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A

SET-Y

M.Phil./Ph.D./URS-EE-2019

SUBJECT : Electrical Engineering

Sr. No. 10017

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

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1. A fair coin is tossed three times in succession. If the first toss produces a head, then the probability of getting exactly two heads in three tosses is :

(1) 1/8 (2) 1/2 (3) 3/8 (4) 3/4

2. Let the probability density function of a random variable X be given as $fx(x) = \frac{3}{2}e^{-3x}\,u(x) + ae^{4x}\,u(-x)$ where $u(x)$ is the unit step function. Then the value of a and $Prob\{X \le 0\}$, respectively are :

(1) 2, 1/2 (2) 4, 1/2 (3) 2, 1/4 (4) 4, 1/4

3. Let $A = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}$, and I is the identity matrix, then A^9 is given by :

(1) $511A + 510I$ (2) $309A + 104I$ (3) $154A + 155I$ (4) e^{9A}

4. The equations $\begin{bmatrix} 2 & -2 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ has

(1) no solution
(2) only one solution $x_1 = 0, x_2 = 0$
(3) non zero unique solution
(4) multiple solutions

5. The Laplace transform of the function $f(t) = e^{2t}\sin(5t)\,u(t)$ is :

(1) $\frac{5}{s^2 - 4s + 29}$ (2) $\frac{5}{s^2 + 5}$ (3) $\frac{s-2}{s^2 + 4s + 29}$ (4) $\frac{5}{s+5}$

6. Consider a signed defined as $x(t) = \begin{cases} e^{j10t} & |t| \le 1 \\ 0 & |t| > 1 \end{cases}$.

Its Fourier transform is given as :

(1) $\frac{2\sin(w-10)}{w-10}$ (2) $2e^{j10}\frac{\sin(w-10)}{w-10}$

(3) $\frac{2\sin(w-10)}{w-10}$ (4) $e^{j10w}\frac{\sin(w-10)}{w-10}$

7. In a two port reciprocal network, the output open circuit voltage by the input current is equal to :

(1) h_{12} (2) Z_{12} (3) Y_{11} (4) B

8. A series RLC circuit consists of L = 0.5 H, C = 50μF and R = 40Ω. When excited with 220V AC rms and 50Hz frequency source, the voltage across the capacitor is :

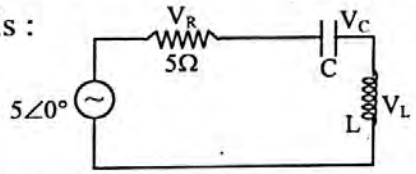
(1) 140V (2) 139.6V (3) 138.02V (4) 142V

9. The Y-parameter of the following network is $\begin{bmatrix} 0 & -1/2 \\ 1/2 & 1 \end{bmatrix}$, then the network is :

(1) non-reciprocal and active (2) non-reciprocal and passive

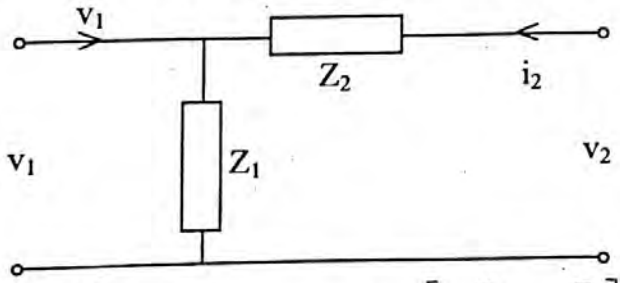
(3) reciprocal and active (4) reciprocal and passive

10. In the circuit shown below, the magnitudes of V_L and V_C are twice that of V_R. The inductance of the coil is :



(1) 2.14mH (2) 5.30mH (3) 31.8mH (4) 1.32mH

11. For a two port network shown below, the Z-matrix is given by :



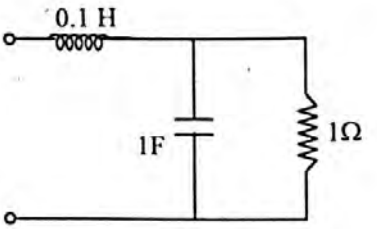
(1) $\begin{bmatrix} Z_1 & Z_1+Z_2 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$ (2) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$

(3) $\begin{bmatrix} Z_1 & Z_2 \\ Z_2 & Z_1+Z_2 \end{bmatrix}$ (4) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1 & Z_2+Z_2 \end{bmatrix}$

12. The Z-matrix of a network is given as $Z = \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$, then Y_{22} is given by :

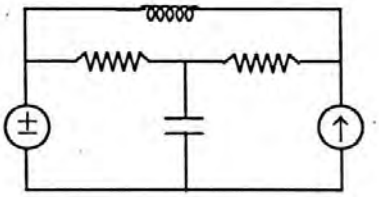
(1) 1.2 (2) 0.4 (3) –0.4 (4) 1.8

13. The resonant frequency for the given circuit below is :



(1) 1 rad/s (2) 3 rad/s (3) 2 rad/sec (4) 5.1 rad/sec

14. The number of chords in the graph of the circuit shown below is :



(1) 3 (2) 4 (3) 5 (4) 6

15. The average power absorbed by an impedance of $Z = 30 - j70\Omega$ when a voltage of $V = 120\angle 0°$ is applied across it is :

(1) 21.4W (2) 37.24W (3) 32.74W (4) 12.4W

16. The Q-factor of a coil with resonating frequency f_0 is given by :

(1) $\frac{2\pi f_0 R}{L}$ (2) $\frac{2\pi f_0 R}{C}$

(3) $\frac{bandwidth}{f_0}$ (4) None of these

17. Which of the following statements holds for the divergence of electric and magnetic flux densities ?

(1) Both are zero

(2) These are zero for static densities but non-zero for time varying densities.

(3) It is zero for the electric flux density

(4) It is zero for the magnetic flux density

18. The value of flux density at a point in space is $\vec{B} = 4x\hat{a}_x + 2ky\hat{a}_y + 8\hat{a}_z$ W/m^2. The value of constant k must be equal to :

(1) –2 (2) –0.5 (3) +0.5 (4) +2

19. Two electric charges +q and –2Q are placed at (0, 0) and (6, 0) in the x-y plane. The equation of the zero equipotential curve in the x-y plane is :

(1) $x = -2$ (2) $y = 2$

(3) $x^2 + y^2 = 2$ (4) $(x+2)^2 + y^2 = 16$

20. A 4-pole lap wound DC shunt generator has an armature winding consisting of 220 turns each of 0.004Ω resistance, then the armature resistance will be :

(1) 0.055Ω (2) 0.0275Ω

(3) 0.110Ω (4) 0.22Ω

21. Full load voltage regulation of a power transformer is zero when the power factor of the load is :

(1) unity and leading (2) zero and leading

(3) zero and lagging (4) unity and lagging

22. In an autotransformer of voltage ratio V_1/V_2 and $V_1 > V_2$, the fraction of power transferred inductively is :

(1) $\frac{V_1}{V_1+V_2}$ (2) $\frac{V_2}{V_1}$ (3) $\frac{V_1-V_2}{V_1+V_2}$ (4) $\frac{V_1-V_2}{V_1}$

23. A series motor drawing an armature current of 1_a is operating under saturated magnetic conditions. The torque developed in the motor is proportional to :

(1) $\frac{I}{I_a}$ (2) $\frac{I}{I_a^2}$ (3) I_a^2 (4) I_a

24. Which of the following are the features of a shaded pole motor

a. Salient pole stator

b. Uniform air-gap

c. Two stator windings one of which is a short circuited ring

d. Squirrel cage rotor

Select the correct answer using following

Code :

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

25. A synchronous motor is running from an infinite bus of voltage V_t in steady state at about 50% of its rated load with a power angle δ_1 between V_t and E_f. The load is suddenly decreased to 25%. E_f attains its new steady state power angle δ_2 with V_t by initially :

(1) falling behind and making a complete rotation

(2) advancing and making a complete rotation

(3) falling behind followed by oscillation about δ_2

(4) advancing followed by oscillation about δ_2

26. The rotor output of a three phase induction motor is 15kW and the corresponding slip is 4%. The rotor copper loss will be :

(1) 600W (2) 625W (3) 650W (4) 700W

27. A single phase transformer has a rating of 15kVA, 600/120V. It is reconnected as an autotransformer to supply 720V from a 600V primary source. The maximum load it can supply is :

(1) 90kVA
(2) 18 kVA
(3) 15 kVA
(4) 12kVA

28. A 200V DC shunt motor delivers an output of 17kW with an input of 20kW. The field winding resistance is 50Ω and armature resistance is 0.04Ω. Maximum efficiency will be obtained when the total armature copper losses are equal to :

(1) 2632W
(2) 3000W
(3) 3680W
(4) 5232W

29. A three phase alternator is connected to a delta-delta transformer. The hysteresis and eddy current loasses of the transformer are 300W and 400W respectively. If the speed of the alternator is reduced by 10% then the hysteresis and eddy current losses of the transformer respectively will be :

(1) 218W and 262.44W
(2) 243W and 324W
(3) 243W and 360W
(4) 270W and 400W

30. A 220V DC shunt motor is operating at a speed of 1440rpm. The armature resistance is 1.0Ω and armature current is 10A. If the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79Ω (2) 2.1Ω (3) 3Ω (4) 18.9Ω

31. For a motor to deliver a torque of 2.5Nm at 1400rpm, the armature voltage to be applied is :

(1) 125.5V (2) 193.3V

(3) 200V (4) 241.7V

32. The direct axis and quadrature axis reactances of a salient pole alternator are 1.2pu and 1.0pu, respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at unity power factor and at rated voltage, then its power angle is :

(1) 30° (2) 45° (3) 60° (4) 90°

33. The locked rotor current in a three phase start connected 15kW, 4-pole, 230V, 50Hz induction motor at rated condition is 50A. Neglecting losses and magnetising current, the approximate locked rotor line current dawn when the motor is connected to a 236V, 57Hz supply is :

(1) 58.5A (2) 45.0A (3) 42.7A (4) 55.6A

34. The slip of an induction motor normally does not depend upon

(1) rotor speed (2) synchronous speed

(3) shaft torque (4) core loss component

35. A synchronous generator is feeding a zero power factor (lagging) load at rated current. The armature reaction is :

(1) magnetising (2) demagnetising

(3) cross-magnetising (4) ineffective

36. A single phase transmission line of $j0.8\Omega$ is supplying a load of 40A at 200V and unity power factor. Then, the sending end power factor will be :

(1) 1 (2) 0.987 (3) 0 (4) 0.982

37. Two incoming lines with fault levels at their terminals equal to 100MVA and 150MVA terminate on a common bus in a substation. A 1MVA step down transformer having 10% reactance is connected to this bus. Then, the fault level on LV side of the transformer will be :

(1) 12.57 (2) 9.57 (3) 11.57 (4) 18.57

38. When a bundled conductor is used in place of a single conductor, the changes in line parameters are :

(1) L increases and C decreases
(2) L decreases and C increases
(3) L decreases and C not affected
(4) both L and C are not affected

39. A lossless transmission line with characteristic impedance of 300Ω and length $\lambda/2$ is shortened at one end and termined in its characteristic impedance at the othe. The input impedance measured at the mid section of the line is :

(1) 0Ω (2) 200Ω (3) 300Ω (4) 150Ω

40. In load flow analysis, the load connected to a bus is represented as :

(1) constant current drawn from the bus
(2) constant impedance connected at the bus
(3) voltage and frequency dependent source at the bus
(4) constant real and reactive power drawn from the bus

41. A 200 km long three phase transmission line is transferring a power of 200MVA having line losses of 5MW. If the recieving end voltage is 110kV, the line has a resistance of :

(1) 10Ω/ph
(2) 1.5Ω/ph
(3) 1Ω/ph
(4) 2.5Ω/ph

42. The cost function of a 50MW generator is $F(P_1) = 225 + 53P_1 + .02P_1^2$ where P_1 is the generator loading in MW. For 100% loading the cost is :

(1) Rs. 55 per Mwh (2) Rs. 55 per Mw

(3) Rs. 58.5 per Mwh (4) Rs. 55.5 per Mwh

43. Two insulator discs of identifical capacitance value C make up of a string for a 22kV, 50 Hz single phase overhead line insulation system. If the pin to earth capacitance is also C, then the string efficiency is :

(1) 50% (2) 75% (3) 90% (4) 86%

44. The surge impedance of a three phase 400kV transmissionline is 400Ω. Then the surge impedance loading is :

(1) 400MW (2) 1000MW (3) 1600MW (4) 800MW

45. A three phase generator rated at 110MVA, 11kV is connected through circuit beakers to a transformer. The generator has direct axis sub-transient reactance X''_d = 19%, transient reactance X'_d = 26% and synchronous reactance 130%. The generator is operating at no load and rated voltage when a three phase short circuit fault occurs between the breakers and the transformer. The magnitude of initial symmetrical RMS current in the breakers will be :

(1) 4.44kA (2) 22.20kA (3) 30.39kA (4) 38.45kA

46. The bus admittance matrix of a three-bus three line system is :

$$Y = j\begin{bmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{bmatrix}$$

if each transmission line between the two buses is represented by an equivalent π-network, the magnitude of the shunt susceptance of the line connecting bus 1 and 2 is :

