DRDO, ISRO, BSNL(JTO)

Previous Solved Papers and Practice Sets

(Technical & Non-Technical)

EC

ELECTRONICS ENGINEERING

Also useful for

State Engineering Services Examinations & Public Sector Examinations

MADE EASY PUBLICATIONS

MADE EASY Publications Pvt. Ltd.

Corporate Office: 44-A/4, Kalu Sarai (Near Hauz Khas Metro Station), New Delhi-110016
E-mail: infomep@madeeasy.in
Contact: 9021300500
Visit us at: www.madeeasypublications.org

DRDO, ISRO, BSNL-JTO: Previous Solved Papers and Practice Sets (Technical & Non Technical)
Electronics Engineering

1st Edition : 2011
2nd Edition : 2013
3rd Edition : 2016
4th Edition : 2017
5th Edition : 2018
6th Edition : 2019
7th Edition : 2020
8th Edition : 2021
Reprint : 2022
Reprint : 2023

Reprint : 2024

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 (Ex. IES)

CMD, MADE EASY Group

DRDO, ISRO and BSNL(JTO)

EC: Previous Years Solved Papers and Practice Sets

CONTENTS

EC

ISRO

Indian Space Research Organization

(Technical)

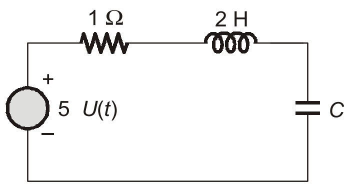
• 2006 • 2007 • 2008 • 2009 • 2010
• 2011 • 2012 • 2013 • 2014 • 2015
• 2016 • 2017 (2 Papers) • 2018 • 2020

1

ISRO-2006

(Indian Space Research Organisation)

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

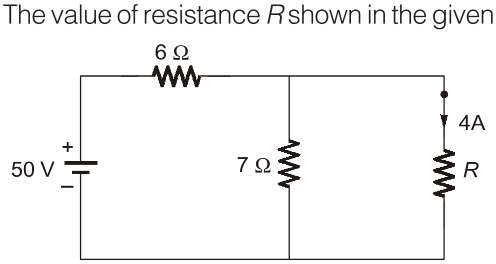


(a) 2 F (b) 4 F
(c) 8 F (d) 1 F

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

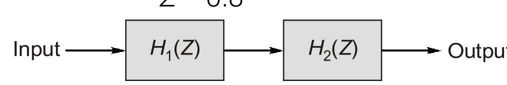
Q.6 If each stage had gain of 10 dB and noise figure of 10 dB, then the overall noise figure of two-stage cascade amplifier will be
(a) 10 (b) 1.09
(c) 1.0 (d) 10.9

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

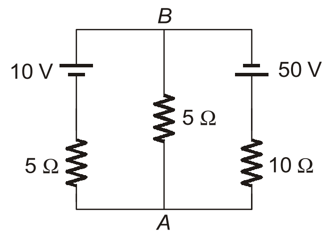
(d) $H_2(Z) = \frac{Z^{-2}-0.8Z^{-3}}{1-0.5Z^{-1}}$

Q.10 The z-transform of the signal

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

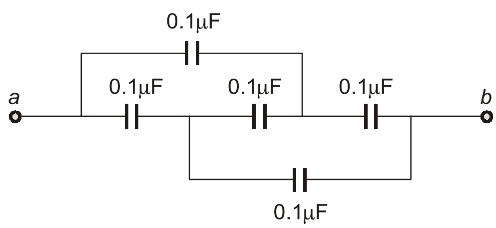
(a) $z + 2 - z^{-1} + z^{-2}$ (b) $z^{-1} + 2 - z + z^{2}$
(c) $z + 2z^{2} - z^{-1} + z^{-2}$ (d) $z + 2 - z^{+1} + z^{-2}$

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, $T(s) = \dfrac{s}{s+a}$ is that of a

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

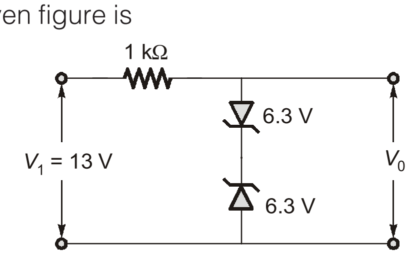
Q.14 A particular current is made up of two components : a 10 A dc and a sinusoidal current of peak value of 1.414 A. The average value of the resultant current is

(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

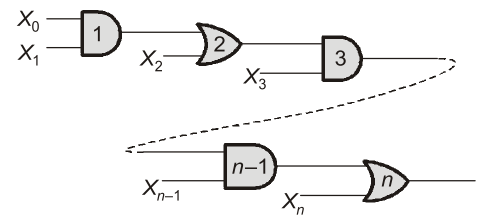


(a) zero (b) 5.7 V
(c) 6.9 V (d) 12.6 V

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

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 $\xi = 1$

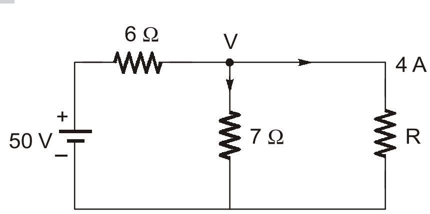
$$1 = \frac{R}{2}\sqrt{\frac{C}{L}}$$

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

2. (c)

