**Answers**

# Electrical Machines

1. A device inserted into the system for the purpose of satisfying the specification is called …………….                    .
2. In………….. compensation the compensator is placed in series with the feedback.
3. The lag compensator will reduce the        …………….. of the system which will result in slower …………… response.
4. The addition of a                          to the open loop transfer function has the effect of pulling the root locus to the ………………….
5. In lead compensation the conflict between dominance condition and noise elimination can be avoided by locating the pole at …………………          times the value of zero location.
6. The ……………… frequency region of bode plot provides information regarding ……………………….. performance of the system.
7. The frequency corresponding to maximum phase lag, wm=…………..
8. The lead compensator increase the ……………. and reduce the …………………
9. In lead compensator if alpha is too low then the ………………….at the output will be very low.
10. Typical choices of alpha in lead compensator and beta in lag compensator are ……………. And……………… respectively.
11. The frequency corresponding to maximum phase lead , wm=…………….
12. In lag lead compensator , the phase lag occurs in …………………. region and phase lead occurs in ……………… region
13. The transfer function of lag lead compensator has too real ………….. and…………                .
14. The proportional control is not used alone because it produces a constant………………….
15. The PI controller ……………. the steady state error .

## Answers

16. The PD controller increases the ………….. of the system which results in reducing the ……………..                    .
17. In system subjected to frequent load disturbances ,……….. compensation can be preferred        .
18. In rate feedback a ………………    is connected in cascade with rate device in order to eliminate the reduction in velocity error constant.
19. The addition of a ……………………        to the open loop transfer function has the effect of pulling the root locus to the
20. The limited cycle is a phenomenon observed in …………….
21. The……… are oscillations are fixed frequency and oscillations.
22. The……… are those which inherently present in system.
23. The……… are those which  deliberately inserted in the system to modify its characteristics.
24. The………………….. in which the output of the system is zero.
25. The coulomb friction and stiction are ………..friction.
26. The co ordinate plane in which the state variables x1 &x2 is called………..
27. The locus of-1/kn is called…………..
28. When the -1/kn locus is not enclosed by g(jw) the locus of the system is…………………..
29. When the -1/kn locus is  enclosed by g(jw) the locus of the system is……
30. The ……………exists as an interaction point of -1/kn  and g(jw) locus/
31. The locus of the set pint in …… with time as running parameter
32. A point of ……… at which the derivatives of all state variables are zero is called…………
33. A locus passing through the points of same slope in the phase plan is……
34. When the eigen values are complex ,conjugate with negative real part then the singular point is called…………..
35. When the eigen values are complex ,conjugate with negative  then the singular point is called…………..
36. A digital controller can be employed for time shared……………..

**Answers**

37. A discrete system is a linear it obeys ……………………..
38. The impulse response of a discrete time system is……………
39. …………………………… is the conversion of continuous time signal into discrete time signal.

40. The short circuit current at 1000 rpm is 20 A, the short circuit current at 900 rpm, for the same excitation will be

a) 20A b) 220 A c) > 20A d) none

41. The short circuit current at 1000 rpm is 20 A for a field current of 1A. The short circuit current at 900 rpm, for the field current of 1.5 A is (neglect saturation)

a) 20A b) < 20 A c) > 30A d) Data Insufficient

42. An alternator is supplying a rated load current of 20 A for a pure capacitive load current of 20 A at 1000 rpm. If the alternator is running at 900 rpm, for the same load and same excitation, the load current will be

a) 20A b) < 20 A c) > 20A d) Data Insufficient

43. The voltage regulation of an alternator is

a) much more than the power transformer of equivalent rating

b) much less than the power transformer of equivalent rating

c) nearly same as that of power transformer of equivalent rating

d) None

44. For a synchronous machine with low value of short circuit ratio (SCR)

Answers

a) higher is the stability limit b) lower is the stability limit

c) better is the speed regulation d) better is the voltage regulation

45. Match the following

| | | Zs (P.U) |
|---|---|---|
| 1. | Cylindrical Rotor synchronous machine | P) 0.7 |
| 2. | Salient pole synchronous machine | Q) 1 |
| 3. | Synchronous condenser | R) 2.5 |

a) 1-P, 2-Q, 3-R b) 1-P, 2-R, 3-Q c) 1-Q, 2-P, 3-R d) 1-Q, 2-R, 3-P

46. A synchronous machine has its field winding on the stator and poly phase armature winding on the rotor. When running under steady state – conditions, its air gap field is

i) Stationary with respect to stator

ii) Rotating at synchronous speed Ns with respect to stator

iii) Rotating at Ns in the direction of rotor rotation

iv) Rotating at double the Ns with respect to rotor

v) Rotating at Ns with respect to rotor

vi) Rotating in a direction opposite to rotor rotation

From these, the correct answer is

a) 2, 5 b) 1, 4, 6 c) 2, 4, 6 d) 1, 3, 5

**Answers**

47. A synchronous machine has its field winding on the rotor and poly phase armature winding on the stator. When running under steady-state conditions, its air gap field is

i) Stationary with respect to stator

ii) Rotating at synchronous speed Ns with respect to stator

iii) Rotating at double the Ns with respect to rotor

iv) Rotating with respect to rotor

v) Rotating at Ns in the direction of rotor rotation

From these, correct answer is

a) 2, 5 b) 1, 4, 5 c) 2, 3, 4 d) 2, 4, 5

48. Read the following statements about a cylindrical – rotor alternator

i) Emf generated by armature reaction lags armature current by $90^0$

ii) Armature reaction due to intermediate lagging P.F. is partly cross-magnetizing and partly magnetizing

iii) Air gap voltage leads terminal voltage

iv) Air gap voltage lags the field flux lag $90^0$

v) Armature reaction mmf lags the field flux by $(90^0 + \psi)$

From these the correct answers are

a) 1, 2, 3, 5 b) 1, 3, 5 c) 2, 3, 5 d) 2, 3, 4, 5

49. Read the following statements about a cylindrical - rotor alternator

i) Armature reaction due to 0.8 lag p.f. current is partly cross-magnetizing and partly demagnetizing

ii) The field pole leads the resultant air gap flux

iii) The field poles have a tendency to go away from the resultant air-gap flux

**Answers**

iv) Terminal voltage lags the field flux by $(90^0 + \psi)$

From these the correct answers are

a) 1, 2, 4 b) 1, 2, 3, 4 c) 2, 3, 4 d) 1, 3, 4

50. In a slip test on a salient pole machine the emf. induced in the field winding is

a) Zero for $X_d$ b) max positive for $X_d$ c) Zero for $X_q$ d) max negative for $X_q$

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

a) d- axis b) q- axis c) $45^o$ to d – axis d) $45^o$ to q – axis

52. In a slip test on a synchronous machine, match the following.

| | Armature flux | Voltage in field winding | Armature current | Reactance |
|---|---|---|---|---|
| 1. | Maximum | Maximum | Maximum | $X_q$ |
| 2. | Maximum | Maximum | Minimum | $X_d$ |
| 3. | Maximum | Zero | Minimum | $X_d$ |
| 4. | Minimum | Maximum | Minimum | $X^d$ |
| 5. | Minimum | Maximum | Maximum | $X_q$ |

From there the correct answer is

a) 1, 4 b) 2, 5 c) 3, 4 d) 3, 5

53. While conducting a slip test for determination of $X_q$ for a salient synchronous machine, the rotor of the machine is run with a slip 's' and start supply frequency 'f' the frequency of

