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TRANSCO/GENCO/DISCUM
Assistant – Engineers Examination
ELECTRICAL ENGINEERING
AP TRANSCO – APEPDCL – AE 2014

PREVIOUS PAPER

1

1. Identify the instrument which has no controlling torque

a) Electrostatic voltmeter
b) Power factor meter
c) Wattmeter
d) Dynamometer type Ammeter

2. A 5 A, 220 V, energy meter on full load, unity power factor, makes 60 revolutions in 360 secs. The constant of energy meter is 600 resolutions per kWh. The error in the energy recorded is

a) 0.02 kWh b) 0.05 kWh c) 0.01 kWh d) 0.1 kWh

3. The instrument with good accuracy for measurement of A.C. quantities is

a) Dynamometer type
b) Moving iron type
c) Moving coil type
d) Induction type

4. The Bridge network commonly employed for measurement of very low resistances is

a) Carey Foster's Bridge
b) Wheatstone Bridge
c) Kelvin's Double Bridge
d) Schering Bridge

5. The Bridge network commonly employed for measurement of mutual inductance is

a) Wein's Bridge
b) Owen's Bridge
c) Anderson Bridge
d) Heaviside Campbell Bridge

6. The four arms of bridge network has $Z_{AB} = 100\angle 30^0\ \Omega$, $Z_{BC} = 100\angle -30^0\ \Omega$. $Z_{CD} = 50\angle -60^0\ \Omega$ and an unknown impedance is connected between D and A. Then unknown impedance Z_{DA} is

a) $50\angle 0^0\ \Omega$ b) $100\angle 0^0\ \Omega$ c) $50\angle -120^0\ \Omega$ (d) $200\ \angle 60^0\ \Omega$

7. Wagner's earthing device is employed in A.C. bridge network to

a) Shield the bridge elements
b) eliminate the effect of earth capacitances
c) eliminate the effect of stray magnetic fields
d) eliminate the effect of stray electric fields

8. The transducer employed for measurement of angular displacement is

a) LVDT
b) Thermocouple
c) Thermistor
d) Circular Potentiometer

9. Thermistor is employed for measurement of

a) Linear displacement
b) Acceleration
c) Pressure
d) Temperature

10. The "Gauge factor" of a stain gauge is given by

a) $\frac{\Delta L/L}{\Delta R/R}$ b) $\frac{\Delta R/R}{\Delta L/L}$ c) $\frac{\Delta R}{\Delta L}$ d) $\frac{\Delta L}{\Delta R}$

11. A lissajous pattern on the oscilloscope has 6 vertical maximum values and 4 horizontal maximum values. The frequency of horizontal input is 1000 Hz. The frequency of the vertical input is

a) 4000 Hz b) 1500 Hz c) 6000 Hz d) $\frac{2000}{3}$ Hz

12. The cut in voltage for Silicon and Germanium diodes respectively is

a) 0, 6 V, 0.2 V b) 0.7 V, 0.3 V c) 0.3 V, 0.7 V d) 0.2 V, 0.6 V

13. In a FET

a) $r_d = \mu \times g_m$ b) $r_d = \frac{g_m}{\mu}$ c) $\mu - r_d \times g_m$ d) $\mu - \frac{r_d}{g_m}$

14. The transistor amplifier in the following configuration is called emitter follower

a) CB b) CE c) CC d) Cascode

15. The Barkhausen criterion is

a) $A = \beta$ b) $A = -\beta$ c) $A\beta = 1$ d) $A\beta = -1$

16. The maximum conversion efficiency of a class sB push pull amplifier is

a) 10π b) 15π c) 20π d) 25π

17. Which of the following is not an ideal op-amp characteristic?

a) infinite voltage gain b) infinite output resistance

c) infinite input resistance d) infinite bandwidth

18. Which is a voltage to frequency converter multivibrator?

a) Bistable b) Astable

c) Monostable d) Schmitt trigger

19. The bandwidth of a low pass RC Circuit is 1 KHz. What is the rise time of output for a step input?

a) 0.35 ms b) 3.5 ms c) 0.35 s d) 1 ms

20. The gate whose output is high when all the inputs are low and low for other combinations of inputs is

a) OR gate b) AND gate c) NAND gate d) NOR gate

21. Which of the following is a D/A converter?

a) flash converter b) weighted resistor

c) successive approximation d) dual slope

22. Power factor of a transformer on no load is poor due to

a) magnetizing reactance of the transformer

b) open circuited secondary

c) low primary winding resistance

d) low no load current

23. During short circuit test the core losses are negligible. This is because

a) The voltage applied across the high voltage side is a fraction of its rated voltage and so is the mutual flux

b) The Current on the low voltage side is very small

c) The power factor is high

d) Iron becomes fully saturated

24. The efficiency of a power transformer at relatively light loads is quite low. This is due to

a) Small copper losses

b) Small secondary output

c) High fixed loss in comparison to the output

d) Poor power factor

25. A2 kVA transformer has iron loss of 150 W and full load copper loss of 250 W. The maximum efficiency of the transformer would occur when the total loss is

