1. Zero voltage regulation in a transformer occurs at :
   (A) zero p.f. lead (B) unity p.f. (C) leading p.f. (D) lagging p.f.

2. A parallel plate capacitor has 15 μF capacitance. If the linear dimensions of the plate are doubled and the distance between the plates are also doubled, then new value of capacitance would be :
   (A) 15 μF (B) 30 μF (C) 60 μF (D) 7.5 μF

3. Resistance of a 230 V 100 W bulb is R_1 and that of a 230 V 75 W is R_2. Then,
   (A) $R_1 = R_2$ (B) $R_1 > R_2$ (C) $R_1 < R_2$ (D) $R_1 = 2R_2$

4. The current in a series RL circuit with $R = 10\ \Omega$ and $L = 0.05$ H is suddenly connected to a DC voltage source of 200 V. The current in the series circuit, just after the switch is closed is equal to :
   (A) 20 A (B) 10.75 A (C) 4000 A (D) zero

5. A $\frac{230}{115}$ V transformer has its LV side resistance of 0.06 p.u. The resistance referred to HV side is :
   (A) 0.24 p.u. (B) 0.06 p.u. (C) 0.03 p.u. (D) 0.015 p.u.

6. Laplace transform of the function t^3e^{-at} is :
   (A) $\frac{a}{(s+a)^3}$ (B) $\frac{6}{(s+a)^4}$ (C) $\frac{3}{(s+a)^3}$ (D) $\frac{4}{(s+a)^4}$

7. The effect of addition of zero to the open loop transfer function is :
   (A) pulling the root locus to the right and to slow down the settling of response
   (B) pulling the root locus to the left and to slow down the settling of response
   (C) pulling the root locus to the left and to speed up the settling of response
   (D) pulling the root locus to the right and to speed up the settling of response

8. Polar plot of a sinusoidal transfer function is a plot of :
   (A) magnitude and phase angle (B) magnitude versus frequency
   (C) phase angle versus frequency (D) none of the above

9. Gain margin is the :

(A) magnitude of $|G(j\omega)|$ at the frequency at which the phase angle is $-90°$

(B) magnitude of $|G(j\omega)|$ at the frequency at which the phase angle is $-180°$

(C) reciprocal of the magnitude of $|G(j\omega)|$ at the frequency at which the phase angle is $-90°$

(D) reciprocal of the magnitude of $|G(j\omega)|$ at the frequency at which the phase angle is $-180°$

10. A bipolar transistor is specified to have forward current gain in the range of 8 to 40. The load resistance is 11 Ω. The dc supply voltage $V_{cc} = 200$ V and input voltage to the base circuit is 10 V. If $V_{CEsat} = 1.0$ V and $V_{BEsat} = 1.5$ V, what is the collector saturation current ?

(A) 144.4 A (B) 18.09 A (C) 0.045 A (D) 17.27 A

11. The current rating of a relay is 5 A and it is set at 150%. C.T. ratio is $\frac{400}{5}$. Fault current is 6000 A. PSM is :

(A) 75 (B) 15 (C) 10 (D) 20

12. A 11 kV 100 MVA alternator is grounded through a resistance of 4 Ω. The C.T.s have a ratio of $\frac{500}{5}$. The relay is set to operate when there is an out of balance current of 2 A. What percentage of the generator winding will be protected by the percentage differential protection scheme ?

(A) 93.7 (B) 6.3 (C) 54.6 (D) 84.5

13. A generating station has a connected load of 500 MW and a maximum demand of 300 MW. The units generated being 600×10^6 per annum. The load factor is :

(A) 60% (B) 13.7% (C) 40% (D) 22.83%

14. A 132 kV, 200 km long transmission line has a reactance of 0.2 Ω/phase/km. What is its reactance/phase in p.u. on 100 MVA base ?

