131/2023

1. The matrix $\begin{bmatrix} 2 & b \\ 3 & 5 \end{bmatrix}$ is symmetric, if the value of b is :

    (A)   3   (B)   2

    (C)   5   (D) −3

2. If minor of 2 in $\begin{bmatrix} 1 & 2 & 1 \\ 3 & 0 & 4 \\ 5 & 1 & b \end{bmatrix}$ is −5, then the value of b is :

    (A)   5   (B)   0

    (C) −5   (D) −4

3. Coefficient of x^3 in $\left(x + \dfrac{1}{x} \right)^5$ is :

    (A)   5   (B)   10

    (C) −5   (D)   1

4. $\sin 30 \cos 15 + \cos 30 \sin 15$ equals :

    (A) $\dfrac{1}{\sqrt{2}}$ (B) $\dfrac{1}{\sqrt{3}}$

    (C) $\dfrac{\sqrt{3}}{2}$ (D)   1

5. If $y = 2x$ and $x = \alpha y$ are perpendicular then α equals :

    (A)   2   (B) $\dfrac{1}{2}$

    (C) −2   (D) $\dfrac{-1}{2}$

6. $\int (\cos^2 x - \sin^2 x)\,dx$ equals :

    (A) $x + c$

    (B) $\dfrac{\sin 2x}{2} + c$

    (C) $-\dfrac{\sin 2x}{2}$

    (D) $\dfrac{\cos 2x}{2} + c$

7. Solution of $\sqrt{x}\,dy + \sqrt{y}\,dx = 0$ is :

    (A) $\sqrt{x} + \sqrt{y} = c$

    (B) $\sqrt{x} - \sqrt{y} = c$

    (C) $x^{\frac{3}{2}} + y^{\frac{3}{2}} = c$

    (D) $\dfrac{1}{\sqrt{x}} + \dfrac{1}{\sqrt{y}} = c$

8. Derivative of $\sin^{-1}(\sin x)$ is :

    (A)   1

    (B) $\tan x$

    (C) -1

    (D) $\cot x$

9. Slope of normal to the curve $x = 2t^2$, $y = 2t$ at $t = 1$ is :

    (A)   2

    (B) $\dfrac{1}{2}$

    (C) -2

    (D) $\dfrac{-1}{2}$

10. Which of the following is true?

    (A)   Every differentiable function is continuous

    (B)   Every continuous function is differentiable

    (C) $\sin\left(\dfrac{1}{x}\right)$ is continuous at $x = 0$

    (D) $|x|$ is differentiable at $x = 0$

11. Workability of fresh concrete is measured by :

    (A)   Flexure test

    (B)   Compaction test

    (C)   Compression test

    (D)   Slump test

12. Increase in volume of a given mass of sand due to the presence of moisture in it is termed as :

    (A)   Specific gravity

    (B)   Bulking

    (C)   Bulk density

    (D)   Porosity

13. Portion of a brick obtained by cutting a brick length-wise into two portions is termed as :

    (A)   Closer   (B)   Queen closer

    (C)   King closer   (D)   Brick bat

14. An offset is laid out at 30° from its true direction on the field. Find the resulting displacement of the plotted point on the paper in a direction parallel to the chain line given that the length of the offset is 25 m and the scale is 10 m to 1 cm:

    (A)   1.250 cm   (B)   2.165 cm

    (C)   0.335 cm   (D)   0.631 cm

15. The consecutive readings taken at points A, B, C, D with a dumpy level at a single station are 5.21, 3.92, 4.12, 7.42. Reduce level at point A is 100 m. reduce level of the point D is :

