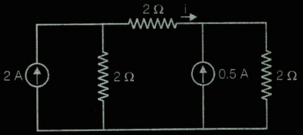
DRDO-2009

SECTION - A

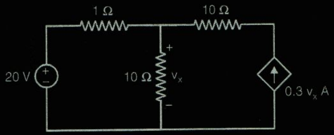
1. The current i in figure is



(a) 0.5 A (b) $\frac{5}{6}$ A

(c) 1.5 A (d) 2.5 A

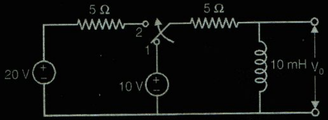
2. In figure the voltage source



(a) delivers $\frac{200}{3}$ W (b) absorbs 100 W

(c) delivers 100 W (d) absorbs $\frac{200}{3}$ W

3. The switch shown in figure Q.3 is ideal and has been in position 1 for t < 0.

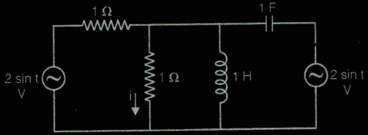


If the switch is moved to position 2 at t = 0, then V_0 for t > 0 is given by

(a) 0 V (b) $2 + 2(1 + e^{-1000\,t})$V

(c) $2(1 - e^{-1000\,t})$V (d) $2\,e^{-1000\,t}$ V

4. The current i in figure Q.4 is



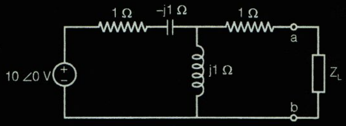
(a) $\sqrt{2}\sin(t + 45°)$ A

(b) $\sqrt{2}\sin(t - 45°)$ A

(c) $2\sin(t + 45°)$ A

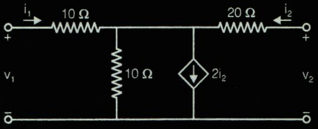
(d) $2\sin(t - 45°)$ A

5. For the circuit given in figure Q.5, in order to obtain maximum power transfer, the load Z_L (in Ω) should be



(a) 1 – j (b) 1 + j
(c) 2 – j (d) – j

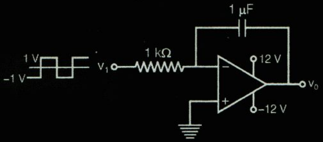
6. The h_{21} parameter of the two port network shown in figure Q.6 is



(a) $-\frac{1}{3}$ (b) –1

(c) $\frac{1}{3}$ (d) 2

7. The input v_i to the circuit shown in figure Q.7 is a square wave of amplitude ± 1 V and frequency 100 Hz.



Assuming ideal components, the peak-to-peak amplitude of the output v_a is
(a) 2 V (b) 5 V
(c) 10 V (d) 12 V

8. A network has 8 branches and 5 nodes. The fundamental loop matrix B of the network is

$$B = \begin{bmatrix} 1 & 0 & 0 & 0 & -1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & -1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & -1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & -1 & 1 & 0 \end{bmatrix}$$

The fundamental cut-set matrix Q of the same network is

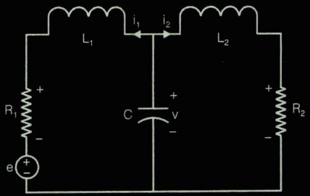
(a) $\begin{bmatrix} -1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & -1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & -1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & -1 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & -1 & -1 & -1 & 0 & 0 & 1 & 0 \\ 0 & -1 & -1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} -1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & -1 & -1 & -1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

(d) $\begin{bmatrix} -1 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 1 & -1 & 1 & 0 & 1 & 0 & 0 \\ 0 & -1 & -1 & -1 & 0 & 0 & 1 & 0 \\ 0 & -1 & -1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

9. A linear time invariant RLC network is shown in figure Q.9.



The state equation corresponding to the state variables v(t), $i_1(t)$ and $i_2(t)$ is

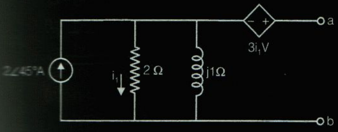
(a) $\begin{bmatrix} \frac{dv}{dt} \\ \frac{di_1}{dt} \\ \frac{di_2}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{-1}{C} & \frac{-1}{C} \\ \frac{1}{L_1} & \frac{-R}{L_1} & 0 \\ \frac{1}{L_2} & 0 & \frac{-R_2}{L_2} \end{bmatrix} \begin{bmatrix} v \\ i_1 \\ i_2 \end{bmatrix} + \begin{bmatrix} 0 \\ \left(-\frac{1}{L}\right) \\ 0 \end{bmatrix} e$

(b) $\begin{bmatrix} \frac{dv}{dt} \\ \frac{di_1}{dt} \\ \frac{di_2}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{C} & \frac{1}{C} \\ \frac{1}{L_1} & \frac{-R_1}{L_1} & 0 \\ \frac{1}{L_2} & 0 & \frac{-R_2}{L_2} \end{bmatrix} \begin{bmatrix} v \\ i_1 \\ i_2 \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix} e$

(c) $\begin{bmatrix} \frac{dv}{dt} \\ \frac{di_1}{dt} \\ \frac{di_2}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{-1}{C} & \frac{-1}{C} \\ \frac{1}{L_1} & \frac{R_1}{L_1} & 0 \\ \frac{1}{L_2} & 0 & \frac{R_2}{L_2} \end{bmatrix} \begin{bmatrix} v \\ i_1 \\ i_2 \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix} e$

(d) $\begin{bmatrix} \frac{dv}{dt} \\ \frac{di_1}{dt} \\ \frac{di_2}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{C} & \frac{1}{C} \\ 1 & \frac{-R_1}{L_1} & 0 \\ 1 & 0 & \frac{R_2}{L_2} \end{bmatrix} \begin{bmatrix} v \\ i_1 \\ i_2 \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix} e$

10. The Norton equivalent admittance (in S) with respect to terminals a-b of the circuit shown in figure Q.10 is



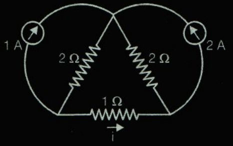
(a) $0.2 - j\,0.4$ (b) $0.1 - j\,0.2$
(c) $1 - j\,2$ (d) $5 + j\,2.5$

11. When a unit ramp is applied as input to a linear time invariant system having transfer function $H(s) = \frac{s}{s^2 + 4s + 3}$, the steady state output is

(a) ∞ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) $\frac{1}{5}$

12. The current i through the 1 Ω resistor shown in figure Q.12 is

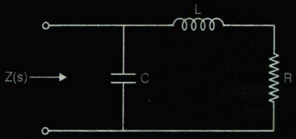


(a) $-\frac{1}{3}$ A (b) $\frac{1}{5}$ A

(c) $\frac{2}{5}$ A (d) 1 A

13. The driving point impedance of the network shown in figure is given by

$$Z(s) = \frac{s+3}{2s^2 + 6s + 1}$$



The values of the components are
(a) R = 3 Ω, L = 1 H and C = 2 F
(b) R = 3 Ω, L = 2 H and C = 1 F
(c) R = 3 Ω, L = 0.5 H and C = 4 F
(d) R = 3 Ω, L = 4 H and C = 0.5 H

14. At room temperature, which one of the following band gap energy E_g corresponds to that of a semiconductor?
(a) $E_g = 0$ eV (b) $E_g = 1.2$ eV
(c) $E_g = 5$ eV (d) $E_g = 9$ eV