1. Voltage induced across open field terminals
2. Envelope of armature terminal voltage
3. Envelope of armature current
4. Armature terminal voltage will be respectively

a) sf, 2sf and f b) sf, f, sf and f

c) f, sf, and sf d) f, (i-s)f, (2-s)f and sf

54. A salient pole alternator has $X_q$ = 0.7856 pu, $X_d$ = 12 pu with negligible armature resistance. If the generator delivers rated KVA at 0.8 PF lag at rated voltage, then its load angle is

a) $60^o$ b) $369^o$ c) $23^o$ d) $25^o$

55. A 6600 V, 1200 KVA, 3-phase alternator is delivering full load at 0.8 pf lag. Its reactance is 25% and resistance is negligible. By changing the excitation, the emf is increased by 30%. At this the new current is

a) 390 A b) 105 A c) 225 A d) 200 A

56. For a salient pole alternator excitation voltage is 1.2 $30^o$ pu $X_d$ = 1 pu, $X_q$ = 0.6 pu. The power developed at rated voltage when the excitation fails is

a) 1 p.u b) 0.5 p.u c) 0.288 p.u d) 1.2 p.u

Answers

57. A 50 Hz 3 – phase, 480 V, delta connected salient pole synchronous generator has $X_d$ = 0.1 and $X_q$ = 0.075. The generator is supplying 1200 A at 0.8 PF lag. The load angle is

a) $41.5^o$ b) $14.5^o$ c) $4.6^o$ d) $6.4^o$

58. An alternator is feeding an infinite bus bar. Its prime mover is suddenly shut down. The alternator will

a) Continue to work as alternator but the direction of rotator will reverse.

b) Come to stand still.

c) Continue to work as synchronous motor and direction of rotation will be also same.

d) Start working as an induction motor.

59. A salient pole synchronous motor is running with normal excitation. If the excitation is reduced to zero,

a) It becomes an induction motor. b) It becomes as reluctance motor.

c) It remains a synchronous motor. d) The motor would stop.

60. The synchronous reactance per phase of 3-phase star connected 6600 V synchronous motor is 20 Ω. The input is 915 kW at normal voltage and the induced line emf is 8942 V. The line current is

Answers

a) 97 A b) 56 A c) 168 A d) 80 A

61. For the above question the power factor is

a) 0.82 lag b) 0.82 lead c) UPF d) 0.7 lead

62. The results of slip test for determining direct axis ($X_d$) and quadrature axis ($X_q$) reactance of star connected, salient pole alternator are given below.

Phase value : $V_{max}$ = 108 V ; $V_{min}$ = 96 V ; $I_{max}$ = 12A ; $I_{min}$ = 10A

a) $X_d$ = 10.8Ω, $X_q$, = 8 Ω b) $X_d$ = 9Ω, $X_q$ = 9.6Ω

c) $X_d$ = 9.6Ω, $X_q$ = 9Ω d) $X_d$ = 8Ω, $X_q$ = 10.8Ω

63. In the measurement of $X_d$ and $X_q$ ( in ohms), following data are obtained by the slip test on a salient pole machine

$I_{dmax}$ = 10 A $I_{omn}$ = 6.5 A

$V_{dmax}$ = 30 V $V_{dmin}$ = 25V

Which of the following is correct?

a) $X_d$ = 3 $X_q$ = 3.86 b) $X_d$ = 4.4.615 $X_q$ = 2.5

c) $X_d$ = 3 $X_q$ = 2.15 d) $X_d$ = 4.61 $X_q$ = 3.86

64. The short circuit ratio of salient pole alternator having direct axis reactance $X_d$ quadrature reactance Xq is

a) 1/ ($X_d$(p.u)) b) 1/ ($X_d$(p.u)) $x_q$(p.u) c) 1/$X_q$ (p.u) +$X_d$ d) 1/$X_d$(p.u)-$X_q$ (p.u)

**Answers**

65. A 2KVA, 3 phase star connected alternator, within impedance of 5Ω and a resistance of 0.5 Ω, is operating on parallel with constant voltage 11kV bus bars. If its field current is adjusted to give an excitation voltage of 12 kV,

(i) The max. power output from the alternator will be

a) 8 MW b) 16 MW c) 24 MW c) 32 MW

(ii) the power factor under maximum power condition will be

a) 0.506 lead b) 0.606 lead c) 0.706 lead d) 0.806 lead

66. A 10kW , 1 – ϕ alternator has following oc & sc test results : o.c. test : 300V, 1A ; s.c. test : 30A, 1 A. If the excitation is such that the open circuit voltage at a particular load when it is thrown off is 400 V

i) the maximum power output of generator is

a ) 10 kW b) 12 kW c) 14 kW d) 16 kW

ii) Current supplied by alternator at maximum power output

a) 50 A b) 60 A c) 70 A d) 100 A

67. What are the conditions to be satisfied for alternator to be synchronized with an incoming supply?

1.Equal voltage 2.Equal frequency 3.Same power rating 4.Same phase sequence Select the correct answer using the code given below.

a) 2, 3 and 4 b) 3 and 4 c) 1, 2 and 3 d) 1, 2 and 4

**Answers**

68. Which of the following conditions is not mandatory for alternators working in parallel?

a) The terminal voltage of each machine must be the same.

b) The machine must have equal KVA rating.

c) Alternators must operate at the same frequency.

d) Machine must have the same phase rotation.

69. The dark and bright lamp method is used in alternator for

a) balancing of load b) Phase sequence

c) Transfer of load d) Synchronizing

70. An infinite bus is basically a network having

a) Variable frequency and variable voltage at its terminals.

b) Infinite frequency and infinite voltage at its terminals.

c) Constant frequency and constant voltage at its terminals.

d) Constant frequency and variable voltage at its terminals.

71. Two alternators ($M_1$ and $M_2$) have been properly synchronized and connected in parallel to a common bus bar. If there is no load on the bus bar and the field excitation of the second alternator ($M_2$) is increased gradually by a small amount, from its normal excitation for which the induced emf s $E_1$ and $E_2$ of the two machines are equal, the armature reaction due to the circulating armature current would be

a) Magnetizing for $M_1$ but demagnetizing for $M_{2.}$

b) Demagnetizing for $M_2$, but magnetizing for $M_{3.}$

c) Magnetizing for both $M_1$ and $M_{2.}$

d) Demagnetizing for both $M_1$ and $M_{2.}$

**Answers**

72. Two alternators ($M_1$ and $M_2$) of same rating, excited equally are connected in parallel, and supplying for a pure resistive load. If the excitation of $M_1$ is increased, then

(a) $M_1$ is operating at LAG pf and $M_2$ is operating at LEAD pf.

(b) $M_1$ is operating at LEAD pf and $M_2$ is operating at LAG pf.

(c) Both $M_1$ and $M_2$ operating at UPF.

(d) Both are operating at LAG pf.

73. Two alternators running in parallel and supplying a fixed load operate with same excitation voltage and the same armature currents. If the steam input to alternator 1 is increased, then

a. Alternator 1 shares increased armature current 1a with improved power factor

b. Alternator 1 shares increased 1a with worsened power factor

c. Alternator 2 shares decreased 1a with worsened power factor

d. Alternator 2 shares decreased 1a with worsened power factor

From these, the correct answer is

a) A, C  b) A, D  c) B, C  d) B, D

74. Two alternators running in parallel have the same excitation voltage and armature current and same power factor. If excitation of alternator 1 is increased, then for the same terminal voltage

a. Alternator 1 operate at a poor power factor with increased $I_a$

b. Alternator 1 operate at a better power factor with increased $I_a$

c. Alternator 2 operate at a poor power factor with decreased $I_a$

From these, the correct answer

a) A, C b) A, D c) B, C d) B, D

75. A 2000 V, 3-phase, star connected synchronous motor has an effective resistance and synchronous reactance of 0.2 ohm and 2.2 ohm respectively. The input is 800 kW at normal voltage and the induced line voltage is 2500 V. The line current is

a) 254 A b) 440 A c) 231 A d) 400 A

76. For the above question the power factor will be

a) 0.908 lag b) 0.908 lead c) 0.7 lag d) 0.7 lead

77. A 3-ϕ alternator is supplying power to infinite bus at a frequency of 50 Hz with constant steam input, alternator excitation increased with this.

a) Load angle decreases and power factor increased

b) increases and power factor decreases.

c) both and power factor decreases

d) both and power factor increases

78. A cylindrical synchronous machine connected to an infinite but is working with a load angle of $30^o$. If the load on the machine is doubled, excitation remaining constant, then the load angle would be

a) $30^o$ b) $60^o$ c) $90^o$ d) $45^o$

79. A synchronous generator, connected to an infinite bus, is working at half full load. If there is an increase in its field current and a reduction in the armature current. then the generator is

a) Delivering reactive power to the bus at lead power factor.

b) Delivering reactive power to the bus at lag power factor.

c) Absorbing reactive power from the bus at lead power factor.

d) Absorbing reactive power from the bus at lag power factor.

