Q. 1 – Q. 25 carry one mark each.

Q.1 Given
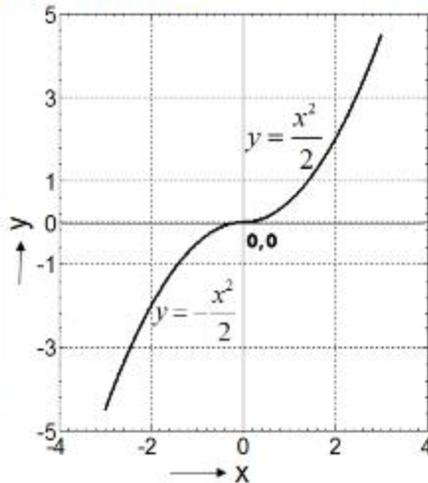
$$x(t) = 3\sin(1000\,\pi t)\text{ and }y(t) = 5\cos\left(1000\,\pi t + \frac{\pi}{4}\right)$$

The x-yplot will be

(A) a circle   (B)a multi-loop closed curve

(C)a hyperbola   (D)an ellipse

Q.2 Given that x is a random variable in the range $[0,\infty]$ with a probability densityfunction $\dfrac{e^{-\frac{x}{2}}}{K}$, the value of the constant K is_____.

Q.3 The figure shows the plot of y as a function of x

The function shown is the solution of the differential equation (assuming all initial conditions to be zero) is :

(A) $\dfrac{d^2 y}{dx^2} = 1$ (B) $\dfrac{dy}{dx} = x$ (C) $\dfrac{dy}{dx} = -x$ (D) $\dfrac{dy}{dx} = |x|$

Q.4 A vector is defined as

$$\mathbf{f} = y\hat{\mathbf{i}} + x\hat{\mathbf{j}} + z\hat{\mathbf{k}}$$

where $\hat{\mathbf{i}}$, $\hat{\mathbf{j}}$ and $\hat{\mathbf{k}}$ are unit vectors in Cartesian (x,y,z) coordinate system.
The surface integral $\oiint \mathbf{f}.\mathbf{ds}$ over the closed surface S of a cube with vertices having the following coordinates: (0,0,0), (1,0,0), (1,1,0), (0,1,0), (0,0,1), (1,0,1), (1,1,1), (0,1,1) is

_____.

Q.5 The figure shows the schematic of a production process with machines A, B and C. An input job needs to be pre-processed either by A or by B before it is fed to C, from which the final finished product comes out. The probabilities of failure of the machines are given as:

$P_A = 0.15$, $P_B = 0.05$, $P_C = 0.1$.
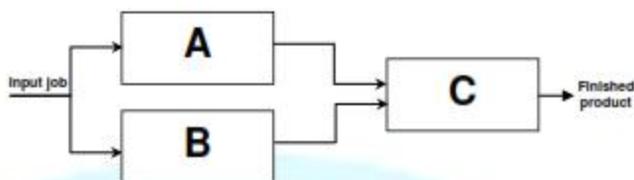
Assuming independence of failures of the machines, the probability that a given job is successfully processed (up to the third decimal place) is _____.

Q.6 The circuit shown in figure was at steady state for $t < 0$ with the switch at position 'A'. The switch is thrown to position 'B' at time $t = 0$. The voltage V (volts) across the 10 Ω resistor at time $t = 0^+$ is_____.
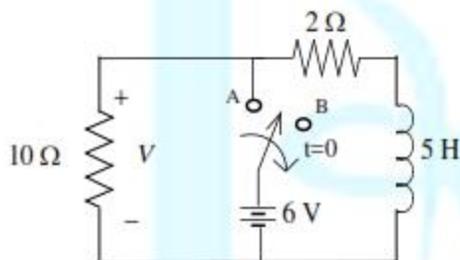
Q.7 The average real power in watts delivered to a load impedance $Z_L = (4 - j2)\Omega$ by an ideal current source $i(t) = 4 \sin(\omega t + 20°)$A is _____.

Q.8 Time domain expressions for the voltage $v_1(t)$ and $v_2(t)$ are given as
$v_1(t) = V_m \sin(10t - 130°)$ and $v_2(t) = V_m \cos(10t + 10°)$.
Which one of the following statements is TRUE?

(A)$v_1(t)$leads $v_2(t)$ by $130°$

(B)$v_1(t)$ lags $v_2(t)$ by $130°$

(C)$v_1(t)$ lags $v_2(t)$ by $-130°$

(D)$v_1(t)$ leads$v_2(t)$by $-130°$

Q.9 A pHelectrode obeys Nernst equation and is being operated at 25°C. The change in the open circuit voltage in millivolts across the electrode for a pH change from 6 to 8 is_____.