15. Resistivity of an n-type Si material at a particular temperature is 0.625 Ω cm. The electron and hole mobilities in that material at the same temperature are $\mu_n = 1600$ cm²/V-s and $\mu_p = 500$ cm²/V-s, respectively. Which one of the following best represents the donor dopant concentration N_D?
(a) 2.5×10^{13} cm^{-3} (b) 6.25×10^{13} cm^{-3}
(c) 6.25×10^{15} cm^{-3} (d) 2.5×10^{16} cm^{-3}

16. The diffusion constant and mobility for electrons in a semiconductor material at a given temperature are 20 cm^2/s and 1600 cm^2 V-s, respectively. The thermal voltage V_T for a diode made of this material at the same temperature is

(a) 125 mV (b) 32 mV
(c) 12.5 mV (d) 3.2 mV

17. A diode D_1, under certain biasing conditions, has a forward voltage drop V_{Di} = 0.7 V and I_{Di} = 5.6 mA. Under the same external conditions, another diode D_2 whose doping levels N_A and N_D are both twice that of D_1 has the same forward voltage drop V_{D2} = .7 V. Assuming the same ideality factor for both the diodes, I_{D2} is

(a) 1.4 mA (b) 2.8 mA
(c) 5.6 mA (d) 11.2 mA

18. If C_d and C_s represent the depletion and diffusion capacitances of a diode, respectively, which one of the following statements is NOT correct?

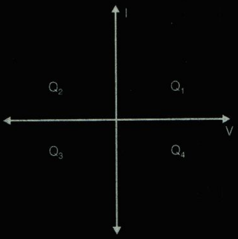
(a) C_d varies inversely with the depletion width.
(b) C_s varies directly with the rate of change of diode current with respect to diode voltage.
(c) C_d varies directly with the transit time.
(d) Effective junction capacitance is the parallel combination of C_s and C_d.

19. The correct match between the following two columns is

A.	Tunnel diode	1.	Microwave amplification
B.	Zener diode	2.	Voltage regulation
C.	PIN diode	3.	Photo detection
D.	Schottky diode	4.	High speed switching

(a) A-1, B-4, C-2, D-1
(b) A-1, B-3, C-2, D-4
(c) A-4, B-2, C-1, D-3
(d) A-1, B-2, C-3, D-4

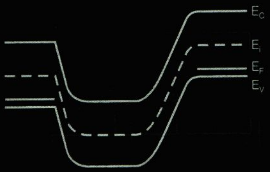
20. The I-V characteristics of devices can be divided into quadrants as shown in figure Q.20.



Photodiodes and solar cells are normally operated quadrants

(a) Q3 and Q4, respectively
(b) Q1 and Q1, respectively
(c) Q1 and Q3, respectively
(d) Q2 and Q3, respectively

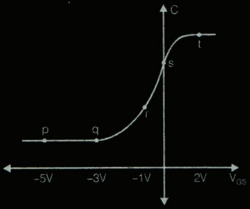
21. The band structure of a BJT is shown in figure Q.21.



It represents

(a) a pnp BJT biased in active mode
(b) an npn BJT biased in saturation mode
(c) an npn BJT biased in reverse-active mode
(d) a pnp BJT biased in cutoff mode

22. The high-frequency C-V_{GS} characteristics of a MOSFET is shown in figure Q.22 (V_{DS} = 0).



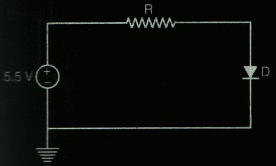
In the curve, the accumulation condition is shown by the point

(a) p (b) q
(c) s (d) t

23. The C-V_{GS} characteristics shown in figure Q.22 is of
(a) an enhancement type PMOSFET
(b) an enhancement type NMOSFET
(c) a depletion type PMOSFET
(d) a depletion type NMOSFET

24. In circuits fabricated by n-tub process, for electrical isolation between NMOSFETs and PMOSFETs in the IC,
(a) both p-type and n-type substrates are grounded
(b) p-type substrate is grounded and n-type substrate is connected to the most positive part of the circuit
(c) n-type substrate is grounded and p-type substrate is connected to the most positive part of the circuit
(d) n-type substrate is grounded and p-type subtrate is connected to the most negative part of the circuit

25. The cut-in voltage V_γ and thermal voltage V_T for the diode D in figure Q.25 are 0.498 V and 2 mV, respectively.



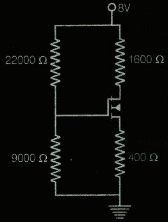
If the value of resistor R is 20 Ω, the current flowing through the diode is

(a) 275 mA (b) 250 mA
(c) 200 mA (d) less than 200 mA

26. Two MOSFETs M_1 and M_2 have channel widths and lengths of W, L and 2 W, L/2, and drain currents of I_{D1} and I_{D2}, respectively. Assuming that both M_1 and M_2 are ON, under the same temperature and biasing voltages, which one of the following is TRUE?

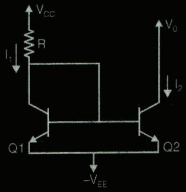
(a) $I_{D2} = I_{D1}/4$ (b) $I_{D2} = I_{D1}/2$
(c) $I_{D2} = 2I_{D1}$ (d) $I_{D2} = 4I_{D1}$

27. The slope (in A/V) of the $I_D - V_{DS}$ load line for the circuit shown in figure Q.27 is



(a) $-\frac{1}{400}$ (b) $-\frac{1}{600}$
(c) $-\frac{1}{2000}$ (d) $-\frac{1}{31000}$

28. In the circuit shown in figure Q.25, β is the same for both the BJTs.



Neglecting early effect, $\frac{I_2}{I_1}$ is

(a) $\frac{1+\beta}{2}$ (b) $\frac{1}{1+\beta}$

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

29. An n-type MOSFET and an npn BJT are biased so that $I_C = I_D = 1$ mA, $V_{GS} = 1.3$ V and $V_{BE} = 0.7$ V. Threshold voltage for the MOSFET is 0.8 V and thermal voltage at the ambient temperature is given to be 25 mV. Transconductances of the BJT and the MOSFET are
(a) $g_{mBJT} = 40$ mA/V and $g_{mMOSFET} = 4$ mA/V
(b) $g_{mBJT} = 40$ mA/V and $g_{mMOSFET} = 2.5$ mA/V
(c) $g_{mBJT} = 80$ mA/V and $g_{mMOSFET} = 2$ mA/V
(d) $g_{mBJT} = 80$ mA/V and $g_{mMOSFET} = 4$ mA/V

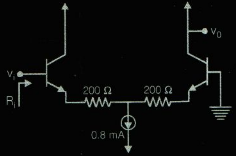
30. Adding a degeneration resistor R_E to a common emitter BJT amplifier will mainly reduce
(a) the voltage gain
(b) the input impedance
(c) the amplifier bandwidth
(d) the output impedance

31. A BJT Darlington pair has
(a) high input impedance and high β
(b) high input impedance and low β
(c) low input impedance and high β
(d) low input impedance and low β

32. The feedback scheme used in a simple opamp based non-inverting amplifier is
(a) series-series (b) series-shunt
(c) shunt-series (d) shunt-shunt

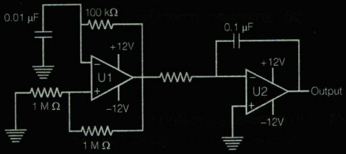
33. An inverting amplifier is designed for a gain of 40 dB using an opamp having open loop gain fo 250000 and unity-gain frequency of 750 KHz. The bandwidth of the designed amplifier is
(a) 2.5 KHz (b) 7.5 KHz
(c) 750 KHz (d) 250 KHz