(1) 4 (2) 2 (3) 1 (4) 0

47. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and currents

(2) angular displacement of the rotor with respect to the stator

(3) angular displacement of the stator mmf with respect to a synchronously rotating axis

(4) angular displacement of an axis fixed to the rotor with respect to a synchronous rotating axis

48. A single phase load is supplied by a single phase voltage source. If the current flowing from the load to the source is $10\angle -150°$ A and if the voltage at the load terminals is $100\angle 60° V$, then the :

(1) load absorbs real power and delivers reactive power

(2) load absorbs real power and absorbs reactive power

(3) load delivers real power and delivers reactive power

(4) load delivers real power and absorbs reactive power

49. A cylindrical rotor generator delivers 0.5pu power in the steady state to an infinite bus through a transmission line of reactance 0.5pu. The generator no load voltage is 1.5pu and the infinite bus voltage is 1pu. The inertia constant of the generator is 5MW-s/MVA and the generator reactance is 1pu. The critical clearing angle in degrees for a three phase dead short circuit fault at the generator terminal is :

(1) 53.5 (2) 60.2 (3) 70.8 (4) 79.6

50. In a biased differential relay, the bias is defined as a ratio of :

(1) number of turns of restraining and operating coil

(2) operating coil current and restraining coil current

(3) fault current and operating coil currents

(4) fault current and restraining coil current

A

51. An electric motor developing a starting torque of 15Nm starts with a load torque of 7Nm on its shaft. If the acceleration at start is 2 rad/s^2 , then moment of inertia of the systems must be (neglecting viscous and Coulomb friction)

(1) 0.25kgm^2 (2) 0.25Nm^2

(3) 4 kgm^2 (4) 4Nm^2

52. The ABCD parameters of a three phase overhead transmission line are $A = D = 0.9 \angle 0°$, $B = 200\angle 90°\Omega$ and $C = 0.95 \times 10^{-3} \angle 90°$. At no load condition, a shunt inductive reactor is connected at the recieving end of the line to limit the receiving end voltage to be equal to the sending end voltage. The ohmic value of the reactor is :

(1) $\infty\,\Omega$ (2) 2000Ω

(3) 105.26Ω (4) 1052.5Ω

53. A round rotor generator with internal voltage $E_1 = 2.0pu$ and $X = 1.1pu$ is connected to a round rotor synchronous motor with internal voltage $E_2 = 1.3pu$ and $X = 1.2pu$. The reactance of the line connecting the generator to the motor is 0.5pu. When the generator supplies 0.5pu power, the rotor angle difference between the machines will be :

(1) 57.42° (2) 1°

(3) 32.58° (4) 122.58°

54. If we make the system insensitive to forward path gain G(s) using negative feedback configuration, it becomes :

(1) slow and stable

(2) more sensitive to feedback path gain variations

(3) stable as well as insensitive to variation in feedback path gains

(4) fast at the cost of stability

55. Which of the following cannot be achieved using open loop control systems :

(1) tracking avarying control command

(2) rejecting some known disturbances

(3) regulation around a set point

(4) sensitivity reduction with respect to forward path gain

56. An integral controller K $(s) = \frac{1}{s}$ is required to be placed in tandem with plant G(s) so as to make the steady state error for ramp input as zero. Then the type of plant G(s) is :

(1) 2 (2) 1 (3) 0 (4) ∞

57. A system with $G(s)\frac{1}{s(s+1)}$ is stablized with a proportional controller K in the forward path. The value of K for which the system will admit sustained oscillations will be :

(1) 1 (2) 2

(3) $2\sqrt{2}$ (4) no value exists

58. An open loop transfer function has one pole and one zero in the right half of s-plane, then if the closed loop system is stable, the nyquist plot should encircle - 1 + j0 point

(1) once in the anticlockwise direction

(2) once in the clockwise direction

(3) should not encircle

(4) none of these

59. The Asymptotes in the root locus plot of unity feedback configuration of $G(s)\frac{1}{s(s+1)(s+2)}$ intersects with the real axis at :

(1) –1.25 (2) –1.5 (3) –1 (4) –1.15

60. Bode gain plots alone can be used to find the transfer function of a linear time invariant system when :

(1) Not possible alone with bode gain plots

(2) system is stable and observable

(3) system is causal and controllable

(4) system is non-minimum phase

61. The transfer function of a phase lead compensator is $\frac{s+a}{s+b}$ and that of phase lag compensator is $\frac{s+p}{s+q}$, then which of the following sets of conditions must be met ?

(1) a > b and p < q (2) a > b and p > q

(3) a < b and p < q (4) a < b and p > q

62. The dynamics of a system are governed by $\dddot{y}(t) - \ddot{x}(t) - x(t-1) = 0$. Then the transfer function of the system is :

(1) $s^2 + se^{-s}$ (2) $1 + s^2e^{-s}$

(3) $1 + s^{-2}e^{-s}$ (4) $1 + s^{-2}e^{s}$

63. A composite RC network has the transfer function $K(s) = \frac{1+21s+20s^2}{1+11s+10s^2}$, then this block can be used as a :

(1) phase lead compensator (2) phase lag compensator

(3) lag-lead compensator (4) none of above

64. The value of K and a, for which the system $G(s) = \frac{K(s+2)}{s^3+s^2+as+1}$ will oscillate with 3 rad/sec frequency in unity feedback configuration, are respectively as :

(1) 2, 2 (2) 4, 5 (3) 3, 4 (4) 2, 3

65. The time taken by the output of a system $G(s)=\frac{1}{(s+1)}$ to settle around 95% of its final value is :

(1) 2 sec (2) 1.33 sec (3) 1.11 sec (4) 3 secondary

66. The system with $G(s)=\frac{1}{s(\tau s+1)}$ when connected in the unity feedback configuration produces error to the step inputs as $e(t) = Ke^{-4t}\sin(10t + \phi)$. The system time constant τ is then given by :

(1) 0.01 (2) 0.03 (3) 10 (4) 4

67. Given a unity feedback system with $G(s)=\frac{K(s-1)(s-2)}{s(s+1)}$, which of the following is true ?

(1) the system will always be stable for all K
(2) the system will be stable for low gain K
(3) the system is stable for high gain K
(4) the system root locus never crosses jw axis

68. The state space equations of a system are as :

$$\dot{x}=\begin{bmatrix}0 & 1\\ 0 & 2\end{bmatrix}x+\begin{bmatrix}0\\ 2\end{bmatrix}u;\ y=[1\ \ 0]\,x$$

then the damping ratio and decay factor are :

(1) .707, 2 (2) 1.414, 1 (3) 0.5, 1 (4) 0.5, 0.5

69. The state space equations of a system are as :

$$\dot{x}=\begin{bmatrix}0 & 1\\ 0 & -2\end{bmatrix}x+\begin{bmatrix}0\\ 2\end{bmatrix}u;\ y=[1\ \ 0]\,x$$

then the position error constant K_p and velocity error constant K_v are respectively as :

(1) 2, 0 (2) ∞, 0 (3) ∞, 1 (4) None of these

70. The dynamics of a system are governed by following state equations :

$$\dot{x} = \begin{bmatrix} 3 & 0 \\ -2 & 2 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u ; \; y = [1 \;\; 1]\, x$$

then this system is :

(1) controllable, observable and unstable

(2) not controllable, observable and stable

(3) not controllable, not observable and unstable

(4) not controllable, observable and unstable

71. A moving coil instrument gives a full scale deflection of 10mA when voltage across its terminal is 100mV. For a 100A current, calculate the shunt resistance required for a full scale deflection :

(1) 0.01Ω (2) 0.001Ω (3) 0.1Ω (4) 1Ω

72. Time response of an indicating instrument is given by :

(1) controlling mechanism (2) bearing mechanism

(3) deflecting mechanism (4) damping mechanism

73. A shunt resistance of 25Ω is necessary to extend range of an ammeter from 100μA to 500μA. The value of internal resistance of the ammeter is :

(1) 25Ω (2) 50Ω (3) 100Ω (4) 1000Ω

74. In a PMMC type instrument, the magnetic field produced by the eddy currents :

(1) doesn't affect the motion of the coil

(2) acts in the same direction of the motion of the coil

(3) acts in the direction opposite to the motion of the coil

(4) none of above

75. In a two wattmeter method of measuring three phase power, power factor is 0.5, one wattmeter reads W then the other meter will read :

(1) $\sqrt{3}$ W (2) W/2 (3) 2W (4) 0W

76. The ratio of the potential transformer and current transformer required to measure power in circuit rated 5500kW, 11kV with a wattmeter rated at 5A and 110V respectively are :

(1) 10, 10 (2) 50, 50 (3) 200, 200 (4) None of these

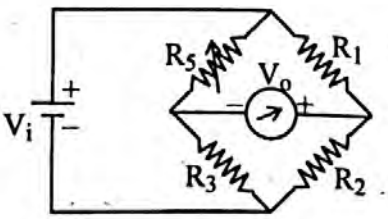
77. The effect of stray magnetic fields on the actuating torque of a portable instrument is maximum when the operating field of the instrument and the stray field are :

(1) perpendicular (2) parallel (3) inclined at 60° (4) inclined at 30°

78. A 500A/5A, 50Hz transformer has a bar primary. The secondary burden is a pure resistance of 1Ω and it draws a current of 5A. If the magnetic core requires 250AT for magnetisation, the percentage ratio error is :

(1) 10.56 (2) –10.55 (3) 11.80 (4) –11.80

79. A strain guage forms one arm of the bridge shown in the figure below, and has a nominal resistance without any load as $R_s = 300\Omega$. Other bridge resistances are $R_1 = R_2 = R_3 = 300\Omega$. The maximum permissible current through the strain guage is 20mA. During certain measurement when the bridge is excited by maximum permissible voltage an the strain guage resistance is increased by 1% over the nominal value, the output voltage V_o in mV is:



(1) 56.02 (2) 40.83 (3) 29.85 (4) 10.02

80. In CE configuration, the input V-I characteristics are drawn by taking :

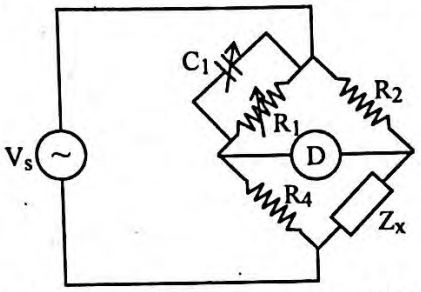
(1) V_{CE} as I_C for constant value of I_E

(2) V_{BE} vs I_E for constant value of V_{CE}

(3) V_{BE} vs I_B for constant value of I_C

(4) V_{BE} vs I_B for constant value of V_{CE}

81. The bridge circuit shown in figure below is used for the measurement of an unknown element Z_x. The bridge circuit is best suited when Z_x is as :



(1) low resistance (2) high resistance (3) low Q inductor (4) lossy capacitor

82. A silicon diode indicates forward currents of 2mA and 10mA when diode voltages are 0.6V and 0.7V respectively. The operating temperature of the diode junction is :

(1) 180K (2) 360K (3) 480K (4) 320K

83. The current gain of a bipolar transistor drops at high frequencies because of :

(1) transistor internal capacitances (2) high current effects in the base

(3) parasitic inductive elements (4) the Early effects

84. A diode has a leakage current of 10μA at certain tempearture. Find its value when temperature is increased by 25°C :

(1) 56.00 μA (2) 56.56 μA (3) 59.56 μA (4) None of these

85. A transistor has $\alpha = 0.98$, then its β is :

(1) 50 (2) 49 (3) 70 (4) None of these

86. A JFET has a value of $g_{m0} = 4000\ \mu S$. Determine the value of g_m at $V_{GS} = -3V$. Given that $V_{GS(off)} = -8V$:

(1) 250 μS (2) 2500 μS (3) 25 μS (4) None of these

87. A multiplexer is a :

(1) one input many output device (2) one input and one output device

(3) many input many output device (4) many input to one output device

88. A J-K flip flop is made to toggle via :

(1) J=0, K=0 (2) J=1, K=0 (3) J=0, K=1 (4) J=1, K=1

89. Multiplexers are used in :

(1) data generation (2) serial to parallel conversion

(3) data selection (4) None of these

90. Which one of the following is a universal gate ?

(1) AND (2) OR (3) Ex-NOR (4) NAND

91. Invalid state of an S-R flip flop occurs when :

(1) S=1, R=0 (2) S=0, R=1 (3) S=0, R=0 (4) S=1, R=1

92. A feature that distinguishes the J-K flip flop from the S-R flip flop is the :

(1) toggle condition (2) preset input

(3) type of clock pulse (4) clear input

93. In DC Choppers, the duty cycle D is usually varied at fixed frequency in order to :

(1) limit operating frequency

(2) have lower impact on filter design and switching losses

(3) reduce operating frequency

(4) have proper voltage at output

94. In order to obtain static voltage equalization in series-connected SCRs, connections are made of :

(1) one resistor across the string

(2) resistors of different value across each SCR

(3) resistors of the same value across each SCR

(4) one resistor in series with the string

95. A single phase full wave half controlled bridge converter feeds an inductive load. The two SCRs in the converter are connected to a common DC bus. The converter has to have a freewheeling diode :

(1) because the converter inherently does not provide way for freewheeling

(2) because the converter does not provide free wheeling for high values of triggering angles

(3) because the freewheeling action of the converter will cause shorting of AC supply