80. A 3-phase, 415 V, 6-pole, 50 Hz star connected synchronous motor has an emf of 520 V(line-to-line). The stator winding has a synchronous reactance of 2 ohm/phase and the motor develops a torque of 220 Nm. The current from the supply is

a) 30 A b) 24.13 A c) 72.4 A d) 41.8 A

81. Two 3- phase y- connected alternators are to be paralleled to a set of common bus bars. The armature has a per phase synchronous reactance of 1.7Ω and negligible armature resistance. The line voltage of the first machine is adjusted to 3300V and that of second machine is this condition, the synchronizing current per phase will be

a) 16.98 A b) 29.41 A c) 33.96 A d) 58.82 A

82. A 400V, 50KVA 0.8 PF leading connected 50 Hz synchronous machine has a synchronous reactance of 2Ω and negligible armature resistance. The friction and windage losses are 2kW and the core loss is 0.8kW. The shaft is supplying 9kW load at a power factor of 0.8 leading. The line current drawn is

a) 12.29 A b) 16.24 A c) 21.29 A d) 36.88 A

**Answers**

83. A 500 MW, 3- phase star – connected synchronous generator has a rated voltage of 21.5kV at 0.85 PF. The line current when operating at full load rated conditions will be

a) 13. 43 kA b). 15.79 kA c) 23.25 kA d). 27.36 kA

84. A 3- phase cylindrical rotor synchronous generator with its armature resistance and leakage reactance being neglected, is synchronized to an infinite bus and its field excitation is kept constant thereafter. Now the machine is loaded by supplying mechanical input to the shaft so that the load angle reaches a value of $60^0$ under this condition, the operating power factor would be

a) 0.866 lead b) 0.866 lag c) 0.5 lead d) 0.5 lag

85. Consider the following statement about a three phase synchronous generator synchronized to an infinite bus when its mechanical input is increased gradually with field current held constant.

1. The power factor of the current supplied becomes more lagging
2. The power factor of the current supplied improves
3. The power factor remains unity
4. The load angle is increased.

Of these statements, the correct are

a) 1 alone b) 2 alone c) 2&4 d) 3&4

86. For a proper synchronization of a large synchronous machines to a bus, the frequency of the incoming machine.

a) should be exactly the same as that of the bus.

**Answers**

b) should be slightly higher than that of the bus.

c) should be slightly lower than that of the bus.

d) can be of any value.

87. A synchronous motor operate at 0.8 pf lag. If the field current of the motor is continuously increased

a) the power factor decreases up to a certain value of field current and
thereafter it increases

b) the armature current increases up to a certain value of field current and
thereafter it decreases

c) the power factor increases up to a certain value of field current and there
after if decreases

d) the armature current deceases up to a certain value of field current and
thereafter if increases.

From these the correct one is

a) a, b  b) b, c  c) c, d  d) a, c

88. A synchronous motor is floating on infinite mains at no-load. If excitation is now increased

a) it will draw unity power factor current.

b) it will draw zero power factor lag current .

c) it will draw zero power factor leading current.

d) it will not draw any current.

**Answers**

89. A synchronous motor is running clockwise. If the direction of field current is reversed, the motor would

a) come to stop.

b) run in the reverse direction.

c) run in the same direction.

d) run in the same direction but at slightly reduced speed.

90. A synchronous motor on load draw a current at a lead power factor angle $\phi$. If the internal power factor angle – which is the phase angle between the excitation emf and the current in time phase or diagram is $\psi$, then the air gap excitation mmf. lags the armature mmf by

a) $\psi$ b) $\pi/2 + \psi$ c) $\pi/2 - \psi$ d) $\psi + \phi$

91. A 3-$\phi$ synchronous motor driving a constant load torque draws power from the infinite bus bar at a lead power factor. If excitation is increased

a) the power angle decreases while power factor increases.

b) the power angle increases while power factor decreases.

c) both power angle and power factor increases.

d) both power angle and power factor decreases.

92. A 3-$\phi$ synchronous motor with constant excitation is driving a certain load drawing electrical power from infinite bus at the lead power factor if the shaft load decreases

a) the power angle decreases while power factor increases.

b) the power angle increases while power factor decreases.

c) both power angle and power factor increases.

d) both power angle and power factor decreases.

93. A 3-ϕ 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 increase and then becomes synchronous.

c) its speed will fluctuate around synchronous speed and then becomes
synchronous.

d) its speed will remain unchanged.

94. A 6-pole, 3-ϕ alternator running at 1000 rpm supplied to an 8-pole, 3-ϕ induction motor which has a rotor current of frequency 2Hz the speed at which the motor operate

a) 1000 rpm b) 960 rpm c) 750 rpm d) 720 rpm

95. A 3300V, star-connected synchronous motor has synchronous impedance of (0.4+j5)Ω per phase. For an excitation emf of 4000 V and motor input power of 1000 kW at rated voltage

i) the line current

a) 184.34 A b) 144.43 A c) 154.53 A d) 164.64 A

ii) the power factor is

a) 0.7486 lead b) 0.8486 c) 9486 lead d) none

**Answers**

96. A 6-pole, 50 Hz, 3-ϕ synchronous motor and an 8-pole, 50Hz, 3-ϕ slip ring induction motor are mechanically coupled and operate on the same 3-phase, 50Hz supply system. If they are left open circuited, then the frequency of the voltage produced across any two slip rings would be

a) 16 2/3 Hz b) 25 Hz c) 37.5 Hz d) 50 Hz

97. Two 550 KVA alternators operate in parallel to supply the following loads

i) 250 kW at 0.95 power factor lag ii) 1400 kW at 0.8 power factor lead. One machine is supplying 200 kW at 0.9 power factor lag. The power factor of the other machine must be

a) 0.89 lead b) 0.95 lead c) 0.95 lag d) 0.89 lag

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 current, $I_{min}$ and $I_{max}$ respectively corresponding to

a) $I_{min}$ at UPF, but $I_{max}$ at ZPF b) $I_{min}$ at UPF, but $I_{max}$ at ZPF
c) both $I_{min}$ and $I_{max}$ at UPF d) both $I_{min}$ and $I_{max}$ at UPF

99. A 230 V, 3-ϕ synchronous motor driving a pump is provided with a line armature and field rheostat. When the rheostat is adjusted such

Answers

that the A.C. line current is minimum the ammeter leads 8.8A what is the power being delivered to the pump, neglecting losses.

a) 60.708 kW b) 35.05 kW c) 20.236 kW d) 0 kW

100. A synchronous motor is floating on infinite main at no load. If its excitation is now increased, it will draw

a) UPF current b) ZPF lag current

c) ZPF lead current d) no current

101. Synchronous motor speed is controlled by varying

a) Field excitation b) supply voltage

c) supply frequency d) both supply voltage & freq.