    (A)   89.75 m   (B)   90.67 m

    (C)   97.79 m   (D)   92.58 m

16. What is the purpose of a spark plug in a four-stroke internal combustion engine?

    (A)   To supply fuel to the engine

    (B)   To ignite the fuel-air mixture

    (C)   To remove exhaust gases from the engine

    (D)   To lubricate the engine

17. How does a diesel engine differ from a gasoline engine in terms of combustion process?

    (A)   Gasoline engines have higher compression ratios

    (B)   Diesel engines do not use spark plugs

    (C)   Gasoline engines use less fuel

    (D)   Diesel engines produce less power

18. Which of the following is NOT a type of internal combustion engine?

    (A)   Two-stroke engine   (B)   Four-stroke engine

    (C)   Rotary engine   (D)   Steam engine

19. What is the function of the carburetor in a gasoline engine?

    (A)   To compress the fuel-air mixture

    (B)   To ignite the fuel-air mixture

    (C)   To mix the fuel with air for combustion

    (D)   To remove exhaust gases from the engine

20. Which of the following is the most common fuel used in thermal power plants?

    (A)   Natural gas   (B)   Coal

    (C)   Nuclear fuel   (D)   Wind energy

21. A series circuit consists of a coil of a resistance 2 Ω and inductance 64 mH and capacitance of 40 μ F. The Q-factor of the circuit at resonance is :

    (A)   20 Ω   (B)   40 Ω

    (C)   60 Ω   (D)   None of the above

22. A coil consists of a resistance of 100 Ω and an inductance of 200 mH. If an alternating voltage v, given by v = 200 sin 500t volts is applied across the coil, the current through the coil is :

    (A)   2 A   (B)   1.5 A

    (C)   1 A   (D)   None of the above

23. Two wattmeters are connected to measure the input power to a balanced three-phase. If the instrument readings are 8 kW and 4 kW, the load power factor is :

    (A)   0.5   (B)   0.866

    (C)   0   (D)   1

24. A d.c source having an open-circuit voltage of 24 V and an internal resistance of 1.2 Ω is connected to a load of resistance R_L. The maximum power dissipated by the load is :

    (A)   100 W   (B)   240 W

    (C)   480 W   (D)   120 W

25. Norton equivalent circuit for the network shown in fig. consists of ————— current source with parallel resistance of —————.


    (A)   9.5A, $\dfrac{2}{3}$ Ω   (B)   9.5A, 1 Ω
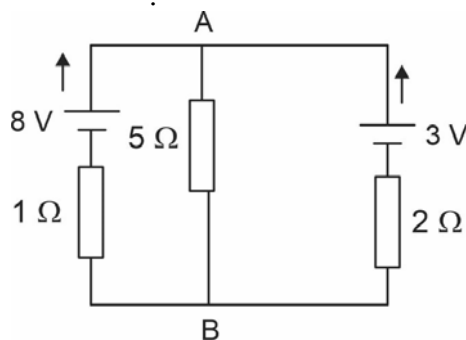
    (C)   6A, 2 Ω   (D)   None of the above

**26.** A point at which two or more elements have a common connection is called :

    (A)   branch   (B)   link

    (C)   node   (D)   tree

27. For a low pass filter, the attenuation is zero throughout the frequency range for which the characteristic impedance is :

    (A)   Purely inductive   (B)   Purely resistive

    (C)   Purely capacitive   (D)   Capacitive and inductive

28. A balanced 3 phase star connected load with $I_R = 5 < 0$, $I_Y = 5 < -120$, $I_B = 5 < 120$. The zero sequence current will be :

    (A)   5 A   (B)   10 A

    (C)   0 A   (D)   None of the above

29. The flux density between two plates separated by mica of relative permittivity 5 is 8.85 μ C/m² voltage gradient between the plates is :

    (A)   200 kV/ m   (B)   20 kV/m

    (C)   0.2 kV/ m   (D)   2 kV/m

30. A straight conductor of 1 m carrying a current of 30 A lies perpendicular to a uniform magnetic field of flux density 0.8 T. The magnitude of force experienced by the conductor is :

    (A)   0 N   (B)   24 N

    (C)   10 N   (D)   15 N

31. A 1-MHz plane wave propagating in fresh water. At this frequency, losses in water are negligible, in water, $\mu_r = 1$ and at 1 MHz, $\epsilon_r' = 81$. The velocity of propagation is :

    (A) 3×10^8 m/s   (B) 0.3×10^7 m/s

    (C) 2×10^8 m/s   (D) 3.3×10^7 m/s

32. The direction of the Poynting vector indicates the direction of the instantaneous —————— at a point.

    (A)   Power flow   (B)   Electric field

    (C)   Magnetic field   (D)   None of the above

33. A capacitor uses a dielectric 0.04 mm thick and operates at 30 V. The electric field strength across the dielectric at this voltage is :