a) 500 W b) 400 W c) 300 W d) 100 W

26. In an autotransformer, power is transferred, through

a) conduction process only

b) induction process only

c) both conduction and induction processes

d) mutual' coupling

27. In an electromechanical energy conversion devices, the developed torque depends upon

a) stator field strength and torque angle

b) rotor field and stator field strengths

c) stator field and rotor field strengths and torque angle

d) stator field strength only

28. Wave winding is employed in a dc machine for

a) High current and low voltage rating

b) Low current and high voltage rating

c) High current and high voltage rating

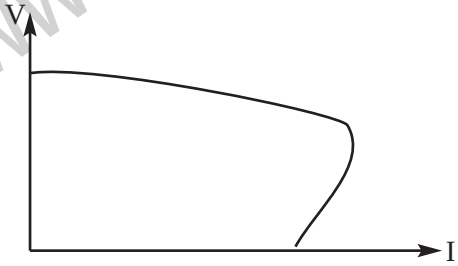
d) Low current and low voltage rating

29. The slight curvature at the lower end of the OCC of a self – excited dc generator is due to

a) Magnetic inertia b) Residual flux

c) High speed d) High field resistance

30. The graph represents which of the following characteristics of dc shunt generator



a) Internal characteristics

b) External characteristics

c) Open circuit characteristics

d) Magnetic characteristics

31. A smaller air gap in a poly phase induction motor helps to

a) Reduce the chance of crawling
b) Increase the starting torque
c) Reduce the chance of cogging
d) Reduce the magnetizing current

32. The rotor of a 3 – Phase induction motor rotates in the same direction as that of stator rotating field. This can be explained by

a) Faraday's law of electromagnetic induction
b) Lenz's law
c) Newton's law
d) Fleming's right hand rule

33. In a three phase slip ring induction motor high starting torque is achieved by

a) Increase supply voltage
b) Increase supply frequency
c) Connecting a capacitor across the motor terminals
d) Connecting a star – connected resistance across the slipring terminals of the motor.

34. Two windings provided on the stator of a single phase induction motor one main winding and other auxiliary winding are connected

a) in parallel
b) in series
c) either in series or parallel depending on the design of the motor
d) through inductive coupling

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

a) Direction of rotating is to be reversed
b) Phase-sequence is to be changed
c) Field excitation is to be decreased
d) Field excitation is to be increased

36. In a synchronous generator with constant stream input supplies power to an infinite bus at a lagging power factor. If the excitation is increased

a) Both power angle and power factor decrease
b) Both power angle and power factor increase
c) Power angle decreases while power factor increases
d) Power angle increases while power factor decreases

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

a) 48 b) 12 c) 24 d) 16

38. Which one among the following has the highest numerical value in a stepper motor?

a) Detent torque
b) Holding torque
c) Dynamic torque
d) Ripple torque

39. Which of the following types of motors are most suitable for a computer printer drive

a) Reluctance motor b) Hysteresis motor

c) Shaded pole motor d) Stepper motor

40. The main advantage of IGBT over SCR in power electronics

a) Reduced weight b) Self-commutating capability

c) Very high reliability d) Self-cooling property

41. In a 2 – pulse bridge converter with free wheeling diode, the width of the diode current pulse over one cycle is (α is firing angle)

a) $\pi + \alpha$ b) $\pi - \alpha$ c) π d) 2α

42. A 440 V, 3 – phase, 10 pole and 50 Hz synchronous motor delivering a torque of $\frac{50}{\pi}$ N – m, delivers a power of:

a) 50 W b) 500 W c) 1000 W d) 2000 W

43. A PWM switching scheme is used with a three phase inverter to

a) Reduce total harmonic distortion with modest filtering

b) Minimize the load on the dc side

c) Increase the life of batteries

d) Reduce the low order harmonics and increase the high order harmonics

44. Which of the following configurations is used for both motoring and regenerative breaking

a) First quadrant chopper b) Second quadrant chopper

c) Two quadrant chopper d) Four quadrant chopper

45. The synchronous reactance is the

a) Reactance due to armature reactance of the machine

b) Reactance due to leakage flux

c) Combined reactance due to leakage flux and armature reaction

d) Reactance either due to armature reaction or leakage flux

46. The results of a slip test for determining direct – axis (X_d) and quadrature – axis (X_q) reactances of a star connected salient pole alternator are given below:

Phase values: $V_{max} = 108$ V; $V_{min} = 96$ V

$I_{max} = 12$ A; $I_{min} = 10$ A

Hence the two reactances will be

a) $X_d = 10.8\ \Omega$ and $X_q = 8\ \Omega$ b) $X_d = 9\ \Omega$ and $X_q = 9.6\ \Omega$

c) $X_d = 9.6\ \Omega$ and $X_q = 9\ \Omega$ d) $X_d = 8\ \Omega$ and Xq = 10.8 Ω