Q.10 The pressure and velocity at the throat of a Venturi tube, measuring the flow of a liquid, are related to the upstream pressure and velocity, respectively, as follows:

(A) pressure is lower but velocity is higher

(B) pressure is higher but velocity is lower

(C) both pressure and velocity are lower

(D) pressure and velocity are identical

Q.11 Semiconductor strain gages typically have much higher gage factors than those of metallic strain gages, primarily due to :

(A) higher temperature sensitivity

(B) higher Poisson's ratio

(C) higher piezoresitive coefficient

(D) higher magnetostrictive coefficient

Q.12 For a rotameter, which one of the following statements is TRUE?

(A) the weight of the float is balanced by the buoyancy and the drag force acting on the float

(B) the velocity of the fluid remains constant for all positions of the float

(C) the measurement of volume flow rate of gas is not possible

(D) the volume flow rate is insensitive to changes in density of the fluid

Q.13 For the op-amp shown in the figure, the bias currents are I_{b1}= 450 nA and I_{b2}=350 nA. The values of the input bias current (I_B) and the input offset current (I_f) are:
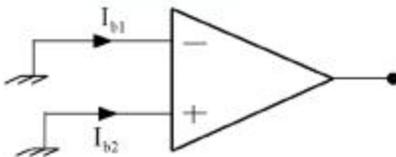

(A) I_B= 800 nA, I_f=50 nA

(B) I_B= 800 nA, I_f=100nA

(C) I_B= 400 nA, I_f=50nA

(D) I_B= 400 nA, I_f=100nA

Q.14 The amplifier in the figure has gain of −10 and input resistance of 50 kΩ. The values of R_i and R_f are:
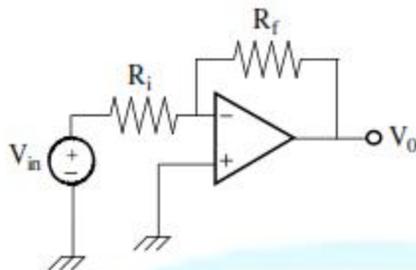
(A) $R_i= 500\ k\Omega,\ R_f = 50\ k\Omega$ (B) $R_i= 50\ k\Omega,\ R_f = 500\ k\Omega$

(C) $R_i= 5\ k\Omega,\ R_f = 10\ k\Omega$ (D) $R_i= 50\ k\Omega,\ R_f = 200\ k\Omega$

Q.15 For the circuit shown in the figure assume ideal diodes with zero forward resistance and zero forward voltage drop. The current through the diode D_2 in mAis _____.
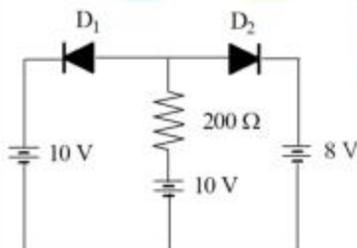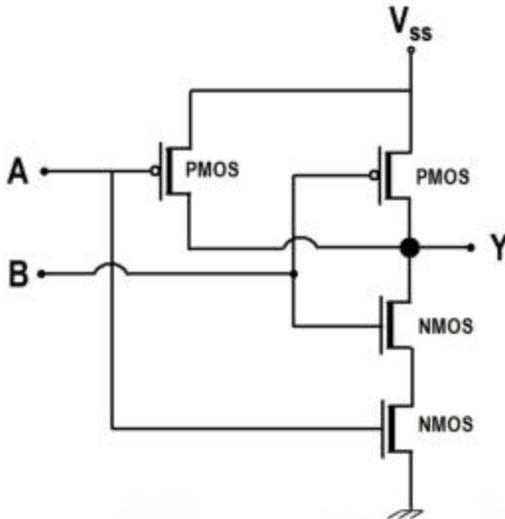

Q.16 The system function of an LTI system is given by

$$H(z) = \frac{1 - \frac{1}{3}z^{-1}}{1 - \frac{1}{4}z^{-1}}$$

The above system can have stable inverse if the region of convergence of $H(z)$ is defined as

(A) $|z| < \frac{1}{4}$ (B) $|z| < \frac{1}{12}$ (C) $|z| > \frac{1}{4}$ (D) $|z| < \frac{1}{3}$

Q.17 The figure is a logic circuit with inputs A and B and output Y. $V_{ss} = +5$ V. The circuit is of type

(A) NOR　　　　(B) AND　　　　(C) OR　　　　(D) NAND

Q.18 The impulse response of an LTI system is given as :

$$h[n]=\begin{cases} \dfrac{\omega_c}{\pi} & n=0 \\ \dfrac{\sin \omega_c n}{\pi n} & n \neq 0 \end{cases}$$

It represents an ideal

(A) non-causal, low-pass filter　　　　(B) causal, low-pass filter

(C) non-causal, high-pass filter　　　　(D) causal, high-pass filter

Q.19 A discrete-time signal $x[n]$ is obtained by sampling an analog signal at 10 kHz. The signal $x[n]$ is filtered by a system with impulse response $h[n] = 0.5\{\delta[n] + \delta[n-1]\}$. The 3dB cutoff frequency of the filter is:

(A) 1.25 kHz　　　　(B) 2.50 kHz　　　　(C) 4.00 kHz　　　　(D) 5.00 kHz

Q.20 A full duplex binary FSK transmission is made through a channel of bandwidth 10 kHz. In each direction of transmission the two carriers used for the two states are separated by 2 kHz. The maximum baud rate for this transmission is:
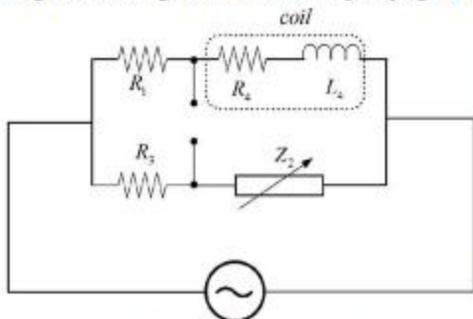
(A) 2000 bps　　　　(B) 3000 bps　　　　(C) 5000 bps　　　　(D) 10000 bps

Q.21 A loop transfer function is given by :

$$G(s)H(s) = \frac{K(s+2)}{s^2(s+10)}$$

The point of intersection of the asymptotes of $G(s)H(s)$ on the real axis in the s-plane is at

_____ .

Q.22 The resistance and inductance of an inductive coil are measured using an AC bridge as shown in the figure. The bridge is to be balanced by varying the impedance Z_2.

For obtaining balance, Z_2 should consist of element(s):

(A) R and C　　　　(B) R and L　　　　(C) L and C　　　　(D) Only C

Q.23 A plant has an open-loop transfer function,

$$G_p(s) = \frac{20}{(s+0.1)(s+2)(s+100)}.$$

The approximate model obtained by retaining only one of the above poles, which is closest to the frequency response of the original transfer function at low frequency is

(A) $\dfrac{0.1}{s+0.1}$　　　　(B) $\dfrac{2}{s+2}$　　　　(C) $\dfrac{100}{s+100}$　　　　(D) $\dfrac{20}{s+0.1}$

Q.24 In order to remove respiration related motion artifacts from an ECG signal, the following filter should be used:

(A) low-pass filter with $f_c = 0.5$ Hz

(B) high-pass filter with $f_c = 0.5$ Hz

(C) high-pass filter with $f_c = 49.5$ Hz

(D) band-pass filter with passband between 0.1 Hz and 0.5 Hz

Q.25 In a time-of-flight mass spectrometer if q is the charge and m the mass of the ionized species, then the time of flight is proportional to

(A) $\dfrac{\sqrt{m}}{\sqrt{q}}$　　　　(B) $\dfrac{\sqrt{q}}{\sqrt{m}}$　　　　(C) $\dfrac{m}{\sqrt{q}}$　　　　(D) $\dfrac{q}{\sqrt{m}}$

Q. 31 – Q. 55 carry two marks each.

Q.26 A scalar valued function is defined as $f(x) = x^T A x + b^T x + c$, where A is a symmetric positive definite matrix with dimension $n \times n$; b and x are vectors of dimension $n \times 1$. The minimum value of $f(x)$ will occur when x equals

(A) $(A^T A)^{-1} b$

(B) $-(A^T A)^{-1} b$

(C) $-\left(\dfrac{A^{-1} b}{2}\right)$

(D) $\dfrac{A^{-1} b}{2}$

Q.27 The iteration step in order to solvefor the cube roots of a given number N using the Newton-Raphson's method is

(A) $x_{k+1} = x_k + \dfrac{1}{3}\left(N - x_k^3\right)$

(B) $x_{k+1} = \dfrac{1}{3}\left(2x_k + \dfrac{N}{x_k^2}\right)$

(C) $x_{k+1} = x_k - \dfrac{1}{3}\left(N - x_k^3\right)$

(D) $x_{k+1} = \dfrac{1}{3}\left(2x_k - \dfrac{N}{x_k^2}\right)$

Q.28 For the matrix A satisfying the equation given below, the eigenvaluesare

$$[A]\begin{bmatrix} 1 & 2 & 3 \\ 7 & 8 & 9 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

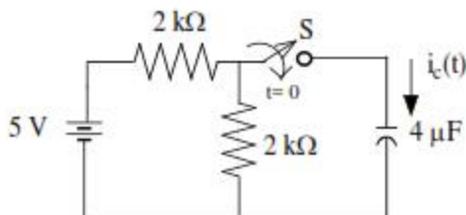(A)$(1, -j, j)$

(B)$(1, 1, 0)$

(C)$(1, 1, -1)$

(D)$(1, 0, 0)$

Q.29 In the circuit shown in the figure, initially the capacitor is uncharged. The switch 'S' is closed at $t = 0$. Two milliseconds after the switch is closed, the current through the capacitor (in mA) is