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

3. (a)



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

$$V = 14\ V$$

$$14 = 4\times R$$

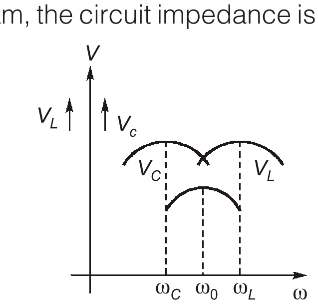
$$\therefore \quad R = \frac{14}{4} = 3.5\ \Omega$$

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)

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

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

2

ISRO-2007

(Indian Space Research Organisation)

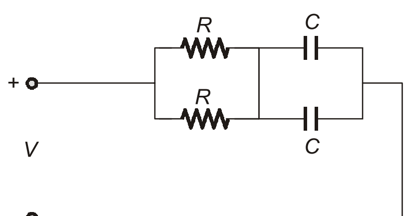
Q.1 With fixed value capacitor C and variable voltage V across it, the energy stored in the capacitor is

(a) CV^2 (b) $0.5\ CV^2$
(c) $2\ CV^2$ (d) CV

Q.2 A dc voltage V is applied to a series RL circuit. The steady state current is

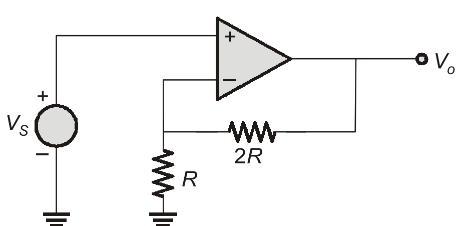
(a) V/R (b) V/L
(c) $\dfrac{V}{\sqrt{R^2 + L^2}}$ (d) zero

Q.3 The time-constant of the network shown in the figure is



(a) CR (b) $2\ CR$
(c) $CR/4$ (d) $CR/2$

Q.4 In the ideal Op-amp circuit shown, V_0 is

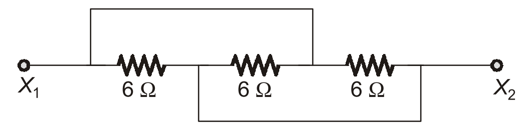


(a) $2\ V_s$ (b) $-2\ V_s$
(c) $3\ V_s$ (d) $-3\ V_s$

Q.5 If the unit step response of a system is a unit impulse function, then the transfer function of such a system will be

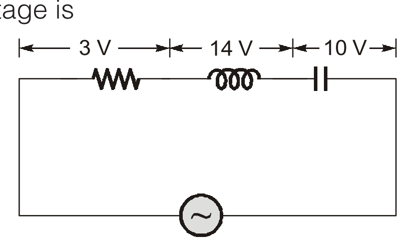
(a) 1 (b) $1/s$
(c) s (d) $1/s^2$

Q.6 Three resistors of 6 Ω each are connected as shown in the following figure. The equivalent resistance between X_1 and X_2 is



(a) 2 Ω (b) 4 Ω
(c) 8 Ω (d) 12 Ω

Q.7 The source in the circuit shown in a sinusoidal source. The supply voltages across various elements are marked in the figure. The input voltage is



(a) 10 V (b) 5 V
(c) 27 V (d) 24 V

Q.8 Laplace transform of $e^{-at} f(t)$ is

(a) $F(s)e^{-at}$ (b) $F(s - a)$
(c) $F(s + a)$ (d) $\dfrac{F(s)}{s} + a$

Q.9 $\cos\theta$ can be represented by

(a) $\dfrac{e^{+j\theta} - e^{-j\theta}}{2}$ (b) $\dfrac{e^{j\theta} - e^{-j\theta}}{2i}$

(c) $\dfrac{e^{j\theta} + e^{-j\theta}}{2}$ (d) $\dfrac{e^{j\theta} + e^{-j\theta}}{2i}$

Q.10 Of the following transfer function of second order linear time-invariant systems, the underdamped system is represented by

(a) $H(S) = \dfrac{1}{S^2 + 4S + 4}$

(b) $H(S) = \dfrac{1}{S^2 + 5S + 4}$

(c) $H(S) = \dfrac{1}{S^2 + 4.5S + 4}$

(d) $H(S) = \dfrac{1}{S^2 + 3S + 4}$

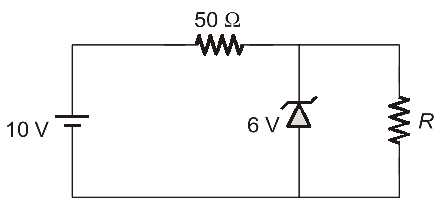
Q.11 A differential amplifier has a differential gain of 20,000. CMRR = 80 dB. The common mode gain is given by