34. In the circuit shown in figure Q.34, β for the BJTs is 99.



Assuming the thermal voltage to be 50 mV, the input resistance R_i is
(a) 650 Ω (b) 25 kΩ
(c) 40 kΩ (d) 65 kΩ

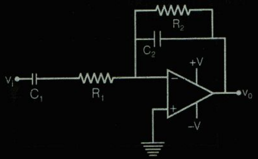
35. Assuming ideal opamps and that the opamp U2 is not saturated, the output voltage waveform in the circuit shown in figure Q.35 is a



(a) pulse (b) sine wave
(c) triangular wave (d) square wave

36. For a class-A power amplifier, supply dc voltage is ±12 V, the quiescent collector current is 72 mA and the load resistance is 100 Ω. If the output voltage across the load is 12 V peak-to-peak, the efficiency of the amplifier is (neglect the loss occuring in the biasing resistors)
(a) 10.4% (b) 20.8%
(c) 25% (d) 33.3%

37. The gain at the centre-frequency for the bandpass filter shown in figure Q.37 is



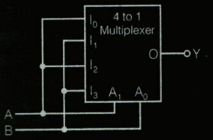
(a) $-\dfrac{\sqrt{R_1C_1}}{\sqrt{R_2C_2}}$ (b) $-\dfrac{\sqrt{R_2C_2}}{\sqrt{R_2C_2}}$

(c) $-\left(\dfrac{R_1}{R_2}+\dfrac{C_2}{C_1}\right)$ (d) $-\dfrac{1}{\dfrac{R_1}{R_2}+\dfrac{C_2}{C_1}}$

38. The specifications given for a TTL logic family gate are as follows:
$I_{OH} = -400$ mA, $I_{OL} = 8$ mA, $I_{1H} = 20$ mA, and $I_{1L} = -0.36$ mA. Fan out is
(a) 10 (b) 18
(c) 20 (d) 22

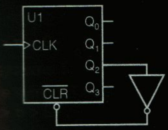
39. In the logic equation
$A(A+\bar{B}\bar{C}+C)+\bar{B}(C+\bar{A}+BC)$
$(A+\bar{B}C+A\bar{C}) = 1$, if $C=\bar{A}$ then
(a) $A + B = 1$ (b) $\bar{A}+B=1$
(c) $A+\bar{B}=1$ (d) $A = 1$

40. A gate having two inputs (A, B) and one output (Y) is implemented using a 4-to-1 multiplexer as shown in figure Q.40. A_1 (MSB) and A_0 are the control bits and $I_0 - I_3$ are the inputs to the multiplexer.



The gate is
(a) NAND (b) NOR
(c) XOR (d) OR

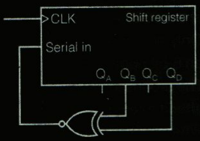
41. In figure Q.41, U1 is a 4-bit binary synchronous counter with synchronous clear. Q_0 is the LSB and Q_3 is the MSB of the output.



The circuit shown in figure Q.41 represents a
(a) mod 2 counter (b) mod 3 counter
(c) mod 4 counter (d) mod 5 counter

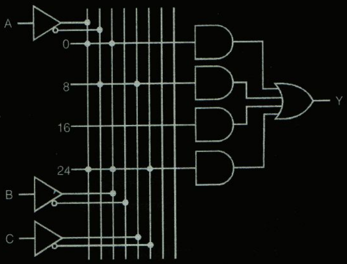
42. An increase in the value of the hold capacitor in a sample-and-hold circuit results in
(a) decrease in the acquisition time and decrease in the droop rate
(b) decrease in the acquisition time and increase in the droop rate
(c) increase inthe acquisition time and increase in the droop rate
(d) increase in the acquisition time and decrease in the droop rate

43. A 4-bit serial-in-parallel-out shift resister is used with a feedback as shown in figure Q.43. The shifting is $Q_A \to Q_B \to Q_C \to Q_D$.



If the output is 0000 initially, the output repeats after
(a) 4 clock cycles (b) 6 clock cycles
(c) 15 clock cycles (d) 16 clock cycles

44. Figure shows a section of a Programming Logic Device (PLD).



The Boolean expression implemented in the PLD is

(a) $AC + AB + \bar{A}B\bar{C}$

(b) $A\bar{C} + \bar{A}B + AB\bar{C}$

(c) $AB + \bar{A}C + A\bar{B}C$

(d) $AB + \bar{A}C + AB\bar{C}$

45. For an 8-bit digital-to-analog converter having reference voltage of 8 V, the least significant 4 bits of the input are grounded and the most significant 4 bits are driven by 4 bit data from a binary counter. The maximum obtainanle peak-to-peak amplitude of a waveform at the output of the digital-to-analog converter is

(a) 4 V (b) 6 V
(c) 7.2 V (d) 7.5 V

46. Which one of the following statements about the 8085 is TRUE?

(a) Only accumulator can be loaded with an 8-bit number in a single instruction.
(b) The processor can be interrupted even after it executes HLT instruction.
(c) When HOLD input is activated, the processor can execute register-to-register instructions.
(d) The program and data memories are separate.

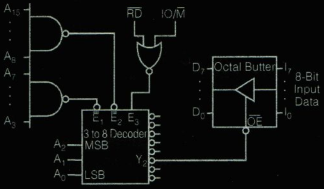
47. The contents of the HL register pair after the execution of the following program onthe 8085 are

```
LXI H, 2095 H
LXI B, 8FBFH
PUSH B
XTHL
POPH
HLT
```

(a) 2095 H (b) 20BFH
(c) 8F95H (d) 8FBFH

48. The figure shows an interfacing circuit for the 8085 microprocessor to read in 8-bit data is

The appropriate instruction for reading the data is



(a) MVI A, FAH (b) IN FAH
(c) IN FFFAH (d) LDA FFFAH

49. When the 8085 receives an interrupt onits INTR pin,

(a) the program is directly transferred to a fixed call location
(b) 8085 waits till an interrupt acknowledgement is received and transfers program to a fixed call location
(c) the call location is determined by an external device
(d) the program is transferred to a call location indicated by HL register pair

50. An input x[n] with length 3 is applied to a linear time invariant system having an inpulse response h[n] of length 5 and $Y(\omega)$ is the DTFT of the output y[n] of the system. If $|h[n]| \leq L$ and $|h[n]| \leq L$ for all n, the maximum value of Y(0) can be

(a) 15 LB (b) 12 LB
(c) 8 LB (d) 7 LB

51. The two-sided Laplace transform of $x(t) = e^{-3t}u(t) + e^{2t}u(-t)$ is

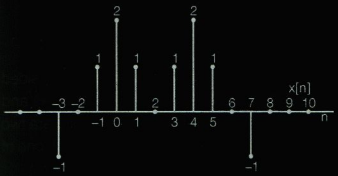
(a) $X(s) = \dfrac{-5}{s^2 + s - 6}, -3 < \sigma < 2$

(b) $X(s) = \dfrac{-5}{s^2 + s - 6}, -2 < \sigma < 3$

(c) $X(s) = \dfrac{-5}{s^2 + s - 6}, -3 < \sigma < -2$

(d) $X(s) = \dfrac{-5}{s^2 + s - 6}, -2 < \sigma < 3$

52. For the signal x[n] shown in figure, x[n] = 0 for n < – 3 and n > 7.



If X(w) is the Fourier transform of x[n], which one of the following is TRUE?

(a) $X(0) = 5$

(b) $\int_{-\pi}^{\pi} X(\omega)d\omega = 2\pi$

(c) The phase $\angle X(\omega) = -2\omega$

(d) $X(\omega) = X(-\omega)$

53. For a time invariant system, the different combinations of the input $x_i[n]$ and corresponding output $y_i[n]$ are given below. The arrow indicates the position of $x_i[0]$ and $y_i[0]$.

