DRDO, ISRO, BSNL (JTO)

Previous Solved Papers and Sample Papers
(Technical & Non-Technical)

Also useful for
State Engineering Services Examinations & Public Sector Examinations
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
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Previous Solved Papers
(Technical)

- 2006 • 2007 • 2008 • 2009 • 2010 •
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Section : A
Previous Solved Papers
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

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

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

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

(a) 3.5 $\Omega$  
(b) 2.5 $\Omega$  
(c) 1 $\Omega$  
(d) 4.5 $\Omega$

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) $\frac{1}{2\sqrt{2}}$

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

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

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

8. Let $\delta(t)$ denote the delta function. The value of the integral $\int_{-a}^{b} \delta(t) \cos \left(\frac{3t}{2}\right) dt$ is

(a) 1  
(b) $-1$  
(c) 0  
(d) $\pi/2$

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
10. The z-transform of the signal
\[ x(n) = \begin{cases} 
1, & n = -1 \\
2, & n = 0 \\
-1, & n = 1 \\
0, & \text{otherwise} 
\end{cases} \]

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

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

12. The equivalent capacitance across 'ab' will be

(a) 0.2 \( \mu \text{F} \)  (b) 0.1 \( \mu \text{F} \)  (c) 0.5 \( \mu \text{F} \)  (d) 0

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

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

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 3 dB  (d) Quantisation noise density increases by 3 dB

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

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 required to implement \( X \oplus Y \)?
(a) 2  (b) 3  (c) 4  (d) 5

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

(a) \( X_2 \)  (b) \( X_1 \)  (c) \( X_2 \)  (d) \( X_3 \)
19. A pulse train with a frequency of 1 MHz is counted using a modulo 1024 ripple-counter built with J-K flip-flops. For proper operation of the counter the maximum permissible propagation delay per flip-flop stage is
   (a) 100 n sec   (b) 50 n sec   (c) 20 n sec   (d) 10 n sec

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

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

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

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

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

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

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 is used
   (d) Multi-emitter transistors are used

27. The output of the circuit shown below is

   ![Circuit Diagram]

   (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

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

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

30. For the switch circuit, taking open as 0 and closed as 1, the expression for the circuit in \(Y\)

   ![Switch Circuit Diagram]

   (a) \(A + (B + C)D\)   (b) \(A + BC + D\)   (c) \((BC + D)\)   (d) None of these
31. The Boolean expression for the shaded area in the Venn diagram is

(a) \( \bar{X} + \bar{Y} + Z \)  \hspace{1cm} (b) \( X\bar{Y}Z + \bar{X}YZ \)
(c) \( X + Y + Z \)  \hspace{1cm} (d) \( \bar{X} \bar{Y} + \bar{Z} + XY \)

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  \hspace{1cm} (b) 24  \hspace{1cm} (c) 12  \hspace{1cm} (d) 8

33. Given the decimal number 19, an eight bit two’s complement representation is given by

(a) 11101110  \hspace{1cm} (b) 11101101  \hspace{1cm} (c) 11101100  \hspace{1cm} (d) None of these

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

\[\begin{array}{c|cccc}
\text{AB} & 00 & 01 & 11 & 10 \\
\hline
\text{CD} & 1 & 0 & 1 & 0 \\
00 & 0 & 1 & 0 & 0 \\
01 & 1 & 0 & 1 & 0 \\
11 & 1 & 0 & 1 & 0 \\
10 & 0 & 1 & 0 & 1 \\
\end{array}\]

(a) 2 terms  \hspace{1cm} (b) 4 terms  \hspace{1cm} (c) 7 terms  \hspace{1cm} (d) 16 terms

35. The logic circuit given below converts a binary code \( Y_1, Y_2, Y_3 \) into

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  \hspace{1cm} (b) 50 ns  \hspace{1cm} (c) 75 ns  \hspace{1cm} (d) 100 ns

