



**GATE-2018**  
**All India Mock GATE Test Series**  
**Instrumentation Engineering**  
**Test Series 4**

Name: .....

Test ID:IN-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 1

### Instrumentation 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:**
  - Some actors are dancers.
  - 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.

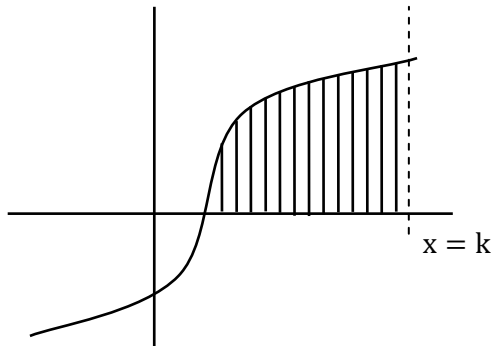
- If Rupert has 4 more coins than Laxmi, Laxmi has 1 more coin than bill and bill has 1 more coin than Hawkins. Finally Hawkins has 4 more coins than Ajim. Then minimum number of coins that must be transferred, if all of them wish to have an equal number of coins:

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. 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.



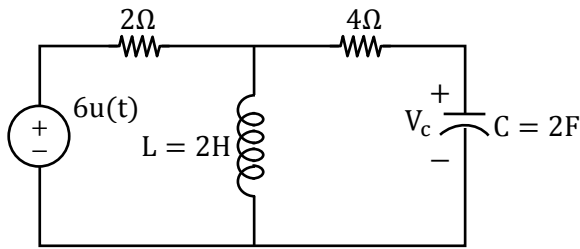
If the region has area 12, what is the exact value of  $k$ ?

2. A husband and wife appear in interview for 2 vacancies in the same post. The probability of husband selection is  $1/7$  and that of wife selection is  $1/5$ . The probability that both of them are selected is \_\_\_\_\_ (Accuracy up-to three decimals)
3. For  $(4x^2D^2 - 24xD + 49)y = 0$ , the complementary function is  
 (A)  $e^{3.5x}(C_1 + C_2x)$   
 (B)  $x^{3.5}(C_1 + C_2x)$   
 (C)  $x^{3.5}(C_1 + C_2 \ln |x|)$   
 (D)  $e^{3.5x}(C_1 + C_2 \ln |x|)$
4. Which of the following is/are the solutions for two dimensional Laplace equations?  
 (A)  $u = x^2 - y^2$  (B)  $u = e^x \cos y$   
 (C)  $u = \sin x \cos hy$  (D) All of these
5. Suppose that the distribution function of  $x$  is given by

$$F(b) = \begin{cases} 0 & b < 0 \\ b/4 & 0 \leq b < 1 \\ \frac{1}{2} + \frac{b-1}{4} & 1 \leq b \leq 2 \\ 11/12 & 2 \leq b < 3 \\ 1 & 3 \leq b \end{cases}$$

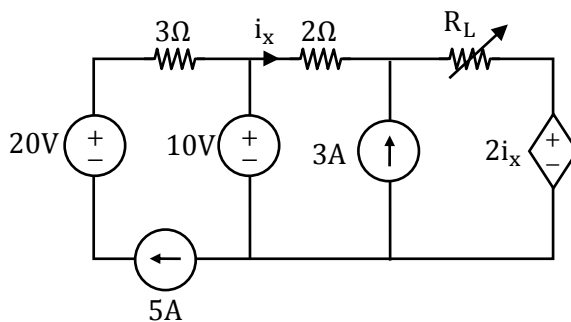
Find  $P\left(\frac{1}{2} < x < \frac{3}{2}\right)$  \_\_\_\_\_

6. Consider the following network

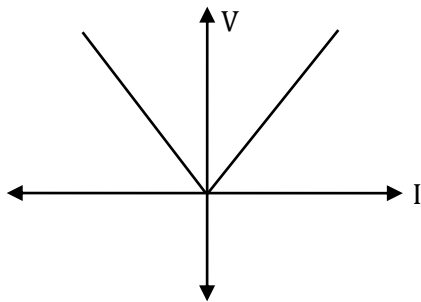


The value of  $V_c(t)$  at steady state is \_\_\_\_\_ V.

7. For the circuit shown below, the value of resistance  $R_L$  for maximum power transfer to it will be \_\_\_\_\_  $\Omega$ .

