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Preface

B. Singh (Ex. IES)

When in fifteenth century, some audacious mariners had sailed to discover America; in the eyes of their contemporaries it wasn't justifiable but the fervour to uncover America from rest of the world made them to set the voyage. As it is rightly said "Heritage of man is not the earth but the entire universe"; and now man dares to assault the sky, just because of thinking what was never thought

DRDO, ISRO and BSNL are such organisations which think creatively and think beyond imagination. Ranging from 31 satellites in one flight to FATBOY to now 104 satellites in one rocket, launching and establishing satellites has become ISRO's metier.

To be a part of such great organisation is matter of pride hence, to help all aspirants looking forward to be the part of INDIA's next space exploration MADE EASY team has solved accurately and in detail all previous years' papers of DRDO, ISRO and BSNL.

MADE EASY team has made deep study of previous exam papers and observed that a good percentage of questions are repetitive. This book containing fully explained questions from 2006 onwards will serve as an effective tool to succeed in examination.

I would like to acknowledge efforts of entire MADE EASY team who worked hard to solve previous years' papers with accuracy and I hope this book will stand upto the expectations of aspirants and my desire to serve student fraternity by providing best study material and quality guidance will get accomplished.

With Best Wishes

B. Singh

CMD, MADE EASY Group

DRDO, ISRO and BSNL(JTO)

EC: Previous Years Solved Papers and Practice Sets

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ISRO

Indian Space Research Organization

(Technical)

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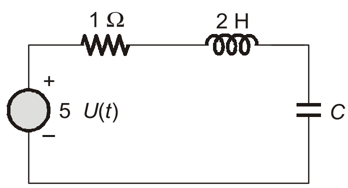
1

ISRO-2006

(Indian Space Research Organisation)

Q.1 The value of C which gives the critical damping in the given circuit is

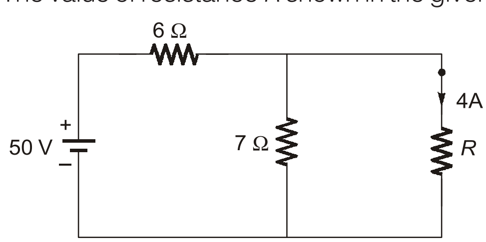


(a) 2 F (b) 4 F
(c) 8 F (d) 1 F

Q.2 A series RLC circuit resonates at 3 MHz and has 3-dB bandwidth of 10 kHz. The Q of the circuit at resonance

(a) 30 (b) $\frac{300}{\sqrt{2}}$
(c) 300 (d) $300\sqrt{2}$

Q.3 The value of resistance R shown in the given figure



(a) 3.5 Ω (b) 2.5 Ω
(c) 1 Ω (d) 4.5 Ω

Q.4 At 3-dB frequencies, current in the series RLC circuit is equal to current at resonance multiplied by

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$
(c) $\frac{1}{4}$ (d) $\frac{1}{2\sqrt{2}}$

Q.5 A series RLC circuit resonates at 1000 kHz. At frequency of 995 kHz, the circuit impedance is
(a) Resistive (b) Minimum
(c) Inductive (d) Capacitive

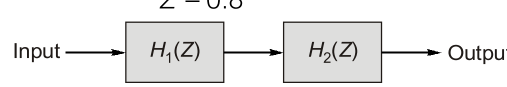
Q.6 If each stage had gain of 10 dB and noise figure of 10 dB, then the overall noise figure of two-stage cascade amplifier will be
(a) 10 (b) 1.09
(c) 1.0 (d) 10.9

Q.7 In sigma delta ADC, high bit accuracy is achieved by
(a) Over sampling and noise shaping
(b) Over sampling
(c) Under sampling
(d) None of the above

Q.8 Let $\delta(t)$ denote the delta function. The value of the integral $\int_{-a}^{a} \delta(t)\cos\left(\frac{3t}{2}\right)dt$ is
(a) 1 (b) – 1
(c) 0 (d) $\pi/2$

Q.9 Consider the compound system shown in below figure. Its output is equal to the input with a delay of two units. If the transfer function of the first system is given by

$H_1(Z) = \frac{Z-0.5}{Z-0.8}$, then the



(a) $H_2(Z) = \frac{Z^{-2}-0.2Z^{-3}}{1-0.4Z^{-1}}$

(b) $H_2(Z) = \frac{Z^{-2}-0.8Z^{-3}}{1-0.5Z^{-1}}$

(c) $H_2(Z) = \frac{Z^{-1}-0.2Z^{-3}}{1-0.4Z^{-1}}$

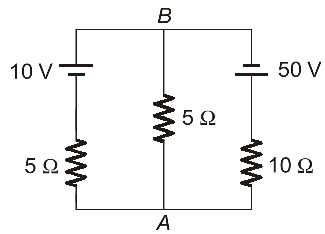
(d) $H_2(Z) = \frac{Z^{-2}-0.8Z^{-3}}{1-0.5Z^{-1}}$

Q.10 The z-transform of the signal

$$x(n) = \begin{Bmatrix} 1, n=-1 \\ 2, n=0 \\ -1, n=1 \\ 1, n=2 \\ 0, \text{otherwise} \end{Bmatrix}$$

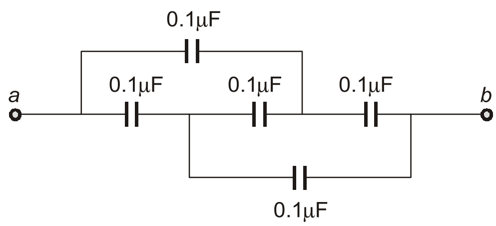
(a) $z + 2 - z^{-1} + z^{-2}$ (b) $z^{-1} + 2 - z + z^2$
(c) $z + 2z^2 - z^{-1} + z^{-2}$ (d) $z + 2 - z^{+1} + z^{-2}$

Q.11 For the circuit shown in the given figure, the voltage V_{AB} is



(a) 6 V (b) 10 V
(c) 25 V (d) 40 V

Q.12 The equivalent capacitance across 'ab' will be



(a) 0.2 μF (b) 0.1 μF
(c) 0.5 μF (d) 0

Q.13 The transfer function, $T(s) = \frac{s}{s+a}$ is that of a

(a) Low-pass filter (b) Notch filter
(c) High-pass filter (d) Band-pass filter

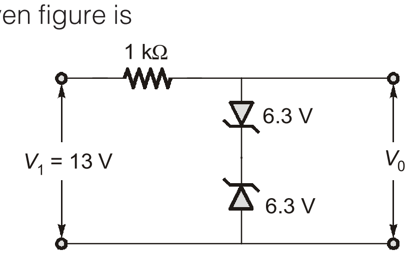
Q.14 A particular current is made up of two components : a 10 A dc and a sinusoidal current of peak value of 1.414 A. The average value of the resultant current is

(a) zero (b) 24.14 A
(c) 10 A (d) 14.14 A

Q.15 By doubling the sampling frequency

(a) Quantisation noise decreases by 3 dB
(b) Quantisation noise density decreases by 3 dB
(c) Quantisation noise increases by 3dB
(d) Quantisation noise density increases by 3 dB

Q.16 The output voltage (v_0) of the circuit shown in the given figure is

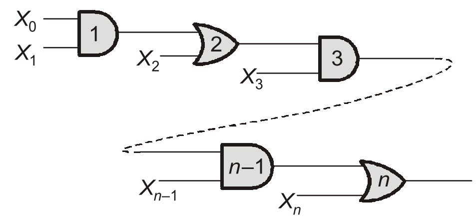


(a) zero (b) 5.7 V
(c) 6.9 V (d) 12.6 V

Q.17 Assuming that only the X and Y logic inputs are available and their complements $\bar{X}$ and $\bar{Y}$ are not available, what is the minimum number of two-input NAND gates requires to implement $X \oplus Y$?

