



GATE-2018
All India Mock GATE Test Series
Electronics & Communication Engineering
Test Series 4

Name:

Test ID: **ECE-TS-04-18**

Duration: 3 hours

Maximum marks : 100

Please read the following instructions carefully

General Instructions

1. Total duration of examination is 180 minutes (3 hours).
2. The clock will be set at the server. The countdown timer in the top right corner of screen will display the remaining time available for you to complete the examination. When the timer reaches zero, the examination will end by itself. You will not be required to end or submit your examination.
3. The Question Palette displayed on the right side of screen will show the status of each question using one of the following:
 - a. You have not visited the question yet.
 - b. You have not answered the question.
 - c. You have answered the question.
 - d. You have NOT answered the question, but have marked the question for review.
 - e. You have answered the question, but marked it for review.

The **Marked for Review** status for a question simply indicates that you would like to look at that question again. If a question is answered and **Marked for Review**, your answer for that question will be considered in the evaluation.

Navigating to a Question

4. To answer a question, do the following:
 - a. Click on the question number in the Question Palette to go to that question directly.
 - b. Select an answer for a multiple choice type question by clicking on the bubble placed before the 4 choices namely A, B, C, D. Use the virtual numeric keypad to enter a number as answer for a numerical type question.
 - c. Click on **Save and Next** to save your answer for the current question and then go to the next question.
 - d. Click on **Mark for Review and Next** to save your answer for the current question, and also mark it for review, and then go to the next question.
 - e. **Caution:** Note that your answer for the current question will not be saved, if you navigate to another question directly by clicking on its question number without saving the answer to the previous questions.
 - f. You can view all the questions by clicking on the **Question Paper** button. This feature is provided, so that if you want you can just see the entire question paper at a glance.

Answering a Question

5. Procedure for answering a multiple choice (MCQ) type question:
 - a. To select your answer, click on the bubble button of one of the options
 - b. To deselect your chosen answer, click on the bubble button of the chosen option again or click on the clear response button
 - c. To change your chosen answer, click on the bubble button of another option
 - d. To save your answer, you **MUST** click on the **Save and Next button**.
 - e. To mark the question for review, click on the **Mark for Review and Next** button. If an answer is selected for a question that is Marked for Review, that answer will be considered in the evaluation.

6. Procedure for answering a numerical answer type question:

- a. To enter a number as your answer, use the virtual numerical keypad
 - b. A fraction (eg. -0.3 or $-.3$) can be entered as an answer with or without '0' before the decimal point. As many as four decimal points, e.g. 12.5435 or 0.003 or -932.6711 or 12.82 can be entered.
 - c. To clear your answer, click on the Clear Response button
 - d. To save your answer, you **MUST** click on the **Save and Next** button
 - e. To mark a question for review, click on the **Mark for Review and Next** button. If an answer is selected (for MCQ) or entered (for numerical answer type) for a question that is Marked for Review, that answer will be considered in the evaluation.
7. To change your answer to a question that has already been answered, first select that question for answering and then follow the procedure for answering that type of question.
8. Note that **ONLY** Questions for which answers are saved or marked for review after answering will be considered for evaluation.

Paper Specific Instructions:

9. There are a total of 65 questions carrying 100 marks. Questions are of multiple choice type or numerical answer type. A multiple choice type question will have four choices for the answer with only one correct choice. For numerical answer type questions, the answer is a number and no choices will be given. A number as the answer should be entered using the virtual keyboard on the monitor.
10. Questions Q.1 – Q.10 belong to General Aptitude (GA) section and carry a total of 15 marks. Questions Q.1 – Q.5 carry 1mark each, and questions Q.6 – Q.10 carry 2marks each.
11. Questions Q.1 – Q.25 carry 1mark each. Questions Q.26 – Q.55 carry 2marks each.
12. Questions not attempted will result in zero mark. Wrong answers for multiple choice type questions will result in **NEGATIVE** marks. For all 1 mark questions, $\frac{1}{3}$ mark will be deducted for each wrong answer. For all 2 marks questions, $\frac{2}{3}$ mark will be deducted for each wrong answer. There is no negative marking for questions of numerical answer type.
13. Physical calculator is **NOT** allowed. All candidates will be provided with an online scientific calculator which has to be used to answer the questions.

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Test Series 4

Electronics & Communication Engineering

General Aptitude:

Q.1 - Q.5 Carry One Mark each.

