as under

(a) $E_f > V_t$ and E_f lags V_t

(b) $E_f < V_t$ and E_f lags V_t

(c) $E_f > V_t$ and E_f leads V_t

(d) $E_f < V_t$, and E_f leads V_t [A.M.I.E. Sec B. Elec. Machines Summer 2002]

Answer: (c) $E_f > V_t$ and E_f leads V_t

86. If the field of a synchronous motor is under-excited, the power factor will be

(a) lagging.

(b) leading.

(b) unity.

(d) more than unity.

Answer: (a) lagging.

87. A synchronous motor is operating on no load at unity power factor. If the field current is increased, the power factor will become

(a) leading and the current will decrease.

(b) lagging and the current will increase.

(c) lagging and the current will decrease.

(d) leading and the current will increase. [I.E.S. E.E.-II, 1998]

Answer: (d) leading and the current will increase.

88. A three-phase, salient pole synchronous motor is connected to an infinite bus. It is operated at no load at normal excitation. The field excitation of the motor is first reduced to zero and then increased in the reverse direction gradually. Then the armature current

(a) increases continuously.

(b) first increases and then decreases steeply.

(c) first decreases and then increases steeply.

(d) remains constant. [GATE E.E., 2011]

Answer: (b) first increases and then decreases steeply.

89. A 3-phase synchronous motor is operating at a given load. If an increase in excitation reduces the armature current, it can be concluded that the motor is

(a) operating at lagging power factor and absorbing reactive power from the mains.

(b) operating at leading power factor and delivering reactive power to the mains.

(c) either (a) or (b).

(d) none of these.

Answer: (a) operating at lagging power factor and absorbing reactive power from the mains.

90. A synchronous motor installed at the end of a transmission line is operating at lagging power factor. With the fall in supply voltage, the power factor of the synchronous motor will

(a) go down.

(b) improve.

(c) remain unchanged.

(d) none of these.

Answer: (b) improve.

91. A synchronous motor operates at 0.8 pf lagging. If the field current of the motor is continuously increased

(a) the power factor decreases upto a certain value of the field current and thereafter it increases.

(b) the armature current increases upto a certain value of the field current and thereafter it decreases.

(c) the power factor increases upto a certain value of field current and thereafter it decreases.

(d) the armature current decreases upto a certain value of field current and there after it increases.

(e) both (c) and (d). [GATE E.E. 1993]

Answer: (e) both (c) and (d).

92. Stability of a synchronous motor with the increase in excitation.

(a) increases

(b) decreases

(c) remains unaffected

Answer: (a) increases

93. Armature reaction in a synchronous motor at rated voltage and zero power factor (lead) is

(a) magnetising.

(b) cross-magnetising.

(c) both magnetising and cross-magnetising.

(d) demagnetising. [A.M.I.E. Sec B. Elec. Machines Winter 1994]

Answer: (d) demagnetising.

94. The torque angle of a synchronous machine operating from a constant voltage bus is usually defined as the space angle between

(a) rotor mmf wave and stator mmf wave.

(b) rotor mmf wave and resultant flux density wave.

(c) stator mmf wave and resultant flux density wave.

(d) stator mmf wave and resultant mmf wave. [GATE E.E. 1992]

Answer: (a) rotor mmf wave and stator mmf wave.

95. A synchronous motor will deliver maximum power when

(a) load angle is equal to internal angle θ.

(b) input power factor is unity.

(c) load angle is 45°.

(d) load angle is 0°. [A.M.I.E. Sec B Elec. Machines Winter 1996]

Answer: (a) load angle is equal to internal angle θ.

96. A synchronous motor with negligible armature resistance runs at a load angle of 20° at the rated frequency. If supply frequency is increased by 10%, keeping other parameters constant, the new load angle will be

(a) 16°

(b) 18°

(c) 20°

(d) 22° [U.P.S.C. I.E.S. E.E.-II, 1999]

Answer: (c) 20°

97. The power developed by a synchronous motor for constant supply voltage and constant excitation will be maximum when load angle δ is

(a) 90°

(b) 0°

(c) slightly less than 90°.

(d) slightly more than 90°.

Answer: (c) slightly less than 90°.

98. For a given developed power, a synchronous motor operating from a constant voltage and constant frequency supply, will draw the minimum and maximum armature currents, I_{min} and I_{max} respectively, corresponding to

(a) I_{min} at unity pf, but I_{max} at zero pf.