37. An electromagnetic wave incident on a perfect conductor is

(a) Entirely reflected  \hspace{1cm} (b) Fully transmitted  \hspace{1cm} (c) Partially transmitted  \hspace{1cm} (d) None of these

38. The characteristic impedance of a lossless transmission line is given by

(a) \( Z = \sqrt{LC} \)  \hspace{1cm} (b) \( Z = \sqrt{C/L} \)
(c) \( Z = LC \)  \hspace{1cm} (d) \( Z = \sqrt{L/C} \)

39. A lossless line of 50 ohms is terminated in a load of 100 ohms resistive. The VSWR is

(a) 1 : 2  \hspace{1cm} (b) 2 : 1  \hspace{1cm} (c) 4 : 1  \hspace{1cm} (d) 1 : 4

40. Which of the following does not exist in waveguides

(a) TE waves  \hspace{1cm} (b) TM waves  \hspace{1cm} (c) TE waves and TM waves  \hspace{1cm} (d) TEM waves

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  \hspace{1cm} (b) 1 : 2  \hspace{1cm} (c) 2 : 1  \hspace{1cm} (d) 1 : 1

42. The bandwidth required for QPSK modulated channel is

(a) Twice the BW of BPSK  \hspace{1cm} (b) Equal to BPSK  \hspace{1cm} (c) Equal to FSK  \hspace{1cm} (d) Half of the BW of BPSK
43. Magic $T$ is
   (a) Four port junction
   (b) Two port junction
   (c) Three port junction
   (d) It is not junction

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

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

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

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

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

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

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

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

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

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

54. A dual directional coupler is connected in a microwave reflectometer measurement setup. The reading of the power meter in the forward direction is 100 mw and in the reverse direction 4 mw. The VSWR is
   (a) 4
   (b) 0.4
   (c) 1.5
   (d) 10

55. Linear amplifier with a gain of 30 dB is fed with 1.0 $\mu$W power, the output power of the amplifier
   (a) 1.0 W
   (b) 0 dBm
   (c) 30 dBm
   (d) $-30$ dBm

56. 10 Watts RF power is transmitted with a circular polarized antenna having gain of 10 dB. A receiving antenna has vertical polarization. The path loss is 100 dB. The receiving signal is
   (a) $-83$ dBW
   (b) $-8$ dBW
   (c) $-8$ dBW
   (d) $+8$ dBW

57. $\vec{p} = 2i - 3j, \vec{q} = -3i + 4j - 2k$, and $\vec{r}$ are in equilibrium, if $\vec{r}$ is
   (a) $-i - j + 2k$
   (b) $i - j + 2k$
   (c) $i + j + 2k$
   (d) $i - j - 2k$
58. A rigid body is rotating with constant angular velocity $\omega$ about a fixed axis, if $v$ is the velocity of a point of the body, then $v$ is (a) $\omega$ (b) $\omega^2$ (c) $2\omega$ (d) $2\omega^2$

59. Laplace transform of $\sin^3 2t$ is (a) $\frac{24}{(s^2 + 4)(s^2 + 36)}$ (b) $\frac{1}{(s^2 + 4)(s^2 + 64)}$ (c) $\frac{48}{(s^2 + 4)(s^2 + 36)}$ (d) $\frac{64}{(s^2 + 4)(s^2 + 36)}$

60. The value of the determinant

\[
\begin{vmatrix}
\cos \theta & 0 & \sin \theta \\
0 & 1 & 0 \\
-\sin \theta & 0 & \cos \theta
\end{vmatrix}
\]

(a) 0 (b) 1 (c) 1 (d) 2

61. Solution of $(D^2 + 4)y = \sin^2 x$ is (a) $y = A \cos 2x + B \sin 2x - \frac{1}{8} - \frac{x}{8} \sin 2x$ (b) $y = A \cos 2x + B \sin 2x + \frac{x}{8} \sin 2x$ (c) $y = A \cos 2x + B \sin 2x - \frac{1}{8} + \frac{x}{8} \sin 2x$ (d) $y = A \cos 2x + B \sin 2x + \frac{x}{8} \sin 2x$