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

Q.12 Two bulbs marked 200 watt-250 volts and 100 watt-250 volts are joined in series to 250 volt supply. Power consumed in circuits is

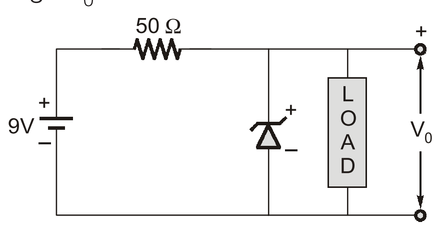
(a) 33 watt (b) 67 watt
(c) 100 watt (d) 300 watt

Q.13 The 6 V Zener diode shown in the figure, has zero Zener resistance and a knee current of 5 mA. The minimum value of R so that the voltage across it does not fall below 6 V is



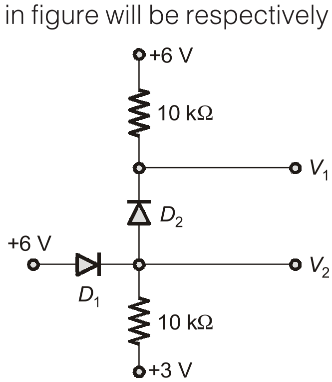
(a) 1.2 k ohms (b) 80 ohms
(c) 50 ohms (d) 0 ohms

Q.14 A Zener diode in the circuit shown in the figure below, has a knee current of 5 mA, and a maximum allowed power dissipation of 300 mW. What are the minimum and maximum load currents that can be drawn safely from the circuit, keeping the output voltage V_0 at 6 V?



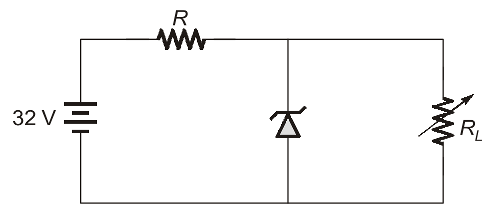
(a) 0 mA, 180 mA (b) 5 mA, 110 mA
(c) 10 mA, 55 mA (d) 60 mA, 180 mA

Q.15 The voltages at V_1 and V_2 of the arrangement shown in figure will be respectively



(a) 6 V and 5.4 V (b) 5.4 V and 6 V
(c) 3 V and 5.4 V (d) 6 V and 6 V

Q.16 A 24 V, 600 mW, Zener diode is to be used for providing a 24 V stabilized supply to a variable load. Assume that for proper Zener action, a minimum of 10 mA must flow through the Zener. If the input voltage is 32 V, what would be the value of R and the maximum load current ?



(a) 320 Ω, 10 mA (b) 400 Ω, 15 mA
(c) 400 Ω, 10 mA (d) 320 Ω, 15 mA

Q.17 A half - adder can be constructed using two 2-input logic gates. One of them is an AND-gate, the other is

(a) OR (b) NAND
(c) NOR (d) EX-OR

Q.18 For one of the following conditions, clocked J-K flip-flop can be used as DIVIDE BY 2 circuit where the pulse train to be divided is applied at clock input

(a) J = 1, K = 1 and the flip-flop should have active HIGH inputs
(b) J = 1, K = 1 and the flip-flop should have active LOW inputs
(c) J = 0, K = 0 and the flip-flop should have active HIGH inputs
(d) J = 1, K = 1 and the flip-flop should be a negative edge triggered one

Q.19 Number of comparators needed to build a 6-bit simultaneous A/D converter is

(a) 63 (b) 64
(c) 7 (d) 6

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 time taken is

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

Answers ISRO-2007

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

Explanations ISRO-2007

1. (b)

Energy stored in capacitor is given as:

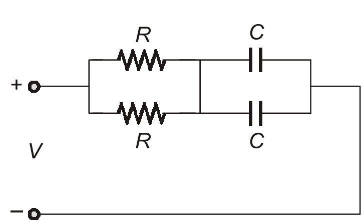
$$\text{Energy} = \frac{1}{2}CV^2$$

2. (a)

$$i(t) = \frac{V}{R}(1 - e^{tR/L})$$

$$i(\infty) = \frac{V}{R}(1 - e^{-\infty}) = \frac{V}{R}$$

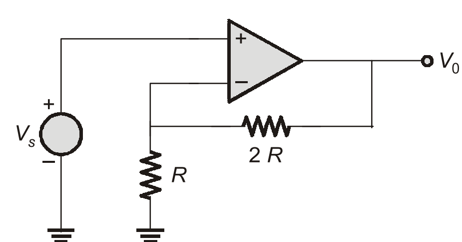
3. (a)



$$R_{eq} = \frac{R}{2}, \quad C_{eq} = 2C$$

$$\text{time-constant} = R_{eq}\,C_{eq} = \frac{R}{2} \cdot 2C = RC.$$

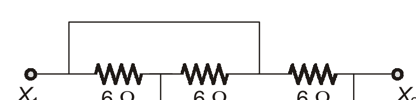
4. (c)



$$V_0 = \left(1 + \frac{R_f}{R_1}\right)V_s$$

$$= \left(1 + \frac{2R}{R}\right)V_s = 3V_s$$

6. (a)