(4) because if a gate pulse to one of the SCRs is missed, it will subsequently cause a high load current in the other SCR

96. A voltage source inverter is used to control the speed of a three phase 50 Hz squirrel cage induction motor. Its slip for rated torque is 4%. The flux is maintained at rated value. If the stator resistance and rotational losses are neglected, then the frquency of the impressed voltage to obtain twice the rated torque at starting should be :

(1) 10 Hz (2) 5 Hz (3) 4 Hz (4) 2 Hz

97. An SCR is considered to be a semi-controlled device because :

(1) it can be turned OFF but not ON with a gate pulse

(2) it conducts only during one half-cycle of an alternating current wave

(3) it can be turned ON but not OFF with a gate pulse

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98. Circuit turn-OFF time of an SCR is defined as the time :

(1) taken by the SCR to turn OFF

(2) required for the SCR current to become zero

(3) for which the SCR is reverse biased by the commutation circuit

(4) for which the SCR is reverse biased to reduce its current below the holding current

99. A half controlled single phase bridge rectifier is supplying an RL load. It is operated at a firing angle α and the load current is continuous. The fraction of cycle that the freewheeling diode conducts is :

(1) $\frac{1}{2}$ (2) $\left(1-\frac{\alpha}{\pi}\right)$ (3) $\frac{\alpha}{2\pi}$ (4) $\frac{\alpha}{\pi}$

100. The typical ratio of the latching current to holding current in a 20A thyristor is :

(1) 5.0 (2) 2.0 (3) 1.0 (4) 0.5

Total No. of Printed Pages : 21

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B

SET-Y

M.Phil./Ph.D./URS-EE-2019

SUBJECT : Electrical Engineering

Sr. No. 10018

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name_____

Mother's Name_____ Date of Examination_____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. A 200 km long three phase transmission line is transferring a power of 200MVA having line losses of 5MW. If the recieving end voltage is 110kV, the line has a resistance of :

(1) 10Ω/ph (2) 1.5Ω/ph

(3) 1Ω/ph (4) 2.5Ω/ph

2. The cost function of a 50MW generator is $F(P_1) = 225 + 53P_1 + .02P_1^2$ where P_1 is the generator loading in MW. For 100% loading the cost is :

(1) Rs. 55 per Mwh (2) Rs. 55 per Mw

(3) Rs. 58.5 per Mwh (4) Rs. 55.5 per Mwh

3. Two insulator discs of identifical capacitance value C make up of a string for a 22kV, 50 Hz single phase overhead line insulation system. If the pin to earth capacitance is also C, then the string efficiency is :

(1) 50% (2) 75% (3) 90% (4) 86%

4. The surge impedance of a three phase 400kV transmissionline is 400Ω. Then the surge impedance loading is :

(1) 400MW (2) 1000MW

(3) 1600MW (4) 800MW

5. A three phase generator rated at 110MVA, 11kV is connected through circuit beakers to a transformer. The generator has direct axis sub-transient reactance X''_d = 19%, transient reactance X'_d = 26% and synchronous reactance 130%. The generator is operating at no load and rated voltage when a three phase short circuit fault occurs between the breakers and the transformer. The magnitude of initial symmetrical RMS current in the breakers will be :

(1) 4.44kA (2) 22.20kA

(3) 30.39kA (4) 38.45kA

6. The bus admittance matrix of a three-bus three line system is :

$$Y = j\begin{bmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{bmatrix}$$

if each transmission line between the two buses is represented by an equivalent π-network, the magnitude of the shunt susceptance of the line connecting bus 1 and 2 is :

(1) 4 (2) 2 (3) 1 (4) 0

7. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and currents

(2) angular displacement of the rotor with respect to the stator

(3) angular displacement of the stator mmf with respect to a synchronously rotating axis

(4) angular displacement of an axis fixed to the rotor with respect to a synchronous rotating axis

8. A single phase load is supplied by a single phase voltage source. If the current flowing from the load to the source is $10\angle -150°$ A and if the voltage at the load terminals is $100\angle 60° V$, then the :

(1) load absorbs real power and delivers reactive power

(2) load absorbs real power and absorbs reactive power

(3) load delivers real power and delivers reactive power

(4) load delivers real power and absorbs reactive power

9. A cylindrical rotor generator delivers 0.5pu power in the steady state to an infinite bus through a transmission line of reactance 0.5pu. The generator no load voltage is 1.5pu and the infinite bus voltage is 1pu. The inertia constant of the generator is 5MW-s/MVA and the generator reactance is 1pu. The critical clearing angle in degrees for a three phase dead short circuit fault at the generator terminal is :

(1) 53.5 (2) 60.2 (3) 70.8 (4) 79.6

10. In a biased differential relay, the bias is defined as a ratio of :

(1) number of turns of restraining and operating coil

(2) operating coil current and restraining coil current

(3) fault current and operating coil currents

(4) fault current and restraining coil current

11. A moving coil instrument gives a full scale deflection of 10mA when voltage across its terminal is 100mV. For a 100A current, calculate the shunt resistance required for a full scale deflection :

(1) 0.01Ω (2) 0.001Ω (3) 0.1Ω (4) 1Ω

12. Time response of an indicating instrument is given by :

(1) controlling mechanism (2) bearing mechanism

(3) deflecting mechanism (4) damping mechanism

13. A shunt resistance of 25Ω is necessary to extend range of an ammeter from 100μA to 500μA. The value of internal resistance of the ammeter is :

(1) 25Ω (2) 50Ω (3) 100Ω (4) 1000Ω

14. In a PMMC type instrument, the magnetic field produced by the eddy currents :

(1) doesn't affect the motion of the coil

(2) acts in the same direction of the motion of the coil

(3) acts in the direction opposite to the motion of the coil

(4) none of above

15. In a two wattmeter method of measuring three phase power, power factor is 0.5, one wattmeter reads W then the other meter will read :

(1) $\sqrt{3}$ W (2) W/2 (3) 2W (4) 0W

16. The ratio of the potential transformer and current transformer required to measure power in circuit rated 5500kW, 11kV with a wattmeter rated at 5A and 110V respectively are :

(1) 10, 10 (2) 50, 50 (3) 200, 200 (4) None of these

17. The effect of stray magnetic fields on the actuating torque of a portable instrument is maximum when the operating field of the instrument and the stray field are :

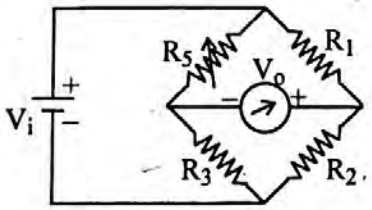
(1) perpendicular (2) parallel

(3) inclined at 60° (4) inclined at 30°

18. A 500A/5A, 50Hz transformer has a bar primary. The secondary burden is a pure resistance of 1Ω and it draws a current of 5A. If the magnetic core requires 250AT for magnetisation, the percentage ratio error is :

(1) 10.56 (2) –10.55 (3) 11.80 (4) –11.80

19. A strain guage forms one arm of the bridge shown in the figure below, and has a nominal resistance without any load as R_s = 300Ω. Other bridge resistances are $R_1 = R_2 = R_3$ = 300Ω. The maximum permissible current through the strain guage is 20mA. During certain measurement when the bridge is excited by maximum permissible voltage an the strain guage resistance is increased by 1% over the nominal value, the output voltage V_o in mV is:



(1) 56.02 (2) 40.83 (3) 29.85 (4) 10.02

20. In CE configuration, the input V-I characteristics are drawn by taking :

(1) V_{CE} as I_C for constant value of I_E

(2) V_{BE} vs I_E for constant value of V_{CE}

(3) V_{BE} vs I_B for constant value of I_C

(4) V_{BE} vs I_B for constant value of V_{CE}

21. Invalid state of an S-R flip flop occurs when :

(1) S=1, R=0 (2) S=0, R=1

(3) S=0, R=0 (4) S=1, R=1

22. A feature that distinguishes the J-K flip flop from the S-R flip flop is the :

(1) toggle condition (2) preset input

(3) type of clock pulse (4) clear input

23. In DC Choppers, the duty cycle D is usually varied at fixed frequency in order to :

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26. A voltage source inverter is used to control the speed of a three phase 50 Hz squirrel cage induction motor. Its slip for rated torque is 4%. The flux is maintained at rated value. If the stator resistance and rotational losses are neglected, then the frquency of the impressed voltage to obtain twice the rated torque at starting should be :

(1) 10 Hz (2) 5 Hz (3) 4 Hz (4) 2 Hz

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(1) $\frac{1}{2}$ (2) $\left(1-\frac{\alpha}{\pi}\right)$ (3) $\frac{\alpha}{2\pi}$ (4) $\frac{\alpha}{\pi}$

30. The typical ratio of the latching current to holding current in a 20A thyristor is :

(1) 5.0 (2) 2.0 (3) 1.0 (4) 0.5

31. A fair coin is tossed three times in succession. If the first toss produces a head, then the probability of getting exactly two heads in three tosses is :

(1) 1/8 (2) 1/2 (3) 3/8 (4) 3/4

32. Let the probability density function of a random variable X be given as $fx(x) = \frac{3}{2}e^{-3x}\,u(x) + ae^{4x}\,u(-x)$ where $u(x)$ is the unit step function. Then the value of a and $Prob\{X \le 0\}$, respectively are :

(1) 2, 1/2 (2) 4, 1/2 (3) 2, 1/4 (4) 4, 1/4

33. Let $A = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}$, and I is the identity matrix, then A^9 is given by :

(1) $511A + 510I$ (2) $309A + 104I$ (3) $154A + 155I$ (4) e^{9A}

34. The equations $\begin{bmatrix} 2 & -2 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ has

(1) no solution

(2) only one solution $x_1 = 0, x_2 = 0$

(3) non zero unique solution

(4) multiple solutions

35. The Laplace transform of the function $f(t) = e^{2t}\sin(5t)\,u(t)$ is :

(1) $\frac{5}{s^2-4s+29}$ (2) $\frac{5}{s^2+5}$ (3) $\frac{s-2}{s^2+4s+29}$ (4) $\frac{5}{s+5}$

36. Consider a signed defined as $x(t) = \begin{cases} e^{j10t} & |t| \le 1 \\ 0 & |t| > 1 \end{cases}$.

Its Fourier transform is given as :

(1) $\frac{2\sin(w-10)}{w-10}$ (2) $2e^{j10}\frac{\sin(w-10)}{w-10}$

(3) $\frac{2\sin(w-10)}{w-10}$ (4) $e^{j10w}\frac{\sin(w-10)}{w-10}$

37. In a two port reciprocal network, the output open circuit voltage by the input current is equal to :

(1) h_{12} (2) Z_{12} (3) Y_{11} (4) B

38. A series RLC circuit consists of L = 0.5 H, C = 50μF and R = 40Ω. When excited with 220V AC rms and 50Hz frequency source, the voltage across the capacitor is :

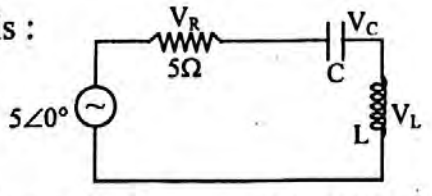
(1) 140V (2) 139.6V (3) 138.02V (4) 142V

39. The Y-parameter of the following network is $\begin{bmatrix} 0 & -1/2 \\ 1/2 & 1 \end{bmatrix}$, then the network is :

(1) non-reciprocal and active (2) non-reciprocal and passive

(3) reciprocal and active (4) reciprocal and passive

40. In the circuit shown below, the magnitudes of V_L and V_C are twice that of V_R. The inductance of the coil is :



(1) 2.14mH (2) 5.30mH (3) 31.8mH (4) 1.32mH

41. An electric motor developing a starting torque of 15Nm starts with a load torque of 7Nm on its shaft. If the acceleration at start is 2 rad/s^2 , then moment of inertia of the systems must be (neglecting viscous and Coulomb friction)

(1) 0.25kgm^2 (2) 0.25Nm^2

(3) 4 kgm^2 (4) 4Nm^2

42. The ABCD parameters of a three phase overhead transmission line are $A = D = 0.9 \angle 0°$, $B = 200 \angle 90° \Omega$ and $C = 0.95 \times 10^{-3} \angle 90°$. At no load condition, a shunt inductive reactor is connected at the recieving end of the line to limit the receiving end voltage to be equal to the sending end voltage. The ohmic value of the reactor is :

(1) $\infty \Omega$ (2) 2000Ω

(3) 105.26Ω (4) 1052.5Ω

43. A round rotor generator with internal voltage $E_1 = 2.0pu$ and $X = 1.1pu$ is connected to a round rotor synchronous motor with internal voltage $E_2 = 1.3pu$ and $X = 1.2pu$. The reactance of the line connecting the generator to the motor is 0.5pu. When the generator supplies 0.5pu power, the rotor angle difference between the machines will be :

(1) 57.42° (2) 1°

(3) 32.58° (4) 122.58°

44. If we make the system insensitive to forward path gain G(s) using negative feedback configuration, it becomes :

(1) slow and stable

(2) more sensitive to feedback path gain variations

(3) stable as well as insensitive to variation in feedback path gains

(4) fast at the cost of stability

45. Which of the following cannot be achieved using open loop control systems :

(1) tracking avarying control command

(2) rejecting some known disturbances

(3) regulation around a set point

(4) sensitivity reduction with respect to forward path gain

46. An integral controller K $(s) = \frac{1}{s}$ is required to be placed in tandem with plant G(s) so as to make the steady state error for ramp input as zero. Then the type of plant G(s) is :

(1) 2 (2) 1 (3) 0 (4) ∞

47. A system with $G(s)\frac{1}{s(s+1)}$ is stablized with a proportional controller K in the forward path. The value of K for which the system will admit sustained oscillations will be :

(1) 1 (2) 2

(3) $2\sqrt{2}$ (4) no value exists

48. An open loop transfer function has one pole and one zero in the right half of s-plane, then if the closed loop system is stable, the nyquist plot should encircle - 1 + j0 point

(1) once in the anticlockwise direction

(2) once in the clockwise direction

(3) should not encircle

(4) none of these

49. The Asymptotes in the root locus plot of unity feedback configuration of $G(s)\frac{1}{s(s+1)(s+2)}$ intersects with the real axis at :

(1) –1.25 (2) –1.5 (3) –1 (4) –1.15

50. Bode gain plots alone can be used to find the transfer function of a linear time invariant system when :

(1) Not possible alone with bode gain plots

(2) system is stable and observable

(3) system is causal and controllable

(4) system is non-minimum phase

51. The transfer function of a phase lead compensator is $\frac{s+a}{s+b}$ and that of phase lag compensator is $\frac{s+p}{s+q}$, then which of the following sets of conditions must be met ?