62. The value of $k$ for which the lines $2x + y - 1 = 0$, $4x + 3y - 3 = 0$ and $3x + ky - 2 = 0$, are concurrent is (a) $-2$ (b) $3$ (c) $2$ (d) $-3$

63. A box contains 5 black and 5 red balls. Two balls are randomly picked one after another from the box, without replacement. The probability for both balls being red is (a) $\frac{1}{90}$ (b) $\frac{1}{5}$ (c) $\frac{19}{90}$ (d) $\frac{2}{9}$

64. $x^3 + x \sin x$ is (a) Constant function (b) Odd function (c) Even function (d) Periodic function

65. $\int \frac{dx}{x \sqrt{x^2 - a^2}}$ is (a) $\frac{1}{a} \cos^{-1} \left( \frac{x}{a} \right)$ (b) $\frac{1}{a} \sin^{-1} \left( \frac{x}{a} \right)$ (c) $\frac{1}{a} \cos^{-1} \left( \frac{1}{2} \right)$ (d) $\frac{1}{a} \sec^{-1} \left( \frac{x}{a} \right)$

66. Eigen values of $\begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$ are (a) $-6, -1$ (b) $6, -1$ (c) $-6, 1$ (d) $6, 1$

67. The approximate equivalent resistance at the points $X_1$ and $X_2$ in the circuit shown in below

\[\begin{array}{c}
X_1 \\
\downarrow \\
10 \Omega \\
\downarrow \\
X_2 \\
\uparrow \\
40 \Omega \\
\uparrow \\
10 \Omega \\
\uparrow \\
10 \Omega \\
\uparrow \\
40 \Omega \\
\uparrow \\
10 \Omega \\
\end{array}\]

(a) 60 $\Omega$ (b) 40 $\Omega$ (c) 80 $\Omega$ (d) 20 $\Omega$

68. An inductor supplied with 50 V ac with a frequency of 10 kHz passes a current of 7.96 mA. The value of inductor is (a) 1 mH (b) 10 mH (c) 100 mH (d) 1 H

69. In a capacitor, the electric charge is stored in (a) Dielectric (b) Metal plates (c) Dielectric as well as metal plates (d) Neither dielectric nor metal plates

70. Oscillator requires (a) No feedback (b) Negative feedback (c) Positive feedback (d) Either positive or negative feedback
71. Which loss in a transformer varies significantly with load?
(a) Hysteresis loss
(b) Eddy current loss
(c) Copper loss
(d) Core loss

72. The resistance of a parallel circuit consisting of two resistors is 12 \( \Omega \). One of the resistance wires breaks and the effective resistance becomes 18 \( \Omega \). The resistance of the broken wire is
(a) 48 \( \Omega \)
(b) 18 \( \Omega \)
(c) 36 \( \Omega \)
(d) 24 \( \Omega \)

73. Time constant of a series R-L circuit equals
(a) \( LR \) second
(b) \( L/R \) second
(c) \( LR^2 \)
(d) \( L/R^2 \)

74. A dc voltage \( V \) is applied at time \( t = 0 \) to a series RC circuit. The steady state current is
(a) \( \frac{V}{R} \)
(b) \( \frac{V}{C} \)
(c) \( \frac{V}{\sqrt{R^2 + C^2}} \)
(d) Zero

75. The given circuit represents a
(a) Low pass filter
(b) High pass filter
(c) Band pass filter
(d) Band stop filter

76. The very low frequency gain of the low pass filter shown in the given figure is
(a) 10 dB
(b) 20 dB
(c) 30 dB
(d) 40 dB

77. The time constant of the network shown in the figure is
(a) \( CR \)
(b) \( 2CR \)
(c) \( CR/4 \)
(d) \( CR/2 \)

78. For the circuit shown below the current \( I \) flowing through the circuit will be
(a) 1/2 A
(b) 1 A
(c) 2 A
(d) 4 A