$x_1[n] = \{\ldots, \underset{\uparrow}{3}, 2, 0, \ldots\}$ and $y_1[n] = \{\ldots 0, \underset{\uparrow}{0}, 2, 3, 0, \ldots\}$

$x_2[n] = \{\ldots, 0, \underset{\uparrow}{0}, 2, 0, \ldots\}$ and $y_2[n] = \{\ldots 0, \underset{\uparrow}{0}, 2, 2, 4, 0, \ldots\}$

$x_3[n] = \{\ldots, 0, \underset{\uparrow}{3}, 0, \ldots\}$ and $y_3[n] = \{\ldots 0, 0, \underset{\uparrow}{3}, 6, 0, \ldots\}$

$x_4[n] = \{\ldots, 0, \underset{\uparrow}{0}, 0, 1, 0 \ldots\}$ and $y_4[n] = \{\ldots 0, 3, 2, \underset{\uparrow}{0}, 0, \ldots\}$

The impulse response h[n] of the system is

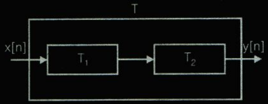
(a) $\{\ldots, 0, \underset{\uparrow}{0}, 2, 1, -4, 0, \ldots\}$

(b) $\{\ldots, 0, \underset{\uparrow}{1}, 1, 1, 2, 0, \ldots\}$

(c) $\{\ldots, 0, 3, 2, 0, 0, \underset{\uparrow}{0}, 0, \ldots\}$

(d) $\{\ldots, 0, \underset{\uparrow}{1}, 2, 0, \ldots\}$

54. Two systems T_1 and T_2 are cascaded to get the system T as shown in figure.



Which one of the following statements is TRUE?

(a) If both T_1 and T_2 are linear then T is NOT necessarily linear.

(b) If both T_1 and T_2 are time invariant then T is NOT necessarily time invariant.

(c) If both T_1 and T_2 are non-linear then T is NOT necessarily non-linear.

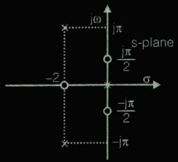
(d) If both T_1 and T_2 are causal then T is NOT necessarily causal.

55. If $x[n] = \begin{cases} \frac{2}{\pi} & n = 0 \\ \frac{\sin 2n}{\pi n}, & n \neq 0 \end{cases}$, the energy of x[n] is

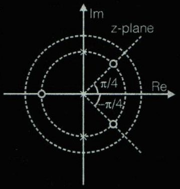
(a) $\frac{2}{\pi}$ (b) $\frac{1}{\pi}$

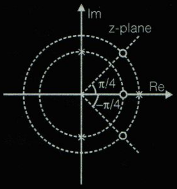
(c) $\frac{1}{2\pi}$ (d) $\frac{3}{\pi}$

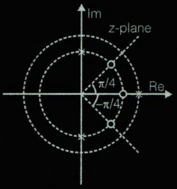
56. The pole-zero plot of the transfer function $(H_a(s))$ of a linear time invariant system in s-plane is shown in figure. The corresponding impulse response $h_a(t)$ is sampled at 2 Hz to get the discrete-time impulse response sequence h[n].

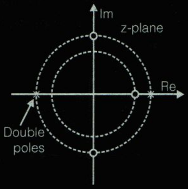


If the right half of the s-plane is mapped into the outside of the unit circle, which one of the following shows the equivalent pole-zero plot of H(z) in the z-plane (the concentric circles are $|z| = \frac{1}{e}$ and $|z| = 1$)?

(a)


(b)


(c)


(d)


57. The z-transform X(z) of a sequence x[n] is given by

$$X(z) = \frac{z^{30}}{\left(z - \frac{1}{2}\right)(z-2)(z+3)}$$

If X(z) converges for $|z| = 1$ then $x[-18]$ is

(a) $-\frac{1}{9}$ (b) $-\frac{2}{21}$

(c) $-\frac{1}{10}$ (d) $-\frac{2}{27}$

58. The z-transform X(z) of a real and right-sided sequence x[n] has exactly two poles and one of them is at $z = e^{j\pi/2}$ and there are two zeros at the origin. If X(1) = 1, which one of the following is TRUE?

(a) $X(z) = \frac{2z^2}{(z-1)^2+2}$, ROC is $\frac{1}{2} < |z| < 1$

(b) $X(z) = \frac{2z^2}{z^2+1}$, ROC is $|z| > \frac{1}{2}$

(c) $X(z) = \frac{2z^2}{(z-1)^2+2}$, ROC is $|z| > 1$

(d) $X(z) = \frac{2z^2}{z^2+1}$, ROC is $|z| > 1$

59. The impulse response h[n] of a linear time invariant system is real. The transfer function H(z) of the system has only one pole and it is at $z = \frac{4}{3}$. The zeros of H(z) are non-real and located at $|z| = \frac{4}{3}$. The system is

(a) stable and causal
(b) unstable and anti-causal
(c) unstable and causal
(d) stable and anti-causal

60. A signal x(t) is band-limited to W Hz, and $y(t) = x^3(t) + x(t) + 1$. The Nyquist sampling frequency of y(t) is

(a) 3 W (b) 6 W
(c) 12 W (d) 27 W

61. Suppose X[k] is the 6-point Discrete Fourier Transform (DFT) of $x[n] = \{\underset{\uparrow}{4}, 3, 2, 1, 0, 0\}$,

and $Y[k] = W_6^{4k}X[k]$, where $Y[k]$ is the 6-point DFT of $y[n]$ and $W_6 = e^{-2\pi/6}$. Which one of the following represents $y[n]$?

(a) $y[n] = \{\underset{\uparrow}{0}, 3, 2, 1, 0, 4, 0\}$

(b) $y[n] = \{\underset{\uparrow}{2}, 1, 0, 0, 4, 3\}$

(c) $y[n] = \{\underset{\uparrow}{0}, 0, 0, 0, 4, 3, 2, 1\}$

(d) $y[n] = \{\underset{\uparrow}{3}, 2, 1, 0, 0, 4\}$

62. A signal $x(t) = \cos(10t)\cos(100t)$ is passed through a system whose impulse response is $H(\omega) = \exp(-j100 - j2(\omega - 100)$. If $y(t)$ is the system output, then

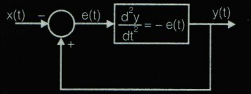
(a) $y(t) = \cos\left(10\left(t - \frac{1}{2}\right)\right)\cos(100(t-1)$

(b) $y(t) = \cos((10(t-1))\cos\left(100\left(t - \frac{1}{2}\right)\right)$

(c) $y(t) = \cos((10(t-2))\cos(100(t-1))$

(d) $y(t) = \cos(10(t-1))\cos(100(t-2))$

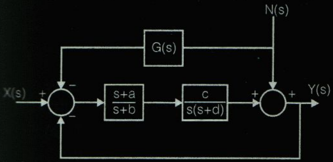
63. For the system shown in figure, e(t) is the error between input x(t) and output y(t).