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

Q.18 In the given network of AND and OR gates f can be written as:



(a) $X_0 X_1 X_2 \ldots X_n + X_1 X_2 \ldots X_n + X_2 X_3 \ldots X_n \ldots X_n$
(b) $X_0 X_1 + X_2 + X_3 + \ldots X_{n-1} . X_n$
(c) $X_0 + X_1 + X_2 + \ldots X_n$
(d) $X_0 X_1 X_3 \ldots X_{n-1} + X_2 + X_3 + X_5 \ldots X_{n-1} + \ldots + X_{n-2} + X_{n-1} + X_n$

Q.19 A pulse train with a frequency of 1 MHz is counted using a modulo 1024 ripple-counter built with J-K filip-flops. For proper operation of the counter the maximum permissible propagation delay per filp-flop stage is

(a) 100 n sec (b) 50 n sec
(c) 20 n sec (d) 10 n sec

Q.20 The A/D converter used in a digital voltmeter could be (1) successive approximation type (2) Flash converter type (3) Dual slope converter type. The correct sequence in the increasing order of their conversion times is

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

Q.21 The resolution of D/A converter is approximately 0.4% of its full-scale range. It is

(a) An 8-bit converter (b) A 10-bit converter
(c) A 12 bit converter (d) A 16 bit converter

Q.22 In a microprocessor, the resistor which holds the address of the next instruction to be fetched is

(a) Accumulator (b) Program counter
(c) Stack pointer (d) Instructor register

Q.23 In microcomputer, WAIT states are used to

(a) Make the processor wait during a DMA operation
(b) Make the processor wait during a power interrupt processing
(c) Make the processor wait during a power shutdown
(d) Interface slow peripherals to the processor

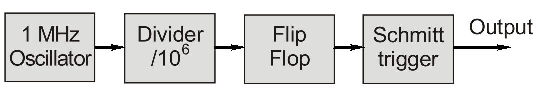
Q.24 Which of the following statements are correct?
1. A flip-flop is used to store 1 bit of information.
2. Race-around condition occurs in a J-K flip-flops when both the inputs are 1.
3. Master-slave configuration is used in flip-flops to store 2 bits of information.
4. A transparent latch consists of a *D*-type flip-flop.

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

Q.25 How many 1's are present in the binary representation of $3 \times 512 + 7 \times 64 + 5 \times 8 + 3$?
(a) 8 (b) 9
(c) 10 (d) 11

Q.26 For emitter-coupled logic, the switching speed is very high because
(a) Negative logic, is used
(b) The transistors are not saturated when conducting
(c) Emitter-coupled transistor are used
(d) Multi-emitter transistors are used

Q.27 The output of the circuit shown below is

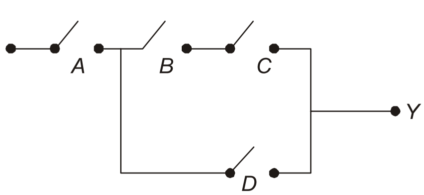


(a) A pulse train of duration 0.5 sec
(b) A pulse train of duration 2 sec
(c) A pulse train of duration 1 sec
(d) A pulse train of duration 5 sec

Q.28 Gray code for number 7 is
(a) 1100 (b) 1001
(c) 0110 (d) 0100

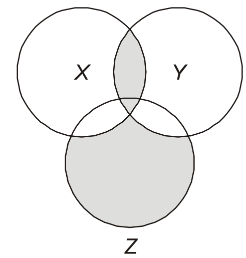
Q.29 10 bit *A*/*D* converters, the quantization error is given by (in percent)
(a) 1 (b) 2
(c) 0.1 (d) 0.2

Q.30 For the switch circuit, taking open as 0 and closed as 1, the expression for the circuit in *Y*



(a) $A + (B + C)D$ (b) $A + BC + D$
(c) $A(BC + D)$ (d) None of these

Q.31 The Boolean expression for the shaded area in the Venn diagram is



(a) $\bar{X} + \bar{Y} + Z$ (b) $X\bar{Y}Z + \bar{X}YZ$
(c) $X + Y + Z$ (d) $\bar{X}\,\bar{Y}\,Z + XY$

Q.32 If the memory chip size is 256*1 bits, then the number of chips required to make up 1 K bytes of memory is
(a) 32 (b) 24
(c) 12 (d) 8

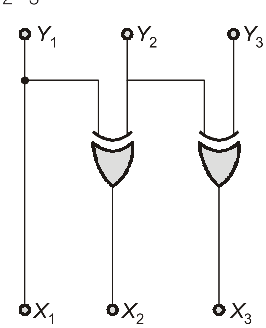
Q.33 Given the decimal number – 19, an eight bit two's complement representation is given by
(a) 11101110 (b) 11101101
(c) 11101100 (d) None of these

Q.34 The function shown in the figure when simplified will yield a result with

CD \ AB	00	01	11	10
00	1	0	1	0
01	0	1	0	0
11	1	0	1	0
10	0	1	0	1

(a) 2 terms (b) 4 terms
(c) 7 terms (d) 16 terms

Q.35 The logic circuit given below converts a binary code $Y_1Y_2Y_3$ into



(a) Excess -3 code (b) Gray code
(c) BCD code (d) Hamming code

Q.36 A 4-bit synchronous counter uses flip-flops with propagation delay time of 25 ns each. The maximum possible time required for change of state will be
(a) 25 ns (b) 50 ns
(c) 75 ns (d) 100 ns

Q.37 An electromagnetic wave incident on a perfect conductor is
(a) Entirely reflected (b) Fully transmitted
(c) Partially transmitted (d) None of these

Q.38 The characteristic impedance of a lossless transmission line is given by
(a) $Z = \sqrt{LC}$ (b) $Z = \sqrt{C/L}$
(c) $Z = LC$ (d) $Z = \sqrt{L/C}$

Q.39 A lossless line of 50 ohms is terminated in a load of 100 ohms resistive. The VSWR is
(a) 1 : 2 (b) 2 : 1
(c) 4 : 1 (d) 1 : 4

Q.40 Which of the following does not exist in waveguides
(a) TE waves
(b) TM waves
(c) TE waves and TM waves
(d) TEM waves

Q.41 Two carriers of 2 GHz and 4 GHz respectively are frequency modulated by a signal of 10 kHz, such that bandwidth of the FM signal in the two cases are same. The peak deviation in the two cases are in the ratio of
(a) 1 : 8 (b) 1 : 2
(c) 2 : 1 (d) 1 : 1

Q.42 The bandwidth required for *QPSK* modulated channel is
(a) Twice the *BW* of *BPSK*
(b) Equal to *BPSK*
(c) Equal to *FSK*
(d) Half of the *BW* of *BPSK*

Q.43 Magic *T* is
(a) Four port junction (b) Two port junction
(c) Three port junction (d) It is not junction

Q.44 Duplexer is made of
(a) Only receive filter
(b) Only transmit filter
(c) Only circulator
(d) Both receive filter and transmit filter

Q.45 The gain *G* of an antenna of effective area *A* is given by
(a) $G = \frac{4\pi\lambda}{A^2}$ (b) $G = \frac{4\pi A}{\lambda}$
(c) $G = \frac{4\pi A}{\lambda^2}$ (d) None

Q.46 If the short circuit and open circuit impedance of line are 5 and 20 Ω respectively the characteristic impedance is given by
(a) 100 Ω (b) 10 Ω
(c) 15 Ω (d) 10000 Ω

Q.47 The input impedance of short circuited line of length l where $\frac{\lambda}{4} < l < \frac{\lambda}{2}$, is
(a) Capacitive (b) Inductive
(c) Resistive (d) None of these

Q.48 Maximum coding gain in
(a) Block codes
(b) Convolution codes
(c) Turbo codes
(d) RS codes

Q.49 Noise figure of an amplifier depends on
(a) Bandwidth (b) Output power
(c) Power input (d) None of the above

Q.50 BCH code belongs to
(a) Block codes (b) Convolution codes
(c) Turbo codes (d) None of the above

Q.51 When a carrier is phase modulated, with an integrated modulating signal, the resultant is
(a) Phase modulated signal
(b) Frequency modulated signal
(c) Amplitude modulated signal
(d) QPSK modulated signal

Q.52 A satellite orbiting in 600 km orbit transmits 5 GHz frequency. The Doppler shift observed at the ground station, when the satellite is over head of the station is
(a) Zero (b) Maximum
(c) Infinity (d) None of the above

Q.53 A communication channel disturbed by additive white Gaussian noise has a bandwidth of 4 kHz and SNR of 15. The highest transmission rate that such a channel can support (in k-bits/sec) is
(a) 16 (b) 1.6
(c) 3.2 (d) 60

Answers ISRO-2006

1.	(c)	2.	(c)	3.	(a)	4.	(b)	5.	(d)	6.	(d)	7.	(b)	8.	(a)
9.	(b)	10.	(a)	11.	(a)	12.	(b)	13.	(c)	14.	(c)	15.	(a)	16.	(c)
17.	(c)	18.	(d)	19.	(a)	20.	(b)	21.	(a)	22.	(b)	23.	(d)	24.	(c)
25.	(b)	26.	(b)	27.	(b)	28.	(d)	29.	(c)	30.	(c)	31.	(d)	32.	(a)
33.	(b)	34.	(c)	35.	(b)	36.	(a)	37.	(a)	38.	(d)	39.	(b)	40.	(d)
41.	(d)	42.	(d)	43.	(a)	44.	(d)	45.	(c)	46.	(b)	47.	(a)	48.	(c)
49.	(d)	50.	(a)	51.	(b)	52.	(b)	53.	(a)	54.	(c)	55.	(b)	56.	(b)
57.	(b)	58.	(c)	59.	(c)	60.	(c)	61.	(d)	62.	(c)	63.	(d)	64.	(a)
65.	(d)	66.	(a)	67.	(b)	68.	(c)	69.	(b)	70.	(c)	71.	(d)	72.	(c)
73.	(a)	74.	(d)	75.	(b)	76.	(d)	77.	(a)	78.	(c)	79.	(d)	80.	(d)