79. When \( L \) is doubled and \( C \) is halved, the resonance frequency of series tuned circuit becomes
(a) Doubled
(b) Halved
(c) One quarter
(d) Unchanged

80. In a series resonant circuit, with the increase in \( L \)
(a) Resonant frequency will decrease
(b) Bandwidth will decrease
(c) \( Q \) will increase
(d) All of these
## AnsWers

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)
1. \( \text{c} \)

In a series \( RLC \) circuit, for critical damping,
\[
\alpha = \omega_0 \sqrt{LC}
\]
\[
\frac{R}{2L} = \frac{1}{\sqrt{LC}}
\]
\[
\Rightarrow \quad C = \frac{4L}{R^2} = \frac{4 \times 2}{1^2} = 8 \text{ F}
\]
Alternate solution:
\[
\xi = \frac{R}{2\sqrt{L}}
\]
For critical damping \( \xi = 1 \)
\[
1 = \frac{R}{2\sqrt{L}}
\]
\[
C = \frac{4}{R^2} \cdot L = \frac{4}{1^2} \cdot 2 = 8 \text{ F}
\]

2. \( \text{c} \)

Quality factor \( Q \) = \( \frac{f_0}{BW} = \frac{3 \times 10^6}{10 \times 10^5} = 300 \)

3. \( \text{a} \)

\[
\begin{align*}
V &= 50 \text{ V} \\
V &= \frac{6}{7} (0 - V) - 4 \\
V &= 14 \text{ V} \\
V &= 4 \times \frac{14}{50} \\
\therefore \quad R &= \frac{14}{4} = 3.5 \text{ } \Omega
\end{align*}
\]

4. \( \text{b} \)

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

5. \( \text{d} \)

\( f_0 = 1000 \text{ kHz and given frequency is } f = 995 \text{ kHz} \). Here at \( f = 995 \text{ kHz} \) it is obvious

from the below diagram, the circuit impedance is capacitive.

6. \( \text{d} \)

\[
F = F_1 + \frac{F_2 - 1}{G_1}
\]
\[
= 10 + \frac{10 - 1}{10} = 10 + 0.9 = 10.9
\]

9. \( \text{b} \)

\[
\begin{align*}
Y(n) &= x(n - 2) \\
\Rightarrow \quad Y(z) &= z^{-2} X(z) \\
\Rightarrow \quad \frac{Y(z)}{X(z)} &= \frac{1}{z^2}
\end{align*}
\]

\[
H_1(z) H_2(z) = \frac{1}{z^2}
\]
\[
\frac{z - 0.5}{z - 0.8}
\]
\[
H_2(z) = \frac{1}{z^2}
\]
\[
\therefore \quad H_2(z) = \frac{z - 0.8}{1 - 0.5z^{-1}}
\]

10. \( \text{a} \)

\[
x(n) = \{1, 2, -1, 1\}
\]

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 \( V \):
\[
\frac{V - 10}{5} + \frac{V + 50}{10} = 0
\]
\[
\therefore V_{BA} = -6
\]
\[
V_{AB} = 6
\]

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)

\[
\frac{(QNP)}{f_0} = \frac{1}{f_0}; \quad \frac{(QNP)_1}{(QNP)_2} = \frac{1/f_0}{1/2f_0} = 2
\]
\[
\Rightarrow \frac{(QNP)_2}{(QNP)_1} = 10 \log \left( \frac{1}{2} \right) = -3.0 \text{ dB}
\]
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.