- In the following question choose the word which is the exact OPPOSITE of the given words.
“QUIESCENT”
(A) Active (B) Dormant
(C) Weak (D) Unconcerned
- Which term of the series 5, 10, 20, 40, is 1280?
- A train normally covers a certain distance at a speed of 60 km/hr. However, if it were to halt for a fixed time interval in each hour, its average reduced to 50 km/hr. what is the time interval for which the train halts in each hour?
(A) 10 minutes (B) 20 minutes
(C) 6 minutes (D) 12 minutes
- Radha moves towards South-East a distance of 7 km, then she moves towards West and travels a distance of 14 km. From here she moves towards North-West a distance of 7 km and finally she moves a distance of 4 km towards east. How far is she now from the starting point?
- In the following question two statements are given and these statements are followed by two conclusions numbered (1) and (2). You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusions and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.
Statements: Some actors are singers. All the singers are dancers.
Conclusions:
1. Some actors are dancers.
2. No singer is actor.
(A) Only (1) conclusion follows (B) Only (2) conclusion follows
(C) Either (1) or (2) follows (D) Neither (1) nor (2) follows

Q.6 - Q.10 Carry Two Mark each.

- If Rupert has 4 more coins than Laxmi, Laxmi has 1 more coin than bill and bill has 1 more coin than Hawkins. Finally Hawkins has 4 more coins than Ajim. Then minimum number of coins that must be transferred, if all of them wish to have an equal number of coins:

7. The last digit of the expression
 $4 \times 9^2 \times 4^3 \times 9^4 \times 4^5 \times 9^6 \times \dots \times 4^{99} \times 9^{100}$ is:
(A) 4 (B) 6
(C) 9 (D) 1
8. The average age of boys in class is 16.66, while the average age of girls is 18.75. Thus average age of all the 40 students of the class is 17.5. If the difference between the number of boys and girls is 8, then the number of girls in the class is:
(A) 12 (B) 16
(C) 18 (D) Data insufficient
9. In an election only two candidates contested 20% of the voters did not vote and 120 votes were declared as invalid. The winner got 200 votes more than his opponents thus he secured 41% votes of the total voters on the voter list. Percentage votes of the defeated candidate out of the total votes casted is :
(A) 47.5% (B) 51.25%
(C) 36% (D) 45%
10. The amount of work in a leather factory is increased by 50%. By what percent is it necessary to increase the number of workers to complete the new amount of work in previously planned time, if the productivity of the new labour is 25% more.

Technical:

Q.1 - Q.25 Carry One Mark each.

1. For the given matrix $A = \begin{bmatrix} a & 1 & 0 & 0 \\ 1 & a & 0 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & -1 & 1 \end{bmatrix}$

Find the set of eigen values

(A) $\lambda = 0, \lambda = 2a, \lambda = a + 1, \lambda = 2$

(B) $\lambda = a + 1, \lambda = a - 1, \lambda = 0, \lambda = 2$

(C) $\lambda = a + 1, \lambda = 2a, \lambda = 0, \lambda = 2$

(D) $\lambda = a - 1, \lambda = a + 1, \lambda = 2, \lambda = 1$

2. The value of the contour integral $\oint_c \frac{\cosh 3z}{z^5}$ around the circle $|z| = 2$ in the counter clockwise direction is

(A) $\frac{27}{4}\pi i$

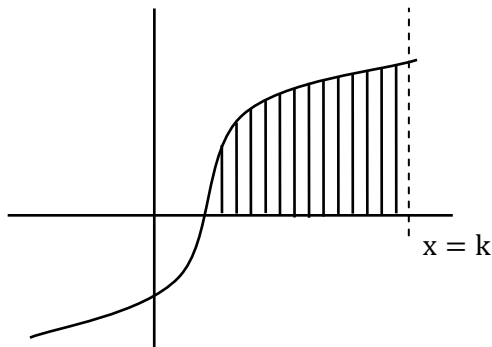
(B) $\frac{81}{4}\pi i$

(C) 0

(D) $\frac{9\pi i}{4}$

3. Given the matrix $A = \begin{pmatrix} 1 & 3 & 1 & -4 \\ -1 & -3 & 1 & 0 \\ 2 & 6 & 2 & -8 \end{pmatrix}$ the rank of $A^T A$ is _____.

4. The shaded region is bounded by the graph of the function $f(x) = \sqrt[3]{x-1}$, the line $x = k$ and the x-axis.



If the region has area 12, what is the exact value of k?