_____.

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Q.30 A capacitor 'C' is to be connected across the terminals 'A' and 'B' as shown in the figure so that the power factor of the parallel combination becomes unity. The value of the capacitance required in µF is _____.
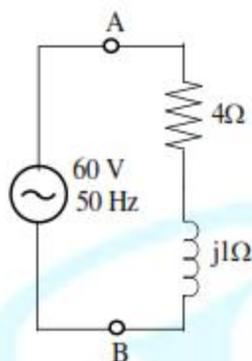

Q.31 The resistance of a wire is given by the expression

$$R = \frac{4\rho L}{\pi D^2}.$$

where, ρ is the resistivity (Ω-meter), L is the length (meter) and D (meter) is the diameter of the wire. The error in measurement of each of the parameters ρ, L, and D is $\pm 1.0\%$. Assuming that the errors are independent random variables, the percent error in measurement of R is

_____.

Q.32 The circuit shown in the figure contains a dependent current source between A and B terminals. The Thevenin's equivalent resistance in $k\Omega$ between the terminals C and D is _____.
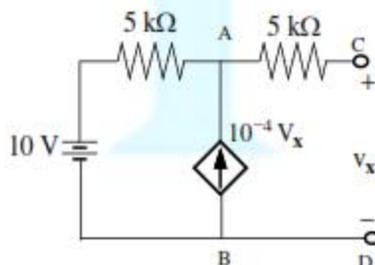
Q.33 A thermistor has a resistance of 1 kΩ at temperature 298 K and 465 Ω at temperature 316 K. The temperature sensitivity in K^{-1} [i.e. $(1/R)(dR/dT)$, where R is the resistance at the temperature T (in K)], of this thermistor at 316 K is _____.

Q.34 A barium titanate piezoelectric crystal with d_{33}=150 pC/N, $C_{crystal}$ = 25 pF and $R_{crystal}$ = 10^{10} Ω is used to measure the amplitude of a step force. The voltage output is measured using a digital voltmeter with input impedance 10^{13} Ω connected across the crystal. All other capacitances and resistances may be neglected. A step force of 2 N is applied from direction "3" on the crystal. The time in milliseconds within which the voltmeter should sample the crystal output voltage so that the drop from the peak value is no more than 0.12V is _____.

Q.35 A thermopile is constructed using 10 junctions of Chromel-Constantan (sensitivity 60μV/°C for each junction) connected in series. The output is fed to an amplifier having an infinite input impedance and a gain of 10. The output from the amplifier is acquired using a 10-bit ADC, with reference voltage of 5 V. The resolution of this system in units of °C is _____.

Q.36 A transit time ultrasonic flowmeter uses a pair of ultrasonic transducers placed at 45° angle, as shown in the figure.
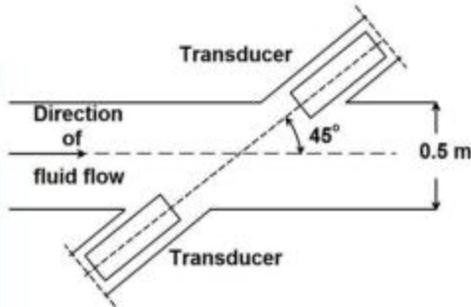
The inner diameter of the pipe is 0.5 m. The differential transit time is directly measured using a clock of frequency 5 MHz. The velocity of the fluid is small compared to the velocity of sound in the static fluid, which is 1500 m/s and the size of the crystals is negligible compared to the diameter of the pipe. The minimum change in fluid velocity (m/s) that can be measured using this system is _____.