47. The most economical power factor with rate per maximum demand per annum is Rs.20 and the expenditure per kVA per annum is Rs.3.8 will be:

a) 0.19 lag or lead b) 0.9 lag or lead

c) 0.9 lag d) 0.9 lead

48. Gas turbine is widely used in

a) Automotive b) Electric locomotives

c) Aircrafts d) Pumping stations

49. Large size nuclear plants are suitable for

a) Base loads b) Peak loads

c) Intermediate loads d) Average loads

50. The characteristic impedance of a line in Ohms, with series impedance of 0.1 Ohms per unit length and shunt admittance of 0.001 Ohms per unit length is given by:

a) 0.0001 b) 0.01 c) 100 d) 10

51. A transmission line has 3% of resistance and 5% of inductive reactance. Its percentage regulation at full load and 0.8 P.F. lead is

a) 8 b) 5.4 c) –0.6 d) –2

52. A single phase short transmission line has an impedance of j 0.6 ohms, supplies a resistive load of 500 A at 400 V. The sending end p.f. will be:

a) Unity b) 0.8 lagging c) 0.8 leading d) 0.6 lagging

53. The transmission network of short transmission line will have the transmission parameters as:

a) 1, Z, 0, 1 b) 0, 1, 1, Z c) Z, 0, 1, 1 d) 1, 1, Z, 0

54. The electrical power transmission network will be

a) Symmetrical but not reciprocal b) Reciprocal but not symmetrical

c) Both symmetrical and reciprocal d) Neither symmetrical nor reciprocal

55. In a three core cable, the capacitance between two conductors (with sheath earthed) is 1 microfarad. The capacitance per phase in microfarads will be:

a) 0.33 b) 3 c) 0.5 d) 2

56. Shunt capacitors are used in distribution lines

a) To provide reactive power compensation

b) To reduce line losses

c) To reduce voltage drop

d) To reduce sending end voltage

57. In a three unit insulator string, the voltage across lowest string is 10 kV, and string efficiency is 90%, then the total string voltage will be:

a) 3 kV b) 27 kV c) 30 kV d) kV

58. Whenever the conductors are dead – ended or there is a change of directions of transmission line, the insulators used are:

a) shackle type b) suspension type c) pin type d) strain type

59. Corona loss will increase with

a) increase in conductor size and decrease in supply frequency

b) decrease in conductor size and decrease in supply frequency

c) decrease in conductor size and increase in supply frequency

d) increase in conductor size and increase in supply frequency

60. The charging reactance of 10 km line is 500 ohms. If the line length is doubled, the charging reactance in ohms will be

a) 1000 b) 500 c) 2000 d) 250

61. The inductance of a transmission line is minimum when

a) both GMD and GMR is high

b) GMD is low and GMR is high

c) GMD is low and GMR is low

d) GMD is high and GMR is low

62. The value of transmission lines impedance is 5 pu with 10 MVA, 10 kV base values. Its impedance value in Ohms is

a) 1 b) 0.5 c) 5 d) 10

63. The off-diagonal element Y_{ij} of a bus admittance matrix is equal to:

a) Same as the admittance of the element connected between buses i and j

b) Minus the admittance of the element connected at buses i and j.

c) Minus of the admittance of the element connected between buses i and j.

d) Same as diagonal element

64. The number of iterations will be least in the following methods to obtain load flow solution.

a) Gauss

b) Gauss-Siedel

c) Fast Decoupled

d) Newton-Raphson

65. In SLG fault, in conventional phases

a) The sequence components of currents are equal

b) Positive and negative sequence components of currents are equal and zero sequence component of current is zero.

c) All sequence net works will be in parallel.

d) Zero sequence component only will be present.

66. The ranking and severity of the fault can be written in ascending order as:

a) LLG, LL, SLG, LLLG

b) SLG, LL, LLG, LLLG

c) LL, LLG, LLLG, SLG

d) LLLG, LLG, LL, SLG

67. If the inertia constant is 4 MJ/MVA and rating of the generator is 10 MVA, then the energy is:

a) 40 MJ b) 4 MJ c) 2.5 MJ d) 0.4 MJ

68. The critical clearing time of a fault in a power system is related to

a) steady state stability limit

b) short circuit current limit

c) transient stability limit

d) reactive power limit

69. In an IDMT relay, electromagnetic over current relay the minimum time is achieved because of

a) Electromagnetic damping

b) proper mechanical design

c) appropriate time delay element

d) saturation of the magnetic circuit

70. The relay used for phase full protection of short transmission line is:

a) impedance relay

b) reactance relay

c) Mho relay

d) admittance relay

71. When voltage is high and current is low, the Circuit Breaker (CB) preferred is

a) Oil CB b) Air Blast CB

c) Air break CB d) Vacuum CB

72. In the power system stability

a) steady state stability limit is equal to transient stability limit

b) steady stage stability limit is less than transient stability limit

c) steady state stability limit is greater than transient stability limit

d) Transient stability limit with governor control mechanism will be more than steady state stability limit.

73. The line currents of a three phase system are: j3A (1 + j1) A, (−1 −j1)A. The zero sequence current will be:

a) j1A b) j3A c) j9A d) 0A

74. In hydroelectric plants

a) Operating cost is high and capital cost is high

b) Operating cost is high and capital cost is low

c) Operating cost is low and capital cost is low

d) Operating cost is low and capital cost is high.

