051/23

Question Booklet Alpha Code

A

A

Question Booklet Sl. No.

Total Number of Questions : 100 **Time : 90 Minutes**

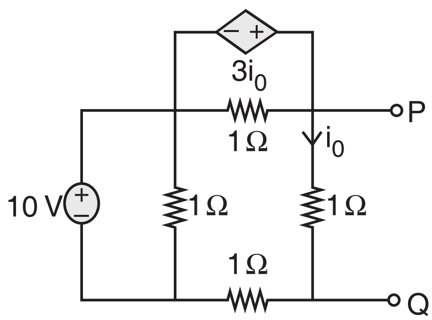
Maximum Marks : 100

INSTRUCTIONS TO CANDIDATES

1. The Question Paper will be given in the form of a Question Booklet. There will be four versions of Question Booklets with Question Booklet Alpha Code viz. **A, B, C** & **D**.
2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the Question Booklet.
3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.
4. If you get a Question Booklet where the alpha code does not match to the allotted alpha code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.
5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your Question Booklet is un-numbered, please get it replaced by new Question Booklet with same alpha code.
6. The Question Booklet will be sealed at the middle of the right margin. Candidate should not open the Question Booklet, until the indication is given to start answering.
7. Immediately after the commencement of the examination, the candidate should check that the Question Booklet supplied to him/her contains all the 100 questions in serial order. The Question Booklet does not have unprinted or torn or missing pages and if so he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same alpha code. This is most important.
8. A blank sheet of paper is attached to the Question Booklet. This may be used for rough work.
9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**
10. Each question is provided with four choices **(A), (B), (C)** and **(D)** having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball Point Pen in the OMR Answer Sheet.
11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**
12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.
13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

A

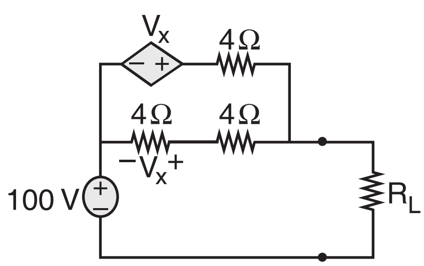
1. For the circuit shown in the figure, the Thevenin equivalent resistance (in Ω) across P-Q is



A) – 1 B) 1

C) 0.5 D) – 0.5

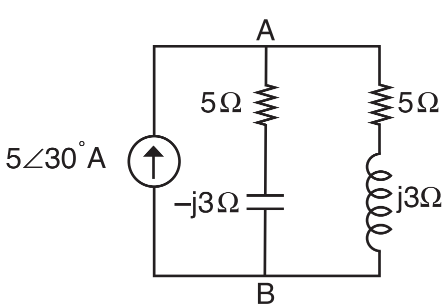
2. In the circuit shown what value of R_L minimizes the power delivered to R_L ?



A) 2.4Ω B) $\frac{8}{3}\Omega$

C) 4Ω D) 6Ω

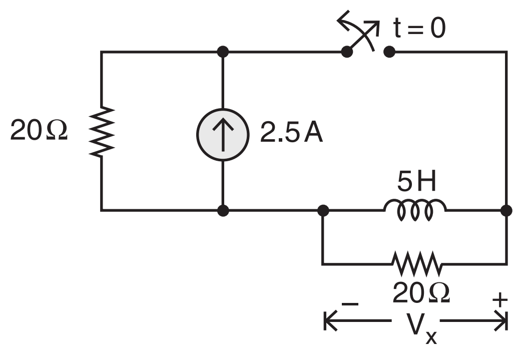
3. In the AC network shown in the figure, the phasor voltage V_{AB} (in volts) is



A) 0 B) 5∠30°

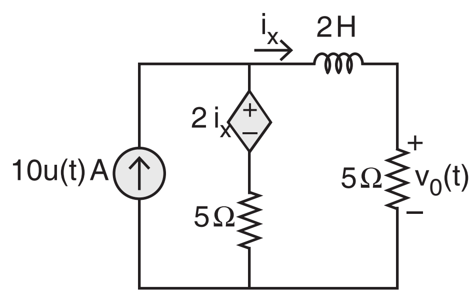
C) 12.5∠30° D) 17∠30°

4. In the figure, the switch was closed for a long time before opening at t = 0. The voltage V_x at $t = 0^+$ is



A) 25 V B) – 50 V C) 50 V D) 0 V

5. For the circuit shown in figure, the value of $v_0(t)$ (in volts) for $t \rightarrow \infty$ is



A) 31.25 B) 33.25 C) 25.31 D) 25.33

6. If capacitor is energized by symmetrical square wave current source, then the steady-state voltage across the capacitor will be a