5. If $z(x,y) = 2000 - 4x^2 - y^2$ (meters) gives the elevation of a mountain above sea level, what is the direction of steepest ascent at $P(3, -6)$?

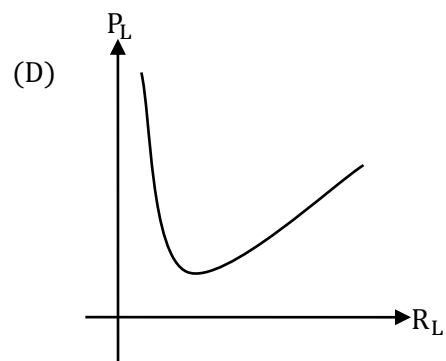
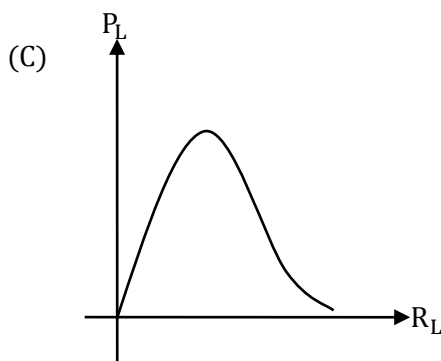
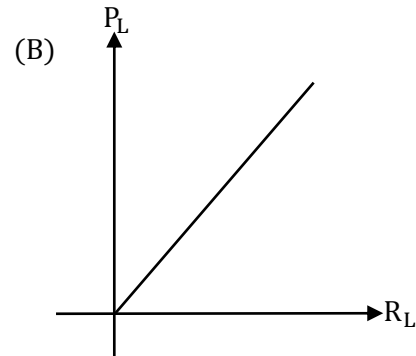
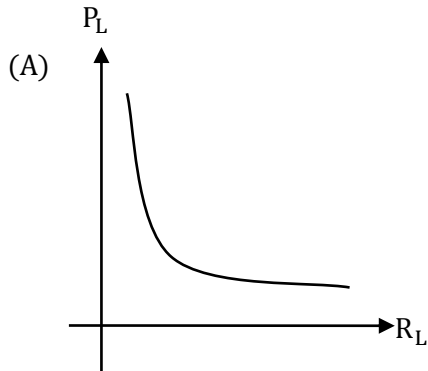
(A) $-24i - 12j$

(B) $+24i + 12j$

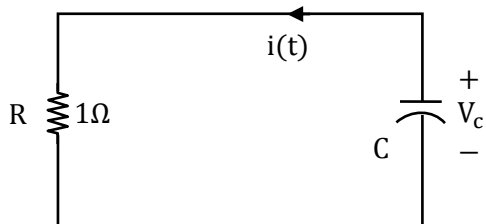
(C) $24i - 12j$

(D) $-24i + 12j$

6. A voltage source with an internal resistance R_s , supplies power to a load R_L . The power delivered to the load varies with R_L as:



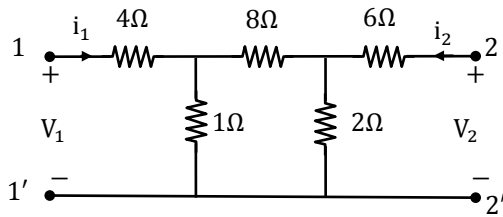
7. For the circuit given below,



If $i(0^-) = 5A$ and $i(t)|_{t=3ms} = 2.5A$
Then value of C is _____ mF

8. In any series RLC circuit, which is operating at a frequency which is less than the resonant frequency. Then behavior of Admittance offered by circuit at that frequency is:
- (A) Capacitive (B) Inductive
(C) Resistive (D) None of these

9. In the given two port network h_{21} is



- (A) $\frac{1}{42}$
(C) $\frac{1}{84}$

- (B) $\frac{1}{-42}$
(D) $\frac{1}{-84}$

10. The value of integral:

$$H(\omega) = 9 \int_{-\infty}^{\infty} \left| \frac{\sin\left(\frac{\omega}{3}\right)}{\omega} \right|^2 d\omega \text{ is } \underline{\hspace{2cm}}.$$

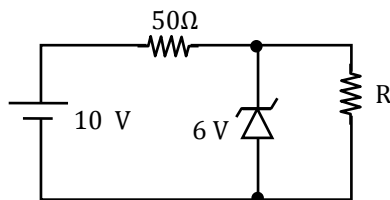
11. The Eber-moll model is applicable to