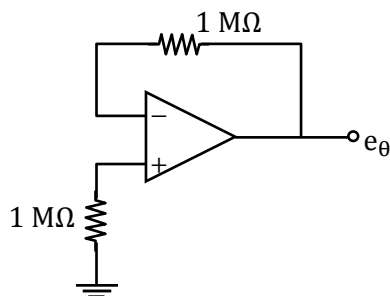


8. The element whose VI- characteristics are shown below in the graph is:

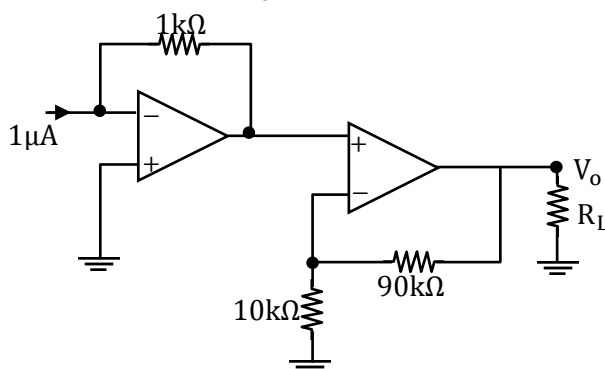


- (A) Linear, Bilateral and Passive  
(B) Linear, Unilateral and Passive  
(C) Non-linear, Unilateral and Active  
(D) Non-linear, Bilateral and Active
9. The resistance of a strain gauge bonded on a steel structure as measured by a Wheatstone bridge was found to be  $1040\Omega$  after the application of stress of finite magnitude. The nominal resistance of gauge at  $25^\circ\text{C}$  is  $1000\Omega$ . If the gauge factor of the strain gauge is 2.5 then the fractional change in the length is \_\_\_\_\_?
- (A) 16 m/m  
(B) 16 mm/m  
(C) 100 mm/m  
(D) 1 m/m
10. The core of an LVDT is connected at the output of seismic mass accelerometer to measure vibration in terms of displacement LVDT is supplied by a 5V oscillator having frequency of 1000 Hz. The maximum frequency of vibration of seismic mass that can be measured by this arrangement is \_\_\_\_\_ (in Hz)

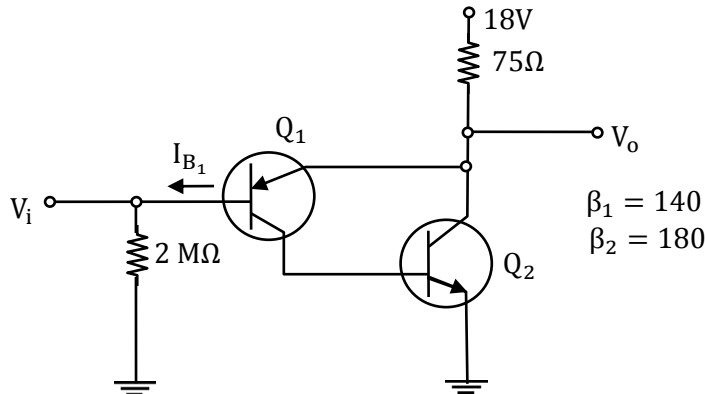
11. Pressure in a process is measured using bridge man gauge. The resistance of the gauge element is  $1\text{k}\Omega$  at an ambient pressure of  $10^5$  pascal's. If during the process the pressure has been raised to  $10^{10}$  pascal's then the change in resistance of gauge element in ohm is? Given pressure coefficient of resistance is  $25 \times 10^{-12} \Omega/\Omega - \text{Pa}$ .
12. The differential pressure across an orifice in a pipe for a flow rate of  $1\text{m}^3/\text{s}$  was found to be  $40 \text{ kPa}$ . If the flow rate has been reduced to half of the actual flow then the change in differential pressure is?  
 (A)  $10 \text{ kPa}$  (B)  $80 \text{ kPa}$   
 (C)  $30 \text{ kPa}$  (D)  $20 \text{ kPa}$
13. The voltage  $e_\theta$  indicated in the figure has been measured by an ideal voltmeter. Which of the following can be calculated?