A) Square wave B) Step function

C) Triangular wave D) Impulse function

7. In a linear circuit the superposition principle can be applied to calculate the

A) Voltage and Current

B) Voltage and Power

C) Current and Power

D) Voltage, Current and Power

8. The poles and zeros of a driving-point function of a network are simple and interlace on the negative real axis with a pole closed to the origin. It can be realized

   A) As an LC driving-point impedance

   B) As an RC driving-point impedance

   C) As an LC driving-point admittance

   D) As an RC driving-point admittance

9. In a non-degenerate bulk semiconductor with electron density $n = 10^{16}$ cm^{-3}, the value of $E_c - E_{Fn} = 200meV$. Assume the thermal voltage is 26 meV and the intrinsic carrier concentration is 10^{10} cm^{-3}. For $n = 0.5 \times 10^{16}$ cm^{-3}, the closest approximation of the value $(E_c - E_{Fn})$ is

   A) 182 meV B) 174 meV

   C) 218 meV D) 226 meV

10. Drift current in semiconductors depends upon

    A) Only the electric field

    B) Only the carrier concentration gradient

    C) Both the electric field and carrier concentration

    D) Both the electric field and carrier concentration gradient

11. Consider the following statements regarding MOS circuit design process.

    1. MOS circuits are formed on four basic layers n-diffusion, p-diffusion, polysilicon and metal; which are isolated from one another by thick or thin silicon dioxide insulating layers.
    2. Thin oxide (Thinox) mask region includes n-diffusion and p-diffusion and transistor channel.
    3. Polysilicon and thinox regions interact so that a transistor is formed where they cross one another.

    Which of the above statements are correct ?

    A) 1 and 2 only B) 1 and 3 only

    C) 2 and 3 only D) 1, 2 and 3

12. Consider the nMOS transistor in a 65 nm process with a nominal threshold voltage of 0.3 V and a doping level of 8×10^{17} cm^{-3}. The body is tied to the ground with a substrate contact. How much does the threshold change at room temperature if the source is at 0.6 V instead of 0 ?

A) 0.04 V
B) 1.04 V
C) 0.06 V
D) 1.06 V

13. For an n-channel enhancement type MOSFET, if the source is connected at a higher potential than that of the bulk (i.e., $V_{SB} > 0$), the threshold voltage V_T of the MOSFET will

A) Remain unchanged
B) Decreases
C) Change polarity
D) Increase

14. What is the minimum threshold voltage for which the leakage current through an OFF transistor ($V_{gs} = 0$) is 10^3 times less than that of a transistor that is barely ON ($V_{gs} = V_t$) at room temperature if n = 1.5 ?

A) 234 mV
B) 270 mV
C) 243 mV
D) 207 mV

15. In CMOS inverter if $V_{tn} \leq V_{in} < V_{DD}/2$ then the following is behaviour of the inverter

A) p-MOS linear, n-MOS saturated
B) p-MOS linear, n-MOS linear
C) p-MOS saturated, n-MOS saturated
D) p-MOS saturated, n-MOS linear

16. The difficulty in achieving high doping concentration leads to

A) Error in concentration
B) Error in variation
C) Error in doping
D) Distribution error

17. The advantage of NORA CMOS logic is that

A) A static CMOS inverter is not required at the output of every dynamic logic stage. Instead, direct coupling of logic blocks is feasible by alternating nMOS and pMOS logic blocks.

B) A static CMOS inverter is required at the output of every dynamic logic stage. Instead, indirect coupling of logic blocks is feasible by alternating nMOS and pMOS logic blocks.

C) A static CMOS inverter is not required at the output of every dynamic logic stage. Instead, indirect coupling of logic blocks is feasible by alternating nMOS and pMOS logic blocks.

D) A static CMOS inverter is required at the output of every dynamic logic stage. Instead, direct coupling of logic blocks is feasible by alternating nMOS and pMOS logic blocks.