Q.37 Assuming an ideal op-amp in linear range of operation, the magnitude of the transfer impedance $\frac{v_0}{i}$ in MΩ of the current to voltage converter shown in the figure is _____.
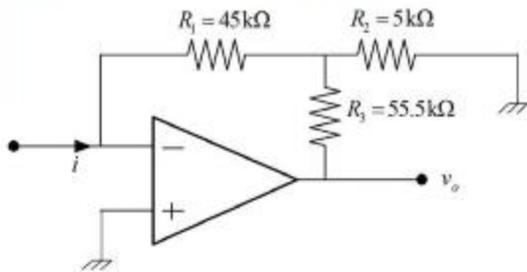
Q.38 For the circuit shown in the figure, the transistor has $\beta = 40$, $V_{BE} = 0.7$ V, and the voltage across the Zener diode is 15 V.The current (in mA) through the Zener diode is _____.
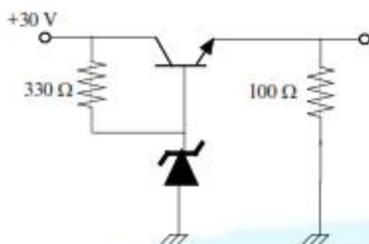
Q.39 In the figure, transistors T_1 and T_2 have identical characteristics. $V_{CE(sat)}$ of transistor T_3 is 0.1 V. The voltage V_1 is high enough to put T_3 in saturation. Voltage V_{BE} of transistors T_1, T_2 and T_3 is 0.7 V. The value of $(V_1 - V_2)$ in V is _____.
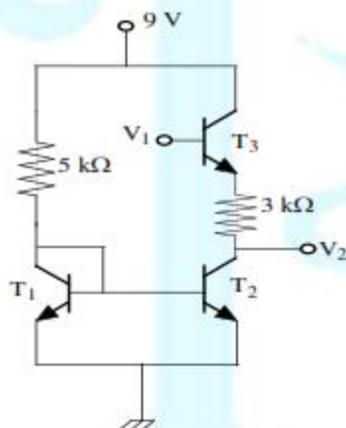
Q.40 The figures show an oscillator circuit having an ideal Schmitt trigger and its input-output characteristics. The time period (in ms) of $v_o(t)$ is _____.
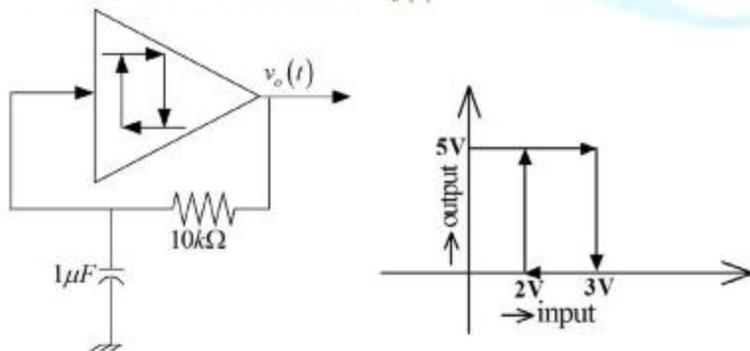
Q.41 An N-bit ADC has an analog reference voltage V. Assuming zero mean and uniform distribution of the quantization error, the quantization noise power will be:

(A) $\dfrac{V^2}{12(2^N-1)^2}$

(B) $\dfrac{V^2}{12(2^N-1)}$

(C) $\dfrac{V}{12(2^N-1)}$

(D) $\dfrac{V^2}{\sqrt{12}}$

Q.42 A microprocessor accepts external interrupts (Ext INT) through a Programmable Interrupt Controller as shown in the figure.
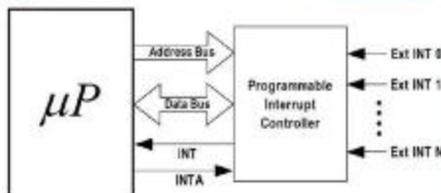
Assuming vectored interrupt, a correct sequence of operations when a single external interrupt (Ext INT1) is received will be :

(A) Ext INT1→ INTA→Data Read→INT

(B) Ext INT1→ INT→INTA→Data Read

(C) Ext INT1→ INT→INTA→Address Write

(D) Ext INT1→ INT→ Data Read→Address Write

Q.43 The circuit in the figure represents a counter-based unipolar ADC. When SOC is asserted the counter is reset and clock is enabled so that the counter counts up and the DAC output grows. When the DAC output exceeds the input sample value, the comparator switches from logic 0 to logic 1, disabling the clock and enabling the output buffer by asserting EOC. Assuming all components to be ideal, V_{ref}, DAC output and input to be positive, the maximum error in conversion of the analog sample value is:

(A) directly proportional to V_{ref}

(B) inversely proportional to V_{ref}

(C) independent of V_{ref}

(D) directly proportional to clock frequency

Q.44 $X(k)$ is the Discrete Fourier Transform of a 6-point real sequence $x(n)$.
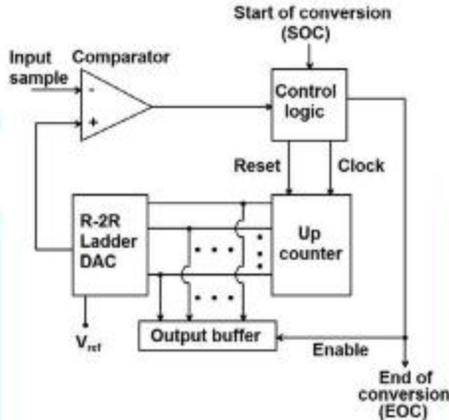
If $X(0) = 9 + j0$, $X(2) = 2 + j2$, $X(3) = 3 - j0$, $X(5) = 1 - j1$, $x(0)$ is

(A) 3   (B) 9   (C) 15   (D) 18

Q.45 The transfer function of a digital system is given by:

$$\frac{b_0}{1 - z^{-1} + a_2 z^{-2}}, \text{ where } a_2 \text{ is real.}$$

The transfer function is BIBO stable if the value of a_2 is:

(A) −1.5   (B) −0.75   (C) 0.5   (D) 1.5

Q.46 The transfer function of a system is given by

$$G(s) = \frac{e^{-s/500}}{s + 500}$$

The input to the system is $x(t) = \sin 100\pi t$. In periodic steady state the output of the system is found to be $y(t) = A\sin(100\pi t - \phi)$. The phase angle ($\phi$) in degree is _____.