75. Equal area criterias is applied to calculate

a) steady state stability power limit

b) transient stability current limit

c) critical clearing voltage angle for transient faults

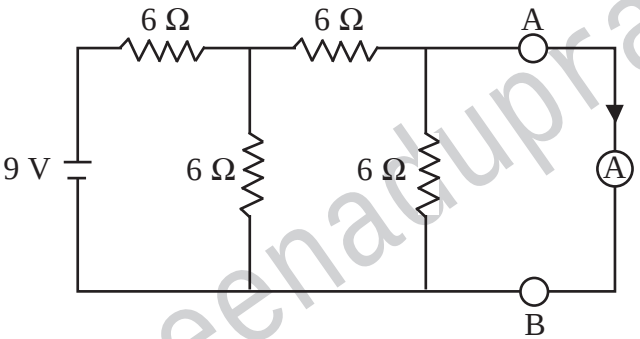
d) critical clearing torque angle and time for transient faults

76. Zero sequence current is used for relaying purposes only in the case of

a) Ground over current relay b) Phase over current relay

c) Phase impedance relay d) Ground impedance relay

77. An ideal ammeter is connected between terminals A and B. The reading of the ammeter is



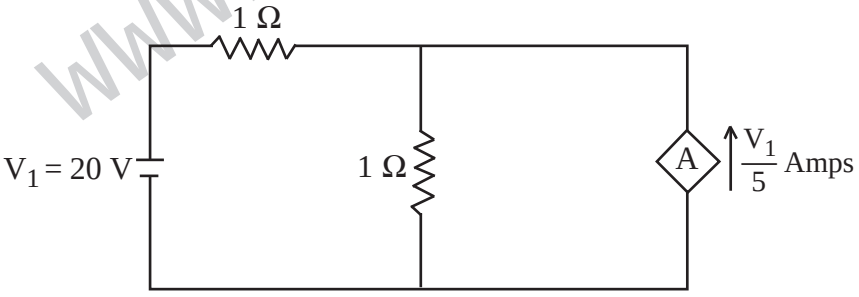
a) 0.8 A

b) 1 A

c) 0.5 A

d) 0.6 A

78. In the circuit shown, the dependent source



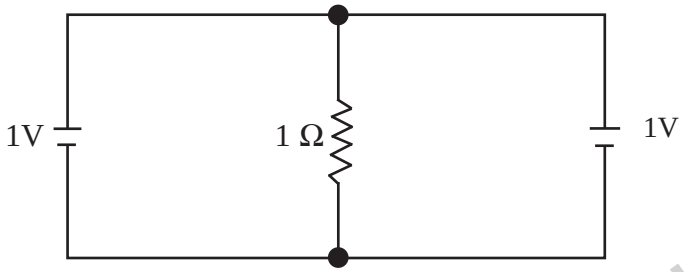
a) delivers 24 W

b) delivers 48 W

c) absorbs 48 W

d) absorbs 24 W

79. The current in the 1 Ohm resistor in the circuit is

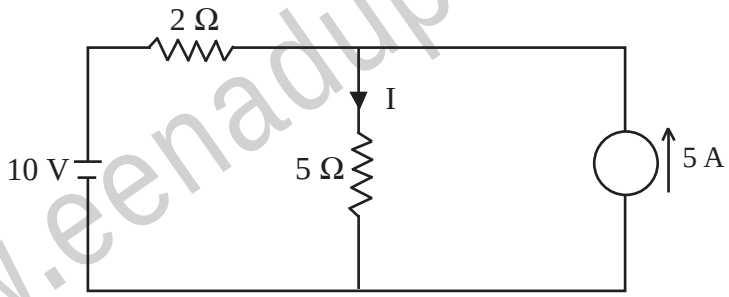


a) zero b) 0.5 A c) 2 A d) 1 A

80. In an A.C. circuit, the Thevenin's voltage is 10 $\angle 30^0$ Volts and Norton's current is 2 $\angle 60^0$ Amps between load terminals. The value of load impedance to have maximum power transfer to the load is

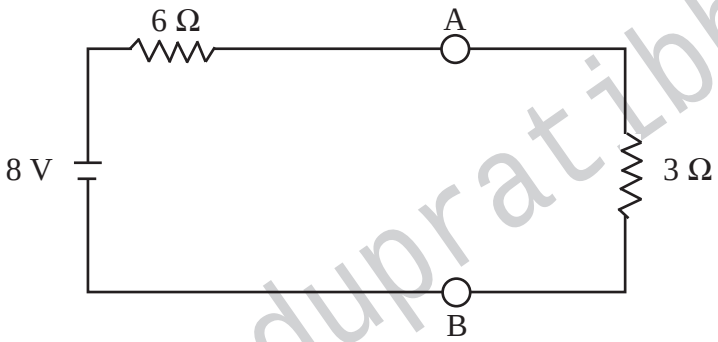
a) 5 $\angle 30^0\ \Omega$ b) 5 $\angle -30^0\ \Omega$ c) 20 $\angle 90^0\ \Omega$ d) 20 $\angle -90^0\ \Omega$

81. The current I in the circuit is



a) $\frac{10}{7}$ A b) zero c) $\frac{20}{7}$ A d) $\frac{30}{7}$ A

82. The value of resistance between terminals A and B is changed to 5 Ω. Then the compensating voltage is



a) 4 V b) 2 V c) 8 V d) 6 V

83. In a given series R – L circuit, the voltage across resistance is 30 V and across inductance is 40 V. Then the total voltage across the circuit is

a) 70 V b) 50 V c) 10 V d) 30 V

84. The impedance of the circuit is (4 + j3) Ohms. The power factor of the circuit is

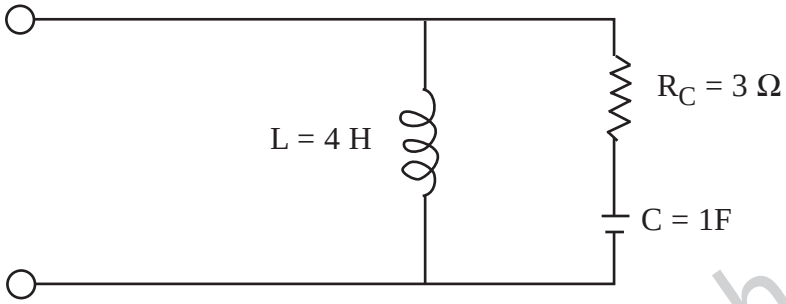
a) 0.6 lag b) 0.8 lead c) 0.4 lag d) 0.8 lag