18. Consider a process with a subthreshold slope of 100 mV/decade and a DIBL coefficient of 0.15. How far must the power supply droop to cut subthreshold leakage by a factor of 2 ?

A) 100 mV
B) 150 mV
C) 175 mV
D) 200 mV

19. A CE amplifier has a resistor R_F connected between collector and base, R_F = 40k R_C = 4k. If h_{fe} = 50, r_{ϖ} = 1k, then output resistance R_O is

A) 40kΩ
B) 20kΩ
C) 4kΩ
D) 0.66kΩ

20. An amplifier has a open loop gain of 100, an input impedance of 1kΩ, and an output impedance of 100Ω. If a feedback network with a feedback factor of 0.99 is connected in voltage series feedback mode, then new input and output impedance are

A) 10Ω and 1Ω
B) 10Ω and 10kΩ
C) 100kΩ and 1Ω
D) 100kΩ and 10kΩ

21. If a differential amplifier has a differential gain of 20000. CMRR = 80dB, then common mode gain is

A) 2
B) 1
C) ½
D) 0

22. An Op-Amp has a slew rate of 5V/μs. The largest sine wave output voltage possible at a frequency of 1MHz is

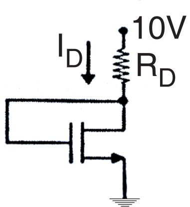
A) 10π volts B) 5 volts C) $\frac{5}{\pi}$ volts D) $\frac{5}{2\pi}$ volts

23. A 10-bit A/D converter is used to digitize an analog signal in the 0V to 5V range. The maximum peak to peak ripple voltage that can be allowed in the d.c supply voltage is

A) Nearly 100 mV B) Nearly 50 mV

C) Nearly 25 mV D) Nearly 5 mV

24. An analog voltage is in the range of 0 to 8V, is divided in eight intervals for conversion to 3-bit digital output. The maximum quantization error is

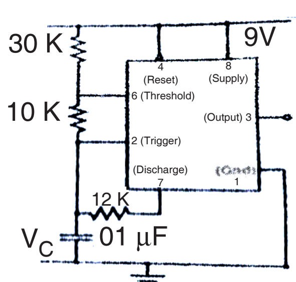


A) 0V B) 0.5V C) 1V D) 2V

25. For the n-channel enhancement MOSFET shown in the given figure, threshold voltage V_{th} = 2V. The Drain current I_D of the MOSFET is 4mA when the drain resistance R_D is 1KΩ. If the R_D is increased to 4KΩ, then the drain current I_D will become

A) 2.8 mA B) 2mA C) 1.4mA D) 1mA

26. An astable multivibrator circuit using IC 555 timer is shown below. Assume that the circuit is oscillating steadily. The voltage V_C across the capacitor varies between



A) 3V to 5V B) 3V to 6V

C) 3.6V to 6V D) 3.6V to 5V

27. The steps involved in the FPGA implementation process are Mapping, Translate, Place and Route. Arrange these implementation steps in the sequence they are performed.

A) Translate, Place, Mapping and Route

B) Translate, Place, Route and Mapping

C) Translate, Mapping, Place and Route

D) Mapping, Translate, Place and Route

28. The Boolean expression y(A, B, C) = A + BC is to be realized using 2-input gates of only one type. What is the minimum number of gates required for realization ?

A) 1 B) 3 C) 2 D) 4 or more

29. Find the complement of the expression $y(A, B, C) = ABC + AB\overline{C} + \overline{A}\,\overline{B}C + \overline{A}BC$

A) $(A + \overline{B})(A + \overline{C})$ B) $(\overline{A} + B)(A + C)$

C) $(A + \overline{B})(\overline{A} + C)$ D) $(\overline{A} + \overline{B})(A + \overline{C})$

30. Measuring units of the figure of merit

A) Pico newton B) Pico watts

C) Pico joules D) Pico pascal

31. The number of distinct Boolean expressions of 3 variables

A) 8 B) 256 C) 128 D) 64

32. A certain JK FF has t_{pd} = 10 ns. The largest MOD counter that can be constructed from such FFs and still operate up to 20 MHz is

A) 32 B) 64 C) 16 D) 8

33. Among the digital IC-families, which of the following statements are false ?

i. ECL is a non-saturated logic family.

ii. HTL has the biggest noise margin.

iii. CMOS has the Highest fanout.