102. If the load of a synchronous motor is increased while keeping the field excitation constant then

a) power factor will increase and power angle will decrease

b) power factor will decrease and power angle will increase

c) both power factor and power angle will increase

d) both power factor and power angle will decrease

103. A 3-ϕ star-connected 400 V synchronous motor takes a power input of 5kW at rated voltage, its synchronous reactance is 10 Ω/ phase, resistance is negligible. If it's excitation voltage adjusted equal to the rated voltage of 400 V

i) The load angle is

a) $9.1^0$ b) $18.2^0$ c) $30^0$ d) $25^0$

ii) The power factor is

**Answers**

a) 0.9874 lead b) 0.654 lead c) 0.9874 lag d) 0.654 lag

iii) The armature current is

a) 10 A b) 12.65 A c) 23.1 A d) 7.3 A

104. A synchronous generator has higher power handing capability when operating at

a) a leading pf

b) a lagging pf

c) it does not depend upon the pf of the generator

d) it depends upon the load pf, as generator has no pf of its own.

105. In a synchronous machine connected to an infinite bus, if rotor speed departs from synchronous speed, then

a) damping power comes into play

b) synchronizing power comes into play

c) both a and b

d) none of these

106. In a synchronous machine connected to an infinite bus, if rotor speed $N_r$, departs from synchronous speed $N_s$ then

A) induction motor (IM) torque is developed if $N_r > N_s$

B) IM torque is developed if $N_r < N_s$

C) Induction generator (IG) torque is developed if $N_r > N_s$

D) IG torque is developed if $N_r < N_s$

a) A, C b) A, D c) B, C d) B, D

Answers

107. In a synchronous machine, synchronized with infinite bus, the resultant air-gap flux wave (AG) coincides with the field – pole (FP) axis at no load. As a generator, a sudden increment in the shaft power input would cause.

a) AG axis to go ahead of FP axis

b) AG axis to fall behind the FP axis

c) AG axis to remain in line with FP axis; otherwise the synchronous machine will fall out of step

d) None of these

108. In a synchronous machine directly connected to a large power system network, the resultant air-gap flux wave (AG) coincides with the field - pole (FP) axis at not load. As a motor, a sudden increment of shaft load would cause

a) AG axis to go ahead of FP axis

b) AG axis to fall behind the FP axis

c) AG axis to remain in line with FP axis; otherwise the synchronous machine will fall out of step

d) None of these

109. An alternator of frequency 50.2 Hz is to be synchronized with an infinite bus of frequency 50 Hz by means of three – dark-lamp method. The lamp-flicker per minute will be

a) 6  b) 25  c) 30.6  d) 12

110. An alternator of 300 kW is driven by a prime-mover of speed regulation 4% and another alternator of 480 kW by a prime mover

**Answers**

(P.M) of speed regulation 5%. Governor settings of PMs are such that their no-load speed is the same. The total load the two alternators in parallel can take, without overloading any one of the two is,

a) 600 kW b) 620 kW c) 650kW d) 720 kW

111. The division of active power amongst alternators running in parallel depends upon

a) speed-load characteristics of prime-movers

b) volt-ampere characteristics of alternators

c) excitation emfs of alternators

d) all of these

112. The division of reactive power amongst alternator running in parallel depends upon

A) speed-load characteristics of prime-movers

B) volt-ampere characteristics of alternators

C) excitation voltages of alternators

from these, the correct answer is

a) A, B b) A, C c) B, C d) all of these

113. A 3–phase synchronous machine is synchronized with infinite bus. Now the prime – mover is disconnected from the synchronous machine. With this, the synchronous machine would.

a) Work as a synchronous motor at a leading pf

b) Work as a synchronous motor at a leading pf

c) Work as a 3-phase induction motor at a lagging pf

d) Stop

**Answers**

114. A 3-phase synchronous machine is synchronized with an infinite bus. Now steam input to synchronous machine is increased. With this, synchronous machine starts working as

a) alternator at a leading pf b) alternator at a lagging pf

c) synchronous motor at a leading pf d) induction generator at a lagging pf

115. A 3-phase alternator is supplying power to infinite bus at lagging pf. With constant steam input, alternator excitation is increased. With this,

a) load angle $\delta$ decreases and pf increases b) $\delta$ increases and pf decreases

c) both $\delta$ and pf decreased d) both $\delta$ and pf increases

116. A synchronous machine has excitation voltage of $0.8 / 15^0$ and the infinite bus voltage of $1.0/ 0^0$. The synchronous machine is working as

a) an alternator and delivers reactive power at leading pf

b) an alternator and absorbs reactive power at leading pf

c) a synchronous motor and delivers reactive power at leading pf

d) a synchronous motor and absorbs reactive power at lagging pf

117. An alternator, driven by a dc shunt motor, is delivering power to an infinite bus. Now field current of dc motor is increased and as a consequence of it.

a) speed $\omega_m$ decreases and alternator armature current $I_a$ decreases

**Answers**

b) $\omega_m$ increases and $I_a$ increases

c) $\omega_m$ remains constant and $I_a$ increases

d) $\omega_m$ remains constant and $I_a$ decreases

118. An alternator, driven, by a dc shunt motor, is delivering 10kW to an infinite bus. If field current of dc motor is decreased, power flow from dc bus to ac bus would be

a) > 10kW b) < 10kW c) 10kW d) reversed

119. An alternator, driven by a dc shunt motor, is delivering 10kW to an infinite bus. If the field current of dc motor is increased, power flow from dc bus to ac bus

A) becomes more than 10 kW

B) becomes less than 10kW

C) remains 10kW

D) may get reversed

From above, the correct answer is

a) A, B b) B, D c) A, D d) C,D

120. A-3 phase salient – pole alternator is delivering about 15% of its rated power to an infinite bus. If its excitation fails, then it acts as a

a) Synchronous motor b) Synchronous Generator

c) reluctance generator d) induction generator

**Answers**

121. Two alternators A and B, running in parallel, supply power to a resistive load. For the same terminal voltage and steam inputs, if excitation of alternator A is increased, then

a) A will supply lagging kVAr

b) B will supply leading kVAr

c) As load is resistive, A cannot supply lagging kVAr

d) As load is resistive, B cannot supply leading kVAr

122. Two alternators A and B running in parallel, supply power to a resistive load. For the same terminal voltage and steam inputs, if excitation of alternator A is increased, then

A) A delivers reactive power at a leading pf

B) A delivers reactive power at a lagging pf

C) B absorbs reactive power at a leading pf

D) B absorbs reactive power at a leading pf

From these, the current answer is

a) B, D b) A, C c) B, C d) A, D

123. Two alternators A and B running in parallel, supply power P to a resistive load. The two alternators share equal powers. For the same load power P, driving torque of alternator A is increased while that of B is suitably adjusted. With this

a) A supplies reactive power to load

b) B absorbs reactive power from load

c) B delivers reactive power to A

d) As load is resistive, no reactive power flow exists

**Answers**

124. For the above question

a) A delivers active and reactive powers to load

b) A absorbs reactive power and delivers active power

c) B absorbs both active and reactive powers

d) As driving torques are only changed, there is not reactive power flow

125. A 3-phase alternator is supplying power to an infinite bus at some pf. With constant steam input, its excitation is increased. With this, which of the following quantities would change

A) active power B) reactive power C) pf

D) armature current E) volt-amperes

a) A, B, C b) B, C, D, E c) B, C, D d) A, D

126. Two alternators, working in parallel, supply power to a load. The excitation of one of them in increased. This will result in a change of their