85. In a two element series circuit, the applied voltage is v (t) = 100 sin ωt and the current flowing is i(t) = 10 sin (ωt – 45^0). Then the values of Resistance and Reactance of the circuit are

a) R = 7.07 Ω X = j7.07 Ω b) R = 5 Ω X = j8.66 Ω

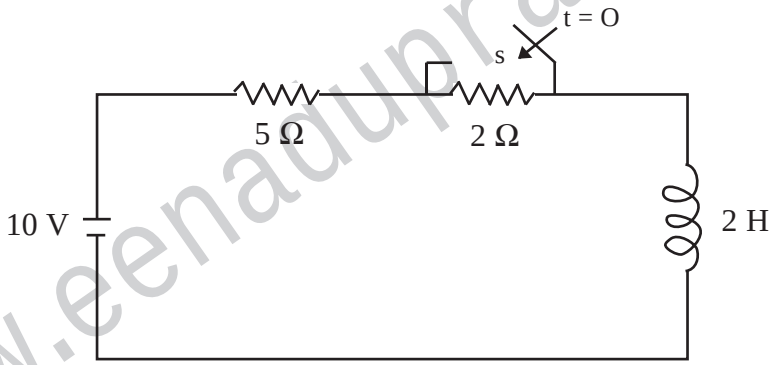
c) R = 7.07 Ω X = –j7.07 Ω d) R = 5 Ω X = –j8.66 Ω

86. The angular frequency of resonance of the circuit is



a) $\frac{1}{\sqrt{2}}$ rad/sec. b) $\frac{1}{\sqrt{3}}$ rad/sec. c) $\frac{1}{\sqrt{5}}$ rad/sec. d) $\frac{1}{\sqrt{6}}$ rad/sec.

87. In the series R – L circuit, the switch is closed at t = 0. The value of current at t = 0 is

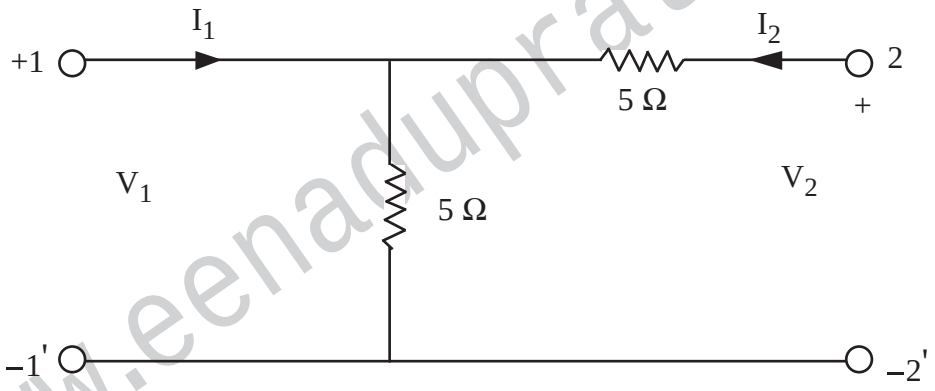


a) zero b) 2 A c) $\frac{10}{7}$ A d) 5 A

88. A series R – C circuit has a time constant of 0.1 sec. and its value of C is 2 micro farads. The value of R is.

a) 0.05 M Ω b) 0.05 Ω c) 0.1 M Ω d) 0.01 Ω

89. The value of the parameter A for the two port network shown is



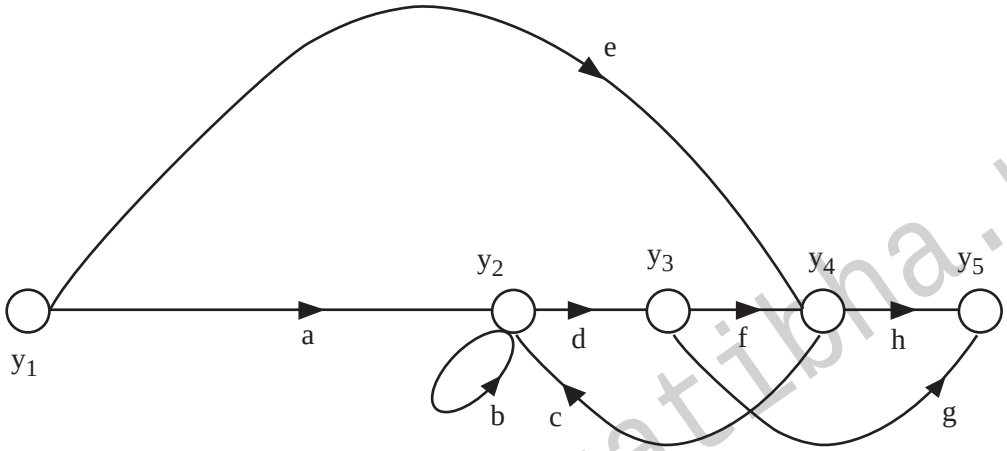
a) zero b) 0.5 c) 2 d) 1

90. The poles and zeros of driving point impedance function are simple and interlace on the negative real axis with a pole closest to the origin. It can be realised.