(A) 0.2 (B) 0.23 (C) 0.6 (D) 0.174

15. Which of the following is **not true** for a fault limiting reactor ?

(A) they limit the short circuit current to a safe value

(B) they protect the circuit breakers which have inadequate rating

(C) they improve the voltage regulation

(D) they avoid the fault from spreading

16. Positive sequence impedance of a transformer is :
(A) 2 times greater than negative sequence impedance
(B) equal to negative sequence impedance
(C) half of negative sequence impedance
(D) none of the above

17. Two parallel alternators each rated 11 kV 50 MVA and each having a subtransient reactance of 15% are connected to a bus bar. What is the fault level for a fault on one of the feeders near the bus bar ?
(A) 666.67 MVA (B) 333.33 MVA (C) 1333.5 MVA (D) 100 MVA

18. The positive sequence and zero sequence impedance of a generator are X_1 and X_0 respectively and its neutral is grounded through a reactance Xn. A single line to ground fault is more severe than a three phase fault at its terminals when ?
(A) $Xn = X_1 - X_0$ (B) $Xn = 3\ (X_1 - X_0)$
(C) $Xn > 1/3\ (X_1 - X_0)$ (D) $Xn < 1/3\ (X_1 - X_0)$

19. A schedule speed of 45 km/h is required between two stops 1.5 km apart. If the stop is 20 s duration, what is the actual time of run for the train ?
(A) 120 s (B) 60 s (C) 100 s (D) 80 s

20. What is the supply voltage of electric traction in Kerala ?
(A) 11 kV AC (B) 110 kV AC (C) 1000 V DC (D) 25 kV AC

21. What is the decimal number for 10101 ?
(A) 21 (B) 22 (C) 28 (D) 91

22. Which gate is known as inverter gate ?
(A) AND (B) OR (C) NOT (D) NAND

23. Which of the following is a binary storage device ?
(A) diode (B) flipflop (C) BJT (D) SCR

24. The address of a memory location of Intel 8085 microprocessor is :
(A) 8 bit (B) 16 bit (C) 32 bit (D) 64 bit

25. A voltage of V is applied across an RLC series circuit. A voltmeter is connected across L and C. What will be the reading of voltmeter at resonance ?
(A) zero (B) V (C) 2 V (D) 0.5 V

26. The mechanical power developed by a shunt motor will be maximum when the ratio of back e.m.f. to applied voltage is :

(A) 4 (B) 2 (C) 1 (D) 0.5

27. The e.m.f. induced in the armature of a shunt generator is 240 V. The armature resistance is 0.8 Ω. If the armature current is 10 A, the terminal voltage will be :

(A) 248 V (B) 240 V (C) 232 V (D) 160 V

28. The speed of a DC shunt motor can be increased by :

(A) Increasing the resistance in the field circuit

(B) Reducing the resistance in the field circuit

(C) Reducing the armature resistance

(D) None of the above

29. At full load, the copper loss and iron loss in a 100 kVA transformer is each equal to 3 kW. What is the efficiency at a load of 60 kVA, 0.8 power factor ?

(A) 88.88% (B) 90.9% (C) 80.6% (D) 92.16%

30. An 8 pole DC generator has 500 armature conductors and has a useful flux/pole of 0.065 Wb. What will be the e.m.f. generated it is lap connected and runs at 1000 r.p.m. ?

(A) 541.67 V (B) 2166.67 V (C) 135.41 V (D) 270.83 V

31. An over excited synchronous motor will take current at :

(A) lagging p.f. (B) leading p.f.

(C) unify p.f. (D) none of the above

32. The V curves of a synchronous motor show relationship between :

(A) armature current and supply voltage

(B) field current and p.f.

(C) armature current and back e.m.f.

(D) dc field current and ac armature current

33. If in a 3 phase 3.5 MVA, 4160 V star connected alternator, a field current of 200 A produces full load current on short circuit and 4750 V on open circuit, its synchronous impedance is :

(A) 9.77 Ω (B) 23.75 Ω (C) 5.64 Ω (D) 13.7 Ω

34. What is the r.m.s. value of the induced e.m.f. per phase of a 10 pole, 3 phase, 50 Hz alternator with 2 slots per pole per phase and 4 conductors per slot in two layers ? The coil span is 150°. Flux per pole is 0.12 Wb.