If $x(t) = t\,u(t)$ and all initial conditions are zero, then e(t) will be

(a) sin t (b) cos t
(c) –cos t (d) –sin t

64. For a linear time invariant system shown in figure, X(s) is the input and Y(s) is the output.

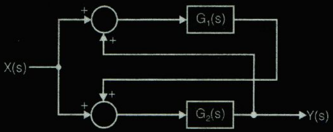


In order to nullify the effect of noise N(s), the gain of the feed-forward path $G_e(s)$ is

(a) $\frac{s(s+a)(s+d)}{c(s+b)}$ (b) $\frac{c(s+a)}{s(s+a)(s+d)}$

(c) $\frac{s(s+b)(s+d)}{c(s+a)}$ (d) $\frac{c(s+a)}{s(s+b)(s+d)}$

65. The transfer function $\frac{Y(s)}{X(s)}$ of the linear time variant system shown in figure is



(a) $\frac{G_1(s)(G_2(s)+1)}{1 - G_1(s)G_2(s)}$

(b) $\frac{G_2(s)(G_1(s)+1)}{1 - G_1(s)G_2(s)}$

(c) $\frac{G_1(s)(G_2(s)+1)}{1 - G_1(s)G_2(s)}$

(d) $\frac{G_2(s)(G_1(s)+1)}{1 - G_1(s)G_2(s)}$

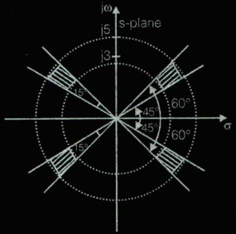
66. The characteristic polynomial of a feedback control system is $s^3 + Ks^2 + 9s + 18$. When the system is marginally stable, the frequency of the sustained oscillation (in rad/s) is

(a) 1 (b) $\sqrt{2}$

(c) $\sqrt{3}$ (d) 3

67. A unity feedback system has the open-loop transfer function $G(s) = \frac{\omega_n^2}{s(s + 2\zeta w_n)}$.

If the closed-loop poles lie in the shaded region of the s-plane as shown in figure, which one of the following is TRUE?



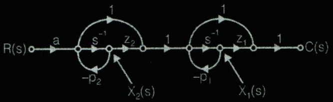
(a) $0.5 \le \zeta \le 0.707$, $3 \text{ rad/s} \le \omega_n \le 5 \text{ rad/s}$

(b) $0.707 \le \zeta \le 0.867$, $\omega_n \le 5 \text{ rad/s}$

(c) $0.5 \le |\zeta| \le 0.707$, $3 \text{ rad/s} \le \omega_n \le 5 \text{ rad/s}$

(d) $0.707 \le |z| \le 0.867$, $\omega_n \le 5 \text{ rad/s}$

68. The state equation for the state diagram shown in figure is



(a) $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -p_1 & z_2 - p_2 \\ 0 & -p_2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} a \\ a \end{bmatrix} r(t)$

(b) $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -p_1 & z_2 - p_2 \\ 0 & -p_2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} a \\ 0 \end{bmatrix} r(t)$

(c) $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -p_1 & z_2 - p_2 \\ -p_2 & z_1 - p_1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} a \\ a \end{bmatrix} r(t)$

(d) $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -p_1 & z_2 - p_2 \\ -p_2 & z_1 - p_1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} a \\ a \end{bmatrix} r(t)$

69. A unity feedback system is shown in fig. (1). The root-locus of its characteristic equation is shown in fig. (2).

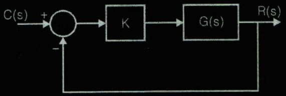


Fig. (1)

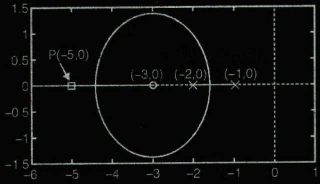


Fig. (2)

If P(−5, 0) is a point on the root-locus, the variable parameter K of the system at P is

(a) 2 (b) 4

(c) 6 (d) 8

70. For a unity feedback system shown in fig. (1), the root-locus of the characteristic equation is shown in fig. (2). If the variable parameter K = 2, the closed-loop transfer function of the system is

(a) $\dfrac{s+3}{s^2+3s+2}$ (b) $\dfrac{2(s+3)}{s^2+5s+8}$

(c) $\dfrac{2(s+3)}{s^2+3s+2}$ (d) $\dfrac{s+3}{s^2+5s+8}$

71. The open-loop trasnfer function of a system is given by $G(s)H(s) = \dfrac{100(s+100)}{s(s+10)}$. In the straight line approximation of the Bode plot, $|G(j\omega)\, H(j\omega)|$ and $\angle G(j\omega)\, H(j\omega)$ at $\omega = 100$ rad/s are

(a) 0 dB and $\dfrac{-3\pi}{4}$ rad

(b) 0 dB and $\dfrac{\pi}{4}$ rad

(c) 20 dB and $\dfrac{-3\pi}{4}$ rad

(d) 20 dB and $\dfrac{\pi}{4}$ rad

72. A linear time invariant system with input u(t) and output y(t) is described by the state space representation as given below.

$$\dot{x}_1(t) = x_2(t)$$

$$\dot{x}_2(t) = x_1(t) + x_2(t) + u(t)$$

and $y(t) = x_1(t) + 3x_2(t)$

The transfer function of the system is

(a) $\frac{s+3}{s^2-s-1}$ (b) $\frac{s+3}{s^2+s+1}$

(c) $\frac{3s+1}{s^2+s+1}$ (d) $\frac{3s+1}{s^2-s-1}$

73. A unity feedback closed-loop system has a plnat $G(s) = \frac{1}{s^2}$ and a PD controller $G_C(s)$ in the forward path. If $G_C(s) = T_P(1 + T_D s)$ where T_P and T_D are positive adjustable parameters, which one of the following statements is NOT true?

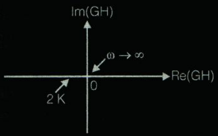
(a) The system is always stable.

(b) The system may have damped oscillation for a unit-step input.

(c) The system amplifies the noise.

(d) The system has zero steady-state error for a unit-parabolic input.

74. Suppose the Nyquist plot of the loop transfer function G(jω) H(jω) for w = 0 and ω = ∞ for a single-loop feedback control system is shown in figure. The gain K appears as a multiplying factor in G(s) H(s). One pole of G(s) H(s) lies in the right half of s-plane and no pole is on the jω axis.



Which one of the following statements is TRUE in the case of closed-loop stability?

(a) The closed-loop system is stable for 0.25 < K < 0.5

(b) The closed-loop system is stable for K > 0.5

(c) The closed-loop system is unstable for all values of K

(d) The closed-loop system is stable for K = 0.25

75. Consider an amplitude modulated (AM) wave $c_m(t) = (A_c + A_m \cos \omega_m t) \cos \omega_c t$. If P_s denotes the power in any one of the side frequencies and P_T denotes the total power of the AM signal, for $A_c = 2 A_m$ which one of the following is TRUE?

(a) $P_T = 3P_s$ (b) $P_T = 6P_s$

(c) $P_T = 9P_s$ (d) $P_T = 18P_s$

76. In a superheterodyne receiver, if the intermediate frequency is 10.7 MHz and the carrier frequency is 89.6 MHz, the image frequency is

(a) 78.9 MHz (b) 100.3 MHz

(c) 111 MHz (d) 121 MHz

77. For the frequency modulated signal $v(t) = \cos\left[2\pi f_c t + k \int_{-\infty}^{t} m(\tau)d\tau\right]$, if m(t) has a probability density function

$f_M(m) = \frac{1}{2\sqrt{2\pi}} e^{-m^2/8}$, the rms frequency deviation is

(a) k (b) 2k

(c) $\frac{k}{2\pi}$ (d) $\frac{k}{\pi}$

78. A PCM system uses a uniform quantizer which has a range –V to +V and it is followed by a 7 bit binary encoder. A zero mean signal applied to the quantizer extends over its entire range and has uniform probability density. The ratio of the signal power to the quantization noise power at the output of the quantizer is (Take $\log_{10} 2 \approx 0.3$)