a) as an LC driving point impedance b) as RL driving point impedance

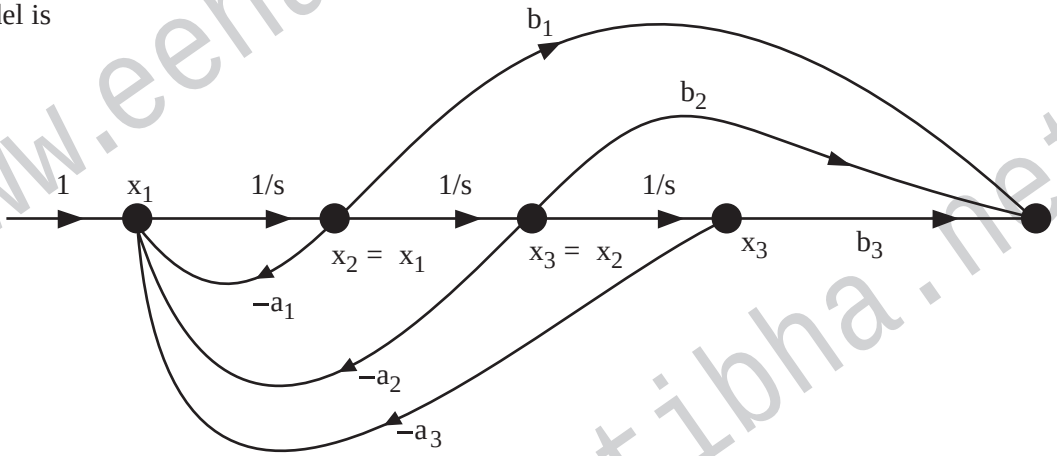
c) as RC driving point impedance d) as RLC driving point impedance

91. The number of forward paths in the following signal flow graph is



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

92. Let $\frac{y(s)}{u(s)} = \frac{b_1s^2 + b_2s + b_3}{s^3 + a_1s^2 + a_2s + a_3}$ is represented by a signal flow graph as shown below, the state vector is $[x_1, x_2, x_3]^T$ where T indicates transpose of the vector. Then the system matrix A of state model is



a) $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -a_3 & -a_2 & -a_1 \end{bmatrix}$ b) $\begin{bmatrix} -a_1 & 1 & 0 \\ -a_2 & 0 & 1 \\ -a_3 & 0 & 1 \end{bmatrix}$

c) $\begin{bmatrix} -a_1 & -a_2 & -a_3 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 0 & 0 & -a_3 \\ 1 & 0 & -a_2 \\ 0 & 1 & -a_1 \end{bmatrix}$

93. The open-loop transformer function, of a unity feedback (negative feedback) system is

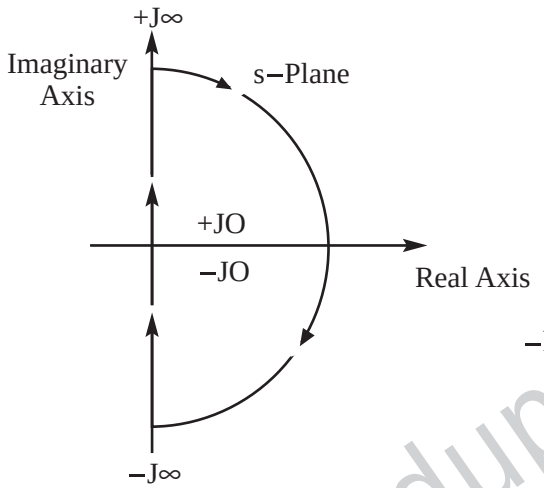
$G(s) = \frac{K}{s(s+2)(s^2+2s+2)}$ Then the closed loop transfer function for k = 1 is

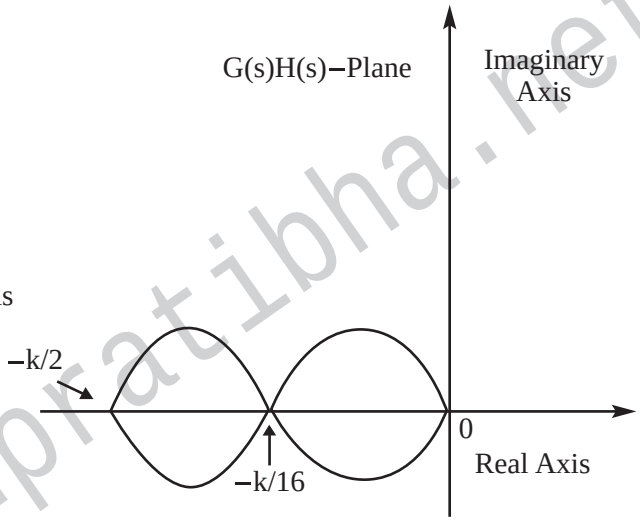
a) $\frac{1}{(s+1)^3}$ b) $\frac{1}{(s+1)^4}$