Q.47 In the microprocessor controlled measurement scheme shown in the figure, R_x is the unknown resistance to be measured, while R_{ref} and C_{ref} are known. C_{ref} is charged from voltage V_L to V_H (by a constant DC voltage source V_S), once through R_{ref} in T_{ref} seconds and then discharged to V_L. It is again charged from voltage V_L to V_H through R_x in T_x seconds.
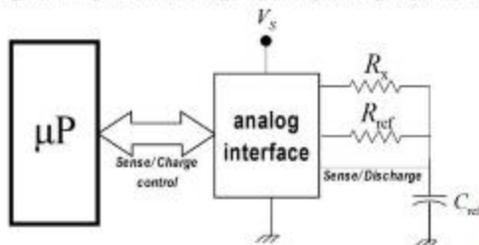
If $T_x = kT_{ref}$ then

(A) $R_x = kR_{ref}\left(1 - \dfrac{V_L}{V_H}\right)$

(B) $R_x = kR_{ref}\,\ln\left(\dfrac{V_H}{V_L}\right)$

(C) $R_x = kR_{ref}$

(D) $R_x = R_{ref}\,\ln k$

Q.48 Frequency of an analog periodic signal in the range of 5kHz - 10kHz is to be measured with a resolution of 100Hz by measuring its period with a counter. Assuming negligible signal and transition delays the minimum clock frequency and minimum number of bits in the counter needed, respectively, are:

(A) 1 MHz, 10-bits

(B) 10 MHz, 10-bits

(C) 1 MHz, 8-bits

(D) 10MHz, 8-bits

Q.49 The loop transfer function of a feedback control system is given by

$$G(s)H(s) = \frac{1}{s(s+1)(9s+1)}$$

Its phase crossover frequency (in rad/s), approximated to two decimal places, is _____.

Q.50 Consider a transport lag process with a transfer function

$$G_p(s) = e^{-s}.$$

The process is controlled by a purely integral controller with transfer function

$$G_c(s) = \frac{K_i}{s}$$

in a unity feedback configuration. The value of K_i for which the closed loop plant has a pole at $s = -1$, is _____.

Q.51 Consider the control system shown in figurewith feedforwardaction for rejection of a measurable disturbance $d(t)$. The value of K, for whichthe disturbance response at the output $y(t)$ is zero mean, is:
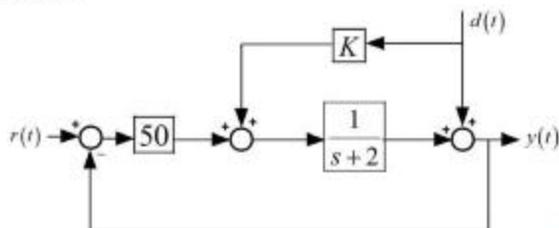

(A) 1   (B)–1   (C) 2   (D) –2

Q.52 A mixture contains two mutually inert solutions 'X' and 'Y' in equal volumes. The mixture is examined in a spectrophotometer using a cuvette. It is observed that the transmittance is 0.40. With only the solution 'X' in the same cuvette, the transmittance is 0.20. With only solution 'Y' in the cuvette the transmittance is_____.

Q.53 Monochromatic light from a step index ($n_1 = 1.500$; $n_2 = 1.485$), multimode optical fiber of core diameter 100 μm is incident through air ($n = 1.000$) onto a linear photo-detector array placed at 1 mm distance from the tip of the fiber. The tip of the fiber is polished and its exit plane is perpendicular to the axis of the fiber. The detector array is oriented parallel to the exit plane of the tip. The array consists of photo-detector elements each of 5 μm diameter. The distance between the edges of two adjacent elements can be assumed to be zero. The number of elements illuminated by the light coming out of the fiber is_____.