A) active power B) reactive power

C) terminal voltage D) volt-amperes

a) A, B, D b) A, C, D c) B, C, D d) A, D

127. Alternators 1 and 2 share inductive load equality. If excitation of alternator 1 is increased : then alternator 2 as compared to alternator 1 will deliver

a) less current b) more current

c) same current d) zero current

**Answers**

128. The maximum torque that a synchronous motor can deliver is proportional to

a) $1 / V^2$ b) $1 / V$ c) $V$ d) $V^2$

129. In the wave wound and Lap wound armatures of a 6-pole dc generator, the generated emf will be in the ratio of

a) 1:2 b) 3:1 c) 1:1 d) 1:3

130. The armature resistance of a 6-pole lap wound dc machine is 0.05 Ω. If the armature is rewound using wave winding then the armature resistance will be

a) 0.1Ω b) 0.025Ω c) 0.45Ω d) 0.05Ω

131. A 6 Pole, 12W 240V dc machine is wave connected. If the machine is now lap connected, all other things remaining the same, its voltage, current, and power ratings will be

a) 240V, 50A, 12kW b) 80V, 150A, 12kW

c) 80V, 50A, 4kW d) 240V, 150A, 36kW

132. A dc shunt generator builds up to a voltage of 220 V at no load while running at its rated speed if the speed of the generator is raised by 25% keeping the circuit conditions unaltered, then the voltage to which the machine will build up will

a) not change and remain at 220V

b) increases to 1.25 times 220V

c) increases a value lying between 220V and 1.25 times 220V

d) increases to a value greater than 1.25 times 220V

**Answers**

133. A dc shunt generator having a shunt field of 50Ω was generating normally at 1000 rpm. The Critical resistance of this machine was 80Ω. Due to some reason, the speed of the Prime mover become such that the generator just failed to generate. The speed at that time must have been

a) 1000rm b) 800 rpm c) 625rpm d) 500rpm

134. A separately – excited dc motor has an armature resistance of 0.5Ω it runs off a 250 V dc supply drawing an armature current of 20 A at 1500 rpm. The Torque development for an armature current of 10A, for the same field current will be

a) 15.28 Nm b) 15.92 Nm c) 15.6 Nm d) 16.55 Nm

135. A dc shunt motor with negligible armature resistance is required to drive a constant power load under normal rated – load operating conditions when the terminal Voltage $V_t$ = 1.0 p.u. and with liner magnetizing – the field flux$\phi$ = 1.0 p.u. If $V_t$ = 0.5 p.u and the flux $\phi$ is kept constant at 1.0 p.u. then

a) n = ½ u.p. and $I_a$ = 2.0 p.u b) n=1.0p.u. and $I_a$ = 2.0p.u

c) n=2.0 p.u and $I_a$ = 1.0 p.u d) n= ½ p.u and $I_a$ = ½ p.u

136. A dc shunt generator has full load voltage regulation of 8%. If the generator is separately excited and delivers rated load, the regulation will be

a) 7% b) >8% c) <8% d) zero

Answers

137. A 240 V dc shunt motor with an armature resistance of 0.5Ω has a full load current of 40A. Find the ratio of the stalling torque to the full load torque when a resistance of 1 Ω is connected in series with armature

a) 4    b) 2Ω    c) 6Ω    d) none

138. A 4-pole lap wound dc generator has developed power of 'P' watts and Voltage of 'E' volts. The two adjacent brushes of the machine are removed as they are worn out. If the machine operates with the remaining brushes, the developed voltage and power that can be obtained from the machine are

a) E,P    b) E/2, P/2    c) E, P/4    d) E, P/2

139. A 240 V dc series motor takes 40A when giving its rated output at 1500rpm. Its resistance is 0.3Ω. The value of the resistance which must be added to obtain rated torque at 1000 rpm is

a) 6Ω    b) 5.7Ω    c) 2.2 Ω    d) 1.9Ω

140. A permanent magnet dc commutator motor has a no – load speed of 600 rpm. When connected to a 120 V dc supply, the armature resistance is 2.5Ω and other losses may be neglected. The speed of the motor with supply of 60 V developing a torque 0.5 Nm is

a) 3000rpm    b) 2637 rpm    c) 2836 rpm    d) 5346 rpm

**Answers**

141. A 200 V, 2000 rpm, 10 A, separately excited dc motor has an armature resistance of 2 Ω. Rated dc voltage is applied to both the armature and field winding of the motor. If the armature draws 5A, from the source, the torque developed by the motor is

a) 4.30 Nm    b) 4.77 Nm    c) 0.45 Nm    d) 0.50Nm

142. The armature mmf of a dc machine is

1. Stationary w.r.t field poles
2. Stationary w.r.t. armature
3. Rotating w.r.t. field poles
4. Rotating w.r.t. armature

From these the current answer is

a) 1,4    b) 1,3    c) 2,3    d) 2,4

143. A dc shunt motor having unsaturated magnetic runs at 1000 rpm with rated voltage. If the applied voltage is reduced to half of the rated voltage, the motor will run at

a) 2000 rpm    b) 1000 rpm    c) 750 rpm    d) 500 rpm

144. A 2 - pole series motor with its two field coils connected in series runs at a speed of 500 rpm. If the field coil are re-connected in parallel and assuming that the torque is constant and the magnetic circuit is unsaturated, the new speed will be

a) 250 rpm    b) $\frac{500 \text{ rpm}}{\sqrt{2}}$    c) 500 √2 rpm    d) 1000rpm

**Answers**

145. At a certain speed and flux the voltage generated by a dc generator is 230V. If the speed is increased by 20% and the flux is simultaneously reduced by 10% then the voltage will be

a) Increased by 3 % b) Increased by 8%

c) Reduced by 25% d) Increased by 25%

146. A 4 pole dc generator has a wave armature with 722 conductors and delivers 50A on F.L. If the brush load is $8^o$ (mechanical), the armature demagnetizing AT / pole will be

a) 20 b) 401 c) 80 d) 160

147. A 220 V generator supplies 4 kW at terminal voltage of 220 V, the armature resistance being 0.4Ω. If the machine is now operated as a motor at the same terminal voltage with the same armature current but flux per pole is increased by 10 %, then the ratio between generator speed to motor speed will be

a) 1.176 b) 1.07 c) 0.85 d) 1.03

148. A 400V, dc shunt motor takes a current of 5.6 A on no load and 68.3 A on F.L. If armature reaction weakness the field by 3%, the speed regulation will be ___________ given $R_a$ = 0.18Ω B.D - 2 V $R_{sh}$ – 200 Ω

a) 15% b) 0% c) 10% d) 1.03%

**Answers**

149. A 200 V shunt motor has R = 1.0Ω, $R_{Sh}$ = 240Ω and rotational losses 236 W. If the full load line current and speeds are 9.8 A and 1450 rpm. The full load efficiency will be

a) 69.85%  b) 73%  c) 82.6%  d) 79%

150. For a 230V, 10W dc shunt motor, it is required that the starting armature current should not be twice its rated armature current. Then the extra resistance required at the time of starting will be _________

$R_a$= 0.348Ω, $R_{sh}$ = 115Ω

a) 2.772Ω  b) 2.42Ω  c) 5.2Ω  d) none

151. A dc shunt motor takes an armature current of 50 A at its rated voltage of 240 V, its $R_a$ = 0.2Ω. If extra resistance of 1 Ω is inserted in series with the arm & remains unchanged, then the percentage change in speed for the same load torque will be _________

a) 22.64%  b) 25.75%  c) 21.74%  d) 24.25%

152. A dc series motor driving a fan load when the load torque is proportional to $N^3$. the resistance of armature and field is 1Ω and motor takes 10A at 1000 rpm. When operating from 200 V supply, the value of the resistance to be inserted in series with the arm to reduce the operating speed 800 rpm is ________

a) 12.75Ω  b) 11.74Ω  c) 13.74Ω  d) 11.75Ω

153. A 50 kW dc shunt motor is loaded to draw rated armature current at any given speed. When driven (i) at half the rated speed by armature