c) $\frac{1}{(s+1)(s^2+2s+1)}$ d) $\frac{1}{(s^2+2s+1)^2}$

94. The open – loop transformer function of a unity feedback (negative feedback) system is

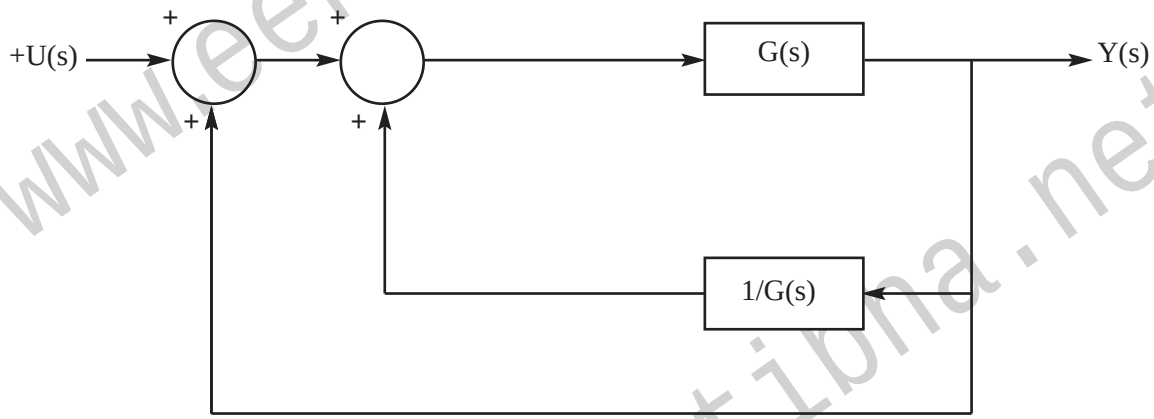
$G(s) = \dfrac{k}{(s-1)(s^2+4s+7)}$. The Nyquist Contour is in s-plane. For k > 0 the Nyquist plot is shown in G(s) H(s) plane. The system is stable for





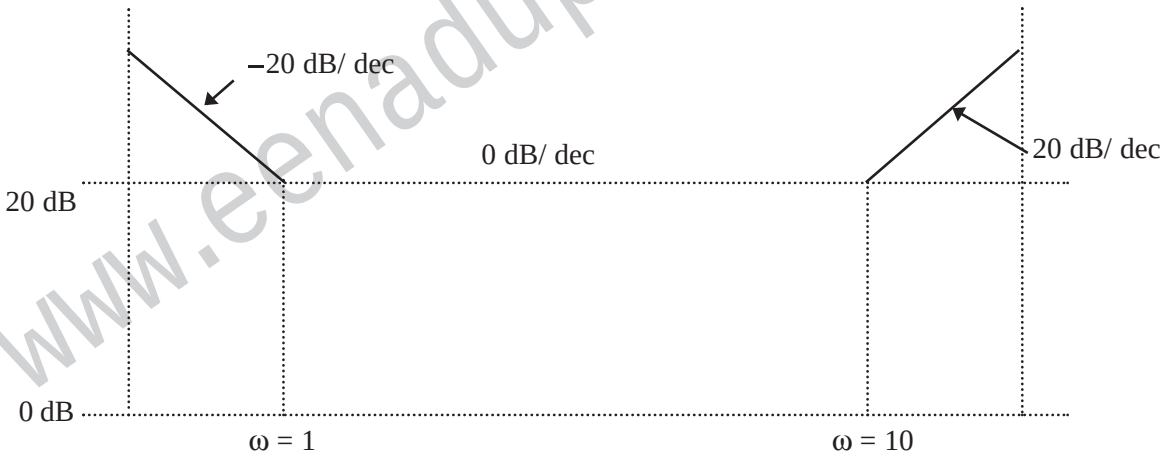
a) 7 < K < 16 b) 0 < k < 16 c) 0 < k < 7 d) K > 0

95. The overall transfer function of the following system is



a) –1 b) Indeterminate c) 1 d) Infinity

96. The magnitude bode plot for a minimum phase transfer function G(s) H(s) is as shown below. The transfer function G(s) H(s) is



a) $\dfrac{10(s+1)(s+10)}{s}$ b) $\dfrac{(s+1)(s+10)}{s}$ c) $\dfrac{S(s+10)}{(s+1)}$ d) $\dfrac{10s(s+10)}{(s+1)}$

97. When the closed loop system is subjected to a step input of magnitude 2, the system response is given by

$y(t) = 2 + 0.4\, e^{-60t} - 2.4\, e^{-10t}$. The closed loop transfer function of this system is