    (A)   15 KV/m   (B)   30 KV/m

    (C)   75 KV/m   (D)   750 KV/m

34. A ceramic capacitor has an effective plate area of 4 cm² separated by 0.1 mm of ceramic of relative permittivity 100. The capacitance of the capacitor is :

(A) 3540 pF   (B) 35.4 pF

(C) 354 pF   (D) 400 pF

35. A 10 V battery is connected across a load having a resistance of 20 Ω. The energy dissipated in 2 minutes is :

(A) 100 J   (B) 300 J

(C) 500 J   (D) 600 J

36. Value of voltage V shown in fig is :
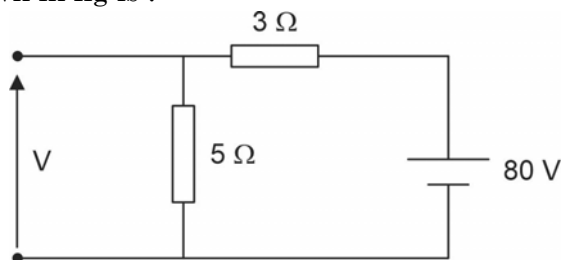
(A) 30 V   (B) 50 V

(C) 40 V   (D) 24 V

37. An e.m.f. of 2kV is induced in a coil when a current of 2 A collapses uniformly to zero in 4ms. The inductance of the coil is :

(A) 40 mH   (B) 4 mH

(C) 4 H   (D) 0.4 H

38. A series RC circuit takes 250 watts at a power factor of 0.5 from a 100 V, 50 Hz supply. The impedance of the circuit is :

(A) 50 Ω   (B) 20 Ω

(C) 10 Ω   (D) None of the above

39. For the circuit shown in fig reading of the ammeter is :
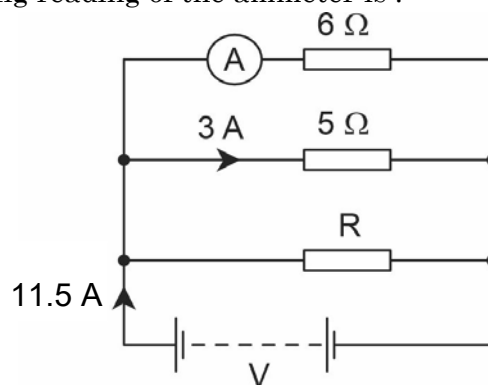
(A) 8.5 A   (B) 3 A

(C) 2.5 A   (D) 5.5 A

40. Emitter follower amplifier has :
  - (A) Low input resistance and low output resistance
  - (B) High input resistance and low output resistance
  - (C) Low input resistance and high output resistance
  - (D) High input resistance and high output resistance

41. The factors which affects the operating point stability are :
  - (A) Temperature
  - (B) Aging of transistor
  - (C) Transistor parameters
  - (D) All the above factors

42. When the input to class C amplifier is a sine wave, the output current will flow?
  - (A) Half the cycle
  - (B) More than half cycle
  - (C) Less than half cycle
  - (D) Full cycle

43. The reduction in voltage gain in the low frequency region of an RC coupled amplifier is due to the presence of :
  - (A) Coupling capacitor
  - (B) Output shunt capacitance
  - (C) Voltage divider biasing
  - (D) Input shunt capacitance

44. An amplifier has a voltage gain of 100. To reduce distortion 5% negative feedback is employed. The gain of the amplifier with feedback is :
  - (A) 16.67
  - (B) 5
  - (C) 50
  - (D) 6.67

45. RC phase shift oscillator employing BJT has angular frequency of oscillation ω, $(n = R_c / R)$:
  - (A) $\dfrac{1}{RC}$
  - (B) $\dfrac{3}{RC} \cdot \dfrac{1}{\sqrt{6 + 4n}}$
  - (C) $\dfrac{1}{RC} \cdot \dfrac{1}{\sqrt{29}}$
  - (D) $\dfrac{1}{RC} \cdot \dfrac{1}{\sqrt{6 + 4n}}$