A) Only ii B) i and ii

C) ii and iii D) None

34. The minimal function that can detect a "divisible by 4" 8421 BCD code digit (representation is $D_3D_2D_1D_0$) is given by

A) $F = \overline{D}_1\overline{D}_0$

B) $F = \overline{D}_3\overline{D}_2$

C) $F = D_2 + \overline{D}_1\overline{D}_0$

D) $F = \overline{D}_1 + \overline{D}_0$

35. Thumb technology in ARM processor is used to

A) create variable length instruction set

B) to make address field variable

C) to assign address to I/O devices dynamically

D) to incorporate dynamic branch prediction

36. Bit 7 of CPSR of ARM processor is

A) Cumulative saturation flag

B) Asynchronous abort disable bit

C) Interrupt disable bit

D) Endianness execution state bit

37. Dispatch Latency is

A) the time interval between start and end of execution of a task

B) the time interval between termination of one task and starting of another task

C) time taken by an instruction in the execution unit

D) time taken by an instruction from fetching to execution state

38. A CISC is not characterized with

A) Complex addressing modes

B) Very large instructions

C) More general-purpose registers

D) Multiple clock cycles for instruction execution

39. How is baud rate modified in 8051 ?

A) Using LSB of SCON register

B) Using MSB of PCON register

C) Using MSB of TCON register

D) Using MSB of TMOD register

40. Cycle stealing is used to

A) Accessing computer memory/bus

B) Service interrupts

C) Reserve computer memory/bus

D) To reduce cycles/instructions

41. Memory space from 80H to F8H in 8051 processor are reserved for

A) ROM B) RAM C) SFR D) ISR

42. Given $X_e(t) = 1/2[x(t) + x(-t)]$ is the even signal component of

A) $x(t) = \sin(\sin\left(\frac{\pi t}{T}\right), -T \leq t \leq T$

B) $x(t) = \sin\left(\frac{\pi t}{T}\right), -T \leq t \leq T$

C) $x(t) = \cos\left(\frac{\pi t}{T}\right), -T \leq t \leq T$

D) $x(t) = \tan\left(\frac{\pi t}{T}\right), -T \leq t \leq T$

43. Given signal $x(t) = e^{-2t} \cos(2\pi t)$ is

A) Periodic

B) Periodic with fundamental period of 2 samples

C) Non Periodic

D) Linear

44. The fundamental period of the given sinusoidal signal $x[n] = 10\cos\left(\left(\frac{4\pi n}{31}\right)+\left(\frac{\pi}{5}\right)\right)$ is

A) 5 samples B) 30 samples C) 10 samples D) 31 samples

45. The Fourier representation of $x(t) = e^{-t}\cos(2\pi t)\,u(t)$

A) DTFS B) DTFT C) FS D) FT

46. The impulse response of a LTI system is $h(n) = (1/2)^n u[n]$. The output of this system is ____________ when the input given is $x[n] = 2(-1/2)^n u[n]$.

A) $y[n] = (1/2)^n u[n] + (-1/2)^n u[n]$

B) $y[n] = (-1/2)^n u[n] + (-1/2)^n u[n]$

C) $y[n] = 2(1/2)^n u[n] + (-1/2)^n u[n]$

D) $y[n] = (1/2)^n u[n] + 2(-1/2)^n u[n]$

47. The forced response of the given system described by $y[n] + 3y[n-1] = x[n] + x[n-1]$ is

A) $-6(-3)^n u[n]$

B) $-3(-6)^n u[n]$

C) $4/7(-3)^n u[n]$

D) $4/7(-3)^n u[n] + 3/7(1/2)^n u[n]$

48. ____________ pulse plays a key role in digital communication.

A) Saw tooth

B) Triangle

C) Rectangle

D) Square

49. The approach used in the design of analog and digital filters

A) Direct digital

B) Analog

C) Analog to digital

D) All the above

50. For the given transfer function of band pass filter $0.1s/(s^2 + 0.1s + 1)$, the mid-band frequency and bandwidth are

A) 1 & 1 B) 0.1 & 1 C) 1 & 0.1 D) 0.1 & 0.1

51. 1. Unfiltered speech signal is harsh.