- (A) Bias current of the inverting input only  
 (B) Bias current of the inverting and non-inverting inputs only  
 (C) Input offset current only  
 (D) Both the bias currents and the input offset current
14. The output voltage  $V_o$  of the given circuit is \_\_\_\_\_ mV

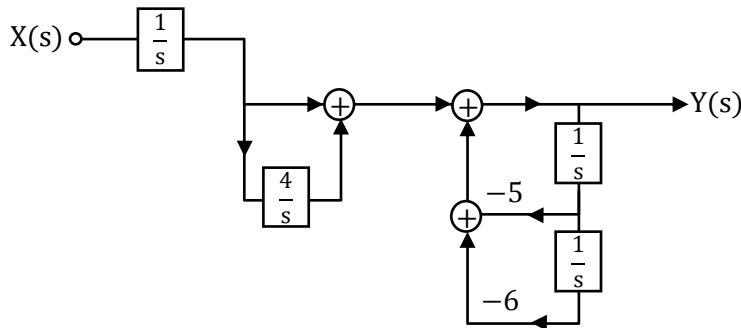


15. Find  $I_{B1}$  [Take appropriate approximation]



- (A)  $4.45 \mu\text{A}$  (B)  $4.45 \text{ mA}$   
(C)  $9.25 \mu\text{A}$  (D)  $9.25 \text{ mA}$

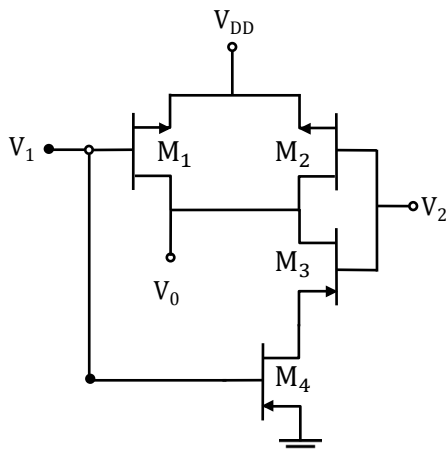
16. A system is represented by the below diagram using integrators  $\frac{1}{s}$ .



The transfer function of a system is  $\frac{Y(s)}{X(s)}$ . The response  $y(t)$  for unit step input is:

- (A)  $\left(\frac{1}{2} + \frac{1}{6}e^{-2t} - \frac{2}{3}e^{+3t}\right)u(t)$  (B)  $\left(\frac{1}{6} + \frac{1}{2}e^{-3t} - \frac{2}{3}e^{-2t}\right)u(t)$   
(C)  $\left(\frac{1}{6} + \frac{1}{2}e^{-2t} - \frac{2}{3}e^{-3t}\right)u(t)$  (D)  $\left(\frac{1}{3} + \frac{1}{6}e^{-3t} - \frac{2}{3}e^{-2t}\right)u(t)$

17. Consider the CMOS circuit shown in figure. It acts as a



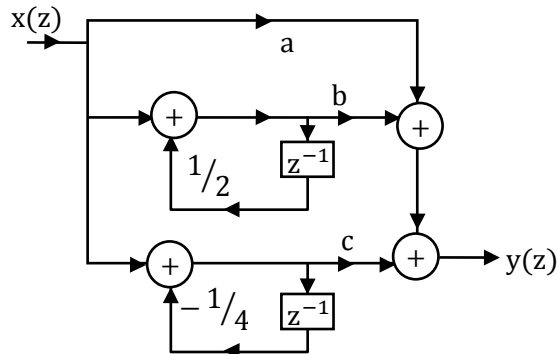
- (A) Negative AND (B) Positive AND  
(C) Negative NOR (D) Positive NOR



18. A discrete time IIR filter is represented as  

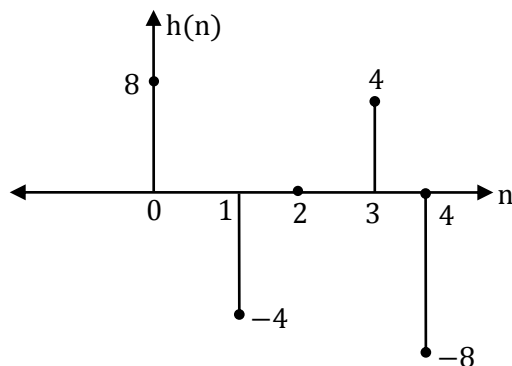
$$y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + 3x(n-1) + 2x(n-2).$$

The realization of above equation is shown below:



The value of  $a + b + c$  is \_\_\_\_\_?