- (A) Bipolar junction transistors
(C) Uni-polar junction transistor

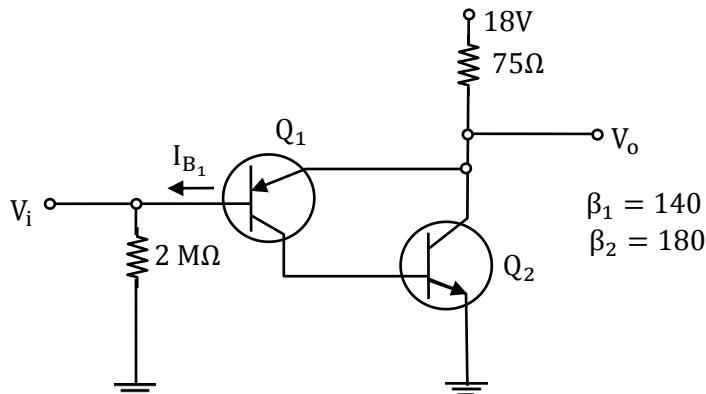
- (B) NMOS transistors
(D) Junction field effect transistors

12. If the saturation mode drain current of nmos transistor is 1.2 mA. Now after saturation channel length modulation is 0.002 V^{-1} at $V_{DS} = 5 \text{ V}$. Then drain current is _____mA[Up to three decimal places]

13. The 6V zener diode shown below 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 6V is $R = \underline{\hspace{2cm}} \Omega$

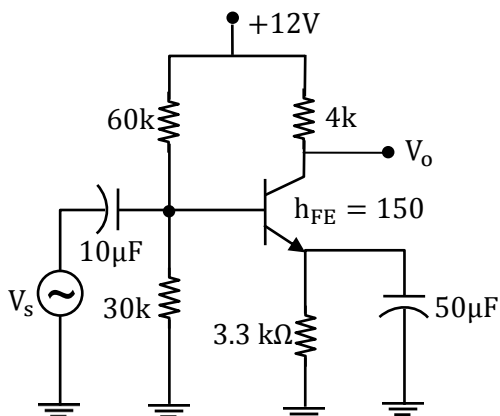


14. Find I_{B1} [Take appropriate approximation]



- (A) 4.45 μ A (B) 4.45 mA
(C) 9.25 μ A (D) 9.25 mA

15. An amplifier circuit is shown in the given figure



The magnitude of voltage gain (V_o/V_s) is

- (A) $\frac{4}{3.33}$ (B) 100
(C) 150 (D) 160

16. A certain logic family has the following voltage parameters

$$V_{IH(\min)} = 3.5 \text{ V}$$

$$V_{IL(\max)} = 1.0 \text{ V}$$

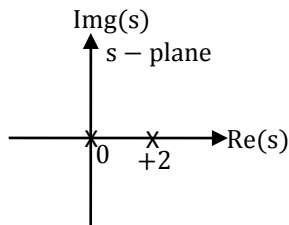
$$V_{OH(\min)} = 4.9 \text{ V}$$

$$V_{OL(\max)} = 0.1 \text{ V}$$

The largest positive going and negative going spike, that can be tolerated is respectively.

- (A) 1.4 V, 0.9 V (B) 0.9 V, 1.4 V
(C) 3.9 V, 3.4 V (D) None of the above

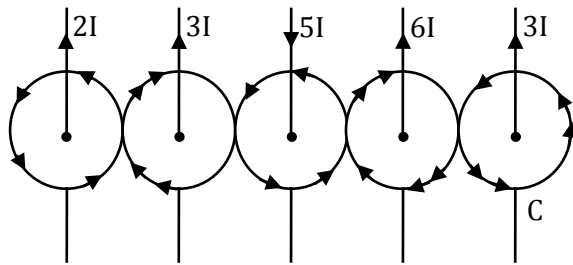
17. The counter starts off in the '0000' state, and then clock pulses are applied. Sometime later the clock pulses are removed and the counter FF's read '0011'. How many clock pulses have occurred?
 (A) 3 (B) 35
 (C) 51 (D) Any of them
18. A Full-adder can be implemented with half adders and OR gates. A 4 bit parallel full adder without any initial carry requires:-
 (A) 8 half adders, 4 OR gates (B) 8 half adders, 3 OR gates
 (C) 7 half adders, 4 OR gates (D) 7 half adders, 3 OR gates
19. The unit step response of a certain control system is given by $C(s) = \frac{1}{s} + \frac{0.2}{(s+60)} - \frac{1.2}{(s+10)}$ the system is
 (A) Under damped (B) Critically damped
 (C) Over damped (D) Un damped
20. The open loop transfer function of a control system has two poles at origin and +2 respectively, as shown in figure.