(b) I_{max} at unity pf, but I_{min} at zero pf.

(c) both I_{min} and I_{max} at unity pf.

(d) both I_{min} and I_{max} at zero pf.

Answer: (a) I_{min} at unity pf, but I_{max} at zero pf.

99. An inverted V-curve of synchronous motor shows the variation of

(a) power factor and de excitation at constant load.

(b) supply voltage and field current at constant excitation.

(c) power factor and supply voltage during hunting.

(d) supply voltage and excitation current at constant load. [I.E.S. E.E.-II, 1992]

Answer: (a) power factor and de excitation at constant load.

100. Synchronous capacitor is

(a) an ordinary static capacitor bank.

(b) an overexcited synchronous motor driving mechanical load.

(c) an overexcited synchronous motor without mechanical load.

(d) none of the above. [A.M.I.E. Sec B. Electrical Machines Winter 1993]

Answer: (c) an overexcited synchronous motor without mechanical load.

101. An induction motor and synchronous motor are connected to a common feeder line. To operate the feeder line at unity pf, the synchronous motor should be

(a) under-excited.

(b) over-excited.

(c) normally excited.

(d) disconnected from the common terminals. [I.E.S. E.E.-II 2000]

Answer: (b) over-excited.

102. Synchronous condensers, when operated at power factor ranging from lagging through unity to leading for voltage control, are called the

(a) voltage boosters.

(b) synchronous reactors.

(c) mechanical synchronisers.

(d) none of the above.

Answer: (b) synchronous reactors.

103. The power factor of a synchronous motor

(a) improves with increase in excitation and may even become leading at higher excitation.

(b) decreases with increase in excitation.

(c) is independent of excitation.

(d) increases with loading for a given excitation. [I.E.S. E.E.-II, 2002]

Answer: (a) improves with increase in excitation and may even become leading at higher excitation.

104. A 3-phase induction motor draws 1,000 kVA at a pf of 0.8 lag. A synchronous condenser is connected in parallel to draw an additional 750 kVA at a power factor of 0.6 lead. The pf of the total load supplied by the mains is

(a) unity.

(b) 0.707 lead.

(c) 0.6 lag.

(d) zero. [I.E.S. E.E.-II 2003]

Answer: (a) unity.

105. Synchronous condenser means

(a) a synchronous motor with capacitor connected across terminals to improve pf.

(b) a synchronous motor operating at full load with leading pf.

(c) an overexcited synchronous motor partially supplying mechanical load, and also improving pf of the system to which it is connected.

(d) an overexcited synchronous motor operating at no load with leading pf used in large power stations for improvement of pf. [I.E.S. E.E.-II 2001]

Answer: (d) an overexcited synchronous motor operating at no load with leading pf used in large power stations for improvement of pf.

106. Which of the following devices can be used as a phase advancer ?

(a) 3-phase induction motor squirrel cage type.

(b) 3-phase induction motor slip-ring type.

(c) Synchronous motor working at leading power factor.

(d) Synchronous motor working at lagging power factor. [I.E.S. 1996]

Answer: (c) Synchronous motor working at leading power factor.

107. The phenomenon of oscillation of the rotor of a synchronous motor about its equilibrium position corresponding to new load on sudden throwing off or increasing of load is called the

(a) swinging.

(b) crawling.

(c) hunting.

(d) none of these.

Answer: (c) hunting.

108. A 3-phase synchronous motor hunts due to

(a) fluctuating load.

(b) fluctuating supply voltage.

(c) excessive field current.

(d) faulty connections.

(e) either fluctuating load or fluctuating supply voltage.

Answer: (e) either fluctuating load or fluctuating supply voltage.

109. In a synchronous motor hunting can be reduced to minimum possible by

(a) providing damper winding in the rotor pole faces.

(b) using a flywheel.

(c) designing the motor for adequate synchronizing power.

(d) any of the above methods.

Answer: (d) any of the above methods.

110. The damper windings also called the squirrel cage windings or damper grids

(a) are provided in a synchronous motor to make it self-starting and to prevent hunting.

(b) consists of short-circuited copper bars embedded in the field pole faces of a synchronous motor.

(c) are provided on the stator of a synchronous motor for improving the power factor.

(d) both (a) and (b).

Answer: (d) both (a) and (b).

111. In a synchronous machine, damper windings are used to

(a) help in starting as a motor.

(b) run it as an induction motor.

(c) help in starting as a motor and to reduce hunting.