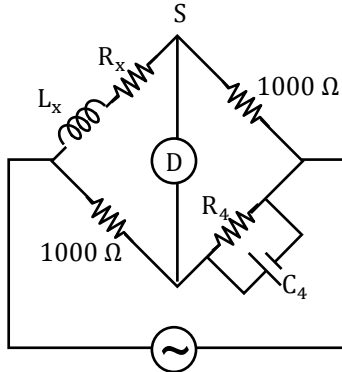
19. An LTI system with unit impulse response  $h(n)$  is shown below:



The impulse response represents

- (A) Low pass filter  
 (B) Band pass filter  
 (C) Band reject filter  
 (D) High pass filter
20. Coherent binary frequency shift keying is to be done over a stream of bits having bit rate 10 kbps. The best possible frequencies are  
 (A) 40 kHz and 50 kHz  
 (B) 40 kHz and 45 kHz  
 (C) 45 kHz and 55 kHz  
 (D) None of these
21. A unity feedback system has open loop poles at  $s = -3 \pm 5j$ ,  $s = -2$ ,  $s = 0$  and zero at  $s = -4$ . The angle at which roots terminate to infinite and centroid of a system are  
 (A)  $30^\circ, 90^\circ, 60^\circ$  and  $-1.33$   
 (B)  $60^\circ, 180^\circ, -60^\circ$  and  $-1.33$   
 (C)  $60^\circ, 180^\circ, 300^\circ$  and  $-4$   
 (D)  $60^\circ, 120^\circ, 180^\circ$  and  $-4$

22. In the bridge circuit shown in figure, at balance condition the value of  $C_4 = 0.5\mu\text{F}$  and  $R_4 = 1000\ \Omega$  then  $L_x = \underline{\hspace{2cm}}$  and  $R_x = \underline{\hspace{2cm}}$



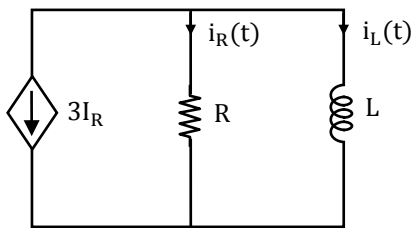
- (A) 0.5 H, 1000  $\Omega$  (B) 0.5 H, 3000  $\Omega$   
(C) 0.25 H, 2000  $\Omega$  (D) 0.25 H, 500  $\Omega$
23. The magnitude plot for the open loop transfer function of a control system is shown in the figure.
- $|G(j\omega)H(j\omega)|\text{dB}$
- 
- The open loop transfer function  $G(s)H(s)$  is
- (A)  $100/s + 1$  (B)  $1000(s + 10)$   
(C)  $\frac{1000}{(s + 10)}$  (D)  $\frac{1}{(s + 10)}$
24. A He-Ne Laser has an oscillating bandwidth of 1500 MHz. If there can be 5 longitudinal oscillating modes can be accommodated within the bandwidth then the cavity length of such laser in mm is \_\_\_\_\_.
25. In the young's double slit experiment the distance between 6<sup>th</sup> flight fringe and central fringe was found to be 12mm. Two slits are 40mm apart. If the screen is 0.8 m away from the slits then the wavelength of unknown source ( $\mu\text{m}$ ) is?

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

26. Solve  $\oint_c \frac{z^2}{z^4-1} dz$  where  $c$  is  $|z + 1| = 1$  and  $z = x + iy$  complex variable
- (A)  $\frac{\pi i}{2}$  (B)  $-\frac{\pi i}{2}$   
(C)  $\pi i$  (D)  $-\pi i$
27. Starting from initial value  $x_0 = 1$  one step of Newton Raphson method is solving the equation  $x^3 + 2x - 7 = 0$  gives the next value  $x_1$  as
- (A) 0.4 (B) 1.2  
(C) 1.6 (D) 1.8

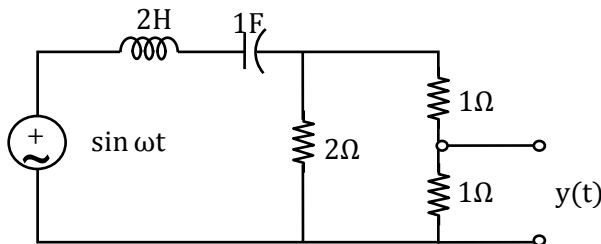
28. Consider the system of linear equation  $Ax = b$ , which of the following is equivalent to saying that  $Ax = b$  is consistent.
- (A) In row reducing  $[A/b]$  a row of the following form never appears  $(0 \ 0 \ 0 \ \dots \ 0/\alpha)$ , where  $\alpha \neq 0$ .
  - (B)  $B$  is a non-basic column in  $[A/b]$ .
  - (C)  $\text{rank } [A/b] = \text{rank } (A)$ .
  - (D) All the above.