46. In the given circuit, $V_a = +4\,V$, $V_b = +1V$, R1, R2, R3 and $Rf = 1K$ $R1 = 10K$, V_o will be :
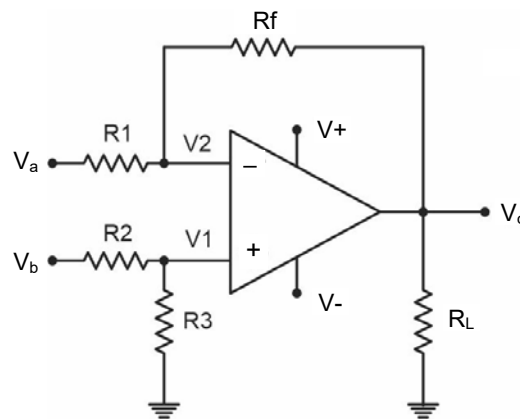
Differential amplifier using one op-amp

  - (A) +3V
  - (B) −3V
  - (C) +5V
  - (D) −5V

47. An Op-Amp circuit which converts sine wave signal into square wave signal :

(A) Multivibrator
(B) Wein bridge oscillator
(C) Schmitt trigger
(D) Integrator

48. FIR filters will have transfer function with :

(A) Only poles
(B) Only zeroes
(C) Poles and zeroes
(D) Only constants

49. The time period of free running multivibrator output cycle of 555 astable multivibrator is :

(A) 1.4/(Ra+Rb)C1
(B) 693/(Ra+2Rb)C1
(C) 0.693*(Ra+2Rb)C1
(D) 1.4*(Ra+2Rb)C1

50. A voltage regulator experiences a 10 μV change in its output voltage when its input voltage changes by 2V. What is the line regulation rating of the circuit :

(A) 2 μV/V
(B) 0.2 μV/V
(C) 5 μV/V
(D) 10 μV/V

51. In 8051 microcontroller, what is the contents of register A after the execution of the following code :

CLR A

ORL #99H

CPL A

(A) 66H
(B) 99H
(C) 00H
(D) 69H

52. A microprocessor with 12 address lines is capable of addressing :

(A) 1024 locations
(B) 2048 locations
(C) 3024 locations
(D) 4096 locations

53. A single phase full wave mid point thyristor converter uses a 230/200V transformer with centre tap on secondary side. The PIV per thyristor is :

(A) 100 V
(B) 141.4 V
(C) 200 V
(D) 282.8 V

54. Gain modulated field effect transistor is also known as :

    (A)   BJT   (B)   MOSFET

    (C)   IGBT   (D)   SCR

55. The typical quiescent power dissipation of low power CMOS units is :

    (A)   2nW   (B)   0.5 μ W

    (C)   1 mW   (D)   3 mW

56. Find the sampling interval for $\sin(2\pi t)$:

    (A)   1 sec   (B)   4 sec

    (C)   0.5 sec   (D)   1.5 sec

57. The ideal SNR of 8 bit ADC is :

    (A)   49.92 dB   (B)   3 dB

    (C)   99.84 dB   (D)   1 dB

58. In which memory the program data for the currently executing program will be stored :

    (A)   Auxiliary memory   (B)   RAM

    (C)   ROM   (D)   Cache memory

59. A 200/400 V, 50Hz, two winding transformer is rated at 20 kVA. Its windings are connected as an auto-transformer of rating 200/600V. The power rating of the autotransformer is :

    (A)   10 kVA   (B)   20 kVA

    (C)   30 kVA   (D)   40 kVA

60. In a 200/100 V, 50 Hz transformer, 150V and 75Hz is applied to the primary side. Assuming that the magnetic circuit will remain unsaturated, the flux density will change to :

    (A)   2.25 times   (B)   2 times

    (C)   0.5 times   (D)   remain unchanged

61. A 400/115 V delta/star transformer has 2A third harmonic current in all the three secondary phases. What is the magnitude of third harmonic line current on the primary side?