Q.54 An image of the chest of a patient is taken with an X-ray machine on a photographic film. The Hurter-Driffield (HD) curve of the film is shown in the figure. The highly absorbing parts of the body (e.g. bones), show up as low exposure regions(mapped near A) and the less absorbing parts (e.g. muscles) show up as high exposure regions(mapped near B).
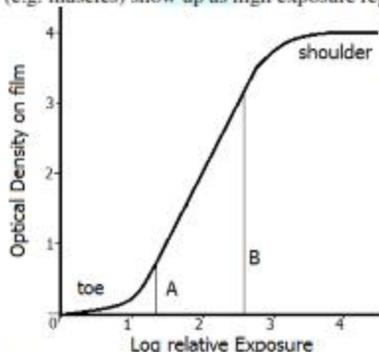
If the exposure time is increased 10 times, while keeping the voltages and currents in the X-ray machine constant, in the image,

(A)contrast decreases since B moves into the shoulder region

(B)contrast decreases since both A and B move into the shoulder region

(C)contrast increases sinceA moves into the toe region

(D)contrast decreases since both A and B move into the toe region

Q.55
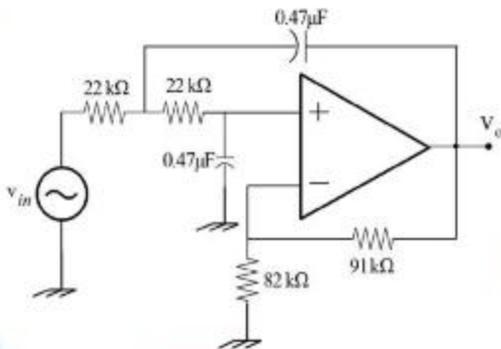
For the given low-pass circuit shown in the figure, the cutoff frequency in Hz will be _____.

END OF THE QUESTION PAPER

1. Total duration of the GATE examination is **180** minutes.
2. The clock will be set at the server. The countdown timer at 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 need not terminate the examination or submit your paper.
3. Any useful data required for your paper can be viewed by clicking on the **Useful Common Data** button that appears on the screen.
4. Use the scribble pad provided to you for any rough work. Submit the scribble pad at the end of the examination.
5. You are allowed to use a non-programmable type calculator, however, sharing of calculators is not allowed.
6. The Question Palette displayed on the right side of screen will show the status of each question using one of the following symbols:

| 1 | You have not visited the question yet. |

| 3 | You have not answered the question. |

| 5 | You have answered the question. |

| 7 | You have NOT answered the question, but have marked the question for review. |

| 9 | 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, but marked for review, then the answer will be considered for evaluation unless the status is modified by the candidate.*

Navigating to a Question :

7. 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 and D. Use the virtual numeric keypad to enter a number as answer for a numerical type question.
    c. Click on **Save & Next** to save your answer for the current question and then go to the next question.
    d. Click on **Mark for Review & Next** to save your answer for the current question and also mark it for review, and then go to the next question.

We are providing a piece of information. This may not be an Official One. This migh

Caution: Note that your answer for the current question will not be saved, if you navigate to another question directly by clicking on a question number without saving the answer to the previous question.

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.

<u>**Answering a Question :**</u>

8. Procedure for answering a multiple choice (MCQ) type question:
   a. Choose one answer from the 4 options (A,B,C,D) given below the question, click on the bubble placed before the chosen option.
   b. To deselect your chosen answer, click on the bubble of the chosen option again or click on the **Clear Response** button.
   c. To change your chosen answer, click on the bubble of another option.
   d. To save your answer, you MUST click on the **Save & Next** button.

9. Procedure for answering a numerical answer type question:
   a. To enter a number as your answer, use the virtual numerical keypad.
   b. A fraction (e.g. -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 & Next** button
10. To mark a question for review, click on the **Mark for Review & 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 unless the status is modified by the candidate.*

11. 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.
12. Note that ONLY Questions for which answers are *saved* or *marked for review after answering* will be considered for evaluation.

<u>**Choosing a Section :**</u>

13. Sections in this question paper are displayed on the top bar of the screen. Questions in a Section can be viewed by clicking on the name of that Section. The Section you are currently viewing will be highlighted.
14. A checkbox is displayed for every optional Section, if any, in the Question Paper. To select the optional Section for answering, click on the checkbox for that Section.
15. If the checkbox for an optional Section is not selected, the **Save & Next** button and the **Mark for Review & Next** button will NOT be enabled for that Section. You will

only be able to see questions in this Section, but you will not be able to answer questions in the Section.

16. After clicking the **Save & Next** button for the last question in a Section, you will automatically be taken to the first question of the next Section in sequence.

17. You can move the mouse cursor over the name of a Section to view the answering status for that Section.

Changing the Optional Section :

18. After answering the chosen optional Section, partially or completely, you can change the optional Section by selecting the checkbox for a new Section that you want to attempt. A warning message will appear along with a table showing the number of questions answered in each of the previously chosen optional Sections and a checkbox against each of these Sections. Click on a checkbox against a Section that you want to reset and then click on the **RESET** button. Note that RESETTING a Section will DELETE all the answers for questions in that Section. Hence, if you think that you may want to select this Section again later, you will have to note down your answers for questions in that Section. If you do not want to reset the Section and want to continue answering the previously chosen optional Section, then click on the **BACK** button.