These three resistance one in parallel, so

$$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6}$$

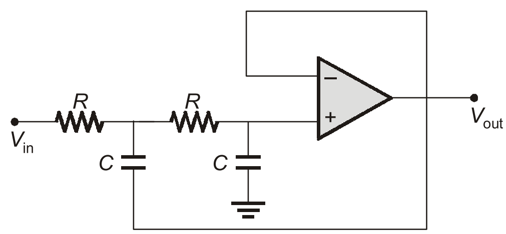
$$\therefore \quad R_{eq} = \frac{6}{3} = 2\ \Omega.$$

3

ISRO-2008

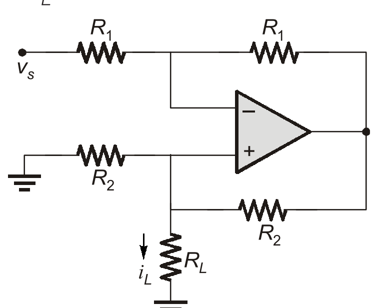
(Indian Space Research Organisation)

Q.1 The circuit shown in figure is a



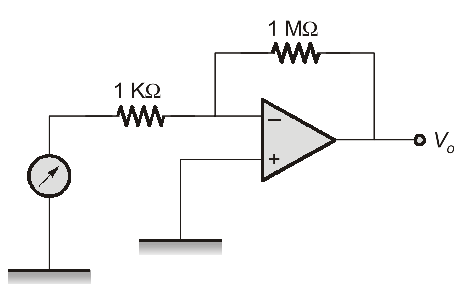
(a) Low-pass filter (b) High-pass filter
(c) Band-pass filter (d) Band-reject filter

Q.2 In the op-amp circuit given in figure, the load current i_L is



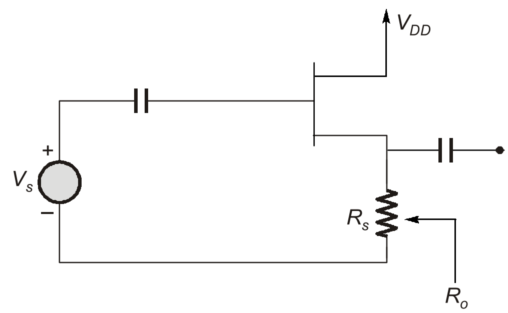
(a) $-\frac{v_s}{R_2}$ (b) $\frac{v_s}{R_2}$
(c) $-\frac{v_s}{R_L}$ (d) $-\frac{v_s}{R_1}$

Q.3 An op-amp has an offset voltage of 1 mV and is ideal in all other respects. If this op-amp is used in the circuit shown in figure, the output voltage will be



(a) 1 mV (b) 1 V
(c) ± 1 V (d) 0 V

Q.4 For the circuit shown below if $g_m = 3 \times 10^{-3}$ and $R_s = 3000\ \Omega$, then the approximate value of R_o is



(a) 3000 Ω (b) 1000/3 Ω
(c) 300 Ω (d) 100 Ω

Q.5 Where does the operating point of a class-B power amplifier lie?
(a) At the middle of a.c. load line
(b) Approximately at collector cut-off on both the d.c. and a.c. load lines
(c) Inside the collector cut-off region on a.c. load line
(d) At the middle point of d.c. load line

Q.6 The Laplace transform of e^{-2t} is

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

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

Q.7 The system with characteristic equation

$$s^4 + 3s^3 + 6s^2 + 9s + 12 = 0$$

(a) Stable
(b) Unstable
(c) Marginally stable
(d) Marginally unstable

Q.8 Compared to field effect photo transistors, bipolar photo transistors are
(a) More sensitive and faster
(b) Less sensitive and slower
(c) More sensitive and slower
(d) Less sensitive and faster

Q.9 The output V-I characteristics of an enhancement type MOSFET has
(a) Only an ohmic region
(b) Only a saturation region
(c) An ohmic region at low voltage value followed by a saturation region at higher voltages
(d) An ohmic region at large voltage values preceded by a saturation region at lower voltages

Q.10 Which of the following relation is valid?
Where
MTBF = Mean Time Between Failure
MTTF = Mean Time To Failure
MTTR = Mean Time To Repair
(a) MTBF = MTTF + MTTR
(b) MTTR + MTTF + MTBF = 1
(c) $\frac{1}{\text{MTTR}} + \frac{1}{\text{MTTF}} = \frac{1}{\text{MTBF}}$
(d) MTBF . MTTF . MTTR = 1

Q.11 Two transistors have the same value of α but different gain bandwidth products. One of them is a germanium transistor and the other is a silicon transistor. Both the transistors have similar geometries and base width. The transistor with lower *GB* product
(a) is the germanium
(b) is the silicon
(c) both are same
(d) Cannot be identified unless more information is available