(d) increase efficiency. [I.E.S. E.E.-II 2000]

Answer: (c) help in starting as a motor and to reduce hunting.

112. During hunting of synchronous motor

(a) negative phase sequence currents are generated.

(b) harmonics are developed in the armature circuit.

(c) damper bar develops torque.

(d) field excitation increases. [GATE E.E. 1996]

Answer: (c) damper bar develops torque.

113. When a salient pole 3-phase synchronous motor is started by induction motor action and its field is connected across a field discharge resistance, starting torque is developed by

(a) reluctance torque due to saliency of the rotor.

(b) eddy current and hysteresis torque in pole faces.

(c) induction motor torque in field and damper windings.

(d) all of the above.

Answer: (d) all of the above.

114. Which of the following methods is employed for starting a 3-phase synchronous motor ?

(a) Star-delta starter.

(b) Damper winding.

(c) Resistance starter in the stator circuit.

(d) Damper winding in conjunction with a star-delta starter or an auto-transformer starter.

Answer: (d) Damper winding in conjunction with a star-delta starter or an auto-transformer starter.

115. While starting a 3-phase synchronous motor by induction motor action, very high emf is induced in the field winding. The damage to the insulation of field winding and slip-rings can be avoided by

(a) splitting the field winding in several sections.

(b) short circuiting the field winding through field discharge resistance. (c) either (a) or (b).

(d) none of these.

Answer: (c) either (a) or (b).

116. Synchronous motors are inherently not self-starting motors as

(a) the direction of instantaneous torque on the rotor reverses after each half cycle.

(b) there is no slip.

(c) the stator does not produce revolving magnetic field.

(d) it has no starting winding.

Answer: (a) the direction of instantaneous torque on the rotor reverses after each half cycle.

117. Electrical machines (ac) should have proper ………. in order to limit the operating temperature.

(a) voltage rating

(b) current rating

(c) speed

(d) kW rating

Answer: (d) kW rating

118. During short-circuit test on a synchronous motor ………. is/are short circuited.

(a) armature terminals

(b) field terminals

(c) all stator phase windings

(d) one of the stator phase winding

Answer: (a) armature terminals

119. The rotor copper losses of a synchronous motor are met by

(a) armature input.

(b) dc source.

(c) ac supply mains.

(d) none of these.

Answer: (b) dc source.

120. The efficiency of a properly designed synchronous machine is of the order of

(a) 60%

(b) 80%

(c) 92%

(d) 99%

Answer: (c) 92%

121. The negative phase sequence in a 3-phase synchronous motor exists when the motor is

(a) under-loaded.

(b) overloaded.

(c) supplied with unbalanced voltage.

(d) hot. [I.E.S. E.E.-II, 1992]

Answer: (c) supplied with unbalanced voltage.

122. In case one phase of a 3-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. [A.M.LE. Sec B. Elec. Machines Summer 1996]

Answer: (d) take less than the rated load.

123. A synchronous motor may fail to pull into synchronism owing to

(a) excessive load.

(b) low excitation.

(c) high friction.

(d) any of these.

Answer: (d) any of these.

124. Which of the following is not the advantage of a synchronous motor ?

(a) High operation efficiency.

(b) Operation over a wide range of power factor—from lagging to leading.

(c) It can always be adjusted to operate at unity power factor for optimum efficiency and economy.

(d) Its rotor has 2 slip-rings.

(e) Operation at constant speed from no-load to full load.

Answer: (d) Its rotor has 2 slip-rings.

125. Which of the following is not the disadvantage of a synchronous motor ?

(a) Its torque is less sensitive to variations in supply voltage.

(b) DC excitation is required.

(c) It has tendency to hunt.

(d) Its starting under load is not possible.

(e) It is unsuitable for line shaft drive in a small workshop.

Answer: (a) Its torque is less sensitive to variations in supply voltage.

126. Which of the following synchronous motors has cost comparable to that of an induction motor ?

(a) High kW output high speed.

(b) High kW output low speed.

(c) Low kW output low speed.

(d) Low kW output high speed.

Answer: (b) High kW output low speed.

127. A 3-phase synchronous motor is widely used for

(a) power factor improvement.

(b) control of voltage at the end of a transmission line.

(c) high torque loads.

(d) fluctuating loads.

(e) both (a) and (b).

Answer: (e) both (a) and (b).

128. Synchronous motors are not used

(a) in power houses and substations in parallel to bus-bars for pf correction.