2. Filtered speech signal is soft.

A) 2 is contrast to 1

B) 2 is correlation with 1

C) 2 is same as 1

D) None of the above

52. The magnitude of vector A : $(A_x a_x + A_y a_y + A_z a_z)/(A^2x + A^2y + A^2z)^{1/2}$ is ________ $(A_r a_r + A_\theta a_\theta + A_\varnothing a_\varnothing)/(A^2r + A^2y + A^2\varnothing)^{1/2}$.

A) Lesser than
B) Greater than
C) Not related
D) Same as

53. Given Vector A = $(-3a_r + 2a_\theta + 1a_\varnothing)$ is _________ to Vector B = $(5a_r + 6a_\theta + 3a_\varnothing)$.

A) Not related
B) At an angle 45 degree
C) Perpendicular
D) Parallel

54. ___________ is defined as the total flux out of a closed surface is equal to the net charge within the surface.

A) Coulomb's Law
B) Gauss's Law
C) Newton Law
D) Ohms Law

55. The Electric field E is ____________ to the electric equipotential lines.

A) Parallel
B) Normal
C) At an angle of 20 degree
D) Not related

56. The insertion of displacement current in Ampere's law is basically done to

A) Satisfy equation of continuity
B) Satisfy Gauss's law
C) Satisfy Faraday's Law
D) Satisfy Coulomb's law

57. Lenz's law is applicable for

A) Closed loop
B) Open loop
C) Both closed and open loop
D) None of the above

58. When an equivalent T – network in a equivalent circuit of a transmission line is replaced by equivalent π – network

A) The value of circuit impedance will change
B) The value of propagation constant will change
C) The telegrapher line equation remains same
D) The telegrapher line equation will change

59. The propagation of electromagnetic wave is in (–Z) direction, if electric field component is along ____________ and magnetic field component is along __________ direction.

A) Y & X B) X & Y C) Y & Y D) X & X

60. An inductance of 0.1 nH at 10 GHz represents a reactance of

A) 6.28 ohms B) 6.00 ohms C) 0.6 ohms D) 0.66 ohms

61. A capacitance of 0.1 pF at 10 GHz has a reactance of

A) 129 ohms B) 139 ohms C) 149 ohms D) 159 ohms

62. In a transmission line, __________ is the attenuation due the conductor loss for the given R_1 and R_2 and Zc.

A) $R_1 + R_2/2Zc$ B) $R_1 + R_2/Zc$ C) R_1/Zc D) R_2/Zc

63. Bethe-hole coupler consists of __________ rectangular waveguides.

A) 4 B) 8

C) 2 D) None of the above

64. What is the coherence bandwidth when a radio channel is characterized by 4 millisecond multipath spread ?

A) 200 Hz B) 500 Hz C) 250 Hz D) 250 KHz

65. For the given coherence time of 100 sec, the Doppler Spread is equal to

A) 0.01 Hz B) 0.001 Hz

C) 0.1 Hz D) None of the above

66. IEEE 802.11 wireless technology employ __________ multiple access scheme to avoid collision.

A) RTS/CTS B) Polling C) CSMA/CD D) CSMA/CA

67. In WLAN, the channel bandwidth is divided into ______ sub channels with subcarrier frequency spacing of 312.5 KHz.

A) 48 B) 52 C) 46 D) 54

68. In a DSSS communication system, the processing gain in dB for the given $(SNR)_D$ = 20 and PI/PS = 100 is

A) 20dB B) 10dB C) 30dB D) 1000dB

69. The differential entropy of a random variable X when uniformly distributed in [0, a] is

A) 1 B) Log 0

C) Log a D) None of the above

70. The difference between the true value and the measured value of the quantity

A) Static error B) Static value

C) Static correction D) None of the above

71. A Wheatstone bridge is constructed with two strain gauge and two resistors. One strain gauge is active and other one is dummy. These two are in the opposite arms of a Wheatstone bridge. The other two arms are formed with resistors of equal resistance of 120 ohms each at 300 K. The frequency bandwidth is 100,000 Hz. When a pressure of 7000 kN/m^2 is applied, and the output voltage is 0.12 mV. Find signal to noise ratio generated by the resistors.