The system has constant gain k is 4. The number of encirclement with respect to critically point in clockwise direction is _____

21. Which of the following statement is not true
 (A) Entropy of a source is maximum if all the symbols are equiprobable
 (B) Entropy of a source depends only on the probability distribution of symbols
 (C) Entropy of a source can never be zero
 (D) Entropy of a source gives average information present in the symbol
22. Pulse code modulation uses uniform quantizer followed by an 8-bit binary encoder. If bit rate of the system is 56×10^6 bits per second, maximum message band width for which the system operates satisfactorily (in MHz) is _____

23. The circulation of \vec{H} around the closed contour C shown in the figure is:

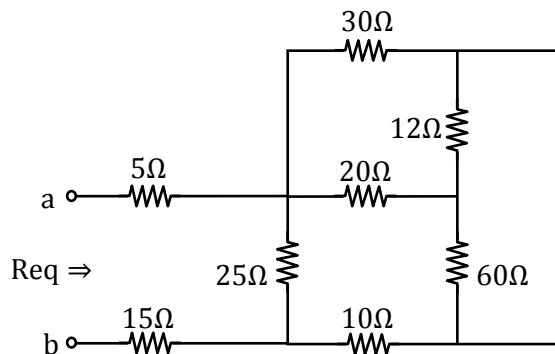


- (A) $9I$ (B) $-9I$
(C) $19I$ (D) $-19I$
24. $E = 5\cos\left(10^8t - \frac{z}{\sqrt{3}}\right)\vec{u}_x - 2\sin\left(10^8t - \frac{z}{\sqrt{3}}\right)\vec{u}_y$ V/m. The E field of a uniform plane wave propagating in a loss less dielectric medium is given by the above equation. The dielectric constant of the medium is:
(A) $\sqrt{3}$ (B) 3
(C) $3\sqrt{3}$ (D) 1
25. An optical fiber operating at 1400 nm with the diameter of about $10\mu\text{m}$, $n_1 = 1.3$, $\Delta = 0.80\%$, $V = 3.5$. Then how many modes are possible?
(A) 12.5 (B) 3.5
(C) 6.125 (D) None of these

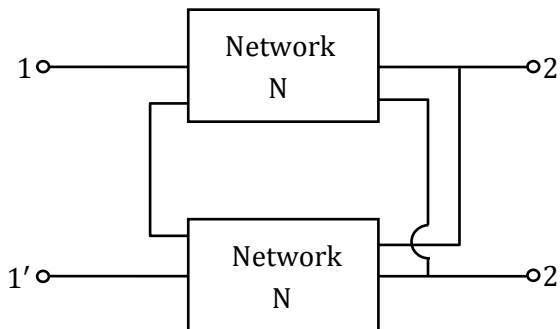
Q.26 - Q.55 Carry Two Mark each.

26. Newton's method iteration scheme for finding the square root of 3
(A) $x_{n+1} = \frac{1}{2} [x_n + 2/x_n]$ (B) $x_{n+1} = \frac{1}{2} [x_n - 3/x_n]$
(C) $x_{n+1} = 3/x_n$ (D) $x_{n+1} = \frac{1}{2} [x_n + 3/x_n]$
27. The determinant of the matrix $\begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$ is _____
28. A sample of 3 items is selected at random from a box containing 20 items of which 4 are defective. What is the expected number of defective items in the sample _____.
29. Consider the system of linear equation $Ax = b$, which of the following is equivalent to saying that $Ax = b$ is consistent.
(A) In row reducing $[A/b]$ a row of the following form never appears $(0\ 0\ 0\ \dots\ 0/\alpha)$, where $\alpha \neq 0$.
(B) B is a non-basic column in $[A/b]$.
(C) $\text{rank}[A/b] = \text{rank}(A)$.
(D) All the above.