Answers

voltage control and (ii) at1.5 lines the rated speed by field control, the respective output powers delivered by the motor are approximately

a) 25 kW in (i) and 75 kW in (ii)    b) 25 kW in (i) and 50 kW in (ii)

c) 50 kW in (i) and 75 kW in (ii)    d) 50 kW in (i) and 50 kW in (ii)

154. In a relation to DC machines, match the following and choose the correct combination

| Group - I | Group – II |
|---|---|
| Performance Variable | Proportional to |
| P. Armature emf (E) | 1. Flux ($\phi$), Speed (w) and armature current (1a) |
| Q. Development Torque(T) | 2. $\phi$ and W only |
| R. Development power (P) | 3. $\phi$ and $I_a$ only |
| | 4. $I_a$ and W only |
| | 5. $I_a$ only |

a) P-3, Q-3, R-3    b) P-2, Q-5, R-4

c) P-3, Q-5, R-4    d) P-2, Q-3, R-1

155. The armature resistance of a permanent magnet dc motor is 0.8Ω. At no – load the motor draws 1.5A from a supply voltage of 25 V and runs at 1500 rpm. The efficiency of the motor while it is operating on load at 1500 rpm drawing a current of 3.5A from the same source will be

a) 48.0%    b) 57.1%    c). 59.2%    d) 88.8%

**Answers**

156. A dc series motor driving an electric train falls a constant power load. It is running at rated speed and rated voltage. If the speed has to be brought down to 0.25 pu. The supplying voltage to be approximately brought down to

a) 0.75 pu  b) 0.5 pu  c) 0.25 pu  d) 0.125 pu

157. A dc shunt motor is driving a constant power load. Under rated conditions, the motor takes rated armature current and runs at rated speed.

The speed and current for the following changes.

i) Armature terminal voltage V is halved, field current if unchanged

a) 2pu, 0.5pu  b) 0.5pu, 2pu  c) 1 pu, 1 pu  d) 1pu, 0.5 pu

ii) 'V' is unchanged, field current is halved

a) 2pu, 1 pu  b) 1pu, 2 pu  c) 0.5 pu, 1pu  d) 0.5pu, 2pu

iii) Both 'V' and field current if halved

a) 1pu, 0.5 pu  b) 1pu, 2 pu  c) 2 pu, 1pu  d) 1pu, 4pu

158. A dc shunt motor is driving a constant torque load. Under rated conditions, the motor takes rated armature current and runs at rated speed.

The speed and armature current for the following changes

i) 'V' is halved, current is unchanged

**Answers**

a) 1pu, 0.5 pu  b) 0.25pu, 2 pu  c) 1 pu, 2pu  d) 0.5pu, 1pu

ii) 'V' is unchanged, current is halved

a) 2pu, 2 pu  b) 1pu, 1 pu  c) 0.5 pu, 0.5pu  d) 2pu, 0.5 pu

iii) Both 'V' and current is halved

a) 1pu, 2 pu  b) 2pu, 1 pu  c) 1 pu, 0.5pu  d) 2pu, 4pu

159. A slope, dc generation has simplex wave wound armature containing 32 coils of 6 turns each. If the flux per pole is 0.06 Wb, the machine is running at 250 rpm. The induced armature voltage is

a) 96 V  b) 192 V  c) 384 V  d) 768 V

160. A 50 kW dc shunt motor is loaded to draw rated armature current at any given speed. When driven i) at half the rated speed by armature voltage control, (ii) at 1.5 times the rated speed by field control, the respective power delivered by the motors are approximately

a) 25 kW, 75 kW  b) 25 kW, 50 kW  c) 50 kW, 75 kW  d) 50 kW,50 kW

161. A 220 V dc machine supplies 20A at 200V as a generator. The armature resistance is 0.2 Ω. If the machine is now operated as a motor at the same terminal voltage and current but with flux increased by 10%, the ratio of motor speed to generator speed is

a) 0.87  b) 0.95  c) 0.96  d) 1.06

**Answers**

162. A 250 V dc shunt motor has an armature resistance of 0.5 Ω and field resistance of 250 Ω. When driving a constant torque load at 600 rpm, the motor draws 21A. The new speed of the motor, if an additional 250 Ω resistance is inserted in the field circuit will be

a) 1200 rpm b) 600 rpm c) 780 rpm d) 1150 rpm

163. A 4 – pole dc series fan motor takes an armature current of 60 A, when running at 2000 rpm on 220 V supply. The four field coils are now connected in two parallel groups of two in series. If the load torque increases as the square of the speed, the new speed and armature current is

a) 2000 rpm, 60A b) 2379 rpm, 101 A

c) 2000 rpm, 101 A d) 2379 rpm, 123 A

164. A 4-pole dc motor runs at 600 rpm on full load and takes 25 A at 450V. The armature is lap wound with 500 conductors and flux per pole is given by = I (1.7 x 10-2) .0.5 weber, where 'I' is the motor current. If the supply voltage and torque both are halved, the speed at which motor will run is

a) 600 rpm b) 744 rpm c) 372 rpm d) 300 rpm

165. The highest speed at which synchronous motor generator sets could run to link up a 25 Hz with a 60 Hz system is

a) 3600 rpm b) 1500 rpm c) 300 rpm d) 200 rpm

**Answers**

166. The armature of a 1-phase alternator is completely wound with 'T' single turn coils distributed uniformly. The induced emf in each turn is 2V (rms) and the induced emf of whole winding with all T coils in series in volts is

a) 2T  b) 4T/II  c) 3T  d) none

167. A 300 KVA, 400 V alternator connected in delta is reconnected in star. The new voltage, current and KVA rating are

a) 400V, 250A, 100 KVA  b) 693V, 433A, 300 KVA

c) 693V, 200A, 300 KVA  d) 693V, 433A, 100 KVA

168. A 3-phase star connected alternator is delivering 20 MW and 8MVAR to an infinite bus at 11kV. The alternator has synchronous impedance of (0+j3)Ω. The excitation emf (line) of the alternator in volts is

a) $14267 \angle 0^0$  b) $14267 \angle 22.48^0$

c) $82.37 \quad 21.8^0$  d) $11000 \angle 22.48^0$

169. A three phase, 50Hz, 2000 KVA, 11kV, star connected alternator has a full load voltage regulation of 10% at 0.8 pf lag. If the speed of the alternator prime mover decreases to give a frequency of 48 Hz, the field and armature currents are unchanged

i) The terminal voltage (line-to-line)

a) 10.56 kV  b) 11 kV  c) 6.35 kV  d) 6.09 kV

ii) Alternator rating

a) 2000 KVA  b) 1920 KVA  c) 1600 KVA  d) 1536 KVA

Answers

iii) Voltage regulation at 0.8 p.f. lag

a) <10%   b) > 10%   c) 10%   d) Insufficient data

170. A 3-phase star connected alternator with synchronous impedance of 0+j5Ω per phase is connected to an 11-KV system. The alternator power output is 10MW and reactive power output is 3 MVAR. The magnitude of line current and load angle is

(a) 547.96A, 20.18°   (b) 52.4 86A, 20.18°

(c) 157.46A, 11.54°   (d) 272A, 11.54°

171. A 433V, 3-phase star connected synchronous motor has synchronous reactance of 5Ω / phase. For a power output of 15 kW, for minimum armature current, the excitation voltage (line –to-line) will be.