A) 269 B) 296 C) 259 D) 256

72. Two resistors R_1 = 29.5 ohms and R_2 = 69 ohms are connected in series. Then the total resistance is

A) 39.5 B) 2035.5 C) 2.338 D) 98.5

73. In Photoconductive transducer

A) Change in conductivity appears as change in resistance

B) Change in conductivity appears as change in inductance

C) Change in conductivity appears as change in impedance

D) None of the above

74. Time required by a measurement system to begin to respond to a change in the measurand is

A) Dwell time B) Holding time

C) Serving time D) Dead time

75. In a pyrometer, the dead zone is assumed to be 0.125 percent of span. Calibration can be done from 400°C to 1000°C. Determine the change in temperature expected before the occurrence can be detected.

A) 0.85°C B) 0.95°C C) 0.75°C D) 0.65°C

76. Assume a voltmeter (0 to 150 V) has a guaranteed accuracy of 1 percent of full scale reading. The voltage measured by this instrument is 100 V. Calculate the limiting error in percent.

A) 1.5

B) 66.67

C) 2

D) None of the above

77. Construct a parallel circuit with two branches. The current in one branch is $I_1 = 200 \pm 7A$ and in the other is $I_2 = 200 \pm 1A$. Then the value of total current considering the errors in I_1 and I_2 as limiting errors is

A) 200 B) $400 \pm 7A$ C) $400 \pm 1A$ D) $400 \pm 8A$

78. The steady state error of a control system with unity feedback and transfer function

$$\frac{C(s)}{R(s)} = \frac{1}{s^2 + s + 1}$$

when exited with a unit ramp input is,

A) $e_{ss} = 0$ B) $e_{ss} = 1$ C) $e_{ss} = 2$ D) $e_{ss} = \infty$

79. Consider the first order system with a closed loop transfer function

$$\frac{1}{Ts + 1}$$

What is the slope of unit step response $\frac{dc}{dt}$ at $t = T$, where c(t) is the unit step response of the system ?

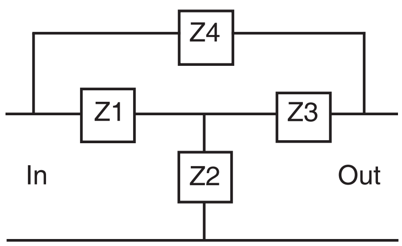
A) $\frac{dc}{dt} = \frac{T}{e}$

B) $\frac{dc}{dt} = \frac{1}{eT}$

C) $\frac{dc}{dt} = \frac{e}{T}$

D) $\frac{dc}{dt} = eT$

80. In the bridge T network shown in figure, Z1 = Z3 = R and Z2 = Z4 = $\frac{1}{Cs}$. If RC = τ, the overall transfer function of the network is given by



A) $H(s) = \frac{\tau^2 s^2 + 3\tau s + 1}{\tau^2 s^2 + 2\tau s + 1}$

B) $H(s) = \frac{2\tau^2 s^2 + \tau s + 1}{3\tau^2 s^2 + \tau s + 1}$

C) $H(s) = \frac{3\tau^2 s^2 + \tau s + 1}{2\tau^2 s^2 + \tau s + 1}$

D) $H(s) = \frac{\tau^2 s^2 + 2\tau s + 1}{\tau^2 s^2 + 3\tau s + 1}$

81. Considering the Hurwitz condition for stability, choose the most accurate statement for the system with characteristic equation $s^4 + 2s^3 + (4 + K)s^2 + 9s + 25 = 0$.

A) The system is stable when K > 5

B) The system is stable when K < 5

C) The system is stable when K > 7

D) The system is stable when K < 7

82. Consider the root loci of the system with

$$G(s) = \frac{K}{s(s+1)(s+2)}$$

and H(s) = 1. The number of asymptotes and the point of intersection are

A) Two asymptotes meets at s = $-\sqrt{3}$

B) Three asymptotes meets at s = $-\sqrt{3}$

C) Two asymptotes meets at s = – 1

D) Three asymptotes meets at s = – 1

83. The forward transfer function of a unity feedback system is given by

$$G(s) = \frac{1+s}{1+2s+3s^2}$$

The number and direction of encirclements around the point –1 + j0 in the complex plane by the Nyquist plot is