Explanations ISRO-2006

1. (c)

In a series *RLC* circuit, for critical damping.

$$\alpha = \omega_0$$

$$\frac{R}{2L} = \frac{1}{\sqrt{LC}}$$

$$\Rightarrow \quad C = \frac{4L}{R^2} = \frac{4\times 2}{1^2} = 8\text{ F}$$

Alternate solution:

$$\xi = \frac{R}{2}\sqrt{\frac{C}{L}}$$

For critical damping $\xi = 1$

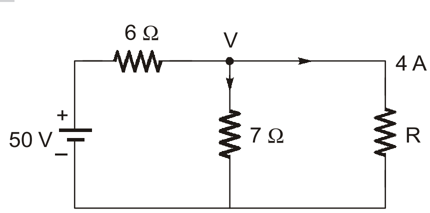
$$1 = \frac{R}{2}\sqrt{\frac{C}{L}}$$

$$C = \frac{4}{R^2}\cdot L = \frac{4}{1^2}\cdot 2 = 8\text{ F}$$

2. (c)

$$\text{Quality factor } (Q) = \frac{f_r}{B.W.} = \frac{3\times 10^6}{10\times 10^3} = 300$$

3. (a)



$$\frac{V-50}{6} = \frac{0-V}{7} - 4$$

$$V = 14\ V$$

$$14 = 4\times R$$

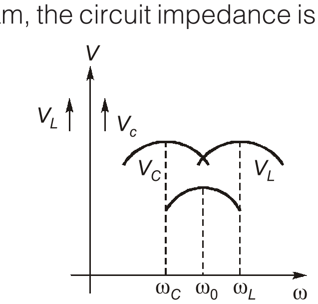
$$\therefore \quad R = \frac{14}{4} = 3.5\ \Omega$$

4. (b)

At 3-dB frequencies current is multiplied by $\frac{1}{\sqrt{2}}$ of the current at resonant frequency.

5. (d)

$f_0 = 1000$ kHz and given frequency is $f = 995$ kHz. Here at f = 995 kHz it is obvious from the below diagram, the circuit impedance is capacitive.



6. (d)

$$F = F_1 + \frac{F_2 - 1}{G_1}$$

$$= 10 + \frac{10-1}{10} = 10 + 0.9 = 10.9$$

9. (b)

$$Y(n) = x(n-2)$$
$$\Rightarrow \quad Y(z) = z^{-2} X(z)$$
$$\Rightarrow \quad \frac{Y(z)}{X(z)} = \frac{1}{z^2}$$
$$H_1(z)\, H_2(z) = \frac{1}{z^2}$$
$$\frac{z-0.5}{z-0.8} \cdot H_2(z) = \frac{1}{z^2}$$
$$\Rightarrow \quad H_2(z) = \frac{1}{z^2}\,\frac{z-0.8}{(z-0.5)}$$
$$\therefore \quad H_2(z) = \frac{z^{-2} - 0.8z^{-3}}{1-0.5z^{-1}}$$

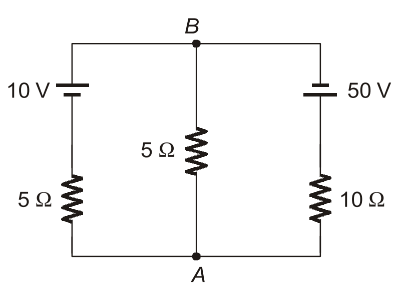
10. (a)

$$x(n) = \{1, \underset{\uparrow}{2}, -1, 1\}$$

By the definition of z-transform

$$x(n) = \sum_{n=-\infty}^{\infty} x(n) z^{-n} = \sum_{n=-1}^{2} x(n) z^{-n}$$
$$= x(-1)\, z + x(0) + x(1)\, z^{-1} + x(2)\, z^{-2}$$
$$= z + 2 - z^{-1} + z^{-2}$$

11. (a)



Apply KCL at point B, let the potential at point B is V:

$$\frac{V-10}{5} + \frac{V}{5} + \frac{V+50}{10} = 0$$
$$V_{BA} = -6$$
$$\therefore \quad V_{AB} = 6$$

14. (c)

$$I_{av} = \frac{1}{2\pi}\int_0^{2\pi} (10 + a\sin t)\, dt$$
$$a = 1.414$$
$$I_{av} = 10 \text{ A}$$

15. (a)

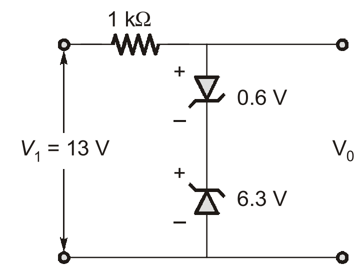
$$(\text{QNP})\ \alpha \frac{1}{f_s}; \qquad \frac{(\text{QNP})_1}{(\text{QNP})_2} = \frac{1/f_s}{1/2f_s} = 2$$

$$\Rightarrow \quad \frac{(\text{QNP})_2}{(\text{QNP})_1} = 10\log\left(\frac{1}{2}\right) = -3.0 \text{ dB}$$

It means quantisation noise decreases by 3 dB and negative sign signifies decreases in quantisation noise.

16. (c)

One Zener diode will be forward biased and will behave as a normal diode. So voltage drop in 0.6 V and another Zener diode will be reversed biased and voltage drop will be 6.3 V.



So, the output (V_0) = (6.3 + 0.6 V) = 6.9 V

19. (a)

$$f_{max} = \frac{1}{nt_{pd}}$$
$$\therefore \quad t_{pd} = \frac{1}{10 \times 10^6} = 100 \text{ nsec.}$$

20. (b)

Conversion time

Dual slope converter > successive approximation type > flash type converter.

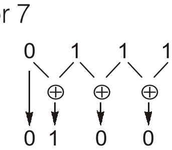
27. (b)

The output of divider is 1 Hz, Schmitt trigger will not change the frequency and flip-flop will half the input frequency. So, ultimately the output frequency is $\frac{1}{2}$ Hz.

$$\therefore \quad T = \frac{1}{f} \quad \Rightarrow \quad T = \frac{1}{1/2} = 2 \text{ sec.}$$

28. (d)

Gray code for 7



32. (a)

$$\text{Number of chips} = \frac{1 \times 1024 \times 8}{256 \times 1} = 32.$$

33. (b)

The binary representation of +19 in 8-bit is

0 0 0 1 0 0 1 1

2's complement of +19 is –19 and binary representation is

1 1 1 0 1 1 0 1

36. (a)

In synchronous counter, clock is given to all the flip-flops simultaneously. Hence time required for change of state is equal to the propagation delay time.

38. (d)

For a lossless line $R = 0$, $G = 0$.

$$Z = R + j\omega L = j\omega L$$

$$Y = G + j\omega C = j\omega C$$

$$Z_0 = \sqrt{\frac{Z}{Y}} = \sqrt{\frac{j\omega L}{j\omega C}} = \sqrt{\frac{L}{C}}$$

39. (b)

Reflection coefficient

$$|\Gamma| = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{100 - 50}{100 + 50} = \frac{1}{3}$$

$$\text{VSWR} = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+\frac{1}{3}}{1-\frac{1}{3}} = \frac{\frac{4}{3}}{\frac{2}{3}} = 2:1$$

41. (d)

Bandwidth of FM is given by Carson's rule

$$(\text{B.W.})_{FM} = 2(\Delta f + f_m)$$

$$2(\Delta f_1 + f_{m1}) = 2(\Delta f_2 + f_{m2})$$

$$f_{m1} = f_{m2} = 10 \text{ kHz}$$

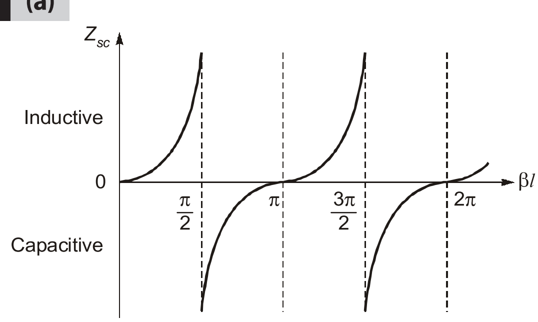
$$\Delta f_1 + 10 \text{ kHz} = \Delta f_2 + 10 \text{ kHz}$$

$$\therefore \quad \frac{\Delta f_1}{\Delta f_2} = \frac{1}{1} = 1:1$$

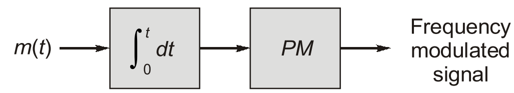
46. (b)

$$Z_0 = \sqrt{Z_{OC} \cdot Z_{SC}} = \sqrt{5 \times 20} = 10\ \Omega.$$

47. (a)