29. If initial current through the inductance is 1 A. The current through inductor  $i_L(t)$  for  $t \geq 0$  in the circuit shown below will be

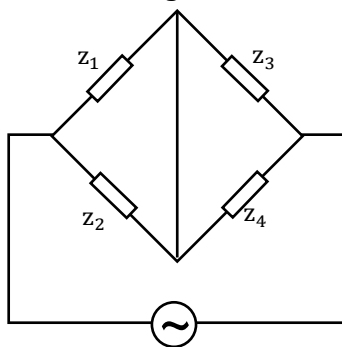


- (A)  $2e^{-\frac{Rt}{L}} \text{ A}$
- (B)  $e^{-\frac{Rt}{4L}} \text{ A}$
- (C)  $2e^{-\frac{Rt}{4L}} \text{ A}$
- (D)  $e^{-Rt/3L} \text{ A}$

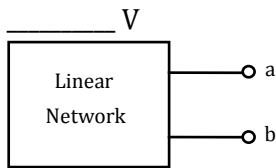
30. The steady state output of the circuit shown below is given by  $y(t) = A(\omega) \cdot \sin[\omega t + \phi(\omega)]$ . If  $\phi(\omega) = -45^\circ$ , then frequency is \_\_\_\_\_ rad/sec.



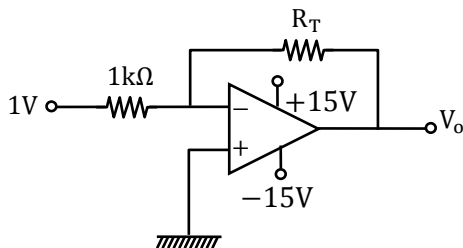
31. The individual uncertainties of  $Z_2$ ,  $Z_3$  and  $Z_4$  connected in an ac bridge shown in figure are 1%, 2% and 2% respectively. The total uncertainty in the measurement of  $Z_1$  is \_\_\_\_\_. Assume bridge is at balance condition.



32. In a linear circuit access terminal ab. When a  $10\text{ k}\Omega$  resistor is connected to terminal ab the voltage  $V_{ab}$  is measured a 6V. When  $30\text{ k}\Omega$  resistors is connected to terminal a – b measured voltage is 12V. If  $20\text{ K}\Omega$  resistor is connected access a-b then voltage  $V_{ab}$  is

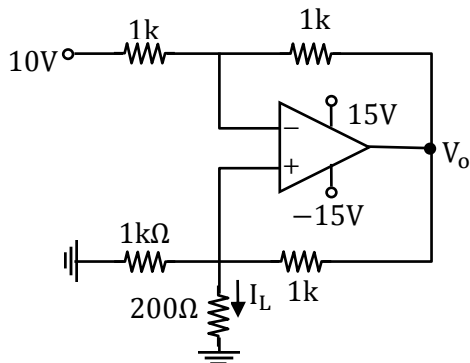


33. A resistance  $R_T$  of a resistance transducer is given as  $R_T = R \exp(-b/x)$  where  $b$  is constant and  $x$  is the input quantity being sensed. The resistance is connected to an ideal op-amp signal conditioning circuit as shown below. The value of  $R$  is  $100\text{ k}\Omega$  and  $b$  is 100. If  $x$  is changing from 50 to 60 then the magnitude of change in output voltage  $V_o$  is ?(involts)



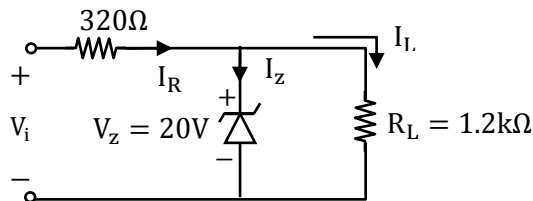
34. A piezoelectric crystal is used for force measurement, has following specifications:  
Electric field generated=  $10\text{ V/cm}$   
Crystal dimensions=  $5\text{ cm} \times 5\text{ cm} \times 1\text{ cm}$   
Young's Modulus=  $200\text{ MN/m}^2$   
If due to application of some compressive force the crystal thickness decrease to  $0.75\text{ cm}$  then the voltage sensitivity constant of the crystal is?  
(A)  $1\text{ V- m/N}$  (B)  $2\text{ V- m/N}$   
(C)  $0.00002\text{ V-m/N}$  (D)  $2000\text{ V-m/N}$
35. Level of liquids in two tanks is measured using gamma ray sensors. The absorption coefficient of liquid in tank A is  $7.7\text{ m}^{-1}$  while that of the liquid in tank B is  $15.4\text{ m}^{-1}$ . If the intensity received by the detectors in each tank is same then the ratio of level of liquids in tank A to B is?
36. A laminar flow experiment is conducted to measure viscosity of a flowing fluid in a pipe of  $10\text{ cm}$  diameter. The flow rate of  $1\text{ m}^3/\text{sec}$  is measured over a pipe length of  $1\text{ m}$  for the differential pressure of  $50\text{ kPa}$  uniform across the entire length. If the density of flowing fluid is  $10\text{ kg/m}^3$  then the approximate Reynold's number is?