    (A)   zero   (B)   0.58 A

    (C)   1A   (D)   1.73 A

62. The dc motor, which can provide zero speed regulation at full load without any controller is :

(A) series (B) shunt

(C) cumulative compound (D) differential compound

63. The series field winding terminals of a differentially compounded dc generator are externally shorted. Then the output terminal voltage will :

(A) increase (B) decrease

(C) reduce to residual voltage (D) become zero

64. A 220V dc motor produces 40 Nm torque at an armature current is 10 A. When the armature current is 15 A, the developed torque will be

(A) 49 Nm (B) 60 Nm

(C) 90 Nm (D) 135 Nm

65. An alternator has 12 slots per pole and the first coil lies in slot 1 and 11. Then the pitch factor for the winding is :

(A) cos 0° (B) cos 15°

(C) cos 22.5° (D) cos 30º

66. An alternator generates 400V, 50 Hz when excited with 5A field current. Assuming the magnetic circuit is unsaturated, the generated voltage when operating at 40 Hz and 4A field current is :

(A) 400 V (B) 320 V

(C) 256 V (D) 200 V

67. A three phase, salient pole synchronous generator is connected to an infinite bus. It is operated at half full load and under excited condition. Then the operation of the generator will be at :

(A) close to unity power factor (B) low lagging power factor

(C) low leading power factor (D) close to zero power factor

68. Distributed winding and short chording employed in AC machines will result in :

(A) increase in emf and reduction in harmonics

(B) reduction in emf and increase in harmonics

(C) increase in both emf and harmonics

(D) reduction in both emf and harmonics

69. A three-phase 415 V, 6 pole, 50 Hz, squirrel cage induction motor is running at a slip of 5%. The speed of stator magnetic field relative to the rotor magnetic field is :

    (A) Zero   (B) 50 rpm

    (C) 950 rpm   (D) 1000 rpm

70. The full load slip of an induction motor depends on :

    (A) Stator copper loss   (B) Rotor copper loss

    (C) Synchronous speed   (D) None of the above

71. A three-phase cage induction motor is started by Direct-On-Line (DOL) switching at the rated voltage. If the starting current drawn is 5 times the full load current, and the full load slip is 5%. then ratio of the starting developed torque to the full load torque is approximately equal to :

    (A) 2.24   (B) 1.25

    (C) 1.56   (D) 0.25

72. By design, what is the phase difference between the currents in the main winding and auxiliary winding in a capacitor start single phase induction motor?

    (A) 45 degrees   (B) 90 degrees

    (C) 120 degrees   (D) 180 degrees

73. A 150 MW power station delivers 150 MW for 2 hours, 100 MW for 7 hours and is shut down for rest of the hours of each day. Calculate the annual load factor if the plant is shut down for 25 days for maintenance work in a year :

    (A) 20.56%   (B) 30.5%

    (C) 27.78%   (D) 23.33%

74. When Sag is increased on the OH lines?

    (A) Repair can be done easily   (B) String efficiency is decreased

    (C) String efficiency is increased   (D) Tension is decreased

75. A load of 15000 kW with load current 80A is delivered by a 3 phase transmission line having conductors each of resistance $1\,\Omega$/km. Calculate the distance over which load is delivered with a transmission loss of 6% :

    (A) 46.88 km   (B) 37.83 km

    (C) 14.06 km   (D) 39.45 km

76. Current chopping occurs in :

(A) Bulk oil circuit breaker (B) Air blast circuit breaker

(C) Minimum oil circuit breaker (D) All the above

77. The equal area criteria is used to obtain information about :

(A) transient stability (B) swing curves

(C) reactive power limit (D) short circuit current limit

78. The positive sequence and negative sequence voltages are equal in a :

(A) line to line fault (B) single line to ground fault

(C) symmetrical fault (D) double line to ground fault

79. Calculate the plug setting multiplier of a 6A over current relay having a current setting of 150%, connected to a supply circuit through 420/6A CT when the circuit carries a fault current of 4200A :

(A) 6.67 (B) 4.6

(C) 8 (D) 8.32

80. The voltage magnitude and voltage phase angle are specified in a :

(A) Load bus (B) Generator bus

(C) Swing bus (D) Voltage controlled bus

81. Find the number of revolutions made by a single phase energy meter when used to measure the energy consumption by a 230 V, 0.8 pf, 10A load for 2 hours if the energy meter constant is 750?

(A) 1440 (B) 1540

(C) 1480 (D) 1380

82. Calculate the flux density of a moving coil voltmeter with $10\,\Omega$ resistance which gives full scale deflection for 50mV. The coil has 4 cm length and 2 cm breadth and is wound for 75 turns. The controlling torque produced for full scale deflection is 55×10^{-6} N-m.