51. (b)



53. (a)

According to Shannon's channel capacity theorem:

$$C = B\log_2(1 + \text{SNR})$$

$$= 4\log_2(1 + 15)$$

$$= 4\log_2^{16} = 4\log_2^{2^4} = 16 \text{ kbps}$$

54. (c)

$$P_r = |\rho|^2\ P_i$$

Where, P_r = Reverse power

P_i = input power

P = Reflection coefficient

$$\therefore \quad |\rho|^2 = \frac{P_r}{P_i} = \frac{4}{100}$$

$$\Rightarrow \quad |\rho| = \frac{2}{10} = \frac{1}{5}$$

$$\text{VSWR} = \frac{1+|\rho|}{1-|\rho|} = \frac{1+\frac{1}{5}}{1-\frac{1}{5}} = \frac{\frac{6}{5}}{\frac{4}{5}} = 1.5$$

55. (b)

$$P_{dB} = 10\log\left(\frac{P_0}{P_{in}}\right) \text{dB}$$

$$\Rightarrow \quad 30 = 10\log\frac{P_0}{P_{in}}$$

$$\frac{P_0}{P_{in}} = 1000$$

$$P_0 = 1000 \times 10^{-6} \text{ W} = 1 \times 10^{-3} \text{ W}.$$

$$P_0(\text{dBm}) = 10\log\left(\frac{P_0}{10^{-3}}\right) \text{dBm}$$

$$= 10\log\left(\frac{10^{-3}}{10^{-3}}\right) \text{dBm} = 0 \text{ dBm}$$

56. (b)

$$P_{r(\text{dB})} = (P_t G_t)_{\text{dB}} - L_{\text{path}}$$

$$10 = 10\log G_t$$

$$\Rightarrow \quad G_t = 10$$

$$P_t G_t = 10 \times 10 = 100$$

$$(P_t G_t)_{\text{dB}} = 10\log 100 = 20 \text{ dB}$$

Path loss (L_{path}) = 100 dB

$$\therefore \quad P_r(\text{dB}) = (20 - 100) \text{ dBW} = -80 \text{ dBW}$$

EC

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16 DRDO-2008

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SECTION-A (TECHNICAL)

Q.1 The threshold voltage V_t is negative for
(a) an n-channel enhancement MOSFET
(b) an n-channel depletion MOSFET
(c) a p-channel depletion MOSFET
(d) a p-channel JFET

Q.2 At a given temperature a semiconductor with intrinsic carrier concentration $n_i = 10^{16}/m^3$ is doped with a donor of dopant concentration $N_D = 10^{26}/m^3$. Temperature remaining the same the hole concentration in the doped semiconductor is
(a) $10^{26}/m^3$ (b) $10^{16}/m^3$
(c) $10^{14}/m^3$ (d) $10^{6}/m^3$

Q.3 At room temperature the diffusion and drift constants for holes in a P-type semiconductor were measured to be D_p = 10 cm^2/s and μ_p = 1200 cm^2/V-s, respectively. If the diffusion constant of electrons in an N-type semiconductor at the same temperature is D_n = 20 cm^2/s, the drift constant for electrons in it is
(a) μ_n = 2400 cm^2/V-s
(b) μ_n = 1200 cm^2/V-s
(c) μ_n = 1000 cm^2/V-s
(d) μ_n = 600 cm^2/V-s

Q.4 A common LED is made up of
(a) intrinsic semiconductor
(b) direct semiconductor
(c) degenerate semiconductor
(d) indirect semiconductor

Q.5 When operating as a voltage regulator the breakdown in a Zener diode occurs due to the
(a) tunneling effect
(b) avalanche breakdown
(c) impact ionization
(d) excess heating of the junction

Q.6 If the common base DC current gain of a BJT is 0.98, its common emitter DC current gain is
(a) 51 (b) 49
(c) 1 (d) 0.02

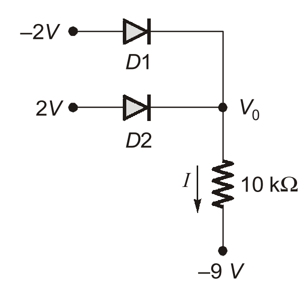
Q.7 Negative resistance characteristics is exhibited by a
(a) Zener diode (b) Schottky diode
(c) Photo diode (d) Tunnel diode

Q.8 Let E_{Fn} and E_{Fp}, respectively, represent the effective Fermi levels for electrons and holes during current conduction in a semiconductor. For lasing to occur in a P-N junction of band-gap energy 1.2 eV. ($E_{Fn} - E_{Fp}$) should be
(a) greater than 1.2 eV
(b) less than 1.2 eV
(c) equal to 1.1 eV
(d) equal to 0.7 eV

Q.9 In a P-well fabrication process, the substrate is
(a) N-type semiconductor and is used to build P-channel MOSFET
(b) P-type semiconductor and is used to build P-channel MOSFET
(c) N-type semiconductor and is used to build N-channel MOSFET
(d) P-type semiconductor and is used to build N-channel MOSFET

Q.10 In a MOS capacitor with n-type silicon substrate, the Fermi potential ϕ_F = –0.41 V and the flat-band voltage V_{FB} = 0 V. The value of the threshold voltage V_T is
(a) –0.82 V (b) –0.41 V
(c) 0.41 V (d) 0.82 V

Refer Figure for Q.11 and Q.12. Assume $D1$ and $D2$ to be ideal diodes.



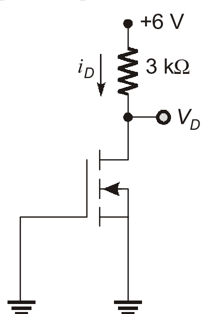
Q.11 Which one of the following statements is true?
(a) Both $D1$ and $D2$ are ON
(b) Both $D1$ and $D2$ are OFF
(c) $D1$ is ON and $D2$ is OFF
(d) $D2$ is ON and $D1$ is OFF

Q.12 Values of V_0 and I, respectively, are
(a) 2 V and 1.1 mA (b) 0 V and 0 mA
(c) –2 V and 0.7 mA (d) 4 V and 1.3 mA

Q.13 In a BJT CASCODE pair, a
(a) common emitter follows a common base
(b) common base follows a common collector
(c) common collector follows a common base
(d) common base follows a common emitter

Q.14 Inside a 741 op-amp the last functional block is a
(a) differential amplifier
(b) level shifter
(c) class-A power amplifier
(d) class-AB power amplifier

Q.15 For the MOSFET in the circuit in figure, the threshold voltage $V_T = 0.5$ V, the process parameter $K_P = 150\ \mu A/V^2$ and $W/L = 10$. The values of V_D and I_D, respectively, are



(a) $V_D = 4.5$ V and $I_D = 1$ mA
(b) $V_D = 4.5$ V and $I_D = 0.5$ mA
(c) $V_D = 4.8$ V and $I_D = 0.4$ mA
(d) $V_D = 6$ V and $I_D = 0$ mA

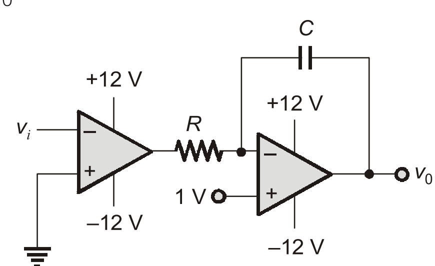
Q.16 A negative feedback is applied to an amplifier with the feedback voltage proportional to the output current. This feedback increase the
(a) input impedance of the amplifier
(b) output impedance of the amplifier
(c) distortion in the amplifier
(d) gain of the amplifier

Q.17 The early effect in a BJT is modeled by the small signal parameter
(a) r_0 (b) r_π
(c) g_m (d) β

Q.18 For a given filter order, which one of the following type of filters has the least amount of ripple both in pass-band and stop-band?
(a) Chebyshev type-I
(b) Bessel
(c) Chebyshev type-II
(d) Elliptic