30. Equivalent resistance across a – b is _____ Ω .



31. Given z parameter of two port network N as $\begin{bmatrix} 30 & 20 \\ 20 & 20 \end{bmatrix}$. The overall h parameters of the network shown below are



(A) $\begin{bmatrix} 60 & 40 \\ 40 & 40 \end{bmatrix}$
(C) $\begin{bmatrix} 20 & 2 \\ -2 & 0.1 \end{bmatrix}$

(B) $\begin{bmatrix} 0.1 & -0.1 \\ -0.1 & 0.15 \end{bmatrix}$
(D) $\begin{bmatrix} 30 & 20 \\ 20 & 20 \end{bmatrix}$

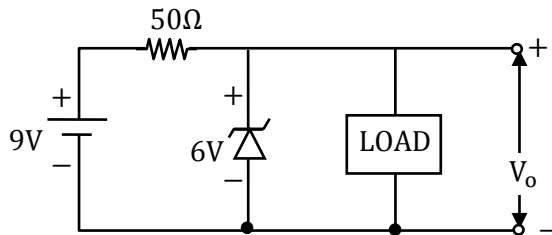
32. A continuous time causal filter has $x(t)$ as input and $y(t)$ as output is represented by differential equation $\frac{d^2y(t)}{dt^2} + \frac{3dy(t)}{dt} + 2y(t) = \frac{10dx(t)}{dt} + 15x(t)$. A continuous time filter is converted to a discrete time filter which have transfer function $H(z) = \frac{10-8.61z^{-1}}{1-az^{-1}+bz^{-2}}$. If the sampling frequency is 10Hz, then the value of $a+b$ is _____.

33. The discrete time signal $x(n)$ is represented in table.

n	0	1	2	3	4	5
x(n)	2	1	3	1	2	0

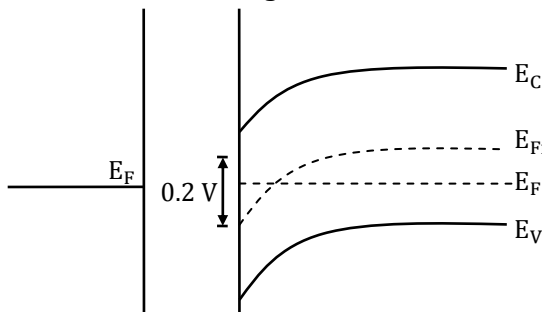
Let $y[e^{j\omega}] = e^{j\omega}x(e^{j\omega})$, where $x(e^{j\omega})$ is DTFT of $x(n)$ and $y(e^{j\omega})$ is DTFT of $y(n)$. Then the value of $|y(e^{j\omega})|$ at $\omega = \frac{\pi}{2}$ is _____.

34. A zener diode in the circuit shown below has a knee current of 5mA, and a maximum allowed power dissipation of 300 mV. What are the minimum and maximum load currents that can be drawn safely from the circuit keeping the output voltage V_o constant at 6V?



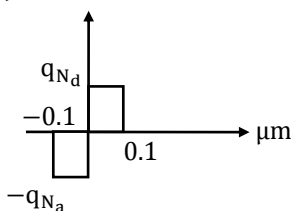
- (A) 0mA, 180 mA
(B) 5 mA, 110 mA
(C) 10mA, 55mA
(D) 60 mA, 180mA

35. Energy band diagram of a n -channel MOS capacitor is given below. Doping of the substrate is $10^{17}/\text{cm}^3$. If surface potential at oxide semiconductor interface is 0.2 volts. Then inversion charges at the interface surface is $\text{_____} \times 10^5 / \text{cm}^3$



Where intrinsic carrier concentration is $1.8 \times 10^{10} / \text{cm}^3$. Thermal voltage = 26 mV

36. Charge density profile of any P-N junction is shown in figure. The built in potential of the junction in volts is _____ V. Where permittivity of the material is 15.



$\epsilon_0 = 8.85 \times 10^{-4} \text{ F/cm}$
 $q = 1.6 \times 10^{-19} \text{ C}$
 $N_a = 10^{17} / \text{cm}^3$
 $N_d = 10^{17} / \text{cm}^3$

37. Given the Fermi energy level for a material is 6.25 eV. The temperature at which there is 2% probability that a state 0.3 eV below the Fermi energy level will not contain any electron is _____ k.

Assume Boltzmann constant

$k = 1.38 \times 10^{-23} \text{ J/k}$
 $q = 1.6 \times 10^{-19} \text{ C}$

38. There are two CV curves shown in figure below of two different MOS capacitor. All the parameters are identical except substrate doping. Corresponding threshold voltage is V_{T_1} and V_{T_2} and inversion charge θ_{i_1} and θ_{i_2} at any particular voltage from gate to body voltage. Then which is correct?