A) Zero
B) One clockwise
C) One anti-clockwise
D) Two anti-clockwise

84. The state space representation of a system is given by $\dot{x} = Ax + Bu$ and y = Cx, where

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad C = \begin{bmatrix} 3 & 1 \end{bmatrix}$$

The system is represented by,

A) $\frac{Y(s)}{U(s)} = \frac{s+3}{s^2+3s+2}$
B) $\frac{Y(s)}{U(s)} = \frac{s-3}{s^2-3s-2}$
C) $\frac{Y(s)}{U(s)} = \frac{s+3}{s^2+3s-2}$
D) $\frac{Y(s)}{U(s)} = \frac{s-3}{s^2+3s+2}$

85. Consider the compensation network given by

$$G(s) = \frac{s + \frac{1}{T_1}}{s + \frac{1}{T_2}}$$

Determine the condition for network to be a lead network.

A) If $T_1 > 0$ it is a lead network
B) If $T_2 > 0$ it is a lead network
C) If $T_1 > T_2$ it is a lead network
D) If $T_2 > T_1$ it is a lead network

86. The state space representation of a system is given by $\dot{x} = Ax + Bu$ and y = Cx, where

$$A = \begin{bmatrix} 1 & 1 \\ -2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 0 \end{bmatrix}$$

Choose the correct statement.

A) The system is not controllable and not observable.

B) The system is not controllable but completely observable.

C) The system is completely controllable but not observable.

D) The system is completely controllable and completely observable.

87. A proportional controller with unity feedback has a forward transfer function

$$G(s) = \frac{1}{Ts + 1}$$

The steady state error for unit step input is,

A) 0 B) $\frac{1}{2}$ C) $\frac{1}{3}$ D) ∞

88. Consider the statements. 1 :- A super-lattice is a periodic structure of layers of two (or more) materials. 2 :- The thickness of one layer of a super-lattice is several millimeters.

A) Statements 1 and 2 are correct

B) Statements 1 is false but 2 is correct

C) Statements 1 is correct but 2 is false

D) Statements 1 and 2 are false

89. Consider the two statements given below.

1 :- Quantum well is a two dimensional nano structure in which there is a confinement in one dimension and particle is free to move in the other two dimensions.

2 :- Quantum dot is a one dimensional nano structure in which there is confinement in two dimensions and particle is free to move in the third dimension only.

A) Both the statements 1 and 2 are wrong

B) Statement 1 is wrong and 2 is correct

C) Statement 1 is correct and 2 is wrong

D) Both the statements 1 and 2 are correct

90. In the ISO OSI seven layer model, the raw bits are converted to frames by

A) Physical layer
B) Data link layer
C) Network layer
D) Transport layer

91. An IPv4 datagram has type of service (TOS) bits ‘1000’. The datagram service type is

A) Normal
B) Minimize delay
C) Maximize reliability
D) Maximize throughput

92. A discrete source emits five symbols independently with frequencies as given below.
a : 1/8 b : 1/8 c : 1/4 d : 1/4 e : 1/4

Find the average length of the symbols when encoded with an optimal, uniquely decodable source coding method.

A) 11/5
B) 12/5
C) 13/5
D) 14/5

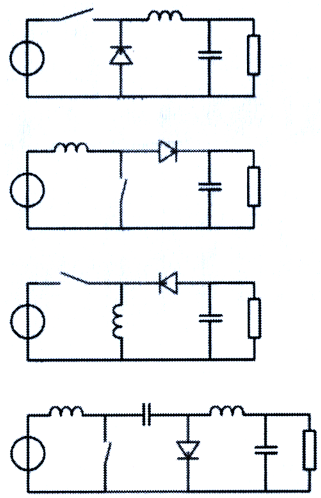
93. A (7,4) linear block code is generated by the matrix

$$G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

If a received code vector, R, is affected by an error vector E = [0 0 1 0 0 0 0], the syndrome of R will be,

A) 101
B) 1101
C) 011
D) 1010

94. The following figure shows various DC to DC converter configurations. Starting from top to bottom, the configurations are,