Q.12 The following transistor configuration has the highest input impedance
(a) *CC* (b) *CE*
(c) *CB* (d) All of the above

Q.13 If t_c, h and t_m specify the cache access time, hit ratio and main memory access time then the average access time is (Given t_c = 160 ns, t_m = 960 ns, h = 0.99)
(a) 160 ns (b) 960 ns
(c) 256 ns (d) 950 × 0.9 ns

Q.14 The advantage of write (copy) back data cache organization over write through organization is
(a) Main memory consistency
(b) Write allocate on write miss
(c) Less memory bandwidth requirement
(d) Higher capacity

Q.15 E^2PROM storage element is
(a) Cross - coupled latch
(b) Isolated gate transistor
(c) Capacitor
(d) Flip flop

Q.16 The modulus of 1 + cos α + i sin α is
(a) $2\sin\frac{\alpha}{2}$ (b) $2\cos\frac{\alpha}{2}$
(c) $\sin^2\frac{\alpha}{2}-1$ (d) $\cos^2\frac{\alpha}{2}-1$

Q.17 The 8 bit DAC produces 1.0 V for a digital input of 00110010. What is the largest output it can produce?
(a) 5 V (b) – 5 V
(c) 5.5 V (d) 5.10 V

Q.18 The fastest ADC among the following is
(a) Successive approximation type
(b) Dual slope type
(c) Sigma-Delta ADC
(d) Flash Converter

Q.19 The mod number of a Johnson counter will be always equal to .... the number of flip flops used
(a) same
(b) twice
(c) 2^N where N is the number of flip flops
(d) None of these

Q.20 Odd parity generator uses .... logic
(a) XNOR (b) XOR
(c) Sequential (d) OR

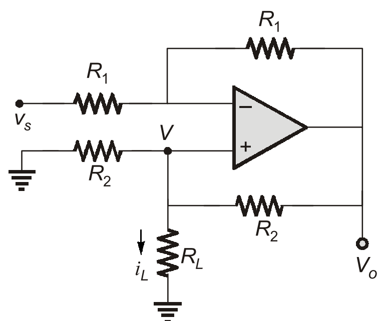
Q.21 Which type of memory has fast erase and write times
(a) EPROM (b) EEPROM
(c) Flash memory (d) None of these

Q.22 The performance gain that can be obtained by improving some portion of a computer can be calculated using
(a) Moore's law
(b) Dijkstra's algorithm
(c) Amdahl's law
(d) Murphy's law

Q.23 Microprogramming refers to
(a) Emulation
(b) Programming at micro level
(c) The use of storage to implement the control unit
(d) Array processing

Explanations **ISRO-2008**

2. (a)



$$\frac{V}{R_2} + \frac{V}{R_L} = \frac{V_0 - V}{R_2}$$

$$\Rightarrow \quad 2\frac{V}{R_2} + \frac{V}{R_L} = \frac{V_0}{R_2} \quad \text{...(i)}$$

$$\frac{V_s - V}{R_1} = \frac{V - V_0}{R_1}$$

$$\Rightarrow \quad V_S - 2V = -V_0 \quad \text{...(ii)}$$

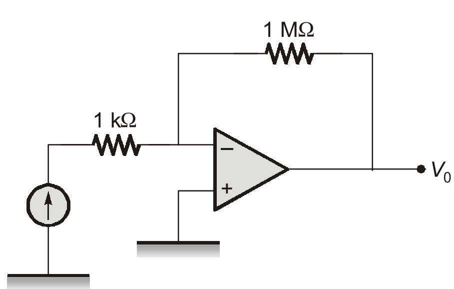
Putting V_0 from equation (i) in equation (ii) we get

$$\frac{-V_s + 2V}{R_2} = +\left(\frac{2V}{R_2} + \frac{V}{R_L}\right)$$

$$I_L = \frac{V}{R_L} = -\frac{V_S}{R_2}.$$

3. (c)

$$V_0 = \left(\frac{R + R_f}{R}\right) V_{i0}$$



where, V_{i0} = input offset voltage

$$V_0 = \left(1 + \frac{R_f}{R_0}\right) V_{i0}$$

$$= \left(1 + \frac{1\times 10^6}{1\times 10^3}\right) \times 1 \times 10^{-3}$$

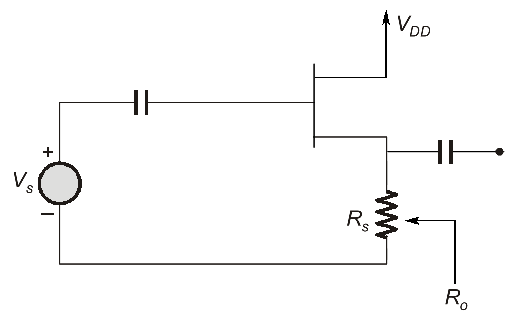
$$= 1001 \times 1 \times 10^{-3}$$

$$= 1.001\text{ V} \simeq 1\text{ V}$$

Nature cannot be predicted

So, $V_0 = \pm 1$ V

4. (c)



$$r_d = \frac{1}{g_m} = \frac{1000}{3}\ \Omega$$

$$R_0 = r_d \| R_s$$

$$= \frac{\frac{1000}{3} \times 3000}{\frac{1000}{3} + 3000}$$

$$= \frac{1000 \times 3000}{3} \times \frac{3}{1000} = 300\ \Omega$$

7. (b)

According to *R-H* array

s^4	1	6	12
s^3	3	9	0
s^2	3	12	0
s^1	–3	0	0
s^0	12	0	0

Two sign change. So it has two poles in RHS.
So, system is unstable.