(b) in factories having a large number of induction motors and other power apparatus operating at lagging power factor, for pf improvement.

(c) for driving electric trains, cranes, machine tools and line shaft drives.

(d) in rubber mills, textile mills, cement factories, mining industries and other big industries for power applications.

(e) for driving continuously operating and constant peed equipment such as centrifugal pumps, fans, blowers, ammonia and air compressors, motor generator sets etc.

Answer: (c) for driving electric trains, cranes, machine tools and line shaft drives.

129. The alternators are operated is parallel because it

(a) increases the reliability of supply.

(b) makes the repairing economical and convenient.

(c) is easy to install an additional unit as and when required.

(d) all of the above.

Answer: (d) all of the above.

130. Which of the following conditions are to be satisfied for proper synchronization of alternators?

1. Equal terminal voltage.

2. Same frequency.

3. Same phase sequence.

4. Same kVA rating.

5. Same phase displacement

Select the correct answer using the code given below:

(a) 1, 3 and 4 only.

(b) 1, 2, 4 and 5 only.

(c) 2, 3, 4 and 5 only.

(d) 1, 2, 3 and 5 only. [I.E.S. E.E.-II, 2008]

Answer: (d) 1, 2, 3 and 5 only.

131. Which one of the following is not a necessary condition to be satisfied for synchronizing an incoming alternator to an already operating alternator?

(a) Same voltage magnitude.

(b) Same frequency.

(c) Same prime mover speed.

(d) Same phase sequence. [I.E.S. E.E.-II 2004]

Answer: (c) Same prime mover speed.

132. Which of the following methods used for synchronising of 3-phase synchronous generators is considered best one ?

(a) Three dark lamp method.

(b) two-bright and one dark lamp method.

(c) Synchroscope.

(d) none of these.

Answer: (c) Synchroscope.

133. While synchronising a 3-phase alternator to the bus-bar the paralleling switch should be closed

(a) just before the pointer reaches the vertical position when moving in the fast direction.

(b) just after the pointer passes the vertical position when moving in the fast direction.

(c) when pointer indicates fast position.

(d) when pointer indicates slow position.

Answer: (a) just before the pointer reaches the vertical position when moving in the fast direction.

134. The two-bright and one dark lamp method is used for

(a) determination of phase sequence.

(b) synchronising of 3-phase alternators.

(c) synchronising of single phase alternators.

(d) transfer of load.

Answer: (b) synchronising of 3-phase alternators.

135. Desirable feature for successful parallel operation of two alternators is that both should have

(a) same resistance.

(b) same reactance.

(c) high reactance in comparison to resistance.

(d) low reactance in comparison to resistance.

Answer: (c) high reactance in comparison to resistance.

136. Two alternators are operating in parallel. For taking one of the alternators out from the system

(a) load shared by this alternator is transferred to the other by adjusting the power fed to the prime mover before opening OCB.

(b) power fed to the prime-mover is stopped.

(c) OCB is switched off.

(d) load connected to the bus-bar is reduced.

Answer: (a) load shared by this alternator is transferred to the other by adjusting the power fed to the prime mover before opening OCB.

137. Synchronising current means

(a) the total current supplied to the load by the alternators operating in parallel.

(b) the current supplied by the synchronous generator.

(c) the current circulating in the local circuit of two alternators operating in parallel which brings the alternators in synchronism once they are out of it.

(d) none of the above.

Answer: (c) the current circulating in the local circuit of two alternators operating in parallel which brings the alternators in synchronism once they are out of it.

138. If the voltage of one of the two machines operating in parallel suddenly falls

(a) both the machines will stop.

(b) the machine whose voltage has suddenly decreased, will stop.

(c) the synchronous torque will come into operation to restore synchronism.

(d) none of the above.

Answer: (c) the synchronous torque will come into operation to restore synchronism.

139. Synchronising torque will come into operation whenever

(a) there is a difference in the magnitude of voltages.

(b) there is a phase difference in the voltages.

(c) there is a frequency difference between the two voltages.

(d) excitation of one of the alternators is changed.

(e) in all of the above cases.

Answer: (e) in all of the above cases.

140. The electrical stiffness of a synchronous generator connected to a very large grid can be increased by

(a) increasing the excitation or power angle of the machine.

(b) reducing the excitation or the synchronous reactance of the machine.

(c) increasing the synchronous reactance of the machine.