37. What is the load current  $I_L$  in the circuit below?



- (A)  $-5\text{mA}$  (B)  $-10\text{mA}$   
(C)  $+25\text{mA}$  (D)  $+50\text{mA}$

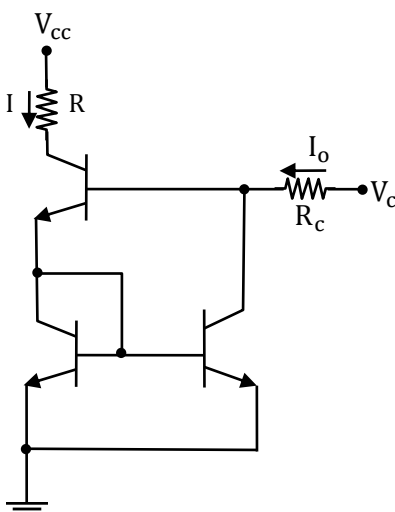
38. Determine the range of value of  $V_i$  that will maintain the zener diode in the 'ON' state



$I_{z_M} = 60\text{mA}$

- (A) (23.67V, 44.53V) (B) (25.33V, 44.53V)  
(C) (23.67V, 25.33V) (D) (25.33, 41.23V)

39. In the circuit of the figure all the transistor are matched Si transistors symbols carry their usual meaning

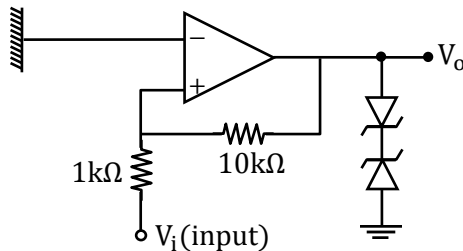


Calculate the value of  $I$  if  $V_c = 5\text{V}$ ,  $R_c = 2\text{k}\Omega$ ,  $V_{cc} = 6\text{V}$  and  $R = 2.2\text{k}\Omega$ .

Take  $V_{BE} = 0.7\text{V}$  and

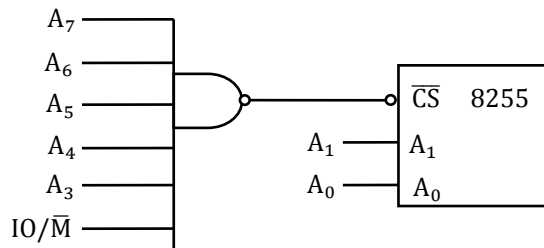
$\beta = 100$ .  $I = \underline{\hspace{2cm}}$  mA

40. Figure below shows a Schmitt trigger circuit using OP-AMP the output  $V_o$  is limited to  $+10V$  and  $-5V$  connecting suitably chosen zener diodes. At the output, the lower and upper trigger voltages are respectively



- (A)  $-1V, 0.5V$  (B)  $-0.5V, +1.0V$   
(C)  $-1V, -0.5V$  (D)  $+0.5V, +1.0V$
41. An n-bit A/D converter is required to convert analog input in the range 0-5 V to an accuracy of 10mV. The value of n should be \_\_\_\_\_

42. An 8255 chip is interfaced to an 8085 microprocessor system as an I/O mapped I/O as shown in the figure. The address lines  $A_0$  and  $A_1$  of the 8085 are used by the 8255 chip to decode internally its 3 ports and the control register. The address lines  $A_3$  to  $A_7$  as well as the  $IO/\bar{M}$  signal are used for address decoding. The range of address for which the 8255 chip would get selected is