(1) a > b and p < q (2) a > b and p > q

(3) a < b and p < q (4) a < b and p > q

52. The dynamics of a system are governed by $\dddot{y}(t) - \ddot{x}(t) - x(t-1) = 0$. Then the transfer function of the system is :

(1) $s^2 + se^{-s}$ (2) $1 + s^2e^{-s}$

(3) $1 + s^{-2}e^{-s}$ (4) $1 + s^{-2}e^{s}$

53. A composite RC network has the transfer function $K(s) = \frac{1+21s+20s^2}{1+11s+10s^2}$, then this block can be used as a :

(1) phase lead compensator (2) phase lag compensator

(3) lag-lead compensator (4) none of above

54. The value of K and a, for which the system $G(s) = \frac{K(s+2)}{s^3+s^2+as+1}$ will oscillate with 3 rad/sec frequency in unity feedback configuration, are respectively as :

(1) 2, 2 (2) 4, 5 (3) 3, 4 (4) 2, 3

55. The time taken by the output of a system $G(s) = \frac{1}{(s+1)}$ to settle around 95% of its final value is :

(1) 2 sec (2) 1.33 sec (3) 1.11 sec (4) 3 secondary

56. The system with $G(s) = \frac{1}{s(\tau s+1)}$ when connected in the unity feedback configuration produces error to the step inputs as $e(t) = Ke^{-4t}\sin(10t + \phi)$. The system time constant τ is then given by :

(1) 0.01 (2) 0.03 (3) 10 (4) 4

57. Given a unity feedback system with $G(s) = \frac{K(s-1)(s-2)}{s(s+1)}$, which of the following is true ?

(1) the system will always be stable for all K

(2) the system will be stable for low gain K

(3) the system is stable for high gain K

(4) the system root locus never crosses jw axis

58. The state space equations of a system are as :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & 2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u;\ y = [1\ \ 0]\, x$$

then the damping ratio and decay factor are :

(1) .707, 2 (2) 1.414, 1 (3) 0.5, 1 (4) 0.5, 0.5

59. The state space equations of a system are as :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u;\ y = [1\ \ 0]\, x$$

then the position error constant K_p and velocity error constant K_v are respectively as :

(1) 2, 0 (2) ∞, 0 (3) ∞, 1 (4) None of these

60. The dynamics of a system are governed by following state equations :

$$\ddot{x} = \begin{bmatrix} 3 & 0 \\ -2 & 2 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u ; \; y = [1 \;\; 1]\, x$$

then this system is :

(1) controllable, observable and unstable

(2) not controllable, observable and stable

(3) not controllable, not observable and unstable

(4) not controllable, observable and unstable

61. Full load voltage regulation of a power transformer is zero when the power factor of the load is :

(1) unity and leading (2) zero and leading

(3) zero and lagging (4) unity and lagging

62. In an autotransformer of voltage ratio V_1/V_2 and $V_1 > V_2$, the fraction of power transferred inductively is :

(1) $\frac{V_1}{V_1 + V_2}$ (2) $\frac{V_2}{V_1}$ (3) $\frac{V_1 - V_2}{V_1 + V_2}$ (4) $\frac{V_1 - V_2}{V_1}$

63. A series motor drawing an armature current of 1_a is operating under saturated magnetic conditions. The torque developed in the motor is proportional to :

(1) $\frac{I}{I_a}$ (2) $\frac{I}{I_a^2}$ (3) I_a^2 (4) I_a

64. Which of the following are the features of a shaded pole motor

a. Salient pole stator

b. Uniform air-gap

c. Two stator windings one of which is a short circuited ring

d. Squirrel cage rotor

Select the correct answer using following

Code :

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

65. A synchronous motor is running from an infinite bus of voltage V_t in steady state at about 50% of its rated load with a power angle δ_1 between V_t and E_f. The load is suddenly decreased to 25%. E_f attains its new steady state power angle δ_2 with V_t by initially :

(1) falling behind and making a complete rotation

(2) advancing and making a complete rotation

(3) falling behind followed by oscillation about δ_2

(4) advancing followed by oscillation about δ_2

66. The rotor output of a three phase induction motor is 15kW and the corresponding slip is 4%. The rotor copper loss will be :

(1) 600W (2) 625W (3) 650W (4) 700W

67. A single phase transformer has a rating of 15kVA, 600/120V. It is reconnected as an autotransformer to supply 720V from a 600V primary source. The maximum load it can supply is :

(1) 90kVA (2) 18 kVA (3) 15 kVA (4) 12kVA

68. A 200V DC shunt motor delivers an output of 17kW with an input of 20kW. The field winding resistance is 50Ω and armature resistance is 0.04Ω. Maximum efficiency will be obtained when the total armature copper losses are equal to :

(1) 2632W (2) 3000W (3) 3680W (4) 5232W

69. A three phase alternator is connected to a delta-delta transformer. The hysteresis and eddy current loasses of the transformer are 300W and 400W respectively. If the speed of the alternator is reduced by 10% then the hysteresis and eddy current losses of the transformer respectively will be :

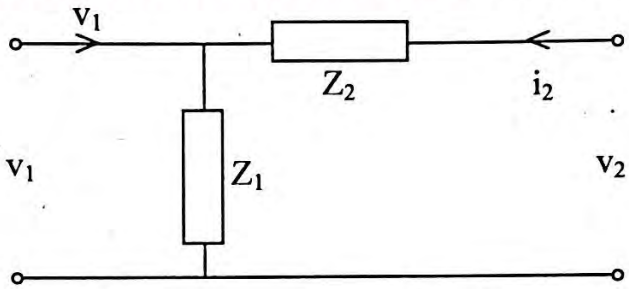
(1) 218W and 262.44W (2) 243W and 324W

(3) 243W and 360W (4) 270W and 400W

70. A 220V DC shunt motor is operating at a speed of 1440rpm. The armature resistance is 1.0Ω and armature current is 10A. If the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79Ω (2) 2.1Ω (3) 3Ω (4) 18.9Ω

71. For a two port network shown below, the Z-matrix is given by :



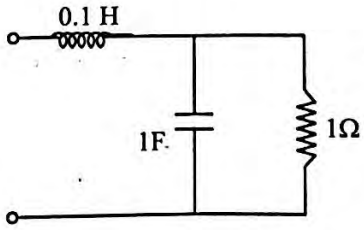
(1) $\begin{bmatrix} Z_1 & Z_1+Z_2 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$ (2) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$

(3) $\begin{bmatrix} Z_1 & Z_2 \\ Z_2 & Z_1+Z_2 \end{bmatrix}$ (4) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1 & Z_2+Z_2 \end{bmatrix}$

72. The Z-matrix of a network is given as $Z = \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$, then Y_{22} is given by :

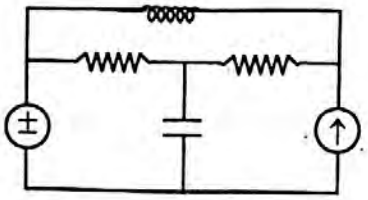
(1) 1.2 (2) 0.4 (3) –0.4 (4) 1.8

73. The resonant frequency for the given circuit below is :



(1) 1 rad/s (2) 3 rad/s (3) 2 rad/sec (4) 5.1 rad/sec

74. The number of chords in the graph of the circuit shown below is :



(1) 3 (2) 4 (3) 5 (4) 6

75. The average power absorbed by an impedance of $Z = 30 - j70\Omega$ when a voltage of $V = 120\angle 0°$ is applied across it is :

(1) 21.4W (2) 37.24W (3) 32.74W (4) 12.4W

76. The Q-factor of a coil with resonating frequency f_0 is given by :

(1) $\frac{2\pi f_0 R}{L}$ (2) $\frac{2\pi f_0 R}{C}$

(3) $\frac{bandwidth}{f_0}$ (4) None of these

77. Which of the following statements holds for the divergence of electric and magnetic flux densities ?

(1) Both are zero

(2) These are zero for static densities but non-zero for time varying densities.

(3) It is zero for the electric flux density

(4) It is zero for the magnetic flux density

78. The value of flux density at a point in space is $\vec{B} = 4x\hat{a}_x + 2ky\hat{a}_y + 8\hat{a}_z$ W/m^2. The value of constant k must be equal to :

(1) –2 (2) –0.5 (3) +0.5 (4) +2

79. Two electric charges +q and –2Q are placed at (0, 0) and (6, 0) in the x-y plane. The equation of the zero equipotential curve in the x-y plane is :

(1) $x = -2$ (2) $y = 2$

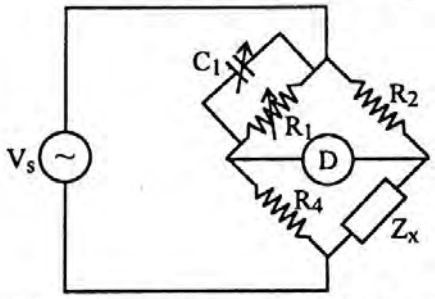
(3) $x^2 + y^2 = 2$ (4) $(x+2)^2 + y^2 = 16$

80. A 4-pole lap wound DC shunt generator has an armature winding consisting of 220 turns each of 0.004Ω resistance, then the armature resistance will be :

(1) 0.055Ω (2) 0.0275Ω

(3) 0.110Ω (4) 0.22Ω

81. The bridge circuit shown in figure below is used for the measurement of an unknown element Z_x. The bridge circuit is best suited when Z_x is as :



(1) low resistance (2) high resistance (3) low Q inductor (4) lossy capacitor

82. A silicon diode indicates forward currents of 2mA and 10mA when diode voltages are 0.6V and 0.7V respectively. The operating temperature of the diode junction is :

(1) 180K (2) 360K

(3) 480K (4) 320K

83. The current gain of a bipolar transistor drops at high frequencies because of :

(1) transistor internal capacitances (2) high current effects in the base

(3) parasitic inductive elements (4) the Early effects

84. A diode has a leakage current of 10μA at certain tempearture. Find its value when temperature is increased by 25°C :

(1) 56.00 μA (2) 56.56 μA (3) 59.56 μA (4) None of these

85. A transistor has $\alpha = 0.98$, then its β is :

(1) 50 (2) 49 (3) 70 (4) None of these

86. A JFET has a value of $g_{m0} = 4000\ \mu S$. Determine the value of g_m at $V_{GS} = -3V$. Given that $V_{GS(off)} = -8V$:

(1) 250 μS (2) 2500 μS (3) 25 μS (4) None of these

87. A multiplexer is a :

(1) one input many output device (2) one input and one output device

(3) many input many output device (4) many input to one output device

88. A J-K flip flop is made to toggle via :

(1) J=0, K=0 (2) J=1, K=0 (3) J=0, K=1 (4) J=1, K=1

89. Multiplexers are used in :

(1) data generation (2) serial to parallel conversion

(3) data selection (4) None of these

90. Which one of the following is a universal gate ?

(1) AND (2) OR (3) Ex-NOR (4) NAND

91. For a motor to deliver a torque of 2.5Nm at 1400rpm, the armature voltage to be applied is :

(1) 125.5V (2) 193.3V

(3) 200V (4) 241.7V

92. The direct axis and quadrature axis reactances of a salient pole alternator are 1.2pu and 1.0pu, respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at unity power factor and at rated voltage, then its power angle is :

(1) 30° (2) 45° (3) 60° (4) 90°

93. The locked rotor current in a three phase start connected 15kW, 4-pole, 230V, 50Hz induction motor at rated condition is 50A. Neglecting losses and magnetising current, the approximate locked rotor line current dawn when the motor is connected to a 236V, 57Hz supply is :

(1) 58.5A (2) 45.0A (3) 42.7A (4) 55.6A

94. The slip of an induction motor normally does not depend upon

(1) rotor speed (2) synchronous speed

(3) shaft torque (4) core loss component

95. A synchronous generator is feeding a zero power factor (lagging) load at rated current. The armature reaction is :

(1) magnetising (2) demagnetising

(3) cross-magnetising (4) ineffective

96. A single phase transmission line of $j0.8\Omega$ is supplying a load of 40A at 200V and unity power factor. Then, the sending end power factor will be :