(A) 560 V (B) 995 V (C) 1000 V (D) 835 V

35. Which of the following devices convert fixed DC to variable DC ?

(A) cyclo converter (B) phase controlled rectifier

(C) chopper (D) voltage source inverter

36. If V_c is the peak value of carrier signal and V_r is that of reference signal, modulation index of a sinusoidal PWM is :

(A) V_r/V_c (B) V_c/V_r (C) $(V_c/V_r)^2$ (D) $(V_r/V_c)^2$

37. Which of the following possess bidirectional current capability ?

(A) BJT (B) Triac (C) MOSFET (D) SCR

38. What is the approximate value of an alternating current producing 4 times the heat produced per second by a steady current of 2 A in a resistor ?

(A) 2.6 A (B) 5.6 A (C) 8 A (D) 4 A

39. A current of 2.2 A flows through a coil when connected to 220 V DC. When 220 V 50 Hz AC is applied to the same coil, current is 1 A. What is inductance of coil ?

(A) 6.24 H (B) 62.4 mH (C) 0.624 H (D) 0.624 mH

40. A 50 Hz AC current of peak value 1 A flows through the primary coil of a transformer. If the mutual inductance between primary and secondary is 1.5 H, the mean value of induced voltage is :

(A) 300 V (B) 225 V (C) 150 V (D) 75 V

41. The r.m.s. value of the e.m.f. given by $E = 8 \sin\omega t + 6 \sin 2\omega t$ volt is :

(A) $7\sqrt{2}$ V (B) $5\sqrt{2}$ V (C) 7 V (D) 10 V

42. A 22 cm long solenoid having total number of turns 1000, consists of a core of cross sectional area 4 cm^2. Half portion of the core consists of air and other half is made of iron of relative permeability 500. The self inductance of the solenoid is :

(A) 0.64 mH (B) 0.057 H (C) 0.57 H (D) 57.0 H

43. Which of the following is a solution to Ferranti effect ?

(A) shunt capacitor (B) shunt reactor

(C) series capacitor (D) none of the above

44. FACTS device is used for :

(A) enhancing controllability (B) varying network impedance

(C) increasing power transfer (D) all of the above

45. P_{max} is the maximum power that can be transferred through a transmission line. What is the maximum power transfer if a series capacitor with a degree of compensation $k = \frac{1}{3}$ is connected in the line ?

(A) $1.5\ P_{max}$ (B) $3\ P_{max}$ (C) $\frac{2}{3} P_{max}$ (D) $\frac{1}{3} P_{max}$

46. STATCOM is a :

(A) variable impedance type shunt compensator
(B) variable impedance type series compensator
(C) switched converter type shunt compensator
(D) switched converter type series compensator

47. A static synchronous series compensator injects :

(A) a current in quadrature with the system voltage
(B) a voltage in quadrature with the line current
(C) a current in phase with the line current
(D) a voltage in phase with the system voltage

48. The operation of a TCSC is prohibited for firing angles in the resonance region, since it offers to the network :

(A) a low impedance (B) a high current
(C) a low voltage (D) a high impedance

49. Which of the following scheme is used for coupling ac systems of different frequencies ?

(A) FACTS device (B) cycloconverter
(C) back to back dc link (D) none of the above

50. Under normal conditions, an HVDC link operates with :

(A) CC control at rectifier station and CEA control at inverter station
(B) CIA control at rectifier station and CC control at inverter station
(C) both at CC control
(D) both at minimum delay angle control

(CC-constant current; CEA-constant extinction angle; CIA-constant ignition angle)

51. What is the penalty factor of a plant if its incremental loss is 0.2 ?

(A) 5 (B) 0.8 (C) 0.2 (D) 1.25

52. What is the new steady state frequency, if a 10 MW load increase occurs in an area with frequency 50 Hz, governor regulation R = 0.1 p.u. and frequency dependent component of load change D = 0.8 p.u. on 100 MVA base ?

(A) 49.889 Hz (B) 49.537 Hz (C) 49.074 Hz (D) 48.554 Hz

53. A circuit breaker is connected to a 132 kV bus bar. What is the maximum value of restriking voltage across the contacts of the circuit breaker ?

(A) 216 kV (B) 108 kV (C) 373.35 kV (D) 264 kV

54. Current chopping occurs during :

(A) disconnection of capacitor

(B) lightning

(C) disconnection of transformer on no load

(D) short circuit fault

55. A 400 kV surge travels on an overhead line of surge impedance 400 Ω towards its junction with a cable which has a surge impedance of 40 Ω. What is the transmitted voltage ?