13. (a)

Average access time

$$t_{avg} = ht_c + (1 - h)(t_m + t_c)$$

Where, h = hit ratio

t_c = cache access time

t_m = main memory access time

$$t_{avg} = 0.99 \times 160 + 0.01(160 + 960)$$

$$= 169.6\text{ ns}$$

4 ISRO-2009

(Indian Space Research Organisation)

Q.1 A 5 bit DAC has a current output. For a digital input of 10100, an output current of 10 mA is produced. What will be the output current for a digital input of 11101?

(a) 14.5 mA
(b) 10 mA
(c) 100 mA
(d) Not possible to calculate

Q.2 The ethernet protocol uses

(a) CSMA/CA (b) SCPC
(c) CSMA/CD (d) Slotted ALOHA

Q.3 A micro controller differs from a microprocessor in terms of

(a) I/O interfaces and instruction decoding
(b) Memory configuration and I/O interfaces
(c) Data bus width and clock speed
(d) Memory configuration and instruction decoding

Q.4 An 8-bit microcontroller has an external RAM with the memory map from 8000H to 9FFFH.
The number of bytes RAM can store is

(a) 8193 (b) 8192
(c) 8191 (d) 8000

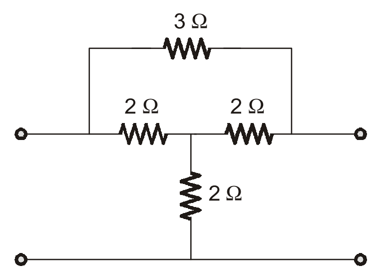
Q.5 An audio frequency of 15 KHz is frequency modulated with a deviation of 75 KHz. The resulting bandwidth is

(a) 180 KHz (b) 150 KHz
(c) 210 KHz (d) 240 KHz

Q.6 A 1 kW carrier is Amplitude Modulated to a depth of 60%. The total power in the modulated carrier is

(a) 1 kW (b) 1.06 kW
(c) 1.6 kW (d) 1.18 kW

Q.7 The y_{21} parameter of the network shown in the given figure will be



(a) $\frac{1}{6}$ (b) $-\frac{1}{2}$
(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

Q.8 An inductance of 1 H is realized using air core with 100 turns. What will be the inductance if the number of turns are doubled?

(a) 1 H (b) 0.5 H
(c) 2 H (d) None of these

Q.9 An inductor of inductance 0.1 H, carrying current of 6 Amps will store energy of

(a) 6 Joules (b) 36 Joules
(c) 1.8 Joules (d) 3.6 Joules

Q.10 A coil has self resistance of 5 Ω and inductance of 1 μH. The value of Q at 1 MHz frequency is

(a) 200 (b) 100
(c) 40 (d) None of these

Q.11 The closed loop transfer function of a unity feedback control system is $G(s) = \frac{1}{(s+2)^2}\cdot$ The closed loop transfer function will have poles at

(a) –2, ± j (b) –2, –1
(c) –2, –2 (d) –2, 2

Q.12 The dominant mode of propagation in microstrip line in low frequency approximation is

(a) TM_{11} (b) Quasi-TEM
(c) TEM (d) TE_{01}

5 ISRO-2010

(Indian Space Research Organisation)

Q.1 An LTI system has the input signal $x(n)$. Which of the following sequence of operations is most appropriate to get output $y(n) = x(n - M/L)$

(a) Interpolation by L, Delay by M, Decimation by L

(b) Delay by M, Interpolation by L, Decimation by M

(c) Decimation by L, Delay by M, Interpolation by L

(d) Interpolation by L, Decimation by L, delay by M

Q.2 Consider a low pass random process with a white noise power spectral density

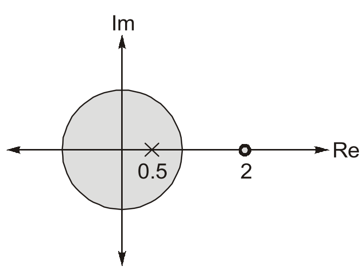
$$S_x(\omega) = N/2 \quad \text{where } -2\pi B \le \omega \le 2\pi B$$
$$= 0 \quad \text{elsewhere}$$

The auto-correlation function $R_x(\tau)$ is

(a) $2NB\,\text{sinc}(2\pi B\tau)$ (b) $\pi NB\text{sinc}(2\pi B\tau)$

(c) $NB\text{sinc}\,(2\pi B\tau)$ (d) None of these

Q.3 Pole-zero plot of a digital filter is shown below, what is the type of filter?