(A) $0.4\ \text{Wb/m}^2$ (B) $0.183\ \text{Wb/m}^2$

(C) $0.312\ \text{Wb/m}^2$ (D) $0.451\ \text{Wb/m}^2$

83. The output voltage of a piezo electric crystal is 240V when it is subjected to a pressure of 2×10^6 N/m². Calculate its voltage sensitivity if the crystal has a thickness of 3mm.

(A) 25 (B) 0.16

(C) 0.04 (D) 2.8

84. Which bridge is preferred for measuring the inductance of high Q coils?

   (A) Maxwell's bridge   (B) Hay's bridge

   (C) Anderson bridge   (D) Wien bridge

85. There are 4 horizontal and 3 vertical tangencies in a lissajous pattern on an oscilloscope. If frequency of the horizontal input is 150 Hz, find the frequency of the vertical input :

   (A) 120 Hz   (B) 162 Hz

   (C) 150 Hz   (D) 200 Hz

86. In real time sampling data acquisition system, the bandwidth is limited to :

   (A) $\dfrac{f_s}{4}$ (B) $\dfrac{f_s}{2}$

   (C) $2f_s$ (D) f_s

87. Identify the unity feedback system with transfer, whose characteristic equation has root locus that exist for the entire portion of negative real axis in s-plane :

   (A) $\dfrac{k(s^2 + 2s + 1)}{(s+2)^2(s+10)}$ (B) $\dfrac{k(s^2 + 2s + 2)}{(s+2)^2(s+10)}$

   (C) $\dfrac{k(s+2)^2}{s(s^2 + 2s + 2)(s+10)}$ (D) $\dfrac{k(s+2)^2}{s(s^2 + 2s + 2)}$

88. Which transfer function has the bode gain plot as shown in figure below :
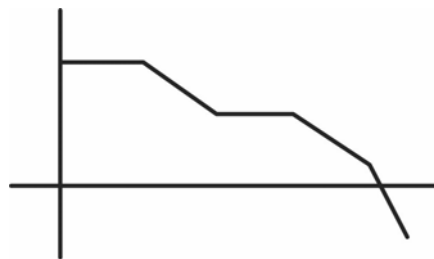
   (A) $\dfrac{k(s+5)}{(s+1)(s+10)(s+20)}$ (B) $\dfrac{k(s+5)(s+10)}{s(s+1)(s+20)}$

   (C) $\dfrac{k(s+5)}{s(s+1)(s+20)}$ (D) $\dfrac{k(s+10)(s+20)}{(s+1)(s+5)(s+50)}$

89. Identify the no. of roots of the characteristic equation lie on the imaginary axis.
$s^7 + 6s^6 + 11s^5 + 6s^4 + 4s^3 + 24s^2 + 44s + 24 = 0$:

    (A)   0   (B)   2

    (C)   4   (D)   6

90. Determine the approximate gain margin for the system with open loop transfer function $\dfrac{10}{s(s+1)^2}$.

    (A)   40 dB   (B)   20 dB

    (C)   −40 dB   (D)   −20 dB

91. The behaviour of a unity feedback system with open loop transfer function $\dfrac{40(s+1)^2}{s(s-1)^2(s+10)}$.

    (A)   Stable   (B)   Unstable

    (C)   Oscillatory   (D)   Cannot predict stability.

92. Identify the kind of singular point at the origin of the system $\dot{x}_1 = x_2 \quad \dot{x}_2 = \sin(x_1) - x_2$

    (A)   Focus   (B)   Node

    (C)   Saddle point   (D)   Center

93. Suggest which among the following frequency be used to sample the signal given below.
$y(t) = 10\sin(10t) + 2.5\sin(314t) + 3.76\cos(1000t)$.

    (A)   5 Hz   (B)   10 Hz

    (C)   200 Hz   (D)   1000 Hz

94. The system $\dot{x} = \begin{bmatrix} 1 & 1 \\ -6 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ -2 \end{bmatrix} u \quad y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$ is

    (A)   Stable and completely state controllable

    (B)   Unstable but completely state controllable

    (C)   Stable but not completely state controllable

   (D)   Unstable and not completely state controllable

95. Compute the time required to settle the unit step response of the system with closed loop transfer function $\dfrac{1}{s^2 + 4s + 8}$.