Q.19 For a practical feedback circuit to have sustained oscillation, the most appropriate value of the loop gain T is
(a) 1 (b) –1
(c) –1.02 (d) 1.02

Q.20 Assume the op-amps in figure to be ideal. If the input signal v_i is a sinusoid of 2 V peak-to-peak and with zero DC component, the output signal v_0 is a

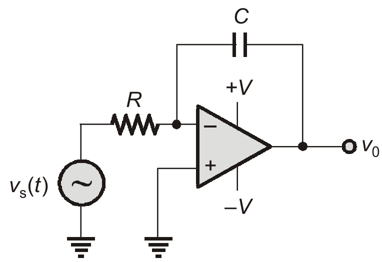


(a) sine wave (b) square wave
(c) pulse train (d) triangular wave

Q.21 In a common source amplifier, the mid-band voltage gain is 40 dB and the upper cut-off frequency is 150 kHz. Assuming single pole approximation for the amplifier, the unity gain frequency f_T is
(a) 6 MHz (b) 15 MHz
(c) 150 MHz (d) 1.5 GHz

Q.22 An op-amp is ideal except for finite-gain and $CMRR$. Given, the open loop differential gain $A_d = 2000$, $CMRR = 1000$, the input to the non inverting terminal is 5.001 V and the input to the inverting terminal is 4.999 V, the output voltage of the op-amp is
(a) 14 V (b) 24 V
(c) –6 V (d) –8 V

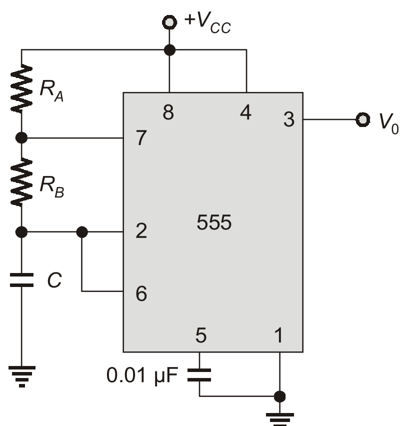
Q.23 The op-amp in the circuit in figure has a non-zero DC-offset. The steady state value of the output voltage v_0 is



(a) $-RC\dfrac{dV_s(t)}{dt}$ (b) $-\dfrac{1}{RC}\int_0^t v_s(t)\,dt$

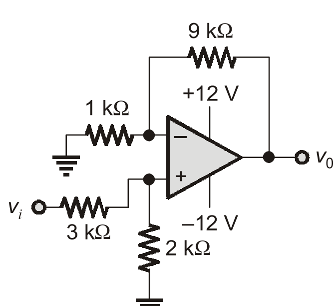
(c) $-V$ (d) $+V$

Q.24 For the circuit in figure, if the value of the capacitor C is doubled, the duty-cycle of the output waveform v_0



(a) increases by a factor of 2
(b) increases by a factor of 1.44
(c) remains constant
(d) decreases by a factor of 1.44

Q.25 Assume the op-amp in the circuit of figure to be ideal. The value of the output voltage v_0 is



(a) 3.2 v_i (b) 4 v_i
(c) 9 v_i (d) 10 v_i

Q.26 The complement of the Boolean expression

$F = (X + \bar{Y} + Z)(\bar{X} + \bar{Z})(X + Y)$

(a) $XYZ + X\bar{Z} + \bar{Y}Z$

(b) $\bar{X}Y\bar{Z} + XZ + \bar{X}\bar{Y}$

(c) $\bar{X}Y\bar{Z} + XZ + \bar{Y}\bar{Z}$

(d) $XYZ + \bar{X}\bar{Y}$

Q.27 The Boolean function $F(A, B, C, D) = \Sigma(0, 6, 8, 13, 14)$ with don't care conditions $d(A, B, C, D) = \Sigma(2, 4, 10)$ can be simplified to

(a) $F = \bar{B}\bar{D} + C\bar{D} + AB\bar{C}$

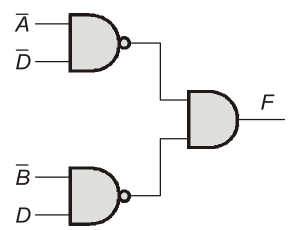
(b) $F = \bar{B}\bar{D} + C\bar{D} + AB\bar{C}D$

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

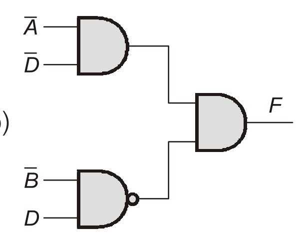
(d) $F = \bar{B}\bar{D} + C\bar{D} + ABCD$

Q.28 The Boolean function $F = \bar{A}\bar{D} + \bar{B}D$ can be realized by

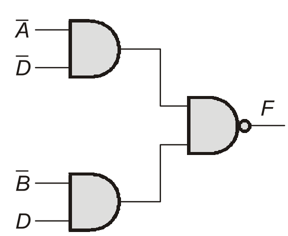
(a)



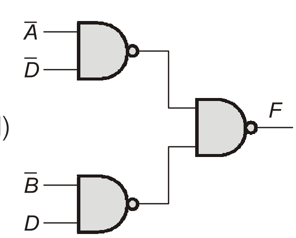
(b)



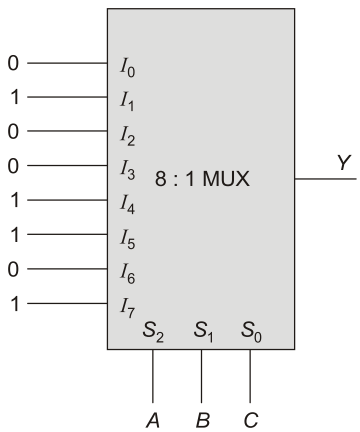
(c)



(d)



Q.29 For the multiplexer shown in figure, the Boolean expression for the output Y is



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

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

Q.30 Which one of the following is TRUE?
(a) Both latch and flip-flop are edge triggered
(b) A latch is level triggered and a flip-flop is edge triggered
(c) A latch is edge triggered and a flip-flop is level triggered
(d) Both latch and flip-flop are level triggered.

Q.31 In a Schottky TTL gate, the Schottky diode
(a) increases the propagation delay
(b) increases the power consumption
(c) prevents saturation of the output transistor
(d) keeps the transistor in cut-off region

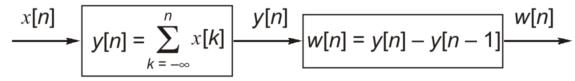
Q.32 For which one of the following ultraviolet light is used to erase the stored contents?
(a) PROM (b) EPROM
(c) EEPROM (d) PLA

Q.33 Which one of the following is NOT a synchronous counter?
(a) Johnson counter
(b) Ring counter
(c) Ripple counter
(d) Up-down counter

Q.34 In 8085 microprocessor, the accumulator is a
(a) 4 bit register (b) 8 bit register
(c) 16 bit register (d) 32 bit register

Q.35 In the register indirect addressing mode of 8085 microprocessor, data is stored
(a) at the address contained in the register pair
(b) in the register pair
(c) in the accumulator
(d) in a fixed location of the memory

Q.36 The output $w[n]$ of the system shown in figure is



(a) $x[n]$ (b) $x[n-1]$

(c) $x[n] - x[n-1]$ (d) $\frac{1}{2}(x[n-1] + x[n])$

Q.37 Which one of the following is a periodic signal?

(a) $x_1(t) = 2e^{j\left(t + \frac{\pi}{4}\right)}u(t)$

(b) $x_2[n] = u[n] + u[-n]$

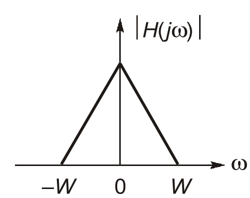
(c) $x_3[n] = \sum_{k=-\infty}^{\infty} \{\delta[n-4k] - \delta[n-1-4k]\}$

(d) $x_4(t) = e^{(-1+j)t}$

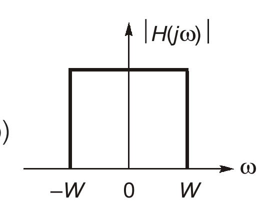
Q.38 If the input-output relation of a system is $y(t) = \int_{-\infty}^{2t} x(\tau)d\tau$, then the system is
(a) linear, time invariant and unstable
(b) linear, non-causal and unstable
(c) linear, causal and time invariant
(d) non-causal, time invariant and unstable

Q.39 Which one of the following can be the magnitude of the transfer function $|H(j\omega)|$ of a causal system?