(d) operating the generator at a much lower MW level compared to the steady state limit. [I.E.S. E.E.-II 2002]

Answer: (c) increasing the synchronous reactance of the machine.

141. 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. [I.E.S. E.E.II-1992]

Answer: (b) alternator B will deliver less current and alternator A will deliver more current.

142. Two similar synchronous generators are working in parallel to supply a common load demand with identical excitations and steam supplies to their prime movers. Now, if the steam supply to the prime mover of one of the generators is increased compared to the other, with field excitation kept unchanged, then

(a) its active power component will remain the same but the reactive power contribution will increase.

(b) its active power will decrease while the reactive power will increase.

(c) both active and reactive components of power will increase.

(d) its active power contribution will increase but reactive power contributions of both will remain unchanged. [I.E.S. E.E.-II, 1993]

Answer: (d) its active power contribution will increase but reactive power contributions of both will remain unchanged.

143. When two alternators are operating in parallel, if the power input to one of the alternators is cut off, the alternator will

(a) continue to run as a synchronous motor rotating in the same direction.

(b) continue to run as a synchronous motor rotating in opposite direction.

(c) stop running.

(d) get damaged due to burning of stator and rotor windings.

Answer: (a) continue to run as a synchronous motor rotating in the same direction.

144. Two alternators each having 4% speed regulation are working in parallel. Alternator 1 is rated 12 MW and alternator 2 is rated 8 MW. When the total load is 10 MW, the load shared by alternators 1 and 2 would be respectively

(a) 4 MW and 6 MW.

(b) 6 MW and 4 MW.

(c) 5 MW and 5 MW.

(d) 10 MW and zero. [U.P.S.C. I.E.S. E.E.-II, 2000]

Answer: (b) 6 MW and 4 MW.

145. An infinite bus-bar has

(a) constant voltage.

(b) constant frequency.

(c) infinite voltage.

(d) both (a) and (b).

Answer: (d) both (a) and (b).

146. If the excitation of an alternator connected to an infinite bus-bar is changed, keeping the power input to its prime mover unchanged, its ……….. will change.

(a) kW output

(b) power-factor

(c) kVA output

(d) kVAR output

(e) all of the above except kW output.

Answer: (e) all of the above except kW output.

147. A stationary alternator should not be connected to the live bus-bar because

(a) it is likely to operate as a synchronous motor.

(b) it will get short circuited.

(c) it will reduce bus-bar voltage.

(d) all of the above.

Answer: (b) it will get short circuited.

148. A 3-phase synchronous generator with constant power input is supplying electrical power to an infinite bus at a lagging power factor. If its excitation is reduced

(a) both power factor and power angle will increase.

(b) both power factor and power angle will decrease.

(c) power factor will improve but power angle will decrease.

(d) power angle will increase but power factor will decrease.

Answer: (a) both power factor and power angle will increase.

149. An alternator connected to an infinite bus, for a given excitation, will develop maximum electromagnetic power when the power angle δ and internal angle θ are related as

(a) $\delta = 180^o - \theta$

(b) $\delta = \theta$

(c) $\delta = 180^o - \theta/2$

(d) $\delta = 180^o - 2\theta$

Answer: (a) $\delta = 180^o - \theta$

150. A salient pole synchronous generator delivering power to an infinite bus through a reactive tie line reaches its steady state stability limit. What is the power angle of the generator relative to the infinite bus voltage reference?

(a) Greater than 90 degrees.

(b) Equal to 90 degrees.

(c) Less than 90 degrees.

(d) Zero. [U.PS.C. I.E.S. 2009]

Answer: (c) Less than 90 degrees.

151. A large ac generator supplying power to an infinite bus, has a sudden short circuit occurring at its terminals. Assuming the prime mover input and the voltage behind the transient reactance to remain constant immediately after the fault, the acceleration of the generator rotor is

(a) inversely proportional to the moment of inertia of the machine.

(b) inversely proportional to the square of the voltage.

(c) directly proportional to the square of the short-circuit current.

(d) directly proportional to the short-circuit power. [U.P.S.C. I.E.S. 1994]

Answer: (a) inversely proportional to the moment of inertia of the machine.

152. Four identical alternators each rated for 20 MVA, 11 kV having a subtransient reactance of 16% are working in parallel. The short-circuit level at the bus-bars is

(a) 500 MVA

(b) 400 MVA

(c) 125 MVA

(d) 80 MVA [I.E.S. 1996]

Answer: (a) 500 MVA