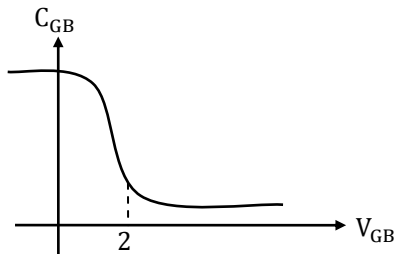


Figure 1

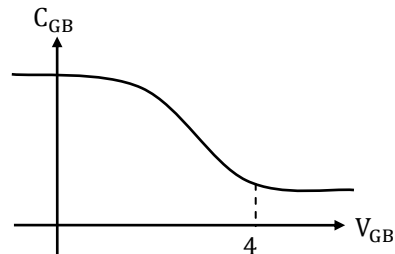
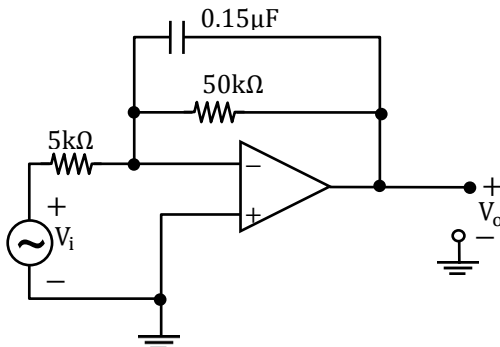
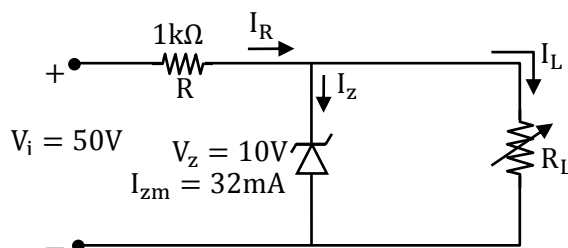


Figure 2

- (A) $V_{T_1} > V_{T_2}, \theta_{i_1} > \theta_{i_2}$
 (B) $V_{T_1} > V_{T_2}, \theta_{i_1} < \theta_{i_2}$
 (C) $V_{T_1} < V_{T_2}, \theta_{i_1} > \theta_{i_2}$
 (D) $V_{T_1} < V_{T_2}, \theta_{i_1} < \theta_{i_2}$
39. The integrator given in figure produces an output voltage $V_o = V_m \sin(100t + \phi)$ in response to an input voltage $V_i = \sin(100t)V$. The value of V_m is



- (A) 1.0V
 (B) 0.8V
 (C) 0.6V
 (D) 0.5V
40. For the network determine the range of R_L that will result in V_{R_L} being maintained at 10V



- (A) $[250\Omega, 1.25k\Omega]$
 (B) $[450\Omega, 1.25k\Omega]$
 (C) $[250\Omega, 1.75k\Omega]$
 (D) $[450\Omega, 1.75k\Omega]$

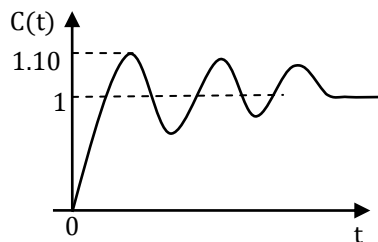
41. A certain general purpose OPAMP has PSRR specification of 100dB. This implies that a one volt change in the power supply will produce an input offset voltage change of _____ μV
42. The vectored address corresponding to the software interrupt RST5.5 in 8085?
 (A) 0020H (B) 002CH
 (C) 0044H (D) 003CH
43. Maximum conversion time of an 8 bit digital ramp ADC is 'P' times that of a successive approximation ADC and 'Q' times that of flash type ADC. $\frac{Q}{P} = \underline{\hspace{2cm}}$

44. A finite machine with the following state table has a single input x and a single out z

Present State	Next state ,z	
	X=1	X=0
A	D,0	B,0
B	B,1	C,1
C	B,0	D,1
D	B,1	C,0

If the initial state is unknown, then the shortest input sequence to reach the final state C is:

- (A) 01 (B) 10
 (C) 101 (D) 110
45. The response of a system for unit step input is shown below



The damped natural frequency $\omega_d = 3.23 \text{ rad/s}$. The settling time of a system for 2% T.B. is _____ [Seconds].

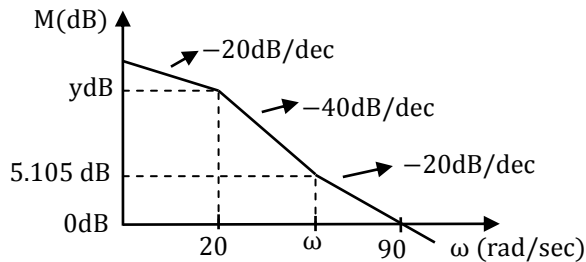
46. A system with zero initial conditions has the closed loop transfer function

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

The system output is zero at the frequency (rad/sec).