(1) 1 (2) 0.987 (3) 0 (4) 0.982

97. Two incoming lines with fault levels at their terminals equal to 100MVA and 150MVA terminate on a common bus in a substation. A 1MVA step down transformer having 10% reactance is connected to this bus. Then, the fault level on LV side of the transformer will be :

(1) 12.57 (2) 9.57 (3) 11.57 (4) 18.57

98. When a bundled conductor is used in place of a single conductor, the changes in line parameters are :

(1) L increases and C decreases

(2) L decreases and C increases

(3) L decreases and C not affected

(4) both L and C are not affected

99. A lossless transmission line with characteristic impedance of 300Ω and length λ/2 is shortened at one end and termined in its characteristic impedance at the othe. The input impedance measured at the mid section of the line is :

(1) 0Ω (2) 200Ω (3) 300Ω (4) 150Ω

100. In load flow analysis, the load connected to a bus is represented as :

(1) constant current drawn from the bus

(2) constant impedance connected at the bus

(3) voltage and frequency dependent source at the bus

(4) constant real and reactive power drawn from the bus

Total No. of Printed Pages : 21

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C

SET-Y

M.Phil./Ph.D./URS-EE-2019

SUBJECT : Electrical Engineering

Sr. No. 10019

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name _____

Mother's Name _____ Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

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4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

SEAL

1. Full load voltage regulation of a power transformer is zero when the power factor of the load is :

(1) unity and leading
(2) zero and leading
(3) zero and lagging
(4) unity and lagging

2. In an autotransformer of voltage ratio V_1/V_2 and $V_1 > V_2$, the fraction of power transferred inductively is :

(1) $\frac{V_1}{V_1+V_2}$
(2) $\frac{V_2}{V_1}$
(3) $\frac{V_1-V_2}{V_1+V_2}$
(4) $\frac{V_1-V_2}{V_1}$

3. A series motor drawing an armature current of 1_a is operating under saturated magnetic conditions. The torque developed in the motor is proportional to :

(1) $\frac{I}{I_a}$
(2) $\frac{I}{I_a^2}$
(3) I_a^2
(4) I_a

4. Which of the following are the features of a shaded pole motor

a. Salient pole stator
b. Uniform air-gap
c. Two stator windings one of which is a short circuited ring
d. Squirrel cage rotor

Select the correct answer using following Code :

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

5. A synchronous motor is running from an infinite bus of voltage V_t in steady state at about 50% of its rated load with a power angle δ_1 between V_t and E_f. The load is suddenly decreased to 25%. E_f attains its new steady state power angle δ_2 with V_t by initially :

(1) falling behind and making a complete rotation

(2) advancing and making a complete rotation

(3) falling behind followed by oscillation about δ_2

(4) advancing followed by oscillation about δ_2

6. The rotor output of a three phase induction motor is 15kW and the corresponding slip is 4%. The rotor copper loss will be :

(1) 600W (2) 625W (3) 650W (4) 700W

7. A single phase transformer has a rating of 15kVA, 600/120V. It is reconnected as an autotransformer to supply 720V from a 600V primary source. The maximum load it can supply is :

(1) 90kVA (2) 18 kVA (3) 15 kVA (4) 12kVA

8. A 200V DC shunt motor delivers an output of 17kW with an input of 20kW. The field winding resistance is 50Ω and armature resistance is 0.04Ω. Maximum efficiency will be obtained when the total armature copper losses are equal to :

(1) 2632W (2) 3000W (3) 3680W (4) 5232W

9. A three phase alternator is connected to a delta-delta transformer. The hysteresis and eddy current loasses of the transformer are 300W and 400W respectively. If the speed of the alternator is reduced by 10% then the hysteresis and eddy current losses of the transformer respectively will be :

(1) 218W and 262.44W (2) 243W and 324W

(3) 243W and 360W (4) 270W and 400W

10. A 220V DC shunt motor is operating at a speed of 1440rpm. The armature resistance is 1.0Ω and armature current is 10A. If the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79Ω (2) 2.1Ω (3) 3Ω (4) 18.9Ω

11. An electric motor developing a starting torque of 15Nm starts with a load torque of 7Nm on its shaft. If the acceleration at start is 2 rad/s^2 , then moment of inertia of the systems must be (neglecting viscous and Coulomb friction)

(1) 0.25kgm^2 (2) 0.25Nm^2

(3) 4 kgm^2 (4) 4Nm^2

12. The ABCD parameters of a three phase overhead transmission line are $A = D = 0.9 \angle 0°$, $B = 200\angle 90°\Omega$ and $C = 0.95 \times 10^{-3} \angle 90°$. At no load condition, a shunt inductive reactor is connected at the recieving end of the line to limit the receiving end voltage to be equal to the sending end voltage. The ohmic value of the reactor is :

(1) $\infty\ \Omega$ (2) 2000Ω

(3) 105.26Ω (4) 1052.5Ω

13. A round rotor generator with internal voltage $E_1 = 2.0pu$ and $X = 1.1pu$ is connected to a round rotor synchronous motor with internal voltage $E_2 = 1.3pu$ and $X = 1.2pu$. The reactance of the line connecting the generator to the motor is 0.5pu. When the generator supplies 0.5pu power, the rotor angle difference between the machines will be :

(1) 57.42° (2) 1°

(3) 32.58° (4) 122.58°

14. If we make the system insensitive to forward path gain G(s) using negative feedback configuration, it becomes :
(1) slow and stable
(2) more sensitive to feedback path gain variations
(3) stable as well as insensitive to variation in feedback path gains
(4) fast at the cost of stability

15. Which of the following cannot be achieved using open loop control systems :
(1) tracking avarying control command
(2) rejecting some known disturbances
(3) regulation around a set point
(4) sensitivity reduction with respect to forward path gain

16. An integral controller K $(s) = \frac{1}{s}$ is required to be placed in tandem with plant G(s) so as to make the steady state error for ramp input as zero. Then the type of plant G(s) is :
(1) 2 (2) 1 (3) 0 (4) ∞

17. A system with $G(s)\frac{1}{s(s+1)}$ is stablized with a proportional controller K in the forward path. The value of K for which the system will admit sustained oscillations will be :
(1) 1 (2) 2
(3) $2\sqrt{2}$ (4) no value exists

18. An open loop transfer function has one pole and one zero in the right half of s-plane, then if the closed loop system is stable, the nyquist plot should encircle - 1 + j0 point
(1) once in the anticlockwise direction
(2) once in the clockwise direction
(3) should not encircle
(4) none of these

19. The Asymptotes in the root locus plot of unity feedback configuration of $G(s)\frac{1}{s(s+1)(s+2)}$ intersects with the real axis at :

(1) −1.25 (2) −1.5 (3) −1 (4) −1.15

20. Bode gain plots alone can be used to find the transfer function of a linear time invariant system when :

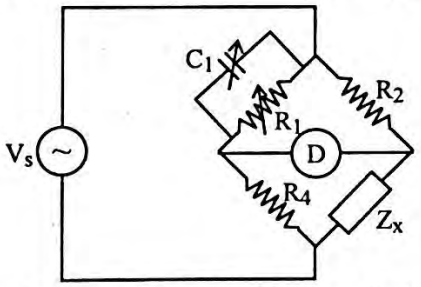
(1) Not possible alone with bode gain plots

(2) system is stable and observable

(3) system is causal and controllable

(4) system is non-minimum phase

21. The bridge circuit shown in figure below is used for the measurement of an unknown element Z_x. The bridge circuit is best suited when Z_x is as :



(1) low resistance (2) high resistance (3) low Q inductor (4) lossy capacitor

22. A silicon diode indicates forward currents of 2mA and 10mA when diode voltages are 0.6V and 0.7V respectively. The operating temperature of the diode junction is :

(1) 180K (2) 360K (3) 480K (4) 320K

23. The current gain of a bipolar transistor drops at high frequencies because of :

(1) transistor internal capacitances (2) high current effects in the base

(3) parasitic inductive elements (4) the Early effects

24. A diode has a leakage current of 10μA at certain tempearture. Find its value when temperature is increased by 25°C :

(1) 56.00 μA (2) 56.56 μA (3) 59.56 μA (4) None of these

25. A transistor has $\alpha = 0.98$, then its β is :

(1) 50 (2) 49 (3) 70 (4) None of these

26. A JFET has a value of $g_{m0} = 4000\ \mu S$. Determine the value of g_m at $V_{GS} = -3V$. Given that $V_{GS(off)} = -8V$:

(1) 250 μS (2) 2500 μS (3) 25 μS (4) None of these

27. A multiplexer is a :

(1) one input many output device (2) one input and one output device

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28. A J-K flip flop is made to toggle via :

(1) J=0, K=0 (2) J=1, K=0 (3) J=0, K=1 (4) J=1, K=1

29. Multiplexers are used in :

(1) data generation (2) serial to parallel conversion

(3) data selection (4) None of these

30. Which one of the following is a universal gate ?

(1) AND (2) OR (3) Ex-NOR (4) NAND

31. A moving coil instrument gives a full scale deflection of 10mA when voltage across its terminal is 100mV. For a 100A current, calculate the shunt resistance required for a full scale deflection :

(1) 0.01Ω (2) 0.001Ω (3) 0.1Ω (4) 1Ω

32. Time response of an indicating instrument is given by :

(1) controlling mechanism (2) bearing mechanism

(3) deflecting mechanism (4) damping mechanism

33. A shunt resistance of 25Ω is necessary to extend range of an ammeter from 100μA to 500μA. The value of internal resistance of the ammeter is :

(1) 25Ω (2) 50Ω (3) 100Ω (4) 1000Ω

34. In a PMMC type instrument, the magnetic field produced by the eddy currents :

(1) doesn't affect the motion of the coil

(2) acts in the same direction of the motion of the coil

(3) acts in the direction opposite to the motion of the coil

(4) none of above

35. In a two wattmeter method of measuring three phase power, power factor is 0.5, one wattmeter reads W then the other meter will read :

(1) $\sqrt{3}$ W (2) W/2 (3) 2W (4) 0W

36. The ratio of the potential transformer and current transformer required to measure power in circuit rated 5500kW, 11kV with a wattmeter rated at 5A and 110V respectively are :

(1) 10, 10 (2) 50, 50

(3) 200, 200 (4) None of these

37. The effect of stray magnetic fields on the actuating torque of a portable instrument is maximum when the operating field of the instrument and the stray field are :

(1) perpendicular (2) parallel

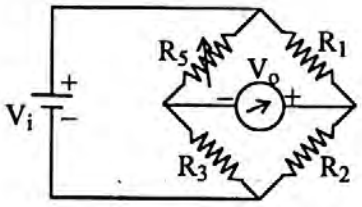
(3) inclined at 60° (4) inclined at 30°

38. A 500A/5A, 50Hz transformer has a bar primary. The secondary burden is a pure resistance of 1Ω and it draws a current of 5A. If the magnetic core requires 250AT for magnetisation, the percentage ratio error is :

(1) 10.56 (2) –10.55

(3) 11.80 (4) –11.80

39. A strain guage forms one arm of the bridge shown in the figure below, and has a nominal resistance without any load as $R_s = 300\Omega$. Other bridge resistances are $R_1 = R_2 = R_3 = 300\Omega$. The maximum permissible current through the strain guage is 20mA. During certain measurement when the bridge is excited by maximum permissible voltage an the strain guage resistance is increased by 1% over the nominal value, the output voltage V_o in mV is:



(1) 56.02 (2) 40.83 (3) 29.85 (4) 10.02

40. In CE configuration, the input V-I characteristics are drawn by taking :

(1) V_{CE} as I_C for constant value of I_E

(2) V_{BE} vs I_E for constant value of V_{CE}

(3) V_{BE} vs I_B for constant value of I_C

(4) V_{BE} vs I_B for constant value of V_{CE}

41. A fair coin is tossed three times in succession. If the first toss produces a head, then the probability of getting exactly two heads in three tosses is :

(1) 1/8 (2) 1/2 (3) 3/8 (4) 3/4

42. Let the probability density function of a random variable X be given as $fx(x) = \frac{3}{2}e^{-3x}\,u(x) + ae^{4x}\,u(-x)$ where $u(x)$ is the unit step function. Then the value of a and $Prob\{X \le 0\}$, respectively are :

(1) 2, 1/2 (2) 4, 1/2 (3) 2, 1/4 (4) 4, 1/4

43. Let $A = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}$, and I is the identity matrix, then A^9 is given by :

(1) $511A + 510I$ (2) $309A + 104I$ (3) $154A + 155I$ (4) e^{9A}

44. The equations $\begin{bmatrix} 2 & -2 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ has

(1) no solution
(2) only one solution $x_1 = 0, x_2 = 0$
(3) non zero unique solution
(4) multiple solutions

45. The Laplace transform of the function $f(t) = e^{2t}\sin(5t)\,u(t)$ is :

(1) $\frac{5}{s^2 - 4s + 29}$ (2) $\frac{5}{s^2 + 5}$ (3) $\frac{s-2}{s^2 + 4s + 29}$ (4) $\frac{5}{s+5}$

46. Consider a signed defined as $x(t) = \begin{cases} e^{j10t} & |t| \le 1 \\ 0 & |t| > 1 \end{cases}$.

Its Fourier transform is given as :