(a) 14 dB (b) 28 dB

(c) 42 dB (d) 56 dB

79. A source generates one of the five symbols s_1, s_2, s_3, s_4 and s_5 once in every $\frac{1}{60}$ second. The symbols are assumed to be independent and occur with probabilities $\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{8}$ & $\frac{1}{8}$. The average information rate of the source in bits/second is
(a) 100 (b) 125
(c) 135 (d) 150

80. A source has 256 symbols which are equiprobable and their successive transmissions are indpendent. If an AWGN channel having a bandwidth of 4 KHz and SNR of 31 is used for transmission of symbols, the maximum rate (in symbols/s) at which the transmission can be made with an arbitrary low probability of error is
(a) 1000 (b) 1500
(c) 2000 (d) 2500

81. A communication system operates in an AWGN channel and employs BPSK modulation. If $\frac{E_b}{N_0} = 4$ (E_b : signal energy per bit, N_0 : noise power spectral density) and given that erf(2) = 0.99532, the average BER is
(a) 2.34×10^{-3} (b) 2.34×10^{-1}
(c) 4.68×10^{-3} (d) 4.68×10^{-1}

82. A matched filter having a frequency response $H(f) = \frac{1 - e^{-j2\pi fT}}{j2\pi f}$ matches to

(a) $s(t) = \begin{cases} 1, & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$

(b) $s(t) = \begin{cases} -1, & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$

(c) $s(t) = \begin{cases} 1 - \frac{t}{T}, & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$

(d) $s(t) = \begin{cases} -1 + \frac{t}{T}, & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$

83. An amplitude modulated signal $s(t) = A_c[1 + km(t)] \cos 2\pi f_c t$ (message signal m(t) has power P and constant k determines the modulation index) is sent through an AWGN channel and detected using an envelope detector. If the average carrier power is large compared to the noise power and any DC component present at the envelope detector output is removed, the figure of merit of the detector is

(a) $\frac{k^2P}{1 + k^2P}$ (b) $\frac{P}{1 + k^2P}$

(c) $\frac{2P}{A_c^2 + 2k^2P}$ (d) $\frac{P}{k^2 + P}$

84. Which one of the following statements is NOT true?
(a) A frequency modulated signal is produced when a modulating signal m(t) is integrated and applied to a phase modulator.
(b) For a sinusoidally modulated FM carrier, it is possible that for particular values of the modulation index β, all the power lies in the side frequencies and no power in the carrier.
(c) When carrier to noise ratio is high, an increase in the transmission bandwidth decreases the figure of merit of an FM system.
(d) A phase modulated signal is produced when a modulating signal m(t) is differentiated and applied to a frequency modulator.

85. If E_b, T_b and f_c, respectively denote bit energy, bit duration and the carrier frequency, the signal

$$\mu_m(t) = \sqrt{\frac{2E_b}{T_b}}\left[\cos(2\pi f_c t)\cos\left(\frac{m\pi}{T_b}t\right) - \sin(2\pi f_c t)\sin\left(\frac{m\pi}{T_b}t\right)\right],$$

$m \in [0,1]$ and $0 \le t \le T_b$ represents a

(a) BPSK modulated signal
(b) QPSK modulated signal
(c) DPSK modulated signal
(d) BFSK modulated signal

86. Which one of the following statements is NOT true?
(a) TDMA systems have high synchronization overhead.
(b) Power control is used to combat the near-far problem in CDMA implementations.
(c) IS-95 is a TDMA digital cellular standard.
(d) The modulation scheme used in GSM is GMSK.

87. There are two fair coins $\left(P(\text{Head}) = P(\text{Tail}) = \frac{1}{2}\right)$ and a third biased coin where P (Head) = $\frac{1}{4}$ and P (Tail) = $\frac{3}{4}$. One coin is picked at random and tossed once and a Head is obtained. The probability that the coin tossed is one of the fair coins is

(a) $R_x(\tau) = \begin{cases} 1, & |\tau| \le 1 \\ 0, & \text{otherwise} \end{cases}$

(b) $R_x(\tau) = \dfrac{\sin\tau}{2\tau}$

(c) $R_x(t) = 1 - \sin^2 \tau$

(d) $R_x(\tau) = \begin{cases} 1-|\tau| & |\tau| \le 1 \\ 0, & \text{otherwise} \end{cases}$

89. If $\vec{F}(\rho, \phi, z) = \rho\hat{a}_\rho + \rho\sin^2\phi\,\hat{a}_\phi - z\hat{a}_z$, which one of the following is TRUE?

(a) $\nabla\cdot\vec{F}\Big|_{\phi=0} < \nabla\cdot\vec{F}\Big|_{\phi=\frac{\pi}{2}}$

(b) $\nabla\cdot\vec{F}\Big|_{\phi=\frac{\pi}{4}} = \nabla\cdot\vec{F}\Big|_{\phi=0}$

(c) $\nabla\cdot\vec{F}\Big|_{\phi=0} > \nabla\cdot\vec{F}\Big|_{\phi=\frac{\pi}{2}}$

(d) $\nabla\cdot\vec{F}\Big|_{\phi=\frac{\pi}{4}} = 2\nabla\cdot\vec{F}\Big|_{\phi=0}$

90. A plane electromagnetic wave with magnetic $\vec{H}_i = \cos(10^8 t - \beta z)\hat{a}_x$ mA/m travels in air for $z \le 0$ and is incident normally on a lossless non-magnetic dielectric medium of relative permittivity 4 which occupies the region $z \ge 0$. Which one of the following is the expression for the reflected electric field (in mV/m)? (Given $\eta_0 \cong 120\,\pi\Omega$ is the intrinsic impedance)

(a) $\vec{E}_r = -40\pi\cos(10^8 t - 3z)\hat{a}_x$

(b) $\vec{E}_r = -40\pi\cos\left(10^8 t + \frac{1}{3}z\right)\hat{a}_x$

(c) $\vec{E}_r = -80\pi\cos(10^8 t - 3z)\hat{a}_x$

(d) $\vec{E}_r = 80\pi\cos\left(10^8 t + \frac{1}{3}z\right)\hat{a}_x$

91. When a lossless transmission line of length $\lambda/8$ is short-circuited at one end, the input impedance seen at the other end is j50 Ω. If the short-circuit is now replaced by a load resistance of 75 Ω, the magnitude of the reflection coefficient is

(a) $\frac{1}{5}$ (b) $\frac{2}{5}$

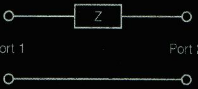
(c) $\frac{3}{5}$ (d) $\frac{4}{5}$

92. Two rectangular waveguides, one air-filled with internal dimensions 2 cm × 1 cm and the other dielectric-filled with internal dimensions 1 cm ×0.5 cm, have the same cut-off frequency for the dominant mode. The relative permittivity of the dielectric material is

(a) 2 (b) 4

(c) 6 (d) 8

93. For the circuit shown in figure, which one of the following is TRUE? (Assume characteristic impedance Z_0 for the ports)



(a) $S_{12} = 1 + S_{11}$ (b) $S_{12} = 1 - S_{11}$

(c) $S_{12} = S_1$ (d) $S_{22} = 1 + S_{21}$

94. Consider an air-filled rectangular waveguide operating in the dominant TE_{10} mode at a frequency f. For this waveguide, λ_g is the guide wavelength and C_{10} is the cut-off wavelength corresponding to the dominant TE_{10} mode propagates, which one of the following is TRUE?