(a) Low pass (b) High pass

(c) Band stop (d) All pass

Q.4 Determine the DTFT of the sequence $y[n] = (n + 1)\alpha^n u[n]$, $|\alpha| < 1 \cdot u[n]$ is unit step sequence

(a) $Y(e^{j\omega}) = 1/(1 - \alpha e^{-j\omega})^2$

(b) $Y(e^{j\omega}) = 1/(1 + \alpha e^{-j\omega})^2$

(c) $Y(e^{j\omega}) = \alpha/(1 - \alpha e^{-j\omega})^2$

(d) None of these

Q.5 The function $f(t)$ has the Fourier transform $g(\omega)$. The Fourier transform of g(t) is

(a) $f(\omega)/2\pi$ (b) $f(-\omega)/2\pi$

(c) $2\pi f(-\omega)$ (d) None of these

Q.6 The purpose of Design for Test (DFT) process in ASIC design flow is

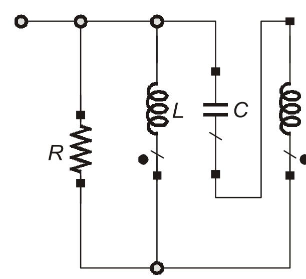
(a) To capture functional errors

(b) To capture manufacturing defects

(c) To capture timing violations

(d) for radiation mitigation

Q.7 The coupling between the two inductors is increased from zero in the circuit shown. Which of the following statements is true?



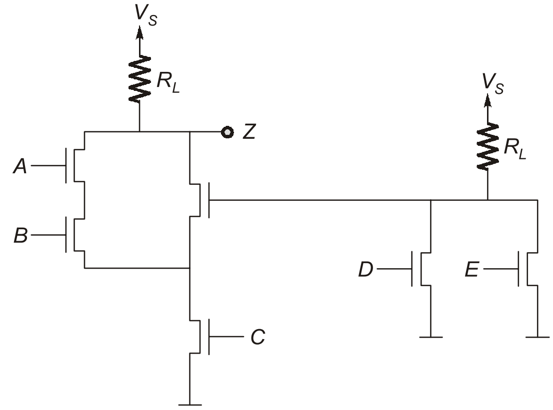
(a) The resonant frequency will increase and the Q will decrease

(b) The resonant frequency and Q will both increase

(c) The resonant frequency and Q will both decrease

(d) The resonant frequency will decrease and the Q will increase

Q.8 Write a Boolean expression for Z in terms of A, B, C, D and E. You need not simplify the expression



6

ISRO-2011

(Indian Space Research Organisation)

Q.1 ____ is used to describe the light gathering or light collecting ability of an optical fiber
(a) Critical angle
(b) Cut-off wavelength
(c) Numerical aperture
(d) Acceptance angle

Q.2 ____ has the maximum fan out capacity
(a) MOS (b) CMOS
(c) ECL (d) RTL

Q.3 If Z transform of $x(n)$ is $X(z)$ then the Z transform of $x(n-k)$ is ____.
(a) $X(z^{-k}z)$ (b) $X(z^{k}z)$
(c) $z^{-k}X(z)$ (d) $z^{k}X(z)$

Q.4 The following code will implement a ____

```
        process (clk, d) begin
          If (clk = '1') then
                q < = d;
          end if;
end process
```

(a) Positive edge triggered D flip-flop
(b) Negative edge triggered D flip-flop
(c) A latch
(d) None of the above

Q.5 In phase modulated signal, the frequency deviation is proportional to
(a) Frequency only (b) Amplitude only
(c) Both (a) and (b) (d) None of the above

Q.6 For a fast communication which of the following requirements have to be met
(a) Large bandwidth
(b) High S/N ratio
(c) High channel capacity
(d) None of the above

Q.7 For an earth station transmitter input power of 40 dBW (10,000 W), with a back off loss of 3 dB, a total branching and feeder loss of 3 dB, and a transmit antenna gain of 40 dB, determine the EIRP.
(a) 40 dBW (b) 74 dBW
(c) 34 dBW (d) 80 dBW

Q.8 The transconductance g_m of an FET in the saturation region equals

(a) $\dfrac{-2I_{DSS}}{V_p}\left[1-\dfrac{V_{GS}}{V_p}\right]$

(b) $\dfrac{-2I_{DSS}}{V_p}\left[1-\dfrac{V_{GS}}{V_p}\right]^2$

(c) $\dfrac{-2I_{DSS}}{V_p}\left[1-\dfrac{V_{GS}}{V_p}\right]^{1/2}$

(d) $\dfrac{1}{V_p}\left[I_{DSS}\ X\ I_{DS}\right]^{1/2}$

Q.9 The transistor amplifier with 85% of efficiency is likely to be
(a) Class A (b) Class B
(c) Class AB (d) Class C