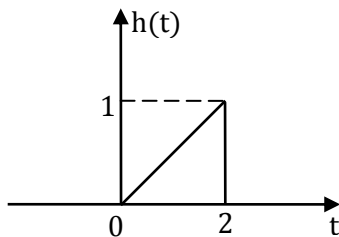
- (A) $\sqrt{2}$ (B) 4
 (C) 3 (D) Undefined

47. Bode plot of a system is shown below



The value of gain k and ω for the system is

- (A) $k = 224.96$ and $\omega = 50$ rad/s
 (B) $k = 284.8$ and $\omega = 100$ rad/s
 (C) $k = 224.96$ and $\omega = 100$ rad/s
 (D) $k = 294.92$ and $\omega = 50$ rad/s
48. A white noise having spectral density $\frac{N_0}{2}$ Watt/hertz is applied to an LTI system having impulse response $h(t)$ shown below

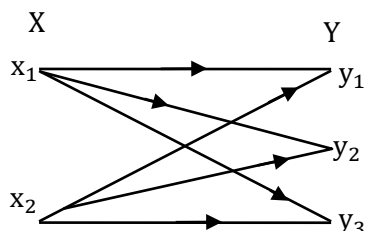


Average power of the output signal is

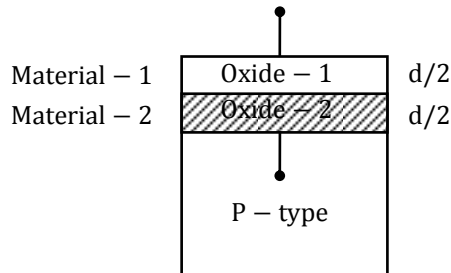
- (A) $\frac{N_0}{2}$
 (B) $\frac{N_0}{3}$
 (C) $\frac{2}{3} N_0$
 (D) $\frac{3}{2} N_0$
49. An M-level QAM is to be used for transmission through a band pass channel ranging from 2000 Hz to 5000 Hz. Minimum value of M for distortion less transmission if raised cosine pulse with 50% excess bandwidth is used for the data rate of 16 Kbps
- (A) 16
 (B) 64
 (C) 32
 (D) None of these
50. $x(t) = u(t) - u(t - 3)$ where $u(t)$ is the step function. $y(t) = x(-2t + 3)$ if $R_y(z)$ is the auto correlation of $y(t)$ then $R_y(0) =$ _____

51. $P\left(\frac{y_1}{x_1}\right) = \frac{1}{4}$, $P\left(\frac{y_2}{x_1}\right) = \frac{1}{2}$, $P\left(\frac{y_2}{x_2}\right) = P\left(\frac{y_3}{x_2}\right) = \frac{1}{4}$ if transmitted symbols x_1 and x_2 are equiprobable,

$H(y) =$ _____ bit/symbol



52. The capacitance of the following mos capacitor when $\epsilon_{r_1} = 4, \epsilon_{r_2} = 6, d = 5\text{mm}$ and area of cross sectional = 30 cm^2 is _____ pF.
($\epsilon_0 = 8.85 \times 10^{-12}\text{ F/m}$)



Where ϵ_{r_1} and ϵ_{r_2} are permittivity of oxide 1 and oxide 2 respectively.

53. In a transmission line the open circuit and short circuit impedance are 40Ω and 5.625Ω respectively. The input impedance of the line of length $\lambda/12$ and with a load 50Ω is _____
 (A) $14.17 + j18.61$ (B) $14.17 - j18.61$
 (C) $18.61 - j14.17$ (D) $18.61 + j14.17$
54. The standing wave ratio of the transmission line having $Z_0 = 300\Omega$ and terminated in $Z_R = 300 + j400$ is _____.
55. A uniform infinite line charge with density $10\mu\text{ C/m}$ lies along the x axis. The electric field at point (3,2,1) is:
 (A) $71.9\vec{a}_y + 35.97\vec{a}_z\text{ kV/m}$ (B) $-71.9\vec{a}_y + 35.9\vec{a}_z\text{ kV/m}$
 (C) $71.9\vec{a}_y - 35.97\vec{a}_z\text{ kV/m}$ (D) $-71.9\vec{a}_y - 35.9\vec{a}_z\text{ kV/m}$