(a) $\frac{1}{f} = \sqrt{\varepsilon_0\mu_0}\,\frac{\lambda_g\lambda_{C_{10}}}{\sqrt{\lambda_g^2 + \lambda_{C_{10}}^2}}$

(b) $f = \frac{1}{\sqrt{\varepsilon_0\mu_0}}\,\frac{\lambda_g\lambda_{C_{10}}}{\sqrt{\lambda_g^2 + \lambda_{C_{10}}^2}}$

(c) $\frac{1}{f} = \sqrt{\varepsilon_0\mu_0}\,\frac{\lambda_g\lambda_{C_{10}}}{\sqrt{\lambda_{C_{10}}^2 - \lambda_g^2}}$

(d) $f = \frac{1}{\sqrt{\varepsilon_0\mu_0}}\,\frac{\lambda_g\lambda_{C_{10}}}{\sqrt{\lambda_{C_{10}}^2 - \lambda_g^2}}$

95. An electromagnetic wave having frequency f_0 gets attenuated by a factor of e^{-2} after propagating a distance d in a good conductor. If the signal frequency is now reduced to 0.5 f_0, after travelling the same distance d in the same conductor, the signal with get attenuated by a factor of

(a) e^{-4} (b) $e^{-2\sqrt{2}}$

(c) $e^{-\sqrt{2}}$ (d) e^{-1}

96. If the amplitude of the time harmonic current distribution on a thin centre-fed short z-directed dipole antenna of length $l (l << \lambda)$ is given by $I(z) = I_0\left(1 - \frac{2|z|}{l}\right)$, which one of the following represents radiations resistance of the antenna?

(a) $320\pi^2\left(\frac{l}{\lambda}\right)$ (b) $80\pi^2\left(\frac{l}{\lambda}\right)^2$

(c) $40\pi^2\left(\frac{l}{\lambda}\right)^2$ (d) $20\pi^2\left(\frac{l}{\lambda}\right)^2$

97. An antenna having a gain of 10 dB radiates 1.5 W power in free space. The electric field intensity $(|\vec{E}|)$ at a distance of 1 km from the antenna is given by (Given the intrinsic impedance of free space, $\eta_0 \cong 120\,\pi\Omega$)

(a) $15\sqrt{2}$ mV/m (b) 30 mV/m

(c) 60 mV/m (d) 90 V/m

98. The cladding material of a step index fiber has a relative permittivity of 2.4375. Assuming both core and cladding materials to be non-magnetic, in order to have a numerical aperture of 0.25, the refractive index of the core should be

(a) 5 (b) 2.5

(c) $\sqrt{3.5}$ (d) $\sqrt{2.5}$

99. Given $\vec{A} = yz\hat{a}_x + xy\hat{a}_z$, $|\nabla \times \vec{A}|$ at the point P(0, 1, 2) is

(a) 0 (b) $\sqrt{2}$

(c) $\sqrt{3}$ (d) $\sqrt{5}$

100. With symbols having their usual meanings, which one of the following relationships is NOT correct?

(a) $\oint_C \vec{E}\cdot\vec{dl} = -\frac{\partial}{\partial t}\int_s \vec{H}\cdot\vec{ds}$

(b) $\oint_C \vec{H}\cdot\vec{dl} = I + \int_s \frac{\partial\vec{D}}{\partial t}\cdot\vec{ds}$

(c) $\oint_C \vec{B}\cdot\vec{ds} = 0$

(d) $\oint_C \vec{D}\cdot\vec{ds} = 0$

SECTION - B

101. $\sqrt{0.00005041}$ equals
(a) 0.00847 (b) 0.0049
(c) 0.0071 (d) 0.019

102. The missing term in the sequence 3, 7, 15, 31,........, 127 is
(a) 63 (b) 71
(c) 92 (d) 113

103. In a computer literacy course, the number of girls registered is half of that of boys. Halfway through, ten boys left the course and five girs joined, after which the number of boys becomes qual to the number of girls. At the begining, how many students registered for the course in total?
(a) 15 (b) 30
(c) 45 (d) 60

104. Consider the following table:

6	9	10
3	3	5
4	2	?
8	6	8

The missing number in the above table is
(a) 16 (b) 12
(c) 9 (d) 4

105. In an abstract mathematical coding, multiplication is codes as ÷, addition as x, subtraction as +, then $5 \times (4 \div 2) + 7$ equals
(a) 4 (b) 6
(c) 10 (d) 17

106. In a school project, the students are asked to form groups. Each group is to have two students. The students have to choose their partners with the restriction that no two students can be in the same group if they have worked together during the previous semester. Avik and Ravi decided to pair up now. Rita does not want to work with Pinki while Pinki worked with Neel during the previous semester. Among the following who could be Rita's partner?
(a) Avik (b) Pinki
(c) Ravi (d) Neel

107. The missing term in the sequence PQR, P^2QR, P^2Q^2R,.....,$P^3Q^2R^2$ is
(a) P^3Q^2R (b) $P^2Q^2R^2$
(c) $P^3Q^3R^2$ (d) P^3QR

108. If the word CAPITAL is written as AYNGRYJ in code, how would you code FORGET?
(a) DMPFCR (b) DMPECR
(c) CMPEBR (d) DLPECR

109. What eyes are to binoculars, lips are to
(a) Lipstic (b) Cigarette
(c) Candy (d) Microphone

110. As cotton is to cloth, gold is to
(a) Goldsmith (b) Ornaments
(c) Women (d) Metal

111. Consider the statements:
1. All mother are women.
2. Some parents are women.

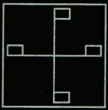
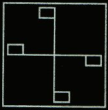
Person X concluded from the above that
P. All mothers are parents.
Q. All parents are mothers.
R. All women are mothers.
S. Some women are parents.

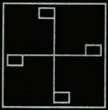
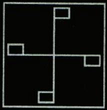
Which one of the following is the correct conclusion?
(a) P (b) Q
(c) R (d) S

112. The word CHEERS is coded as EHCSRE. According to the same rule, the word BASKET is coded as
(a) BSATEK (b) KETBAS
(c) SABTEK (d) ASBEKT

113. The odd one among Eye, Leg, Nose and Hand is
(a) Eye (b) Leg
(c) Hand (d) Nose

114. The odd figure among the following is

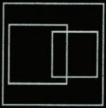
(a)  (b) 

(c)  (d) 

115. The relationship between R and S is same as that between P and Q.

 : 

(P) (Q)

 : 

(R) (S)

The best choice for S is

(a)  (b) 

(c)  (d) 

116. John is the last person in a queue. Ron is seventh in the queue from the front. Tim is positioned between John and Ron such that the number of people between Ron and Tim is the same as that between Tim and John. The position of Tim is 19^{th} from the front. What is the position of John in the queue?

(a) 29 (b) 30
(c) 31 (d) 32

117. Here are some words translated from an artificial language:

(i) PAMCERUL means sky blue.
(ii) CERUL LAX means blue cheese.
(iii) ORAN VITL means star bright.

Which word could mean 'bright sky'?

(a) CERUL PAM (b) ORAN CERUL
(c) LAX VITL (d) VITL PAM

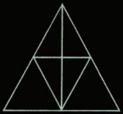
118. A child has X number of toys. If he arranges them in groups of two, three or four, he is left with one toy in each case. But if he arranges them in groups of five, he is left with none. The least possible value for X is

(a) 25 (b) 26
(c) 27 (d) 33

119. If CANE is coded as 1345 and MEAN as 8453, then TOKENS can be coded as

(a) 765239 (b) 142530
(c) 764539 (d) 762039

120. Consider the following figure:



The number of triangles in the above figure is

(a) 6 (b) 10
(c) 13 (d) 16

121. Two alloys contain silver and copper in the ratios 3 : 1 and 5 : 3 respectively. The alloys are mixed to get third alloy. Which of the following is possible for the ratio of silver to copper in the third alloy?