(a) $433\angle 21.83^{o}$   b) $466.4\angle -21.83^{0}$

c) $466.4\angle 0^{0}$   d) $269.3\angle -21.83^{0}$

172. The phase emf of a 3-phase, 50Hz alternator consists of a fundamental, a 20% third harmonic and a 10% fifth harmonic. The peak value of fundamental voltage is 1000 V. The rms line voltage is

a) 1230.85 V   b) 710.74 V   c) 1256 V   d) 725 V

173. In the above question, the alternator is delta connected. The reactance per phase at 50 Hz is 12Ω. The circulating current is

a) 58.92 A   b) 2.76 A   c) 3.93 A   d) 5.6 A

174. A 3-ϕ star connected, 4-pole alternator has a total flux per pole of 0.3 Wb. Each phase has a concentrated winding of 10 full pitched turns

Answers

and the relative velocity between armature winding and field flux is 1500 rpm. The induced emf (line-to-line) is

a) 666.33 V b) 1154.1 V c) 480.6 V d) 831.4 V

175. A 3-$\phi$, 50 Hz, 10-pole alternator with 90 slots has a star connected winding to give a generated emf of 11 kV. At no-load the coils are chorded by one slot. If the flux per pole is 0.011 Wb, the number of series turns required for each phase of this alternator is

a) 27 b) 275 c) 825 d) 81

176. A 3-$\phi$, 50 Hz, 8-pole, star connected alternator has 120 stator slots and each slot has 10 conductors. The coil span is 12 slots. If the flux per pole is 0.12 wb,

i) The induced emf between lines is

a) 4848 V b) 8400 V c) 9234 V d) 7265 V

ii) Which of the emf harmonics is eliminated?

a) $7^{th}$ b) $5^{th}$ c) $3^{rd}$ d) $11^{th}$

177. A 3-phase star connected alternator has the following data. Voltage required to be generated on open circuit = 4000 V (at 50 Hz); speed = 500 rpm; stator slots / pole / phase = 3; conductos / slot = 12. The flux per pole is

a) 0.1 Wb b) 0.05 Wb c) 0.23 Wb d) 0.16 Wb

**Answers**

178. A 3-$\phi$, star connected alternator is rated at 1500 KVA, 1200 V. The armature effective resistance and synchronous reactance are 2 $\Omega$ and 35 $\Omega$ respectively per phase. The percentage voltage regulation for a load of 1200 kW at

i) 0.8 P.F. lag

a) 15.2% b) 26.67% c) 0% d) - 11.3%

ii) 0.8 P.F. lead

a) - 17.11 % b) - 11.3% c) 15.2% d) 0%

179. A 3300 V, 3-phase star – connected alternator has a full load current of 100A. On short circuit a field current of 5 A produce full load current. The emf on open circuit for the same excitation was 900 volts. The armature resistance was 0.8 $\Omega$ / phase.
The full load voltage regulation for 0.8 p.f. lagging is

a) - 14.8% b) 14.8% c) 36.18% d) 22.6%

180. Find the number of armature conductors in series per phase required for the armature of a 3-$\phi$ 50Hz, 10-pole alternator with 90 slots. The winding is to be star connected to give a line voltage of 11000 V. The flux per pole is 0.16 Wb.

a) 180 b) 360 c) 311 d) 208

181. The test results on a 2000 V, 1-phase, alternator are: full load current of 100 A is produced on short circuit by field excitation of 2.5 A; an emf of 500 V is produced on open circuit by the same excitation. The armature resistance is 0.8Ω. The voltage regulation at full load for

i) UPF is

**Answers**

a) 7% b) - 8.9% c) 21.5% d) - 12.5%

ii) 0.8 P.F. Load

a) 7% b) - 8.9% c) 21.5% d) - 12.5%

iii) 0.71 p.f. lag

a) 7% b) - 8.9% c) 21.5% d) - 12.5%

182. A 3-phase, star connected alternator is rated at 1600 KVA, 13500V. The armature effective resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. The percentage regulation for a load of 1280 kW at 0.8 lead, UPF, 0.8 lag respectively

a) 18.6 %, 3.2%, -11.8% b) 18.6 %, -11.8%, 18.6%

c) -11.8%, 3.2%, 18.6 % d) 18.16 %, -11.8%, 3.2%

183. An alternator, with full pitched uniformly distributed winding is wound for single phase & three phase. The ratio of power output for three phase to single phase connection is

a) 1 b) 3 c) 1.5 d) $\sqrt{3}$

184. An alternator, with full pitched uniformly distributed winding is wound for three phase and two phase. The ratio of power output for three phase to two phase is

a) 1.5 b) 2 c) $\sqrt{2}$ d) 1.06

185. A 3-phase, turbo alternator, with a synchronous reactance of 10 Ω per phase and negligible armature resistance is connected to 11 kV

Answers

constant voltage constant frequency bus bars and supplies 100 A at unity p.f. to the system. If the turbine power is kept constant and the excitation of the alternator is increased by 25%

i) The new load angle will be

a) $8.94^0$ b) $7.14^0$ c) $58.4^0$ d) $4.12^0$

ii) The new current will be

a) 190.6 A b) 100 A c) 125 A d) 330.2 A

186. A 3-phase star connected alternator, rated at 11 kV, 1600 KVA, has negligible armature resistances and a synchronous reactance of 30 Ω per phase. When delivering full load current,

i) The power factor at which voltage regulation is zero is

a) 0.9801 lag b) 0.9801 lead c) 0.918 lag d) 0.918 lead

ii) Maximum power output of the machine is

a) 1600 kW b) 1468.8 kW c) 1568.24 kW d) 905.42 kW

187. A salient pole synchronous generator with negligible resistance has the per unit parameters of $X_d = 0.8$, $X_q = 0.5$. If the generator is supplying rated KVA at rated voltage and at 0.8 P.F. lagging,

i) The load angle is

a) $17.1^0$ b) $29.74^0$ c) $32^0$ d) $23.4^0$

ii) The Excitation emf in P.U is

a) 1.72 b) 1.603 c) 0.8 d) 1.0

**Answers**

188. An alternator with synchronous reactance of 0.8 PU is connected to an infinite bus at rated voltage, with its excitation emf adjusted to 1.3 P.U. The alternator delivers an output of 0.5 PU neglecting all losses.

i) The load angle is

a) $31^0$ b) $17.92^0$ c) $9.6^0$ d) $21^0$

ii) The armature current is

a) 0.581 PU b) 0.375 PU c) 1.0 PU d) 0.8 PU

189. A 1000 KVA, 6.6 kV, 3-phase star connected cylindrical pole synchronous generator has a synchronous reactance of 20 Ω. Neglect the armature resistance and consider operator at full load and unity power factor.

i) The induced emf (line-to-line) is close to

a) 5.5 kV b) 7.2 kV c) 9.6 kV d) 12.5kV

ii) The power (or torque) angle is close to

a) $13.9^0$ b) $18.3^0$ c) $24.6^0$ d) $33.0^0$

190. A salient pole synchronous generator with negligible resistance, has per-unit parameters $X_d$ = 0.8 and Xq = 0.5. If the generator is supplying rated KVA at rated voltage and at 0.8PF lagging

i) The load angle is

a) $17.1^0$ b) $29.74^0$ c) $9.8^0$ d) $15.3^0$

ii) The excitation voltage in P.U. is

a) 1.8 b) 1.603 c) 0.5 d) 1.0

**Answers**

191. A salient pole synchronous generator has the following per unit parameters $X_d = 1.00$, $Xq = 0.60$ and $R_a = 0.02\ \Omega$. If the generator is delivering rated KVA at rated voltage and at 0.8 PF leading

i) The power (or load) angle is

a) $19.72^0$ b) $20.1^0$ c) $36.87^0$ d) $0^0$

ii) The excitation emf in P.U. is

a) 0.82 b) 0.5 c) 1.2 d) 1.5

192. A 6.6 kV star connected 3-phase synchronous motor works at constant voltage and constant excitation. Its synchronous reactance is $12\Omega$ / phase when the input power is 1000 kW and the P.F. is 0.8 leading. If the input is increased to 1500 kW

i) The load angle will be

a) $13.4^0$ b) $21.1^0$ c) $17.2^0$ d) $7.13^0$

ii) The operating power factor will be

a) 0.916 lead b) 0.916 lag c) 0.8 lead d) 0.8 lag

193. Two generators A & B rated 400 MW respectively are operating in parallel. The drop characteristics of their governors are 3% and 4% respectively from no-load to full load. The load on the set is 1000 MW. The no-load frequency is 50Hz, the system frequency is

a) 48.7 Hz b) 50 Hz c) 46.4 Hz d) 55.3 Hz

194. A 1500 kW, 3-$\phi$, star connected, 3.3 kV synchronous motor has reactance of $X_d = 4.01\ \Omega$/phase and $Xq = 2.88\ \Omega$/phase. All losses may be neglected. The motor is working at rated load, UPF, with constant excitation.