(A)   0.5s

(B)   2s

(C)   3s

(D)   4s

96. Identify the natural frequency in the response of the system with closed loop transfer function $\dfrac{16}{s^2 + 3s + 9}$.

(A)   2 rad/s

(B)   3 rad/s

(C)   4 rad/s

(D)   5 rad/s

97. Determine the transfer function $\dfrac{Y(s)}{U(s)}$ for the system shown below :
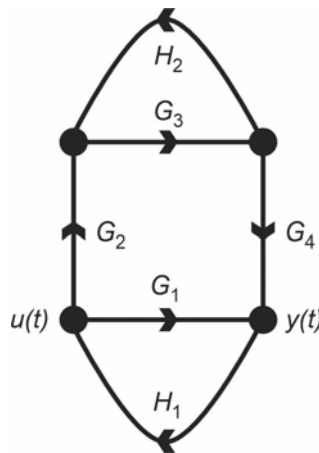

(A) $\dfrac{G_1 - G_1 G_3 H_2 + G_2 G_3 G_4}{1 - G_3 H_2 - G_2 G_3 G_4 H_1 - G_1 H_1 + G_1 G_3 H_1 H_2}$

(B) $\dfrac{G_1 + G_2 G_3 G_4}{1 - G_3 H_2 - G_2 G_3 G_4 H_1 - G_1 H_1}$

(C) $\dfrac{G_1 + G_2 G_3 G_4}{1 - G_3 H_2 - G_2 G_3 G_4 H_1 - G_1 H_1 + G_1 G_3 H_1 H_2}$

(D) $\dfrac{G_1 - G_1 G_3 H_2 + G_2 G_3 G_4}{1 - G_3 H_2 - G_2 G_3 G_4 H_1 - G_1 H_1}$

98. The Nyquist plot of a system, whose open loop transfer function has one pole and two zeros lie to the right of the imaginary axis in s-plane, is shown below. The closed loop system is :
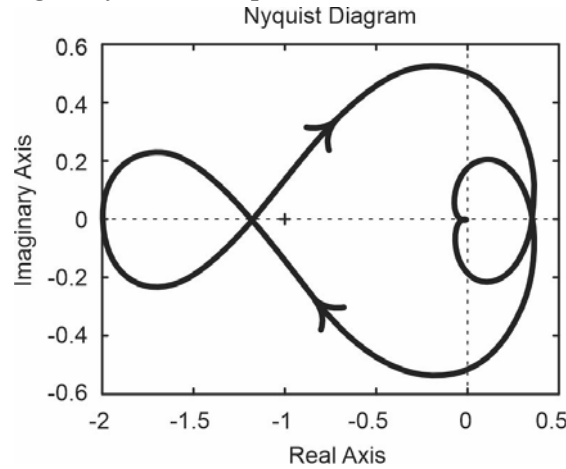
(A) Stable

(B) Unstable with one pole to the right of imaginary axis

(C) Unstable with two pole to the right of imaginary axis

(D) Unstable with three pole to the right of imaginary axis

99. Suggest a suitable controller / compensator for the system with open loop transfer function $\dfrac{10}{s(s+1)}$ to achieve a phase margin of 40° at 1 rad/s with a velocity error constant of atleast 10.

(A) Proportional Controller

(B) PD Controller

(C) Lag

(D) Lead

100. Identify whether the system exhibits limit cycle, if it exhibits determine the nature and frequency of limit cycle. The nonlinearity is a saturation with unity gain for the linear region and saturation occurs at ±1.
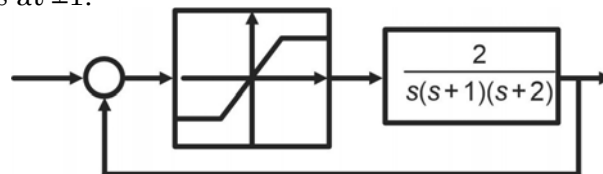
(A) Exhibit stable limit cycle of frequency $\sqrt{2}\ rad\,/\,s$

(B) Exhibit unstable limit cycle of frequency $\sqrt{2}\ rad\,/\,s$

(C) Exhibit semi stable limit cycle of frequency $\sqrt{2}\ rad\,/\,s$

(D) No limit cycle exist

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SPACE FOR ROUGH WORK

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