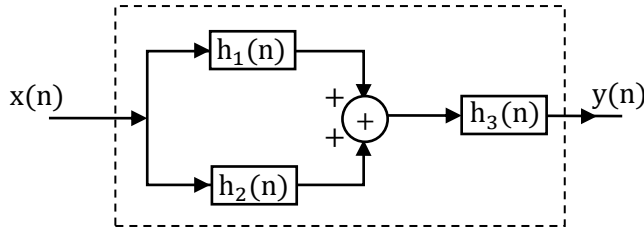
- (A) F8H- FBH (B) F8H-FCH  
(C) F8H-FFH (D) F0H-F7H
43. An 8 bit digital ramp ADC with a 40 mV resolution uses a clock frequency of 2.5 MHz and a comparator with  $V_T = 1mV$ . The digital output for  $V_A = 6.000 V$  is  
(A) 10010111 (B) 10010110  
(C) 1011110 (D) 1011111
44. Assume that a complex multiplication takes  $1 \mu\text{sec}$  and that the amount of time to complete a DFT or FFT is determined by the amount of time it takes to perform all the complex multiplications only. The time required to compute 4096 point DFT using DFT technique is  $T_1$  sec and using radix-2 FFT algorithm is  $T_2$  sec. The approximal integer value of  $T_1 - T_2$  (in sec) is \_\_\_\_\_?

45. Consider the differential equation

$$4 \frac{d^2y(t)}{dt^2} + 6 \frac{dy(t)}{dt} - 4y(t) = \delta(t)$$

The initial value  $y(0^-) = 0$  and  $\frac{dy(0^-)}{dt} = 0$ . The value of  $y(t)$  at  $t=1$  is \_\_\_\_\_?

46. An LTI system having the impulse response  $h_1(n)$ ,  $h_2(n)$  and  $h_3(n)$  is shown below:



$$h_1(n) = \left\{ \begin{matrix} 1, & 2, & 3 \\ \uparrow & & \end{matrix} \right\}$$

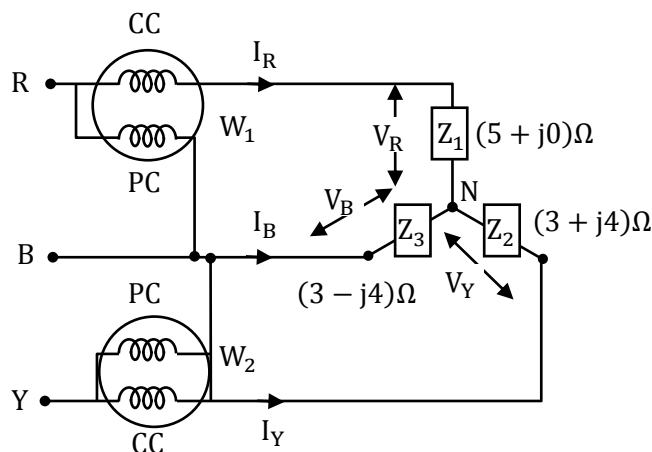
$$h_2(n) = \left\{ \begin{matrix} 0, & -2, & 1 \\ \uparrow & & \end{matrix} \right\}$$

$$h_3(n) = \left\{ \begin{matrix} 1, & 1, & -2 \\ \uparrow & & \end{matrix} \right\}$$

The response of a system  $y(z)$  is, if input  $x(n) = \left\{ \begin{matrix} 1, & 2 \\ \uparrow & \end{matrix} \right\}$

- (A)  $1 + 8z^{-1} + 3z^{-2} + 7z^{-3} - 13z^{-5}$  (B)  $1 + 3z^{-1} + 4z^{-2} + 8z^{-3} - 16z^{-5}$   
(C)  $1 + 3z^{-1} + 4z^{-2} + 8z^{-3} - 16z^{-4}$  (D)  $1 + 8z^{-1} + 3z^{-2} + 16z^{-5}$

47. Two wattmeter's are connected to measure, the total power consumed by star-connected load, supplied by 3-phase, 50 Hz ac source as shown in figure. The line to line input voltage of the circuit is 110 V(rms), then the reading of each wattmeter is \_\_\_\_\_



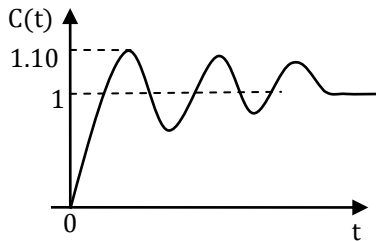
**Note: Assume the phase sequence is RYB**

- (A)  $P_1 = 167.12 \text{ W}, P_2 = 1210 \text{ W}$  (B)  $P_1 = 1210 \text{ W}, P_2 = 167.12 \text{ W}$   
(C)  $P_1 = 1000 \text{ W}, P_2 = 377.12 \text{ W}$  (D)  $P_1 = 377.12 \text{ W}, P_2 = 1000 \text{ W}$

48. A single degree of freedom process exhibit oscillatory characteristics has a mass of 10 kg and stiffness of 1000 N/m. The ratio of un-damped natural frequency to the damped frequency of oscillations, if the damping ratio is adjusted to 0.6 is \_\_\_\_\_