(1) $\frac{2\sin(w-10)}{w-10}$
(2) $2e^{j10}\frac{\sin(w-10)}{w-10}$
(3) $\frac{2\sin(w-10)}{w-10}$
(4) $e^{j10w}\frac{\sin(w-10)}{w-10}$

47. In a two port reciprocal network, the output open circuit voltage by the input current is equal to :

(1) h_{12} (2) Z_{12} (3) Y_{11} (4) B

48. A series RLC circuit consists of L = 0.5 H, C = 50μF and R = 40Ω. When excited with 220V AC rms and 50Hz frequency source, the voltage across the capacitor is :

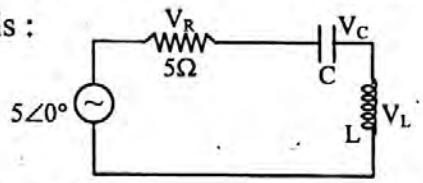
(1) 140V (2) 139.6V (3) 138.02V (4) 142V

49. The Y-parameter of the following network is $\begin{bmatrix} 0 & -1/2 \\ 1/2 & 1 \end{bmatrix}$, then the network is :

(1) non-reciprocal and active (2) non-reciprocal and passive

(3) reciprocal and active (4) reciprocal and passive

50. In the circuit shown below, the magnitudes of V_L and V_C are twice that of V_R. The inductance of the coil is :



(1) 2.14mH (2) 5.30mH (3) 31.8mH (4) 1.32mH

51. For a motor to deliver a torque of 2.5Nm at 1400rpm, the armature voltage to be applied is :

(1) 125.5V (2) 193.3V (3) 200V (4) 241.7V

52. The direct axis and quadrature axis reactances of a salient pole alternator are 1.2pu and 1.0pu, respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at unity power factor and at rated voltage, then its power angle is :

(1) 30° (2) 45° (3) 60° (4) 90°

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(1) rotor speed
(2) synchronous speed
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(3) cross-magnetising
(4) ineffective

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(1) 1 (2) 0.987 (3) 0 (4) 0.982

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(1) 12.57 (2) 9.57 (3) 11.57 (4) 18.57

58. When a bundled conductor is used in place of a single conductor, the changes in line parameters are :

(1) L increases and C decreases
(2) L decreases and C increases
(3) L decreases and C not affected
(4) both L and C are not affected

59. A lossless transmission line with characteristic impedance of 300Ω and length λ/2 is shortened at one end and termined in its characteristic impedance at the othe. The input impedance measured at the mid section of the line is :

(1) 0Ω (2) 200Ω (3) 300Ω (4) 150Ω

60. In load flow analysis, the load connected to a bus is represented as :

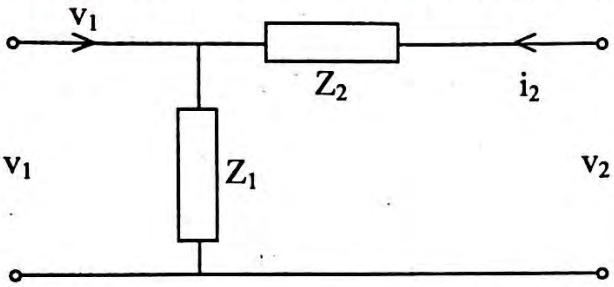
(1) constant current drawn from the bus

(2) constant impedance connected at the bus

(3) voltage and frequency dependent source at the bus

(4) constant real and reactive power drawn from the bus

61. For a two port network shown below, the Z-matrix is given by :



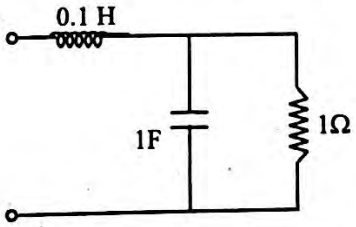
(1) $\begin{bmatrix} Z_1 & Z_1+Z_2 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$ (2) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$

(3) $\begin{bmatrix} Z_1 & Z_2 \\ Z_2 & Z_1+Z_2 \end{bmatrix}$ (4) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1 & Z_2+Z_2 \end{bmatrix}$

62. The Z-matrix of a network is given as $Z = \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$, then Y_{22} is given by :

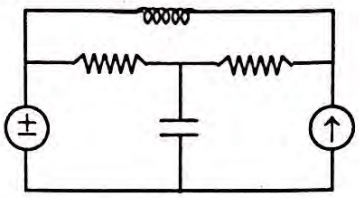
(1) 1.2 (2) 0.4 (3) –0.4 (4) 1.8

63. The resonant frequency for the given circuit below is :



(1) 1 rad/s (2) 3 rad/s (3) 2 rad/sec (4) 5.1 rad/sec

64. The number of chords in the graph of the circuit shown below is :



(1) 3 (2) 4 (3) 5 (4) 6

65. The average power absorbed by an impedance of $Z = 30 - j70\Omega$ when a voltage of $V = 120\angle 0°$ is applied across it is :

(1) 21.4W (2) 37.24W (3) 32.74W (4) 12.4W

66. The Q-factor of a coil with resonating frequency f_0 is given by :

(1) $\frac{2\pi f_0 R}{L}$ (2) $\frac{2\pi f_0 R}{C}$

(3) $\frac{bandwidth}{f_0}$ (4) None of these

67. Which of the following statements holds for the divergence of electric and magnetic flux densities ?

(1) Both are zero

(2) These are zero for static densities but non-zero for time varying densities.

(3) It is zero for the electric flux density

(4) It is zero for the magnetic flux density

68. The value of flux density at a point in space is $\vec{B} = 4x\hat{a}_x + 2ky\hat{a}_y + 8\hat{a}_z$ W/m^2. The value of constant k must be equal to :

(1) –2 (2) –0.5 (3) +0.5 (4) +2

69. Two electric charges +q and –2Q are placed at (0, 0) and (6, 0) in the x-y plane. The equation of the zero equipotential curve in the x-y plane is :

(1) $x = -2$ (2) $y = 2$

(3) $x^2 + y^2 = 2$ (4) $(x+2)^2 + y^2 = 16$

70. A 4-pole lap wound DC shunt generator has an armature winding consisting of 220 turns each of 0.004Ω resistance, then the armature resistance will be :

(1) 0.055Ω (2) 0.0275Ω

(3) 0.110Ω (4) 0.22Ω

71. A 200 km long three phase transmission line is transferring a power of 200MVA having line losses of 5MW. If the recieving end voltage is 110kV, the line has a resistance of :

(1) 10Ω/ph (2) 1.5Ω/ph

(3) 1Ω/ph (4) 2.5Ω/ph

72. The cost function of a 50MW generator is $F(P_1) = 225 + 53P_1 + .02P_1^2$ where P_1 is the generator loading in MW. For 100% loading the cost is :

(1) Rs. 55 per Mwh (2) Rs. 55 per Mw

(3) Rs. 58.5 per Mwh (4) Rs. 55.5 per Mwh

73. Two insulator discs of identifical capacitance value C make up of a string for a 22kV, 50 Hz single phase overhead line insulation system. If the pin to earth capacitance is also C, then the string efficiency is :

(1) 50% (2) 75%

(3) 90% (4) 86%

74. The surge impedance of a three phase 400kV transmissionline is 400Ω. Then the surge impedance loading is :

(1) 400MW (2) 1000MW (3) 1600MW (4) 800MW

75. A three phase generator rated at 110MVA, 11kV is connected through circuit beakers to a transformer. The generator has direct axis sub-transient reactance X''_d = 19%, transient reactance X'_d = 26% and synchronous reactance 130%. The generator is operating at no load and rated voltage when a three phase short circuit fault occurs between the breakers and the transformer. The magnitude of initial symmetrical RMS current in the breakers will be :

(1) 4.44kA (2) 22.20kA (3) 30.39kA (4) 38.45kA

76. The bus admittance matrix of a three-bus three line system is :

$$Y = j\begin{bmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{bmatrix}$$

if each transmission line between the two buses is represented by an equivalent π-network, the magnitude of the shunt susceptance of the line connecting bus 1 and 2 is :

(1) 4 (2) 2 (3) 1 (4) 0

77. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and currents

(2) angular displacement of the rotor with respect to the stator

(3) angular displacement of the stator mmf with respect to a synchronously rotating axis

(4) angular displacement of an axis fixed to the rotor with respect to a synchronous rotating axis

78. A single phase load is supplied by a single phase voltage source. If the current flowing from the load to the source is $10\angle -150°$ A and if the voltage at the load terminals is $100\angle 60° V$, then the :

(1) load absorbs real power and delivers reactive power

(2) load absorbs real power and absorbs reactive power

(3) load delivers real power and delivers reactive power

(4) load delivers real power and absorbs reactive power

79. A cylindrical rotor generator delivers 0.5pu power in the steady state to an infinite bus through a transmission line of reactance 0.5pu. The generator no load voltage is 1.5pu and the infinite bus voltage is 1pu. The inertia constant of the generator is 5MW-s/MVA and the generator reactance is 1pu. The critical clearing angle in degrees for a three phase dead short circuit fault at the generator terminal is :

(1) 53.5 (2) 60.2 (3) 70.8 (4) 79.6

80. In a biased differential relay, the bias is defined as a ratio of :

(1) number of turns of restraining and operating coil

(2) operating coil current and restraining coil current

(3) fault current and operating coil currents

(4) fault current and restraining coil current

81. Invalid state of an S-R flip flop occurs when :

(1) S=1, R=0 (2) S=0, R=1

(3) S=0, R=0 (4) S=1, R=1

82. A feature that distinguishes the J-K flip flop from the S-R flip flop is the :

(1) toggle condition (2) preset input

(3) type of clock pulse (4) clear input

83. In DC Choppers, the duty cycle D is usually varied at fixed frequency in order to :

(1) limit operating frequency

(2) have lower impact on filter design and switching losses

(3) reduce operating frequency

(4) have proper voltage at output

84. In order to obtain static voltage equalization in series-connected SCRs, connections are made of :

(1) one resistor across the string

(2) resistors of different value across each SCR

(3) resistors of the same value across each SCR

(4) one resistor in series with the string

85. A single phase full wave half controlled bridge converter feeds an inductive load. The two SCRs in the converter are connected to a common DC bus. The converter has to have a freewheeling diode :

(1) because the converter inherently does not provide way for freewheeling

(2) because the converter does not provide free wheeling for high values of triggering angles

(3) because the freewheeling action of the converter will cause shorting of AC supply

(4) because if a gate pulse to one of the SCRs is missed, it will subsequently cause a high load current in the other SCR

86. A voltage source inverter is used to control the speed of a three phase 50 Hz squirrel cage induction motor. Its slip for rated torque is 4%. The flux is maintained at rated value. If the stator resistance and rotational losses are neglected, then the frquency of the impressed voltage to obtain twice the rated torque at starting should be :

(1) 10 Hz (2) 5 Hz (3) 4 Hz (4) 2 Hz

87. An SCR is considered to be a semi-controlled device because :
(1) it can be turned OFF but not ON with a gate pulse
(2) it conducts only during one half-cycle of an alternating current wave
(3) it can be turned ON but not OFF with a gate pulse
(4) it can be turned ON only during one half cycle of an alternating voltage wave

88. Circuit turn-OFF time of an SCR is defined as the time :
(1) taken by the SCR to turn OFF
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(4) for which the SCR is reverse biased to reduce its current below the holding current

89. A half controlled single phase bridge rectifier is supplying an RL load. It is operated at a firing angle α and the load current is continuous. The fraction of cycle that the freewheeling diode conducts is :
(1) $\frac{1}{2}$ (2) $\left(1-\frac{\alpha}{\pi}\right)$ (3) $\frac{\alpha}{2\pi}$ (4) $\frac{\alpha}{\pi}$

90. The typical ratio of the latching current to holding current in a 20A thyristor is :
(1) 5.0 (2) 2.0 (3) 1.0 (4) 0.5

91. The transfer function of a phase lead compensator is $\frac{s+a}{s+b}$ and that of phase lag compensator is $\frac{s+p}{s+q}$, then which of the following sets of conditions must be met ?
(1) a > b and p < q (2) a > b and p > q
(3) a < b and p < q (4) a < b and p > q

92. The dynamics of a system are governed by $\dddot{y}(t)-\ddot{x}(t)-x(t-1)=0$. Then the transfer function of the system is :
(1) s^2+se^{-s} (2) $1+s^2e^{-s}$ (3) $1+s^{-2}e^{-s}$ (4) $1+s^{-2}e^{s}$

93. A composite RC network has the transfer function $K(s)=\frac{1+21s+20s^2}{1+11s+10s^2}$, then this block can be used as a :

(1) phase lead compensator (2) phase lag compensator

(3) lag-lead compensator (4) none of above

94. The value of K and a, for which the system $G(s)=\frac{K(s+2)}{s^3+s^2+as+1}$ will oscillate with 3 rad/sec frequency in unity feedback configuration, are respectively as :

(1) 2, 2 (2) 4, 5 (3) 3, 4 (4) 2, 3

95. The time taken by the output of a system $G(s)=\frac{1}{(s+1)}$ to settle around 95% of its final value is :

(1) 2 sec (2) 1.33 sec (3) 1.11 sec (4) 3 secondary

96. The system with $G(s)=\frac{1}{s(\tau s+1)}$ when connected in the unity feedback configuration produces error to the step inputs as $e(t)=Ke^{-4t}\sin(10t+\phi)$. The system time constant τ is then given by :