(a) 5 : 2 (b) 3 : 2
(c) 4 : 1 (d) 2 : 3

122. Mohit, Ajay, Balu, Shila and Anita are five students pursuing Bachelor's degree in five different subjects, namely, English, Physics, Mathematics, History and Statistics. Two of them stay in a hostel while the rest stay at home. Balu does not stay in hostel and studies Statistics. Anita studies Mathematics and Ajay studies English. Shila studies Physics. Also out of the students staying at home, one studies Physics and one studies History. What does Mohit study and where does he stay?
(a) Mathematics, hostel
(b) History, hostel
(c) English, home
(d) History, home

123. Three pencils cost the same as two erasers. Four erasers cost the same as one ruler. Two rulers cost the same as one pencil box. Which of the following statements is true?
(a) Six erasers cost the same as a pencil box.
(b) Two pencil boxes cost the same as five pencils.
(c) Six pencils cost the same as a ruler.
(d) Eight erasers and three pencils cost the same as a pencil box.

124. Four persons P, Q, R and S witnessed a crime and gave the following descriptions of the criminal
(a) Average height, Thin and Middle-aged
(b) Tall, Thin and Middle-aged
(c) Tall, Thin and Young
(d) Tall, Average weight and Middle-aged
The most likely description of the criminal is that of
(a) P (b) Q
(c) R (d) S

125. Consider the following figure:

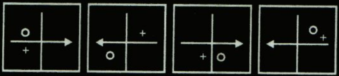
The figure in which of the above figure is embedded is

(a)  (b) 

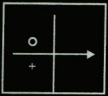
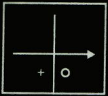
(c)  (d) 

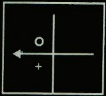
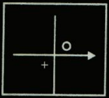
126. In a bus, there are 10 persons who can speak English, 6 persons who can speak French and 4 who can speak Portuguese. Further, two persons on the bus can speak exactly two of the above languages while one person can speak all the three languages. If each person on the bus speaks at least one of the three languages, how many persons are there in the bus?
(a) 20 (b) 19
(c) 17 (d) 16

127. Consider the following sequence of figures:



The next figure in the above sequence is

(a)  (b) 

(c)  (d) 

128. The next term in the sequence

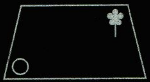
$-\frac{1}{32}, \frac{1}{8}, -\frac{1}{2}, 2, \ldots\ldots$ is

(a) 16 (b) 8
(c) –8 (d) –16

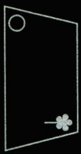
129. The missing term in the sequence 4, 2, 6, 4, 8, 8, 10,.....,12 is

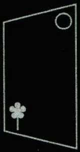
(a) 10 (b) 12
(c) 16 (d) 18

130. Consider the following figure:



When the above figure is rotated clockwise through 90 degrees and held before a plane mirror, the image obtained will be

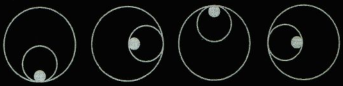
(a) 

(b) 

(c) 

(d) 

131. Consider the following sequence of figures:



The next figure in the above sequence is best given by

(a) 

(b) 

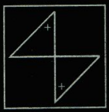
(c) 

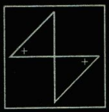
(d) 

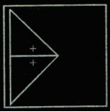
132. Consider the following sequence of figures:

The next figure in the above sequence is best given by

(a) 

(b) 

(c) 

(d) 

133. In a diagram there are disjoint hexagons, pentagons and squares. The number of sides of the pentagons added together is equal to the number of sides of the hexagons added together. This number of two more than the number of sides of the squares added together. Then, the number of hexagons is

(a) 20 (b) 15
(c) 12 (d) 10

134. Let $a_1, a_2, \ldots, a_{10}$ be integers such that $0 < a_1 < a_2 < \ldots < a_{10}$.
If $s = a_1 + a_2 + \ldots + a_{10}$, then
(a) $11 \le s \le 55$ (b) $110 \le s$
(c) $55 \le s$ (d) $55 \le s \le 110$

135. In an institute, car parking spaces for Director, Deputy Director, Registrar and Chief Librarian are reserved in order from left to right. The security person noted the following about the cars:
1. The car in the left most space is while.
2. A black car is parked between a white car and a red car.
3. The right most space has a yellow car.
Then, the colour of the Registrar's car is
(a) Black (b) Red
(c) Yellow (d) White

136. If x(x + 1) x + 2) = 64, then
(a) x is a positive odd integer
(b) x is a positive even integer
(c) x is a negative integer
(d) x is not an integer

137. In Roman numerals, the next term in the sequence LXIV, XXXVI, XVI, ... is
(a) II (b) IV
(c) IX (d) X

138. Q is the son of P and is married to R. S, the sister of R, is married to T. T is the brother of Q. How are S and P related?
(a) S is the sister-in-law of P
(b) S is the daughter of P
(c) S is the daughter-in-law-of P
(d) P is the daughter-in-law of S

139. Let X be a four digit number made up of the digits 6, 7 and 8 such that each of the three digits appears at least once. Then, the total number of distinct number that can be formed by rearranging the digits of X is
(a) 10 (b) 12
(c) 18 (d) 24

140. P, Q, R and S together have 20 marbles and each has at least one marble. If Q has six marbles more than P and S has 8 marbles more than R, then
(a) P and R have the same number of marbles
(b) R has less number of marbles than Q
(c) Q has less number of marbles than R
(d) Q and S have the same number of marbles

141. A goat is tied to a pole with a rope inside a square field of area 64 square metres. If the distance of the pole from each of the nearest boundaries is 3 metres, then the minimum length of the rope in metres such that the goat can graze the entire field is
(a) 5 (b) 10
(c) $5\sqrt{2}$ (d) $5\sqrt{3}$

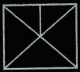
142. The highest power of 3 which exactly divides 10! is
(a) 3 (b) 2
(c) 5 (d) 4

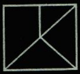
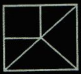
143. If TANGO is coded as NFMZS and APPLES is coded as RDKOOZ, then how is LIMBO coded?
(a) NALHK (b) PCNKM
(c) MJNCP (d) KHLAN

144. 0.99^{100} is closest to
(a) 0 (b) 10
(c) 100 (d) 1000

145. Consider the following sequence of figures:

The next figure of the above sequence is given by

(a)  (b) 

(c)  (d) 

146. Amar has to take five right turns and six left turns while walking from his office to his home. His home faces South. In which direction does his office face?

(a) East (b) West
(c) North (d) South

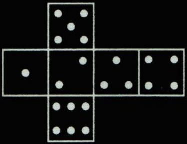
147. Consider the following sequence of figures:

The next figure to the above sequence is given by

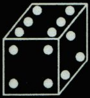
(a)  (b) 

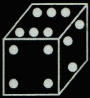
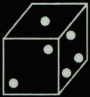
(c)  (d) 

148. A die is made by folding and gluing the following layout on a cardbord.



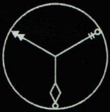
The die obtained woud look like

(a)  (b) 

(c)  (d) 

149. A wheel of radius $\frac{1}{\pi}$ cm has three spokes which are 120 degrees apart from each other. The wheel is oriented initially as shown in the following figure X:

The orientation of the wheel after traversing 5 cm is

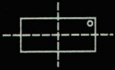
(a)  (b) 

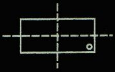
(c)  (d) 

150. Consider the rectangle X.

X

The reflection about the vertical axis is denoted by V and the reflection about the horizontal axis is denoted by H. The compound operation of three times V followed by H will generate the figure

(a)  (b) 

(c)  (d)