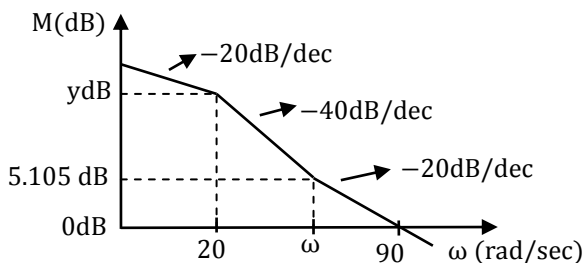
49. The open loop transfer function of a unity feedback system is  $G(s) = \frac{16}{(s+1)^6}$ . The phase cross over frequency and gain margin of a system is
- (A)  $\omega_{PC} = \sqrt{3}$  rad/s and G. m = 0.148                      (B)  $\omega_{PC} = \frac{1}{\sqrt{3}}$  rad/s and G. m = 0.148  
 (C)  $\omega_{PC} = \frac{1}{\sqrt{3}}$  rad/s and G. m = 6.75                      (D)  $\omega_{PC} = \sqrt{3}$  rad/s and G. m = 6.75

50. The response of a system for unit step input is shown below



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

51. Bode plot of a system is shown below

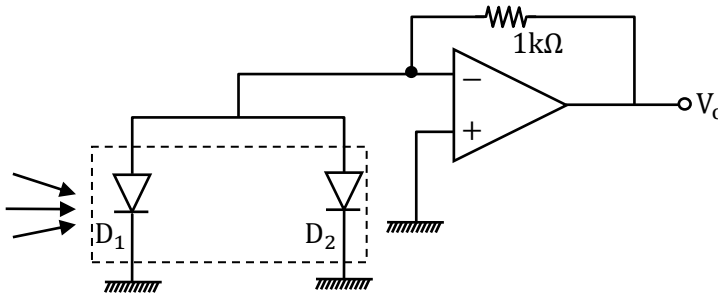


The value of gain  $k$  and  $\omega$  for the system is

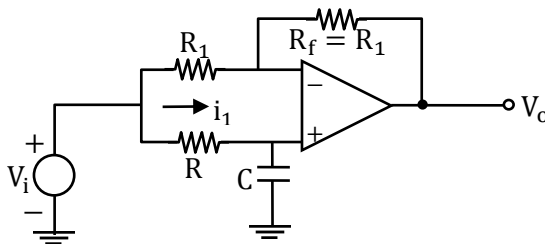
- (A)  $k = 224.96$  and  $\omega = 50$  rad/s                      (B)  $k = 284.8$  and  $\omega = 100$  rad/s  
 (C)  $k = 224.96$  and  $\omega = 100$  rad/s                      (D)  $k = 294.92$  and  $\omega = 50$  rad/s
52. A laser beam of 50 m Watt optical power and 4 mm aperture is coupled with a lens to form an image. If the lense has a focal length of 10cm and laser beam is having 720mm wavelength then the intensity of the image formed will be?
- (A) 33 MW/m<sup>2</sup>                      (B) 33 mW/m<sup>2</sup>  
 (C) 33 kW/m<sup>2</sup>                      (D) 33 W/m<sup>2</sup>



53. Two photo diodes are connected in a signal conditioning circuit shown below. The diodes  $D_1$  and  $D_2$  have responsivity of  $0.55 \text{ A/W}$  each. Light radiations from a source are made incident on each of the diode in the same manner. If diode  $D_1$  produces a current of  $3.9 \text{ mA}$  and the output voltage  $V_o$  is  $-5\text{V}$  then the amount of optical power incident on diode  $D_2$  (in mW) is?



54. A multimode graded index fiber was used for transmitting signal from one point to other. The refractive index of core is  $1.48$  and the relative index difference is  $1.6\%$ . If the fiber is operated at  $0.85\mu\text{m}$  and it allows nearly  $1170$  modes to propagate through it then the half of the core diameter in ( $\mu\text{m}$ ) is?
55. For the circuit shown in figure below, determine  $\frac{V_o(j\omega)}{V_i(j\omega)}$



- (A)  $\left(\frac{1}{1 - j\omega RC}\right)$  (B)  $1 - j\omega RC$
- (C)  $\left(\frac{1 - j\omega RC}{1 + j\omega RC}\right)$  (D)  $\left(\frac{1 + j\omega RC}{1 - j\omega RC}\right)$