(1) 0.01 (2) 0.03 (3) 10 (4) 4

97. Given a unity feedback system with $G(s)=\frac{K(s-1)(s-2)}{s(s+1)}$, which of the following is true ?

(1) the system will always be stable for all K

(2) the system will be stable for low gain K

(3) the system is stable for high gain K

(4) the system root locus never crosses jw axis

98. The state space equations of a system are as :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & 2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u;\ y = [1\ \ 0]\, x$$

then the damping ratio and decay factor are :

(1) .707, 2 (2) 1.414, 1 (3) 0.5, 1 (4) 0.5, 0.5

99. The state space equations of a system are as :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u;\ y = [1\ \ 0]\, x$$

then the position error constant K_p and velocity error constant K_v are respectively as :

(1) 2, 0 (2) ∞, 0 (3) ∞, 1 (4) None of these

100. The dynamics of a system are governed by following state equations :

$$\dot{x} = \begin{bmatrix} 3 & 0 \\ -2 & 2 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u;\ y = [1\ \ 1]\, x$$

then this system is :

(1) controllable, observable and unstable

(2) not controllable, observable and stable

(3) not controllable, not observable and unstable

(4) not controllable, observable and unstable

Total No. of Printed Pages : 21

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SET-Y

D

M.Phil./Ph.D./URS-EE-2019

SUBJECT : Electrical Engineering

Sr. No. 10020

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name _____

Mother's Name _____ Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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10. The typical ratio of the latching current to holding current in a 20A thyristor is :

(1) 5.0 (2) 2.0 (3) 1.0 (4) 0.5

11. For a motor to deliver a torque of 2.5Nm at 1400rpm, the armature voltage to be applied is :

(1) 125.5V (2) 193.3V (3) 200V (4) 241.7V

12. The direct axis and quadrature axis reactances of a salient pole alternator are 1.2pu and 1.0pu, respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at unity power factor and at rated voltage, then its power angle is :

(1) 30° (2) 45° (3) 60° (4) 90°

13. The locked rotor current in a three phase start connected 15kW, 4-pole, 230V, 50Hz induction motor at rated condition is 50A. Neglecting losses and magnetising current, the approximate locked rotor line current dawn when the motor is connected to a 236V, 57Hz supply is :

(1) 58.5A (2) 45.0A (3) 42.7A (4) 55.6A

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(1) rotor speed (2) synchronous speed

(3) shaft torque (4) core loss component

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(1) 0Ω (2) 200Ω

(3) 300Ω (4) 150Ω

20. In load flow analysis, the load connected to a bus is represented as :

(1) constant current drawn from the bus

(2) constant impedance connected at the bus

(3) voltage and frequency dependent source at the bus

(4) constant real and reactive power drawn from the bus

21. A moving coil instrument gives a full scale deflection of 10mA when voltage across its terminal is 100mV. For a 100A current, calculate the shunt resistance required for a full scale deflection :

(1) 0.01Ω (2) 0.001Ω

(3) 0.1Ω (4) 1Ω

22. Time response of an indicating instrument is given by :

(1) controlling mechanism (2) bearing mechanism

(3) deflecting mechanism (4) damping mechanism

23. A shunt resistance of 25Ω is necessary to extend range of an ammeter from 100μA to 500μA. The value of internal resistance of the ammeter is :

(1) 25Ω (2) 50Ω (3) 100Ω (4) 1000Ω

24. In a PMMC type instrument, the magnetic field produced by the eddy currents :

(1) doesn't affect the motion of the coil

(2) acts in the same direction of the motion of the coil

(3) acts in the direction opposite to the motion of the coil

(4) none of above

25. In a two wattmeter method of measuring three phase power, power factor is 0.5, one wattmeter reads W then the other meter will read :

(1) $\sqrt{3}$ W (2) W/2 (3) 2W (4) 0W

26. The ratio of the potential transformer and current transformer required to measure power in circuit rated 5500kW, 11kV with a wattmeter rated at 5A and 110V respectively are :

(1) 10, 10 (2) 50, 50 (3) 200, 200 (4) None of these

27. The effect of stray magnetic fields on the actuating torque of a portable instrument is maximum when the operating field of the instrument and the stray field are :

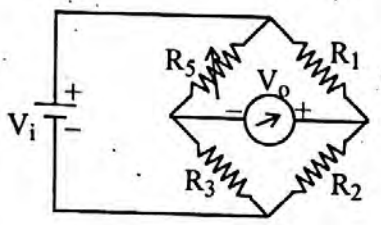
(1) perpendicular (2) parallel

(3) inclined at 60° (4) inclined at 30°

28. A 500A/5A, 50Hz transformer has a bar primary. The secondary burden is a pure resistance of 1Ω and it draws a current of 5A. If the magnetic core requires 250AT for magnetisation, the percentage ratio error is :

(1) 10.56 (2) –10.55 (3) 11.80 (4) –11.80

29. A strain guage forms one arm of the bridge shown in the figure below, and has a nominal resistance without any load as $R_s = 300\Omega$. Other bridge resistances are $R_1 = R_2 = R_3 = 300\Omega$. The maximum permissible current through the strain guage is 20mA. During certain measurement when the bridge is excited by maximum permissible voltage an the strain guage resistance is increased by 1% over the nominal value, the output voltage V_o in mV is:



(1) 56.02 (2) 40.83 (3) 29.85 (4) 10.02

30. In CE configuration, the input V-I characteristics are drawn by taking :

(1) V_{CE} as I_C for constant value of I_E

(2) V_{BE} vs I_E for constant value of V_{CE}

(3) V_{BE} vs I_B for constant value of I_C

(4) V_{BE} vs I_B for constant value of V_{CE}

31. Full load voltage regulation of a power transformer is zero when the power factor of the load is :

(1) unity and leading (2) zero and leading

(3) zero and lagging (4) unity and lagging

32. In an autotransformer of voltage ratio V_1/V_2 and $V_1 > V_2$, the fraction of power transferred inductively is :

(1) $\frac{V_1}{V_1+V_2}$ (2) $\frac{V_2}{V_1}$ (3) $\frac{V_1-V_2}{V_1+V_2}$ (4) $\frac{V_1-V_2}{V_1}$

33. A series motor drawing an armature current of 1_a is operating under saturated magnetic conditions. The torque developed in the motor is proportional to :

(1) $\frac{I}{I_a}$ (2) $\frac{I}{I_a^2}$ (3) I_a^2 (4) I_a

34. Which of the following are the features of a shaded pole motor

a. Salient pole stator

b. Uniform air-gap

c. Two stator windings one of which is a short circuited ring

d. Squirrel cage rotor

Select the correct answer using following

Code :

(1) a and d (2) b and d

(3) a, c and d (4) a, b and d

35. A synchronous motor is running from an infinite bus of voltage V_t in steady state at about 50% of its rated load with a power angle δ_1 between V_t and E_f. The load is suddenly decreased to 25%. E_f attains its new steady state power angle δ_2 with V_t by initially :

(1) falling behind and making a complete rotation

(2) advancing and making a complete rotation

(3) falling behind followed by oscillation about δ_2

(4) advancing followed by oscillation about δ_2

36. The rotor output of a three phase induction motor is 15kW and the corresponding slip is 4%. The rotor copper loss will be :

(1) 600W (2) 625W (3) 650W (4) 700W

37. A single phase transformer has a rating of 15kVA, 600/120V. It is reconnected as an autotransformer to supply 720V from a 600V primary source. The maximum load it can supply is :

(1) 90kVA
(2) 18 kVA
(3) 15 kVA
(4) 12kVA

38. A 200V DC shunt motor delivers an output of 17kW with an input of 20kW. The field winding resistance is 50Ω and armature resistance is 0.04Ω. Maximum efficiency will be obtained when the total armature copper losses are equal to :

(1) 2632W
(2) 3000W
(3) 3680W
(4) 5232W

39. A three phase alternator is connected to a delta-delta transformer. The hysteresis and eddy current loasses of the transformer are 300W and 400W respectively. If the speed of the alternator is reduced by 10% then the hysteresis and eddy current losses of the transformer respectively will be :

(1) 218W and 262.44W
(2) 243W and 324W
(3) 243W and 360W
(4) 270W and 400W

40. A 220V DC shunt motor is operating at a speed of 1440rpm. The armature resistance is 1.0Ω and armature current is 10A. If the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79Ω
(2) 2.1Ω
(3) 3Ω
(4) 18.9Ω

41. The transfer function of a phase lead compensator is $\frac{s+a}{s+b}$ and that of phase lag compensator is $\frac{s+p}{s+q}$, then which of the following sets of conditions must be met ?

(1) a > b and p < q (2) a > b and p > q

(3) a < b and p < q (4) a < b and p > q

42. The dynamics of a system are governed by $\dddot{y}(t) - \ddot{x}(t) - x(t-1) = 0$. Then the transfer function of the system is :

(1) $s^2 + se^{-s}$ (2) $1 + s^2e^{-s}$

(3) $1 + s^{-2}e^{-s}$ (4) $1 + s^{-2}e^{s}$

43. A composite RC network has the transfer function $K(s) = \frac{1+21s+20s^2}{1+11s+10s^2}$, then this block can be used as a :

(1) phase lead compensator (2) phase lag compensator

(3) lag-lead compensator (4) none of above

44. The value of K and a, for which the system $G(s) = \frac{K(s+2)}{s^3+s^2+as+1}$ will oscillate with 3 rad/sec frequency in unity feedback configuration, are respectively as :

(1) 2, 2 (2) 4, 5 (3) 3, 4 (4) 2, 3

45. The time taken by the output of a system $G(s) = \frac{1}{(s+1)}$ to settle around 95% of its final value is :

(1) 2 sec (2) 1.33 sec

(3) 1.11 sec (4) 3 secondary

46. The system with $G(s) = \dfrac{1}{s(\tau s + 1)}$ when connected in the unity feedback configuration produces error to the step inputs as $e(t) = Ke^{-4t}\sin(10t + \phi)$. The system time constant τ is then given by :

(1) 0.01 (2) 0.03 (3) 10 (4) 4

47. Given a unity feedback system with $G(s) = \dfrac{K(s-1)(s-2)}{s(s+1)}$, which of the following is true ?

(1) the system will always be stable for all K

(2) the system will be stable for low gain K

(3) the system is stable for high gain K

(4) the system root locus never crosses jw axis

48. The state space equations of a system are as :

$$\ddot{x} = \begin{bmatrix} 0 & 1 \\ 0 & 2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u;\ y = [1\ 0]\, x$$

then the damping ratio and decay factor are :

(1) .707, 2 (2) 1.414, 1

(3) 0.5, 1 (4) 0.5, 0.5

49. The state space equations of a system are as :

$$\ddot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u;\ y = [1\ \ 0]\, x$$

then the position error constant K_p and velocity error constant K_v are respectively as :

(1) 2, 0 (2) ∞, 0

(3) ∞, 1 (4) None of these

50. The dynamics of a system are governed by following state equations :

$$\dot{x} = \begin{bmatrix} 3 & 0 \\ -2 & 2 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u;\ y = [1\ \ 1]\, x$$

then this system is :

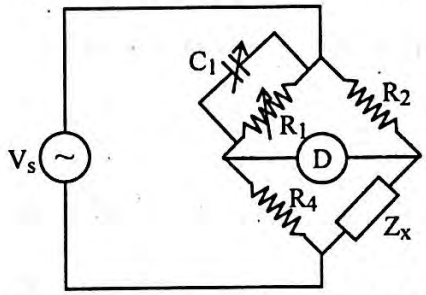
(1) controllable, observable and unstable

(2) not controllable, observable and stable

(3) not controllable, not observable and unstable

(4) not controllable, observable and unstable

51. The bridge circuit shown in figure below is used for the measurement of an unknown element Z_x. The bridge circuit is best suited when Z_x is as :



(1) low resistance (2) high resistance (3) low Q inductor (4) lossy capacitor

52. A silicon diode indicates forward currents of 2mA and 10mA when diode voltages are 0.6V and 0.7V respectively. The operating temperature of the diode junction is :

(1) 180K (2) 360K (3) 480K (4) 320K

53. The current gain of a bipolar transistor drops at high frequencies because of :

(1) transistor internal capacitances (2) high current effects in the base

(3) parasitic inductive elements (4) the Early effects

54. A diode has a leakage current of 10μA at certain tempearture. Find its value when temperature is increased by 25°C :

(1) 56.00 μA (2) 56.56 μA (3) 59.56 μA (4) None of these

55. A transistor has $\alpha = 0.98$, then its β is :

(1) 50 (2) 49 (3) 70 (4) None of these

56. A JFET has a value of $g_{m0} = 4000\ \mu S$. Determine the value of g_m at $V_{GS} = -3V$. Given that $V_{GS(off)} = -8V$:

(1) 250 μS (2) 2500 μS (3) 25 μS (4) None of these

57. A multiplexer is a :

(1) one input many output device (2) one input and one output device

(3) many input many output device (4) many input to one output device

58. A J-K flip flop is made to toggle via :

(1) J=0, K=0 (2) J=1, K=0 (3) J=0, K=1 (4) J=1, K=1

59. Multiplexers are used in :

(1) data generation (2) serial to parallel conversion

(3) data selection (4) None of these

60. Which one of the following is a universal gate ?

(1) AND (2) OR (3) Ex-NOR (4) NAND

61. A 200 km long three phase transmission line is transferring a power of 200MVA having line losses of 5MW. If the recieving end voltage is 110kV, the line has a resistance of :