(A) 36.36 kV (B) 72.73 kV (C) −327.27 kV (D) 400 kV

56. Which of the following is an example of high frequency electric heating ?

(A) salt bath furnace (B) induction furnace

(C) electric arc furnace (D) resistance welding

57. An illumination on the working plane of 32 lux is required in a room 80 m × 15 m. Assuming a utilization factor of 0.5, lamp efficacy of 14 lumen/watt and candle power depreciation of 0.2, estimate the number of 200 W lamps required.

(A) 192 (B) 100 (C) 80 (D) 36

58. The specified parameters for a slack bus in load flow analysis are :

(A) real power and reactive power

(B) real power and voltage magnitude

(C) voltage magnitude and phase angle

(D) reactive power and voltage magnitude

59. Which of the following is **true** for a suburban electric traction service ?

(A) coasting period is longer

(B) free running period is longer

(C) coasting and free running periods are smaller

(D) none of the above is true

60. The dead weight of an electric train is 200 tonnes. The distance between station is 1.6 kms and there is a uniform gradient of 1 in 80 between the stations. The tractive effort due to gradient is :

(A) 2000 kg (B) 2500 kg (C) 250 kg (D) 320 kg

61. For a given schedule speed, the specific energy consumption for an electric train is :

(A) larger for suburban service

(B) larger for main line service

(C) equal for suburban and main line services

(D) none of the above

62. Which of the following material is used as a moderator in nuclear reactors ?

(A) Boron (B) Plutonium (C) Sodium (D) Graphite

63. Choke is provided in a fluorescent lamp to :

(A) eliminate corona effect

(B) avoid radio interference

(C) provide stability to the arc in the tube

(D) improve power factor

64. Which of the following use a resonant converter for its operation ?

(A) Incandescent lamp (B) Fluorescent lamp

(C) CFL (D) LED lamp

65. What will happen if the field of a DC motor opened while running ?

(A) the armature current will reduce

(B) motor will attain dangerously high speed

(C) speed of the motor will be reduced

(D) motor will continue to run at constant speed

66. Which of the following motor has highest no load speed ?

(A) series (B) shunt

(C) cumulative compound (D) differential compound

67. The resistance of a moving coil instrument is 10 Ω which gives full scale deflection when carrying a current of 50 mA. What should be the value of shunt to be connected to extend its range to 100 A ?

(A) 0.1 Ω (B) 0.0005 Ω (C) 0.5 Ω (D) 0.005 Ω

68. What will be the load power factor, if one wattmeter read positive and the other zero in a two wattmeter method for power measurement ?

(A) unity (B) zero (C) 0.5 lag (D) 0.5 lead

69. A dynamometer moving coil instrument can measure :

(A) a.c. only (B) d.c. only

(C) both a.c and d.c. (D) only pulsating quantities

70. Which of the following bridge rectifiers has highest harmonic content in output voltage ?

(A) 1-phase half wave (B) 1-phase full wave

(C) 3-phase half wave (D) 3-phase full wave

71. The rotor copper loss for a 4 pole 3-phase 50 Hz induction motor running at 1495 rpm is 50 W. Its rotor input is :

(A) 250 W (B) 15 kW (C) 50 W (D) 100 W

72. The electrical representation of the variable mechanical load of a 3-phase induction motor is the resistance given by :

(A) $r_2(1-s)$ (B) $r_2(s-1)$ (C) $r_2\left(1-\frac{1}{s}\right)$ (D) $r_2\left[\left(\frac{1}{s}\right)-1\right]$

73. If V is the voltage applied to the stator of an induction motor, the electrical torque Te is proportional to :

(A) V (B) 2 V (C) V^2 (D) V^4

74. The rotor slots of squirrel cage induction motor are given a slight skew in order to :

(A) reduce eddy currents (B) reduce magnetic hum

(C) reduce windage loss (D) reduce accumulation of dirt and dust

75. The speed of a 3-phase, 4 pole, 440 V 50 Hz induction motor is 1440 rpm. What is the frequency of rotor emf ?

(A) 200 Hz (B) 50 Hz (C) 2 Hz (D) 48 Hz

76. The cogging in an induction motor is caused by :

(A) high loads (B) harmonics developed in the motor

(C) low voltage supply (D) none of the above

77. Rotor rheostatic method of speed control is used for :

(A) slip ring induction motor (B) squirrel cage induction motor

(C) DC series motor (D) DC shunt motor

78. What is meant by plugging in the case of a 3-phase induction motor ?

(A) locking of rotor due to harmonics

(B) interchanging two supply phases for quick stopping

(C) starting the motor with direct on line

(D) none of the above

79. What is the condition for maximum torque under running conditions for a 3-phase induction motor, if R_2 is the rotor resistance, X_2 is the rotor reactance and 's' is the slip ?