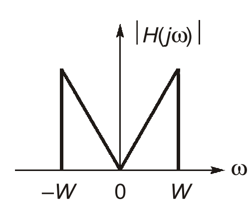
(a)



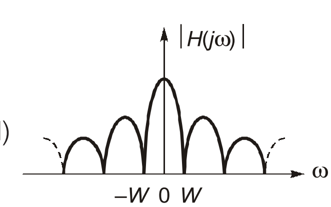
(b)



(c)



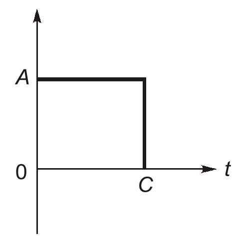
(d)



Q.40 Consider the function $H(j\omega) = H_1(\omega) + jH_2(\omega)$, where $H_1(\omega)$ is an odd function and $H_2(\omega)$ is an even function. The inverse Fourier transform of $H(j\omega)$, is

(a) a real and odd function
(b) a complex function
(c) a purely imaginary function
(d) a purely imaginary and odd function

Q.41 The Laplace transform of the signal given in figure is



(a) $-A\left(\frac{1-e^{cs}}{s}\right)$ (b) $A\left(\frac{1-e^{cs}}{s}\right)$

(c) $A\left(\frac{1-e^{-cs}}{s}\right)$ (d) $-A\left(\frac{1-e^{-cs}}{s}\right)$

Q.42 If $X(z)$ is the z-transform of $x[n] = \left(\frac{1}{2}\right)^{|n|}$, the ROC of $X(z)$ is

(a) $|z| > 2$ (b) $|z| < 2$

(c) $\frac{1}{2} < |z| < 2$ (d) the entire z-plane

Q.43 In a linear phase system, the group delay (τ_g) and the phase delay (τ_p) are

(a) constant and equal to each other
(b) τ_g is a constant and $\tau_p \propto \omega$
(c) a constant and $\tau_g \propto \omega$
(d) $\tau_g \propto \omega$ and $\tau_p \propto \omega$

Q.44 A signal $m(t)$, band-limited to a maximum frequency of 20 kHz is sampled at a frequency f_s kHz to generate $s(t)$. An ideal low pass filter having cut-off frequency 37 kHz is used to reconstruct $m(t)$ from $s(t)$. The minimum of f_s required to reconstruct $m(t)$ without distortion is

(a) 20 kHz (b) 40 kHz
(c) 57 kHz (d) 77 kHz

Q.45 If the signal $x(t)$ shown in figure (a) is fed to an LTI system having impulse response $h(t)$ as shown in figure (b), the value of the DC component present in the output $y(t)$ is

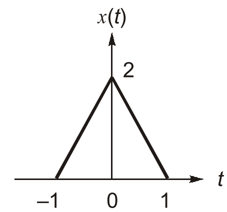


Figure (a)

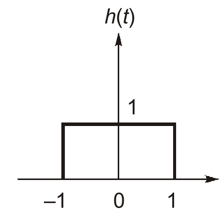


Figure (b)

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

Q.46 The characteristic equation of an LTI system is given as $s^3 + Ks^2 + 5s + 10 = 0$. When the system is marginally stable, the value of K and the sustained oscillation frequency ω, respectively are

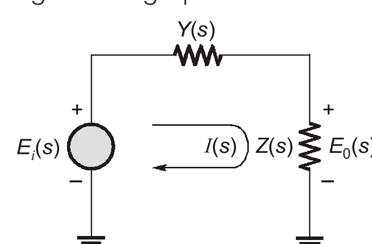
(a) 2 and 5 (b) 0.5 and $\sqrt{5}$

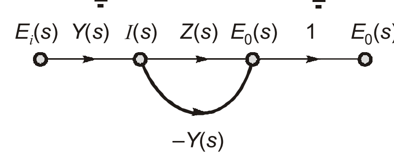
(c) 0.5 and 5 (d) 2 and $j\sqrt{5}$

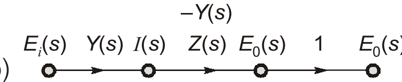
Q.47 The time required for the response of a linear time-invariant system to reach half the final value for the first time is

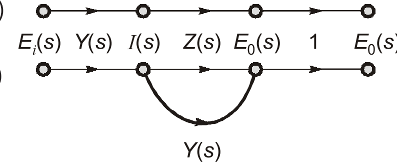
(a) delay time (b) peak time
(c) rise time (d) decay time

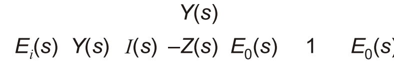
Q.48 The signal flow graph of the network in figure is



(a)


(b)


(c)


(d)


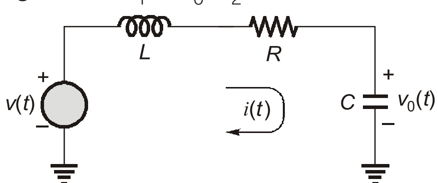
Q.49 Let $c(t)$ be the unit step response of a system with transfer function $\frac{K(s+a)}{(s+K)}$. If $c(0^+) = 2$ and $c(\infty) = 10$, then the values of a and K, respectively, are

(a) 2 and 10 (b) –2 and 10
(c) 10 and 2 (d) 2 and –10

Q.50 The loop transfer function of an LTI system is $G(s)\,H(s) = \dfrac{K(s+1)\,(s+5)}{s(s+2)\,(s+3)}$. For $K > 0$, the point on the real axis that DOES NOT belong to the root locus of the system is

(a) –0.5 (b) –2.5
(c) –3.5 (d) –5.5

Q.51 The state-space equation of the circuit shown in figure, for $x_1 = v_0$, $x_2 = i$ is



(a) $\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 0 & \dfrac{1}{C} \\ \dfrac{1}{L} & \dfrac{-R}{L} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 0 \\ \dfrac{1}{L} \end{pmatrix} V$

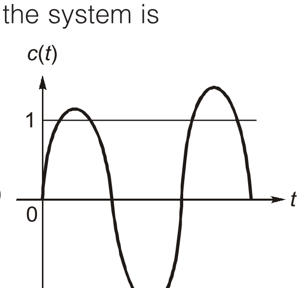
(b) $\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 0 & \dfrac{1}{C} \\ \dfrac{1}{L} & \dfrac{R}{L} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 1 \\ \dfrac{1}{L} \end{pmatrix} V$

(c) $\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 0 & \dfrac{1}{C} \\ \dfrac{-1}{L} & \dfrac{-R}{L} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 0 \\ \dfrac{1}{L} \end{pmatrix} V$

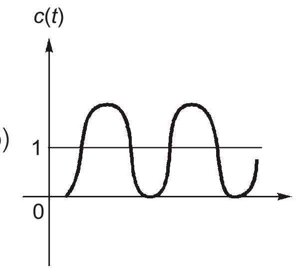
(d) $\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 0 & \dfrac{1}{C} \\ \dfrac{-1}{L} & \dfrac{-R}{L} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 1 \\ \dfrac{1}{L} \end{pmatrix} V$

Q.52 The open-loop gain of a unity feedback system is $G(s) = \dfrac{\omega_n^2}{s(s+2\omega_n)}$. The unit step response $c(t)$ of the system is

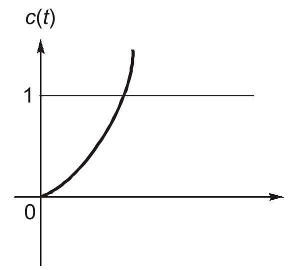
(a)



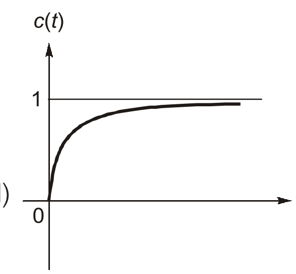
(b)



(c)



(d)



Q.53 If $A = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$, then e^{At} is given by

(a) $\begin{pmatrix} e^{2t} & 0 \\ 0 & e^{2t} \end{pmatrix}$ (b) $\begin{pmatrix} e^{-2t} & 0 \\ 0 & e^{-2t} \end{pmatrix}$

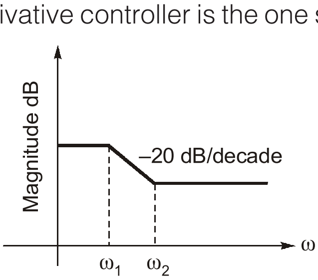
(c) $\begin{pmatrix} e^{t/2} & 0 \\ 0 & e^{t/2} \end{pmatrix}$ (d) $\begin{pmatrix} e^{-t/2} & 0 \\ 0 & e^{-t/2} \end{pmatrix}$