(1) 10Ω/ph (2) 1.5Ω/ph (3) 1Ω/ph (4) 2.5Ω/ph

62. The cost function of a 50MW generator is $F(P_1) = 225 + 53P_1 + .02P_1^2$ where P_1 is the generator loading in MW. For 100% loading the cost is :

(1) Rs. 55 per Mwh (2) Rs. 55 per Mw

(3) Rs. 58.5 per Mwh (4) Rs. 55.5 per Mwh

63. Two insulator discs of identifical capacitance value C make up of a string for a 22kV, 50 Hz single phase overhead line insulation system. If the pin to earth capacitance is also C, then the string efficiency is :

(1) 50% (2) 75% (3) 90% (4) 86%

64. The surge impedance of a three phase 400kV transmissionline is 400Ω. Then the surge impedance loading is :

(1) 400MW (2) 1000MW (3) 1600MW (4) 800MW

65. A three phase generator rated at 110MVA, 11kV is connected through circuit beakers to a transformer. The generator has direct axis sub-transient reactance X''_d = 19%, transient reactance X'_d = 26% and synchronous reactance 130%. The generator is operating at no load and rated voltage when a three phase short circuit fault occurs between the breakers and the transformer. The magnitude of initial symmetrical RMS current in the breakers will be :

(1) 4.44kA (2) 22.20kA (3) 30.39kA (4) 38.45kA

66. The bus admittance matrix of a three-bus three line system is :

$$Y = j\begin{bmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{bmatrix}$$

if each transmission line between the two buses is represented by an equivalent π-network, the magnitude of the shunt susceptance of the line connecting bus 1 and 2 is :

(1) 4 (2) 2 (3) 1 (4) 0

67. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and currents
(2) angular displacement of the rotor with respect to the stator
(3) angular displacement of the stator mmf with respect to a synchronously rotating axis
(4) angular displacement of an axis fixed to the rotor with respect to a synchronous rotating axis

68. A single phase load is supplied by a single phase voltage source. If the current flowing from the load to the source is $10\angle -150°$ A and if the voltage at the load terminals is $100\angle 60° V$, then the :

(1) load absorbs real power and delivers reactive power

(2) load absorbs real power and absorbs reactive power

(3) load delivers real power and delivers reactive power

(4) load delivers real power and absorbs reactive power

69. A cylindrical rotor generator delivers 0.5pu power in the steady state to an infinite bus through a transmission line of reactance 0.5pu. The generator no load voltage is 1.5pu and the infinite bus voltage is 1pu. The inertia constant of the generator is 5MW-s/MVA and the generator reactance is 1pu. The critical clearing angle in degrees for a three phase dead short circuit fault at the generator terminal is :

(1) 53.5 (2) 60.2 (3) 70.8 (4) 79.6

70. In a biased differential relay, the bias is defined as a ratio of :

(1) number of turns of restraining and operating coil

(2) operating coil current and restraining coil current

(3) fault current and operating coil currents

(4) fault current and restraining coil current

71. An electric motor developing a starting torque of 15Nm starts with a load torque of 7Nm on its shaft. If the acceleration at start is 2 rad/s^2 , then moment of inertia of the systems must be (neglecting viscous and Coulomb friction)

(1) $0.25 kgm^2$ (2) $0.25 Nm^2$

(3) $4 kgm^2$ (4) $4 Nm^2$

72. The ABCD parameters of a three phase overhead transmission line are $A = D = 0.9 \angle 0°$, $B = 200\angle 90°\Omega$ and $C = 0.95 \times 10^{-3} \angle 90°$. At no load condition, a shunt inductive reactor is connected at the recieving end of the line to limit the receiving end voltage to be equal to the sending end voltage. The ohmic value of the reactor is :

(1) $\infty\,\Omega$ (2) 2000Ω

(3) 105.26Ω (4) 1052.5Ω

73. A round rotor generator with internal voltage $E_1 = 2.0pu$ and $X = 1.1pu$ is connected to a round rotor synchronous motor with internal voltage $E_2 = 1.3pu$ and $X = 1.2pu$. The reactance of the line connecting the generator to the motor is 0.5pu. When the generator supplies 0.5pu power, the rotor angle difference between the machines will be :

(1) 57.42° (2) 1°

(3) 32.58° (4) 122.58°

74. If we make the system insensitive to forward path gain G(s) using negative feedback configuration, it becomes :

(1) slow and stable

(2) more sensitive to feedback path gain variations

(3) stable as well as insensitive to variation in feedback path gains

(4) fast at the cost of stability

75. Which of the following cannot be achieved using open loop control systems :

(1) tracking avarying control command

(2) rejecting some known disturbances

(3) regulation around a set point

(4) sensitivity reduction with respect to forward path gain

76. An integral controller K $(s) = \frac{1}{s}$ is required to be placed in tandem with plant G(s) so as to make the steady state error for ramp input as zero. Then the type of plant G(s) is :

(1) 2 (2) 1 (3) 0 (4) ∞

77. A system with $G(s)\frac{1}{s(s+1)}$ is stablized with a proportional controller K in the forward path. The value of K for which the system will admit sustained oscillations will be :

(1) 1 (2) 2

(3) $2\sqrt{2}$ (4) no value exists

78. An open loop transfer function has one pole and one zero in the right half of s-plane, then if the closed loop system is stable, the nyquist plot should encircle - 1 + j0 point

(1) once in the anticlockwise direction

(2) once in the clockwise direction

(3) should not encircle

(4) none of these

79. The Asymptotes in the root locus plot of unity feedback configuration of $G(s)\frac{1}{s(s+1)(s+2)}$ intersects with the real axis at :

(1) –1.25 (2) –1.5 (3) –1 (4) –1.15

80. Bode gain plots alone can be used to find the transfer function of a linear time invariant system when :

(1) Not possible alone with bode gain plots

(2) system is stable and observable

(3) system is causal and controllable

(4) system is non-minimum phase

81. A fair coin is tossed three times in succession. If the first toss produces a head, then the probability of getting exactly two heads in three tosses is :

(1) 1/8 (2) 1/2 (3) 3/8 (4) 3/4

82. Let the probability density function of a random variable X be given as $fx(x) = \frac{3}{2}e^{-3x}\,u(x) + ae^{4x}\,u(-x)$ where $u(x)$ is the unit step function. Then the value of a and $Prob\{X \le 0\}$, respectively are :

(1) 2, 1/2 (2) 4, 1/2 (3) 2, 1/4 (4) 4, 1/4

83. Let $A = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}$, and I is the identity matrix, then A^9 is given by :

(1) $511A + 510I$ (2) $309A + 104I$ (3) $154A + 155I$ (4) e^{9A}

84. The equations $\begin{bmatrix} 2 & -2 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ has

(1) no solution (2) only one solution $x_1 = 0, x_2 = 0$

(3) non zero unique solution (4) multiple solutions

85. The Laplace transform of the function $f(t) = e^{2t}\sin(5t)\,u(t)$ is :

(1) $\frac{5}{s^2 - 4s + 29}$ (2) $\frac{5}{s^2 + 5}$ (3) $\frac{s-2}{s^2 + 4s + 29}$ (4) $\frac{5}{s+5}$

86. Consider a signed defined as $x(t) = \begin{cases} e^{j10t} & |t| \le 1 \\ 0 & |t| > 1 \end{cases}$.

Its Fourier transform is given as :

(1) $\frac{2\sin(w-10)}{w-10}$ (2) $2e^{j10}\frac{\sin(w-10)}{w-10}$

(3) $\frac{2\sin(w-10)}{w-10}$ (4) $e^{j10w}\frac{\sin(w-10)}{w-10}$

87. In a two port reciprocal network, the output open circuit voltage by the input current is equal to :

(1) h_{12} (2) Z_{12} (3) Y_{11} (4) B

88. A series RLC circuit consists of L = 0.5 H, C = 50μF and R = 40Ω. When excited with 220V AC rms and 50Hz frequency source, the voltage across the capacitor is :

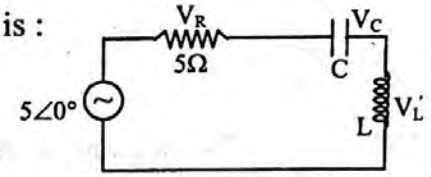
(1) 140V (2) 139.6V (3) 138.02V (4) 142V

89. The Y-parameter of the following network is $\begin{bmatrix} 0 & -1/2 \\ 1/2 & 1 \end{bmatrix}$, then the network is :

(1) non-reciprocal and active (2) non-reciprocal and passive

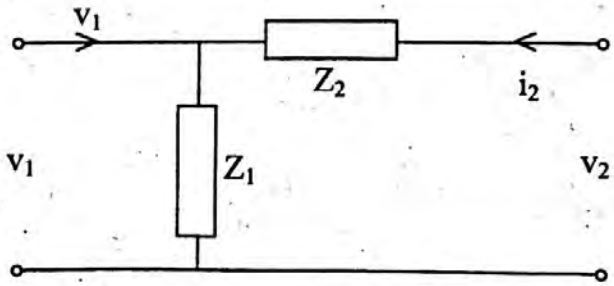
(3) reciprocal and active (4) reciprocal and passive

90. In the circuit shown below, the magnitudes of V_L and V_C are twice that of V_R. The inductance of the coil is :



(1) 2.14mH (2) 5.30mH (3) 31.8mH (4) 1.32mH

91. For a two port network shown below, the Z-matrix is given by :



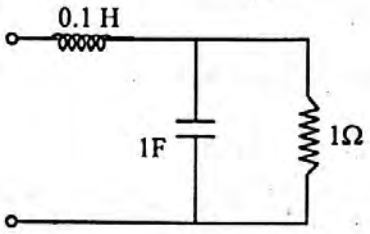
(1) $\begin{bmatrix} Z_1 & Z_1+Z_2 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$ (2) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$

(3) $\begin{bmatrix} Z_1 & Z_2 \\ Z_2 & Z_1+Z_2 \end{bmatrix}$ (4) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1 & Z_2+Z_2 \end{bmatrix}$

92. The Z-matrix of a network is given as $Z = \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$, then Y_{22} is given by :

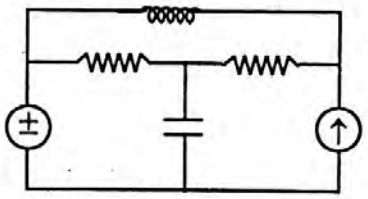
(1) 1.2 (2) 0.4 (3) –0.4 (4) 1.8

93. The resonant frequency for the given circuit below is :



(1) 1 rad/s (2) 3 rad/s (3) 2 rad/sec (4) 5.1 rad/sec

94. The number of chords in the graph of the circuit shown below is :



(1) 3 (2) 4 (3) 5 (4) 6

95. The average power absorbed by an impedance of $Z = 30 - j70\Omega$ when a voltage of $V = 120\angle 0°$ is applied across it is :

(1) 21.4W (2) 37.24W (3) 32.74W (4) 12.4W

96. The Q-factor of a coil with resonating frequency f_0 is given by :

(1) $\frac{2\pi f_0 R}{L}$ (2) $\frac{2\pi f_0 R}{C}$

(3) $\frac{bandwidth}{f_0}$ (4) None of these

97. Which of the following statements holds for the divergence of electric and magnetic flux densities ?

(1) Both are zero

(2) These are zero for static densities but non-zero for time varying densities.

(3) It is zero for the electric flux density

(4) It is zero for the magnetic flux density

98. The value of flux density at a point in space is $\vec{B} = 4x\hat{a}_x + 2ky\hat{a}_y + 8\hat{a}_z$ W/m^2. The value of constant k must be equal to :

(1) –2 (2) –0.5 (3) +0.5 (4) +2

99. Two electric charges +q and –2Q are placed at (0, 0) and (6, 0) in the x-y plane. The equation of the zero equipotential curve in the x-y plane is :

(1) $x = -2$ (2) $y = 2$

(3) $x^2 + y^2 = 2$ (4) $(x+2)^2 + y^2 = 16$

100. A 4-pole lap wound DC shunt generator has an armature winding consisting of 220 turns each of 0.004Ω resistance, then the armature resistance will be :

(1) 0.055Ω (2) 0.0275Ω

(3) 0.110Ω (4) 0.22Ω

Answer Key of Ph.D/URS (Electrical Engg.) 2019				
Sr. No	Set A	Set B	Set C	Set D
1	4	4	3	1
2	3	3	3	2
3	1	1	4	4
4	3	1	2	1
5	2	2	3	2
6	4	3	2	1
7	3	2	1	1
8	4	1	3	2
9	1	4	1	3
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46	3	3	4	1
47	2	4	3	4
48	1	2	4	3
49	4	1	1	2
50	4	3	2	1

20/11/19

20/11/19

Answer Key of Ph.D/URS (Electrical Engg.) 2019				
Sr. No	Set A	Set B	Set C	Set D
51	2	2	1	3
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90	3	3	2	2
91	1	1	2	1
92	2	4	3	4
93	4	3	4	3
94	1	1	1	3
95	2	2	2	2
96	1	4	1	1
97	1	2	4	3
98	2	4	3	1
99	3	3	2	2
100	2	1	1	2

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