i) The load (or) power angle is

**Answers**

a) $15^0$ b) $17.3^0$ c) $30.2^0$ d) $21.6^0$

ii) The Excitation emf (line to line) is

a) 3.738 kV b) 2.158 kV c) 6.47 kV d) 3.3 kV

195. A 6-pole, 50Hz alternator has 42 slots with two layer winding. The flux per pole is 0.012 Wb and each full pitch coil has 8 turns. The line emf when the coils are connected for

i) Two – phase connection is

a) 404 V b) 572 V c) 285 V d) 494 V

ii) Three –phase star connection is

a) 494 V b) 572 V c) 285 V d) 602V

196. A 3-$\phi$, star connected alternator has 81 slots, 6 poles and double layer narrow spread winding with coil span equal to 13 slot pitches. The flux density distribution in the air gap is given by $B(\theta) = \sin\theta + 0.4 \sin3\theta + 0.25 \sin5\theta$.

i) The ratio of fundamental voltage to third harmonic voltage (phase values) is

a) 1 b) 1.0355 c) 0.2643 d) 3.78

ii) The ratio of fundamental voltage to fifth harmonic voltage (phase values) is

a) 0.0486 b) 20.576 c) 0.2643 d) none

iii) The ratio of line voltage to phase voltage is

a) 1 b) 0.597 c) 1.732 d) 1.675

**Answers**

197. The total flux per pole in the air gap of a 50 Hz ac generator is 0.069 Wb. If the flux density distribution is given by B = B1 sinθ + B3θ sin 5θ. Where B3 = 1/3 B, B3 = 1/5B. The coil span is 4/5$^{th}$ of a pole pitch.

i) The fundamental emf per turn

a) 12.674 V b) 7.31 V c) 2.61 V d) 0 V

ii) The third harmonic emf per turn

a) 12.674 V b) 7.31 V c) 2.61 V d) 0 V

iii) The fifth harmonic emf per turn

a) 12.674 V b) 7.31 V c) 2.61 V d) 0 V

198. A 50 Hz, 4- pole synchronous generator with 24 slots is wound with two layer winding. Each full pitch coil has 10 turns. The sinusoidally distributed flux per pole is 0.02 Wb. The induced emf between the lines if the coils are connected to form

i) a two phase winding is

a) 343.3 V b) 594.7 V c) 485.2 V d) 686.2 V

ii) a three phase winding is

a) 343.3 V b) 594.7 V c) 485.2 V d) 686.2 V

199. A 4-pole, 50 Hz synchronous generator has 48 slots in which double layer winding is housed. Each coil has 10 turns and is short pitched by

**Answers**

an angle of $360^0$ electrical. The fundamental flux per pole is 0.025 Wb.

i) The line to line induced emf (in volts), for a three phase star connection is approximately

a) 808 b) 888 c) 1400 d) 1538

ii) The line to line induced emf (in volts), for a two phase star connection is approximately

a) 1143 b) 1332 c) 1617 d) 1791

iii) The fifth harmonic components of phase emf (in volts), for a three phase star connection is approximately

a) 0 b) 269 c) 281 d) 808

200. A 3- phase, 8-pole, 750 rpm, star connected alternator has 144 slots with 6 conductors per pole. Flux per pole is 0.06 Wb and coils are full pitched.

i) The phase and line emf are

a) 1834 V, 3177 V b) 2594 V, 3177 V

c) 1834 V, 5502 V d) 2594 V, 4493 V

ii) If the coils are reconnected to form a balanced two phase winding, the phase and line emf are

a) 1834 V, 3177 V b) 2594 V, 3669 V

c) 1834 V, 5502 V d) 2594 V, 4493 V

1) Principle of superposition
2) Nonlinear system
3) Limit cycles
4) Incidental nonlinearities
5) Intentional nonlinearities
6) Dead zone
7) Non linear
8) Saturation
9) Hysteresis
10) Critical locus
11) Stable
12) Unstable
13) Limit cycle
14) Phase plane
15) Phase plane, phase trajectory
16) phase trajectory ,phase portrait
17) Phase plane,
18) singular point
19) Isocline
20) Stable node
21) Stable focus
22) Control functions
23) Sampling
24) Zero order hold
25) Region of convergence
26) (1-e^-st)s
27) half interior
28) Discrete time system
29) Weighting sequence
30) Stable ,inside
31) Quantization
32) Z=(1+r/1-r)
33) Shanon's  sampling theorem
34) S=(1/t)lnZ
35) Characteristic equation
36) Bilinear transformation
37) State space
38) Phase variables
39) Compensator

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40) none

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|---|---|---|---|---|---|---|---|
| 41.b | 61.d | 81.b | 101.a | 121.b | 141.a | 161.a | 181.a,b,c |
| 42.d | 62.a | 82.d | 102.c | 122.b | 142.a | 162.d | 182.c |
| 43.d | 63.a | 83.d | 103.c | 123.d | 143.b | 163.b | 183.c |
| 44.a | 64.b | 84.d | 104.d | 124.a | 144 c | 164.c | 184.d |
| 45.a | 65.a,b | 85.c | 105.a | 125.a | 145.b | 165.c | 185.b,a |
| 46.a | 66.c,b | 86.b | 106.b | 126.a | 146.b | 166.b | 186.b,a |
| 47.c | 67.d | 87.a | 107.b | 127.b | 147. a | 167.c | 187.a,b |
| 48.b | 68.d | 88.d | 108.b | 128.c | 148. b | 168.b | 188.b,a |
| 49.b | 69.c | 89.c | 109.d | 129.b | 149. d | 169.a,b,c | 189.b,c |
| 50.d | 70.c | 90.b | 110.c | 130.c | 150. b | 170.a | 190.a,b |
| 51.b | 71.c | 91.a | 111.c | 131.b | 151.c | 171.b | 191.a,a |
| 52.c | 72.b | 92.d | 112.a | 132.b | 152.b | 172.a | 192.b,a |
| 53.c | 73.b | 93.c | 113.a | 133.c | 153.b | 173.c | 193.a,b |
| 54.d | 74.a | 94.b | 114.b | 134.a | 154.d | 174.b | 194.d,a |
| 55.a | 75.b | 95.a,d | 115.d | 135.a | 155.a | 175.b | 195.b,a |
| 56.a | 76.b | 96.b | 116.d | 136.c | 156.b | 176. b,b | 196.d,b,d |
| 57.b | 77.b | 97.c | 117.b | 137.a | 157. b | 177.b | 197.a,c,d |
| 58.b | 78.c | 98.c | 118.c | 138.d | 158. d | 178.b,a | 198.d,b |
| 59.b | 79.a | 99.a | 119.a | 139.d | 159.c | 179.c | 199.c,c,a |
| 60.c | 80.a | 100.d | 120.a | 140.b | 160.b | 180.b | 200.a,b |

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