19. (a)

\[
f_{\text{max}} = \frac{1}{n t_{pd}}
\]
\[
\therefore t_{pd} = \frac{1}{10 \times 10^6} = 100 \text{ nsec.}
\]

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 \( \frac{1}{2} \text{ Hz.} \)
\[
\therefore T = \frac{1}{f} \Rightarrow T = \frac{1}{1/2} = 2 \text{ sec.}
\]

28. (d)

Gray code for 7

\[
\begin{array}{cccc}
0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 \\
\end{array}
\]

32. (a)

Number of chips = \( \frac{1 \times 1024 \times 8}{256 \times 1} = 32. \)

33. (b)

The binary representation of +19 in 8-bit is
\[
0 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 1 \quad 1
\]
2's complement of +19 is -19 and binary representation is
\[
1 \quad 1 \quad 1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 1
\]

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 \( R = 0, \ G = 0. \)
\[
Z = R + j\omega L = j\omega L
\]
\[
Y = G + j\omega C = j\omega C
\]
\[
Z_0 = \sqrt{\frac{Z}{Y}} = \frac{j\omega L}{\sqrt{j\omega C}} = \frac{L}{C}
\]
39. (b)
Reflection coefficient
\[ |\Gamma| = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{100 - 50}{100 + 50} = \frac{1}{3} \]
\[ VSWR = \frac{1 + |\Gamma|}{1 - |\Gamma|} = \frac{1 + \frac{1}{3}}{1 - \frac{1}{3}} = \frac{3 + 1}{3 - 1} = \frac{4}{2} = 2 : 1 \]

41. (d)
Bandwidth of FM is given by Carson’s rule
\[ (B.W.)_{FM} = 2(\Delta f + f_m) \]
\[ 2(\Delta f_1 + f_{m1}) = 2(\Delta f_2 + f_{m2}) \]
\[ f_m = f_m = 10 \text{ kHz} \]
\[ \Delta f_1 + 10 \text{ kHz} = \Delta f_2 + 10 \text{ kHz} \]
\[ \therefore \frac{\Delta f_1}{\Delta f_2} = \frac{1}{1} = 1 : 1 \]

46. (b)
\[ Z_z = \sqrt{Z_{oc} \cdot Z_{sc}} = \sqrt{5 \times 20} = 10 \Omega \]

51. (b)
\[ m(t) \]
\[ \int_0^t dt \]
\[ PM \]
Frequency modulated signal

53. (a)
According to Shannon’s channel capacity theorem:
\[ C = B \log_2(1 + SNR) \]
\[ = 4 \log_2(1 + 15) \]
\[ = 4 \log_2 16 = 4 \log_2 2^4 = 16 \text{ kbps} \]

55. (b)
\[ P_{dB} = 10 \log \left( \frac{P_0}{P_{in}} \right) \text{ dB} \]
\[ \Rightarrow 30 = 10 \log \frac{P_0}{P_{in}} \]
\[ \frac{P_0}{P_{in}} = 1000 \]
\[ P_0 = 1000 \times 10^{-6} W = 1 \times 10^{-3} W. \]
\[ P_o(dBm) = 10 \log \left( \frac{P_0}{10^{-3}} \right) \text{ dBm} \]
\[ = 10 \log \left( \frac{10^{-3}}{10^{-3}} \right) \text{ dBm} = 0 \text{ dBm} \]

56. (b)
\[ P_{(dB)} = \langle P_i G_i \rangle_{dB} - L_{\text{path}} \]
\[ 10 = 10 \log G_i \]
\[ \therefore G_i = 10 \]
\[ P_i G_i = 10 \times 10 = 100 \]
\[ \langle P_i G_i \rangle_{dB} = 10 \log 100 = 20 \text{ dB} \]
Path loss \( L_{\text{path}} \) = 100 dB
\[ \therefore P_i(dB) = (20 - 100) \text{ dBW} = -80 \text{ dBW} \]

57. (b)
For equilibrium \( \vec{P} + \vec{Q} + \vec{R} = 0 \)
\[ \vec{R} = -(\vec{P} + \vec{Q}) \]
\[ \vec{R} = -(2\vec{i} - 3\vec{j} - 3\vec{i} + 4\vec{j} - 2\vec{k}) \]
\[ = -(\vec{i} + \vec{j} - 2\vec{k}) = (\vec{i} - \vec{j} + 2\vec{k}) \]