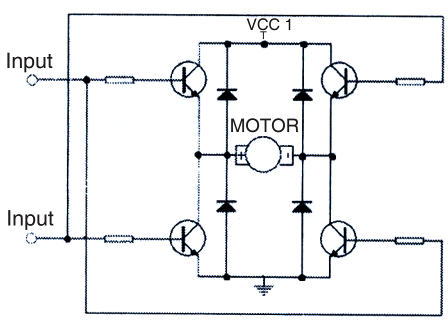
A) Boost, Buck, Buck-boost and Cuk

B) Boost, Buck, Cuk and Buck-boost

C) Buck, Boost, Buck-boost and Cuk

D) Buck, Boost, Cuk and Buck-boost

95. In a DC motor control circuit as shown in figure, by using PWM and /or logic signals at the input points,



A) The speed and direction of rotation of the motor can be controlled

B) The speed of the motor can be controlled but not direction of rotation of the motor

C) The direction of rotation of the motor can be controlled but not the speed of rotation

D) None of the above

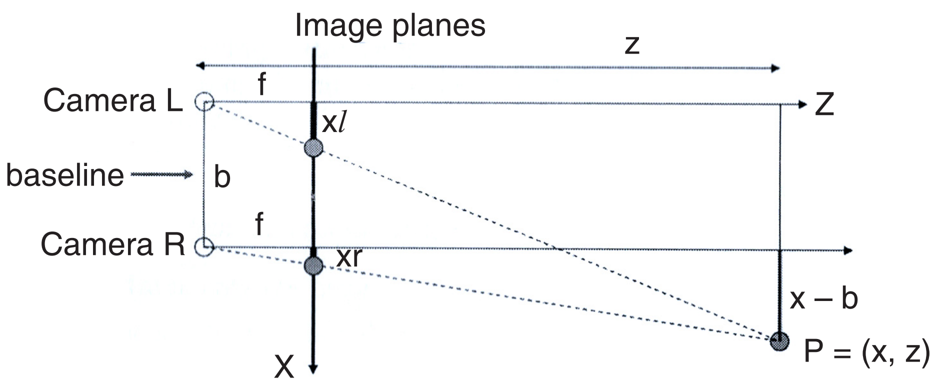
96. An image segment of size 6 × 6 is convolved with a mask $[-1\ 2\ -1]^T$. Assume replication at the edges.

$$f(x,y)=\begin{bmatrix}1&1&1&1&1&1\\1&1&1&1&1&1\\1&1&1&1&1&1\\0&0&0&0&0&0\\1&1&1&1&1&1\\1&1&1&1&1&1\end{bmatrix}$$

Number of non zero values in the resulting image will be,

A) 0 B) 12 C) 18 D) 24

97. A simplified stereo camera model is given in figure. The equations for x and z in P(x, z), with respect to camera L is given by,



A) $z=\dfrac{f\times b}{xl}$ and $x=\dfrac{xr\times z}{f}$

B) $z=\dfrac{f\times b}{xl}$ and $x=\dfrac{xl\times z}{f}$

C) $z=\dfrac{f\times b}{xl-xr}$ and $x=\dfrac{xr\times z}{f}$

D) $z=\dfrac{f\times b}{xl-xr}$ and $x=\dfrac{xl\times z}{f}$

98. Consider the following statements about micro electro mechanical systems.

    1. Surface to volume ratio of MEMS are higher than the macro scale systems.

    2. Electrostatic forces dominate over gravitational forces at micro scale.

    A) Both the statements 1 and 2 are true

    B) Statement 1 is true but 2 is false

    C) Statement 1 is false but 2 is true

    D) Both the statements 1 and 2 are false

99. Consider the linear programming problem to minimize $z = 5x + 4y$ subject to $4x + y \geq 10$, $2x + 3y \geq 10$ and $x, y \geq 0$. Minimum value of z is

    A) 20 B) 18 C) 16 D) 0

100. Consider the following statements.

    1. Message Queuing Telemetry Transport (MQTT) and Constrained Application Protocol (CoAP) are two communication protocols used in IoT applications.

    2. MQTT uses a Publish/subscribe communication model and it is a many-to-many communication protocol.

    A) Both the statements are incorrect

    B) Statement 1 is true but 2 is false

    C) Statement 1 is false but 2 is true

    D) Both the statements 1 and 2 are correct

Space for Rough Work