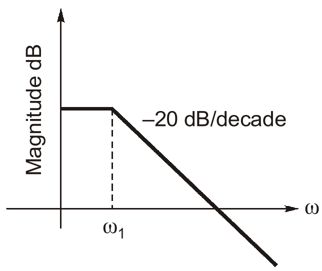
Q.54 The angles of the asymptotes of the root loci of the equation $s^3 + 5s^2 + (K+2)\,s + K = 0$, for $0 \le K < \infty$, are

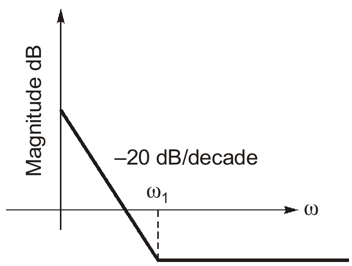
(a) 0° and 270° (b) 0° and 180°
(c) 90° and 270° (d) 90° and 180°

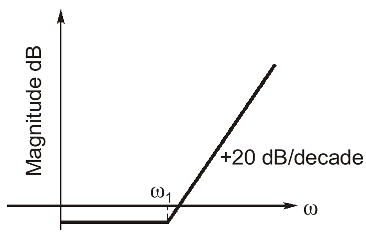
Q.55 The Bode plot corresponding to a proportional derivative controller is the one shown in

(a)



(b) 

(c) 

(d) 

Q.56 In frequency modulation, the instantaneous

(a) amplitude of the carrier signal is varied with the instantaneous amplitude of the message signal

(b) amplitude of the carrier signal is varied with the instantaneous frequency of the message signal

(c) frequency of the carrier signal is varied with the instantaneous amplitude of the message signal

(d) frequency of the carrier signal is varied with the instantaneous frequency of the message signal

Q.57 If X is a zero mean Gaussian random variable, then $P\{X \le 0\}$ is

(a) 0 (b) 0.25

(c) 0.5 (d) 1

Q.58 If a single-tone amplitude modulated signal at a modulation depth of 100% transmits a total power of 15 W, the power in the carrier component is

(a) 5 W (b) 10 W

(c) 12 W (d) 15 W

Q.59 In a superheterodyne receiver, rejection of the image signal can be achieved by using a

(a) higher local oscillator frequency

(b) crystal oscillator

(c) narrow band IF filter

(d) narrow band filter at RF stage

Q.60 The number of bits per sample of a PCM system depends upon the

(a) sampler type

(b) quantizer type

(c) number of levels of the quantizer

(d) sampling rate

Q.61 Which one of the following is used for the detection of AM-DSB-SC signal?

(a) Ratio detector

(b) Foster-Seeley discriminator

(c) Product demodulator

(d) Balanced-slope detector

Q.62 Which one of the following signal pairs can represent a BPSK signal?

(a) $A \cos 2\pi f_c t$, $A \sin 2\pi f_c t$

(b) $A \cos 2\pi f_c t$, $-A \sin 2\pi f_c t$

(c) $-A \cos 2\pi f_c t$, $A \cos 2\pi f_c t$

(d) $A \sin 2\pi f_c t$, $A \cos 2\pi f_c t$

Q.63 Which one of the following can be used for the detection of the noncoherent BFSK signal?

(a) Matched filter

(b) Phase-locked loop

(c) Envelope detector

(d) Product demodulator

Q.64 Bits of duration T_b are to be transmitted using a BPSK modulation with a carrier of frequency f_c Hz. The power spectral density of the transmitted signal has the first null at the normalized frequency

(a) $|f - f_c|\, T_b = 0$ (b) $|f - f_c|\, T_b = 1$

(c) $|f - f_c|\, T_b = 2$ (d) $|f - f_c|\, T_b = 4$

Q.65 The probability of bit error of a BFSK modulation scheme, with transmitted signal energy per bit E_b, in an additive white Gaussian noise channel having one-sided power spectral density N_0, is

(a) $\frac{1}{2} erfc\left(\frac{E_b}{2N_0}\right)$ (b) $\frac{1}{2} erfc\left(\sqrt{\frac{E_b}{2N_0}}\right)$

(c) $\frac{1}{2} erfc\left(\frac{E_b}{N_0}\right)$ (d) $\frac{1}{2} erfc\left(\sqrt{\frac{E_b}{N_0}}\right)$

Answers DRDO-2008

1.	(b)	2.	(d)	3.	(a)	4.	(b)	5.	(a)	6.	(b)	7.	(d)	8.	(b)
9.	(a)	10.	(b)	11.	(d)	12.	(a)	13.	(a)	14.	(d)	15.	(d)	16.	(a)
17.	(b)	18.	(b)	19.	(d)	20.	(d)	21.	(b)	22.	(a)	23.	(b)	24.	(c)
25.	(b)	26.	(b)	27.	(b)	28.	(d)	29.	(c)	30.	(b)	31.	(c)	32.	(b)
33.	(c)	34.	(b)	35.	(a)	36.	(a)	37.	(c)	38.	(b)	39.	(d)	40.	(c)
41.	(c)	42.	(c)	43.	(a)	44.	(c)	45.	(d)	46.	(d)	47.	(a)	48.	(a)
49.	(c)	50.	(c)	51.	(c)	52.	(d)	53.	(a)	54.	(c)	55.	(d)	56.	(c)
57.	(c)	58.	(b)	59.	(d)	60.	(c)	61.	(c)	62.	(c)	63.	(b)	64.	(c)
65.	(d)	66.	(d)	67.	(c)	68.	(c)	69.	(b)	70.	(b)	71.	(c)	72.	(d)
73.	(a)	74.	(b)	75.	(b)	76.	(b)	77.	(b)	78.	(c)	79.	(d)	80.	(b)
81.	(b)	82.	(c)	83.	(d)	84.	(c)	85.	(c)	86.	(c)	87.	(a)	88.	(d)
89.	(a)	90.	(b)	91.	(d)	92.	(a)	93.	(d)	94.	(c)	95.	(a)	96.	(b)
97.	(d)	98.	(a)	99.	(a)	100.	(b)	101.	(d)	102.	(a)	103.	(c)	104.	(a)
105.	(c)	106.	(d)	107.	(b)	108.	(c)	109.	(b)	110.	(a)	111.	(d)	112.	(c)
113.	(a)	114.	(d)	115.	(a)	116.	(c)	117.	(b)	118.	(d)	119.	(a)	120.	(a)
121.	(b)	122.	(c)	123.	(d)	124.	(b)	125.	(d)	126.	(d)	127.	(b)	128.	(a)
129.	(b)	130.	(b)	131.	(c)	132.	(b)	133.	(c)	134.	(c)	135.	(c)	136.	(b)
137.	(a)	138.	(d)	139.	(a)	140.	(b)	141.	(d)	142.	(b)	143.	(c)	144.	(a)
145.	(d)	146.	(c)	147.	(d)	148.	(c)	149.	(b)	150.	(c)				

Explanations DRDO-2008

2. (d)

Hole concentration $= \frac{n_i^2}{N_D} = \frac{10^{32}}{10^{26}} = 10^6/m^3$

3. (a)

$$\frac{D_n}{\mu_n} = \frac{D_p}{\mu_p}$$

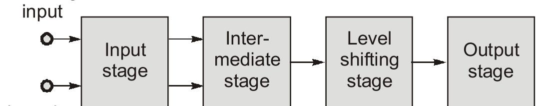
$$\Rightarrow \quad \frac{20}{\mu_n} = \frac{10}{1200}$$

$$\Rightarrow \quad \mu_n = 2400 \text{ cm}^2\text{/V-s}$$

6. (b)

$$\beta = \frac{\alpha}{1-\alpha} = \frac{0.98}{0.02} = 49$$

14. (d)



15. (d)

$V_{GS} < V_T$ so MOSFET will be OFF.

So, $\quad V_D = 6$ V and $I_D = 0$ mA

18. (b)

Elliptic Filter: Ripple in each band i.e. pass-band and stop-band is uniform.

Chebyshev Type-I Filter: Ripple in the stop-band approaches zero but exist in pass-band.

Chebyshev Type-II Filter: Ripple in the pass-band approaches zero but exist in stop-band.

Bessel Filter: Ripple in each band of Butterworth filter and Bessel filter approaches zero.

So, ripple in both the band i.e. pass-band and stop-band is minimum in Bessel filter.

19. (d)

For sustained oscillation in the practical feedback circuit loop gain should be slightly greater than 1 and its range is 1.01 to 1.05.

20. (d)

Comparator followed by integrator.

Comparator generate square wave.

21. (b)

$$20 \log A_V = 40$$

$$A_V = 10^2 = 100$$

For amplifier gain bandwidth product is constant.