a) $\dfrac{1200}{(s + 10)(s + 60)}$

b) $\dfrac{1200}{s(s + 10)(s + 60)}$

c) $\dfrac{600}{(s + 10)(s + 60)}$

d) $\dfrac{1200}{(s - 10)(s + 60)}$

98. The open loop transfer function of a unity feedback (Positive feedback) system is $G(s) = \dfrac{K}{(s^2 + 1)^2}$.

The system stability according to Routh is

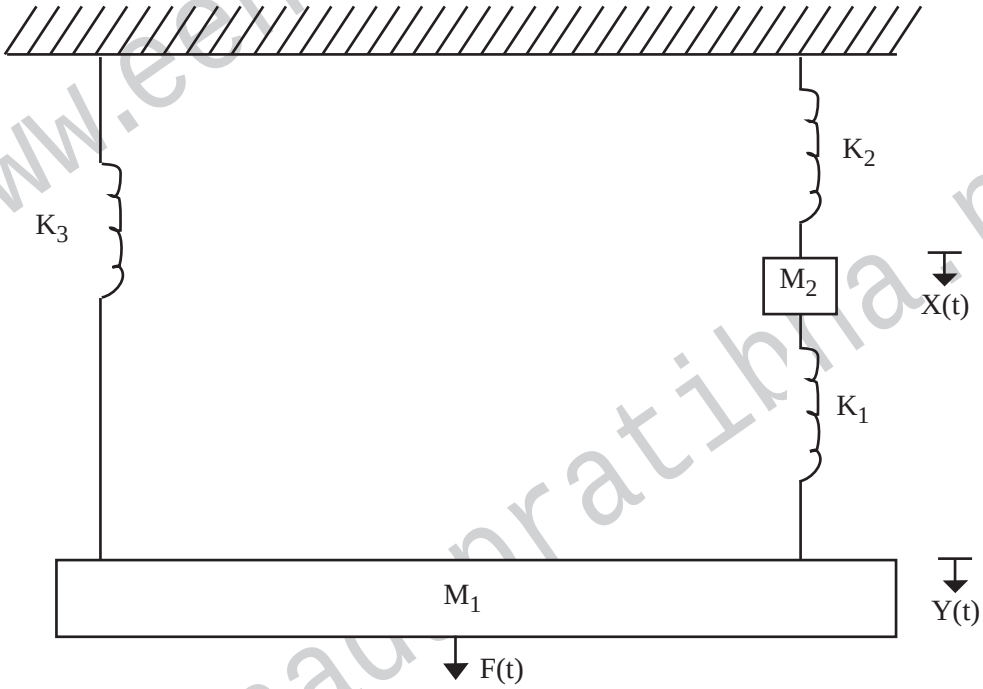
a) Unstable for $K > 0$

b) Stable for $0 < K < 1$

c) Stable for $K > 0$

d) Marginally stable for $0 < K < 1$

99. The mathematical model of an analogous electrical system for the following mechanical system using force current analogy is (i – current, V – voltage, L – Inductance, C – Capacitance)



a) $\dfrac{1}{C_{k1}}\int(i_y - i_x)\,dt = L_{M2}\dfrac{di_x}{dt} + \dfrac{1}{C_{k2}}\int i_x dt,\ V_F(t) = L_{M1}\dfrac{di_y}{dt} + \dfrac{1}{C_{k3}}\int i_y dt + \dfrac{1}{C_{k1}}\int(i_y - i_x)dt$

b) $\dfrac{1}{L_{k1}}\int(i_y - i_x)\,dt = C_{M2}\dfrac{di_x}{dt} + \dfrac{1}{L_{k2}}\int i_x dt,\ V_F(t) = C_{M1}\dfrac{di_y}{dt} + \dfrac{1}{L_{k3}}\int i_y dt + \dfrac{1}{L_{k1}}\int(i_y - i_x)dt$

c) $\dfrac{1}{C_{k1}}\int(v_y - v_x)\,dt = L_{M2}\dfrac{dv_x}{dt} + \dfrac{1}{C_{k2}}\int v_x dt,\ i_F(t) = L_{M1}\dfrac{dv_y}{dt} + \dfrac{1}{C_{k3}}\int v_y dt + \dfrac{1}{C_{k1}}\int(v_y - v_x)dt$

d) $\dfrac{1}{L_{k1}}\int(v_y - v_x)\,dt = C_{M2}\dfrac{dv_x}{dt} + \dfrac{1}{L_{k2}}\int v_x dt,\ i_F(t) = C_{M1}\dfrac{dv_y}{dt} + \dfrac{1}{L_{k3}}\int v_y dt + \dfrac{1}{L_{k1}}\int(v_y - v_x)dt$

100. If the closed loop transfer function T(s) of a unity negative feedback system is given by:

$$T(s) = \frac{a_{n-1} S + a_n}{S^n + n_1 S^{n-1} + ... + a_{n-1} S + a_n}$$ then the steady state error for a unit ramp input is

a) $\frac{a_n}{a_{n-1}}$ b) infinity c) Zero d) $\frac{a_n}{a_{n-2}}$

ANSWERS

1-b; 2-c; 3-a; 4-c; 5-d; 6-a; 7-d; 8-d; 9-d; 10-b; 11-b; 12-b; 13-c; 14-c; 15-c; 16-d; 17-b; 18-b; 19-a; 20-d; 21-b; 22-a; 23-a; 24-c; 25-c; 26-c; 27-c; 28-b; 29-b; 30-b; 31-d; 32-b; 33-d; 34-d; 35-c; 36-a; 37-c; 38-a; 39-d; 40-b; 41-d; 42-c; 43-d; 44-c; 45-c; 46-?; 47-b; 48-c; 49-a; 50-b; 51-c; 52-b; 53-a; 54-c; 55-d; 56-a; 57-b; 58-d; 59-c; 60-d; 61-b; 62-c; 63-c; 64-d; 65-a; 66-d; 67-a; 68-c; 69-c; 70-a; 71-d; 72-c; 73-a; 74-d; 75-d; 76-d; 77-c; 78-b; 79-d; 80-a; 81-c; 82-a; 83-b; 84-d; 85-a; 86-b; 87-c; 88-a; 89-d; 90-c; 91-a; 92-a; 93-b; 94-a; 95-a; 96-b; 97-c; 98-a; 99-d; 100-c.