(A) $X_2 = sR_2$ (B) $R_2X_2 = \frac{1}{s}$ (C) $R_2 = sX_2$ (D) $R_2 = s^2X_2$

80. The torque developed by a single phase induction motor at starting is :

(A) more than rated torque (B) rated torque

(C) less than rated torque (D) zero

81. A reluctance motor is preferable for :

(A) electric traction (B) timing and control devices

(C) refrigerators (D) lifts and hoists

82. The phase displacement between starting and running winding of a capacitor start motor is nearly :

(A) 90° (B) 60° (C) 30° (D) 0°

83. Which of the following does not change in a transformer ?

(A) voltage (B) frequency (C) current (D) all of the above

84. The highest transmission voltage in India is :

(A) 220 kV (B) 400 kV (C) 765 kV (D) 1000 kV

85. Which of the following transformers has its secondary always kept closed ?

(A) star-delta transformer (B) open delta transformer

(C) potential transformer (D) current transformer

86. A 40 kVA, 1-phase transformer has an iron loss of 400 W and full load copper loss of 600 W. Maximum efficiency occurs at a load of :

(A) 17.77 kVA (B) 26.67 kVA (C) 32.66 kVA (D) 37.85 kVA

87. Which winding of the transformer has large cross sectional area ?

(A) primary winding (B) secondary winding

(C) high voltage winding (D) low voltage winding

88. During short circuit test, iron losses are negligible because :

(A) voltage on secondary side is high (B) voltage applied on primary side is low

(C) current in secondary side is low (D) current in primary side is low

89. If the input to the primemover of an alternator is constant but the excitation is changed, then :

(A) reactive power output changed

(B) active power output changed

(C) power factor of the load remains constant

(D) all of the above

90. For a sine wave oscillator, total phase shift around the loop and magnitude of loop gain must be :

(A) zero and unity (B) 180° and unity

(C) zero and less than unity (D) 90° and unity

91. The first column of Routh table contains the following; 1, 2, 4, 3.5, 1. The system is :

(A) unstable (B) stable

(C) marginally stable (D) none of these

92. The effect of a phase lag network is :

(A) phase margin increased and bandwidth reduced

(B) phase margin and bandwidth increased

(C) phase margin and bandwidth reduced

(D) phase margin reduced and bandwidth increased

93. If the bandwidth of a control system is increased, the result will be :

(A) slower response (B) faster response

(C) settling time less (D) none of the above

94. The settling time of the second order linear system is :

(A) $\frac{1}{4}^{th}$ times the time constant of the system

(B) 3 times the time constant of the system

(C) 4 times the time constant of the system

(D) none of the above

95. In force-current analogy, electrical capacitance is analogous to :

(A) damping coefficient (B) mass

(C) force (D) displacement

96. Which of the following is **not** in frequency domain ?

(A) Bode plot (B) Root locus

(C) Nyquist criterion (D) None of the above

97. If the characteristic equation of a system is $s^2+8s+25=0$, value of ω_n is :

(A) 8 rad/s (B) 0.5 rad/s (C) $2\sqrt{2}$ rad/s (D) 5 rad/s

98. The phase shift of $G(s)=\frac{1}{s^2}$ is :

(A) $-180°$ (B) $-90°$ (C) $180°$ (D) $90°$

99. The open loop transfer function of unity feedback system is given by $G(s)=\frac{50}{[(1+0.1s)(s+10)]}$. What is the static position error coefficient K_p ?

(A) 5 (B) zero (C) 50 (D) 10

100. Schmidt trigger is an example of :

(A) monostable multivibrator (B) astable multivibrator

(C) bistable multivibrator (D) none of the above

- o 0 o -