So, $\quad f_T = 100 \times 150 \times 10^3 = 15 \times 10^6 = 15$ MHz

22. (a)

$$\text{CMRR} = \frac{A_d}{A_c}$$

$$\Rightarrow \quad A_c = \frac{2000}{1000} = 2$$

$$V_0 = V_c A_c + V_d A_d = 5 \times 2 + 0.002 \times 2000 = 10 + 4 = 14 \text{ V}$$

23. (b)

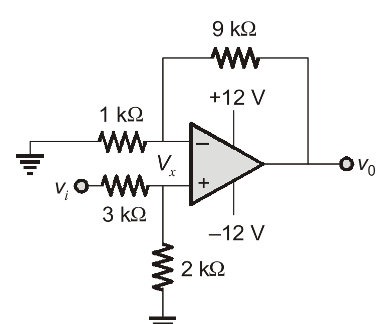
Integrator circuit.

24. (c)

Duty cycle $= \frac{R_A + R_B}{R_A + 2R_B} \times 100$

Independent of capacitor value

25. (b)



$$V_x = \frac{2}{2+3} \times v_i = \frac{2}{5} v_i$$

$$V_0 = \left(1 + \frac{9}{1}\right) V_x = 10 \times \frac{2}{5} v_i = 4 \, v_i$$

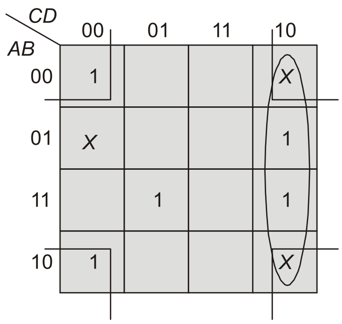
26. (b)

$$F = (X+\bar{Y}+Z)(\bar{X}+\bar{Z})(X+Y)$$

To find the complement of F change AND to OR and vice-versa and then change complement to incomplete and vice-versa.

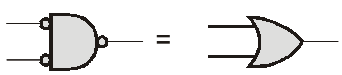
So, $$\bar{F} = \bar{X}Y\bar{Z} + XZ + \bar{X}\bar{Y}$$

27. (b)



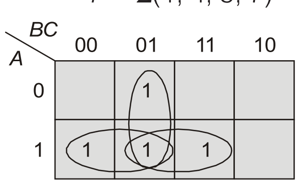
$$F = \bar{B}\bar{D} + C\bar{D} + ABC\bar{D}$$

28. (d)



29. (c)

$$Y = \Sigma(1, 4, 5, 7)$$



$$Y = \bar{B}C + A\bar{B} + AC$$

30. (b)

Latch is level triggered and flip-flop is edge triggered.

31. (c)

It prevent saturation of the output transistor because of this transistor become faster.

32. (b)

EPROM → Erased by uv ray

EEPROM → Erased by electrical signal.

33. (c)

Ripple counter is an asynchronous counter.

36. (a)

Using test signal $x[n] = \delta(n)$

$$y[n] = \sum_{k=-\infty}^{n} x(k)$$

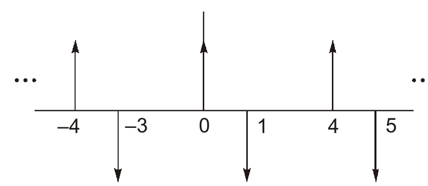
$$= u(n)$$

$$w[n] = y[n] - y[n-1]$$

So $$w[n] = x[n]$$

37. (c)

$$x_3[n] = \sum_{k=-\infty}^{\infty} \{\delta[n-4k] - \delta[n-1-4k]\}$$



39. (d)

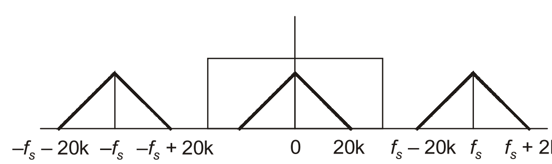
For causal system $h(t) = 0$ for $t < 0$ and (a), (b), (c) options are limited in frequency domain so they are unlimited in time domain. So they can not be causal.

41. (c)

$$x(t) = A[u(t) - u(t-c)]$$

$$x(s) = A\left[\frac{1}{s} - \frac{e^{-cs}}{s}\right] = \frac{A[1-e^{-cs}]}{s}$$

44. (c)



$$f_c = 37k$$

To reconstruct $m(t)$

$$f_c \le f_s - 20k$$

$$\Rightarrow \quad 37k \le f_s - 20k$$

$$\Rightarrow \quad f_{s\min} = 57 \text{ kHz}$$

45. (d)

$y(t) = x(t) * h(t)$; $Y(\omega) = X(\omega) \cdot H(\omega)$

For DC value

$$Y(0) = X(0) \cdot H(0)$$

$$X(0) = \int_{-\infty}^{\infty} x(t)\, dt$$

(∵ central ordinate theorem)

$$= 2$$

$$H(0) = \int_{-\infty}^{\infty} h(t)\cdot dt = 2$$

So $$y(0) = 2\times 2 = 4$$

46. (d)

$s^3 + Ks^2 + 5s + 10 = 0$

s^3	1	5
s^2	K	10
s^1	$\frac{5K-10}{K}$	0
s^0	10	

$$\frac{5K-10}{K} = 0$$

$$\Rightarrow K = 2$$

$$\Rightarrow Ks^2 + 10 = 0$$

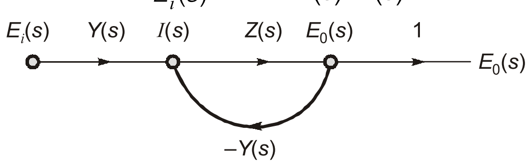
$$\Rightarrow s^2 = -5$$

$$\Rightarrow \omega = j\sqrt{5}$$

48. (a)

$$E_0(s) = \frac{z(s)}{\frac{1}{Y(s)} + z(s)} E_i(s)$$

$$\Rightarrow \frac{E_0(s)}{E_i(s)} = \frac{Y(s)\cdot z(s)}{1+Y(s)\cdot z(s)}$$



$$\frac{E_0(s)}{E_i(s)} = \frac{Y(s)\cdot z(s)}{1+Y(s)\cdot z(s)} \{\text{using } SFG\}.$$

49. (c)

$$C(s) = \frac{k(s+a)}{s(s+k)}$$

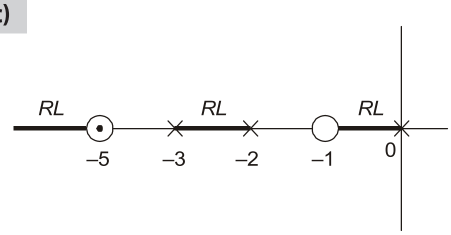
$$C(0) = \lim_{s\to\infty} S\cdot C(s) = \lim_{s\to\infty} \frac{s\cdot k(s+a)}{s(s+k)} = k$$

$$\Rightarrow k = 2$$

$$C(\infty) = \lim_{s\to 0} s\cdot C(s) = \lim_{s\to 0} \frac{s\cdot 2(s+a)}{s(s+2)} = a$$

So, $a = 10$

50. (c)



52. (d)

$$\xi = 1$$

53. (a)

$$e^{AT} = L^{-1}[SI-A]^{-1}$$

$$[SI-A] = \begin{bmatrix} S-2 & 0 \\ 0 & S-2 \end{bmatrix}$$

$$[SI-A]^{-1} = \begin{bmatrix} \frac{1}{S-2} & 0 \\ 0 & \frac{1}{S-2} \end{bmatrix}$$

$$e^{At} = \begin{bmatrix} e^{2t} & 0 \\ 0 & e^{2t} \end{bmatrix}$$

54. (c)

$s^3 + 5s^2 + (k+2)\, s + k = 0$

$$p = 3$$

It $$p - z = 2$$

then angle of asymptotes $(\theta) = \frac{(2q+1)180}{p-z}$

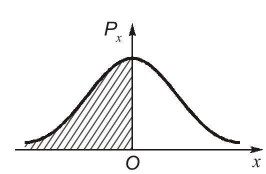
$$\theta_1 = 90° \quad ; \quad \theta_2 = 270°$$

55. (d)

$$\text{T.F.} = k_p(1 + T_d s)$$

Only one zero which will give slope of +20 dB/decade.

57. (c)



$$P(x \le 0) = \int_{-\infty}^{0} P_x(x)dx = \frac{1}{2}$$

58. (b)

$$P_T = P_C\left(1+\frac{m^2}{2}\right) \; ; \; 15 = P_C\left(1+\frac{1}{2}\right)$$

$$\Rightarrow P_C = 10 \text{ W}$$

59. (d)

For selectivity *RF* stage are used.

60. (c)

$$M \le 2^n$$