Q.10 A run-time stack cannot be used in a round-robin scheduling system because of the ____ nature of scheduling
(a) LIFO (Last in First out)
(b) FIFO (First in First out)
(c) FILO (First in Last out)
(d) None of the above

Q.11 $(3+i)/(5+5i)$ is same as
(a) $(2-i)/5$ (b) $3-i$
(c) $5-5i$ (d) $(2+i)/5$

Q.12 The greatest negative number which can be stored in a 8-bit register using 2's complement arithmetic is
(a) –256 (b) –255
(c) –127 (d) –128

Q.13 Two coupled coils have self inductances L_1 = 10 mH and L_2 = 20 mH. The coefficient of coupling (K) being 0.75 in the air. Voltage in the second coil when the current in circuit is given by $I = 2\sin(314\ t)$ A is ______.
(a) 3.14 cos (314t) V (b) 3.33 sin(314t) V
(c) 6.66 cos(314t) V (d) 6.28 cos(314t) V

Q.14 In a radar system, if the peak transmitted power is increased by a factor of 16 and the antenna diameter is increased by a factor of 2, then the maximum range will increase by a factor of

(a) 16 (b) 8

(c) 4 (d) $\sqrt{8}$

Q.15 _____ current is the leakage current that flows through a photo diode with no input used in as light detectors.

(a) Leakage (b) Dark

(c) Saturation current (d) Detection

Q.16 The figure of merit of a logic family is given by

(a) Gain bandwidth product

(b) (propagation delay time) * (power dissipation)

(c) fanout * (propagation delay time)

(d) (noise margin) * (power dissipation)

Q.17 ____ is defined as the time delay that a signal component of frequency (ω) undergoes as it passes from the input to output of the system.

(a) Phase delay

(b) Group delay

(c) Frequency deviation

(d) Latency

Q.18 Which statement is true regarding a behaviour modeling in VHDL?

(a) There can be more than one process statement in an architecture which will interact concurrently.

(b) Behavioral style of architecture can have only concurrent assignment statements.

(c) Process is not a single concurrent statement.

(d) A process need to have sensitivity list for proper implementation.

Q.19 The modulation index of an amplitude modulated wave is changed from 0 to 1. The transmitted power is

(a) Doubled

(b) Halved

(c) Increased by 50 percent

(d) Unchanged

Q.20 In a communication system, each message (1 or 0) is transmitted three times in order to reduce the probability of error. The detection is based on the majority rule at the receiver. If P_c is the probability of bit error, the probability of error for this communication channel will be

(a) $3P_C^2 - 2P_C^3$ (b) $1 - P_C^2 - P_C^3$

(c) P_C^3 (d) $P_C^2(1 - P_C)$

Q.21 For a satellite transponder with a receiver antenna gain of 12 dB, an LNA gain of 10 dB, and equivalent noise temperature of 26 dBK^{-1}, the G/Te is

(a) 4 dBK^{-1} (b) –4 dBK^{-1}

(c) 26 dBK^{-1} (d) –26 dBK^{-1}

Q.22 The conductivity of the intrinsic germanium at 300°K is ____.

When n_i at 300°K = $2.5 \times 10^{13}/cm^3$ and μ_n and μ_p in germanium are 3800 and 1800 cm^2/Vs respectively.

(a) 0.224 S/cm (b) 0.0224 S/cm

(c) 2.24 S/cm (d) 0.00224 S/cm

Q.23 As compared to a full wave rectifier using 2 diodes, the four diode bridge rectifier has the dominant advantage of

(a) Higher current carrying

(b) Lower peak inverse requirement

(c) Lower ripple factor

(d) Higher efficiency

Q.24 In a real time system, the simplest scheme that allows the operating system to allocate memory to two processes simultaneously is ____.

(a) Over lays (b) Pipeline

(c) Swapping (d) None of the above

Q.25 $(\cos 5\theta - i \sin 5\theta)^2$ is same as

(a) $\cos 10\theta + \sin 10\theta$

(b) $\cos 25\theta - i \sin 25\theta$

(c) $(\cos\theta + i \sin\theta)^{-10}$

(d) $(\cos \theta - i \sin \theta)^{-10}$

Q.26 The process of imitating one system with another so that the imitating systems accepts the same data, executes same programs and achieves same results as the imitated systems is known as

(a) Simulation (b) Modification

(c) Translation (d) Emulation

Q.27 The values of R, L and C in series RLC circuit that resonates at 1.5 kHz and consumes 50 W from a 50 V ac source operating at the resonant frequency. The bandwidth is 0.75 kHz.

(a) R = 50 ohm, L = 10.6 mH, C = 1.06 μF.

(b) R = 500 ohm, L = 10.6 mH, C = 10.6 μF.

(c) R = 50 ohm, L = 1.06 mH, C = 10.6 μF.

(d) R = 500 ohm, L = 1.06 mH, C = 1.06 μF.