19. If you deselect the checkbox for an optional Section in the top bar, the following warning message will appear: "Deselecting the checkbox will DELETE all the answers for questions in this Section. Do you want to deselect this Section?" If you want to deselect, click on the **RESET** button. If you do not want to deselect, click on the **BACK** button.

20. You can shuffle between different Sections or change the optional Sections any number of times.

GATE 2014 Examination

IN: Instrumentation Engineering

Duration: **180 minutes**   Maximum Marks: **100**

Read the following instructions carefully.

1. To login, enter your Registration Number and password provided to you. Kindly go through the various symbols used in the test and understand their meaning before you start the examination.
2. Once you login and after the start of the examination, you can view all the questions in the question paper, by clicking on the **View All Questions** button in the screen.
3. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory.
   The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each.
   The subject specific GATE paper section consists of **55** questions, out of which question numbers 1 to 25 are of 1-mark each, while question numbers 26 to 55 are of 2-mark each.
4. Depending upon the GATE paper, there may be useful common data that may be required for answering the questions. If the paper has such useful data, the same can be viewed by clicking on the **Useful Common Data** button that appears at the top, right hand side of the screen.

5. The computer allotted to you at the examination center runs specialized software that permits only one answer to be selected for multiple-choice questions using a mouse and to enter a suitable number for the numerical answer type questions using the virtual keyboard and mouse.
6. Your answers shall be updated and saved on a server periodically and also at the end of the examination. The examination will **stop automatically** at the end of **180 minutes**.
7. In each paper a candidate can answer a total of 65 questions carrying 100 marks.
8. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
9. Multiple choice type questions will have four choices against A, B, C, D, out of which only **ONE** is the correct answer. The candidate has to choose the correct answer by clicking on the bubble (◯) placed before the choice.
10. For numerical answer type questions, each question will have a numerical answer and there will not be any choices. **For these questions, the answer should be entered** by using the virtual keyboard that appears on the monitor and the mouse.
11. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of⅓ marks for a 1-mark question and ⅔ marks for a 2-mark question.
12. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.

13. Non-programmable type Calculator is allowed. Charts, graph sheets, and mathematical tables are **NOT** allowed in the Examination Hall. You must use the Scribble pad provided to you at the examination centre for all your rough work. The Scribble Pad has to be returned at the end of the examination.

Declaration by the candidate:

"I have read and understood all the above instructions. I have also read and understood clearly the instructions given on the admit card and shall follow the same. I also understand that in case I am found to violate any of these instructions, my candidature is liable to be cancelled. I also confirm that at the start of the examination all the computer hardware allotted to me are in proper working condition".

Q. 1 – Q. 5 carry one mark each.

Q.1   Choose the most appropriate word from the options given below to complete the following sentence.

A person suffering from Alzheimer's disease _____ short-term memory loss.

(A) experienced
(B) has experienced
(C) is experiencing
(D) experiences

Q.2   Choose the most appropriate word from the options given below to complete the following sentence.

_____ is the key to their happiness; they are satisfied with what they have.

(A) Contentment   (B) Ambition   (C) Perseverance   (D) Hunger

Q.3   Which of the following options is the closest in meaning to the sentence below?

"As a woman, I have no country."

(A) Women have no country.
(B) Women are not citizens of any country.
(C) Women's solidarity knows no national boundaries.
(D) Women of all countries have equal legal rights.

Q.4   In any given year, the probability of an earthquake greater than Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is ____ years.

Q.5   The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate?

(A) 3-4 years   (B) 4-5 years   (C) 5-6 years   (D) 6-7 years

Q. 6 – Q. 10 carry two marks each.

Q.6   In a group of four children, Som is younger to Riaz. Shiv is elder to Ansu. Ansu is youngest in the group. Which of the following statements is/are required to find the eldest child in the group?
**Statements**
   1.   Shiv is younger to Riaz.
   2.   Shiv is elder to Som.

(A) Statement 1 by itself determines the eldest child.
(B) Statement 2 by itself determines the eldest child.
(C) Statements 1 and 2 are both required to determine the eldest child.
(D) Statements 1 and 2 are not sufficient to determine the eldest child.

Q.7   Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and thus great care was taken to avoid letting any point bias the analysis.
From "BIG DATA" Viktor Mayer-Schonberger and Kenneth Cukier

The main point of the paragraph is:

(A) The twenty-first century is a digital world
(B) Big data is obsessed with exactness
(C) Exactitude is not critical in dealing with big data
(D) Sparse data leads to a bias in the analysis

Q.8   The total exports and revenues from the exports of a country are given in the two pie charts below. The pie chart for exports shows the quantity of each item as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 5 lakh tonnes and the total revenues are 250 crore rupees. What is the ratio of the revenue generated through export of Item 1 per kilogram to the revenue generated through export of Item 4 per kilogram?

Exports   **Revenues**
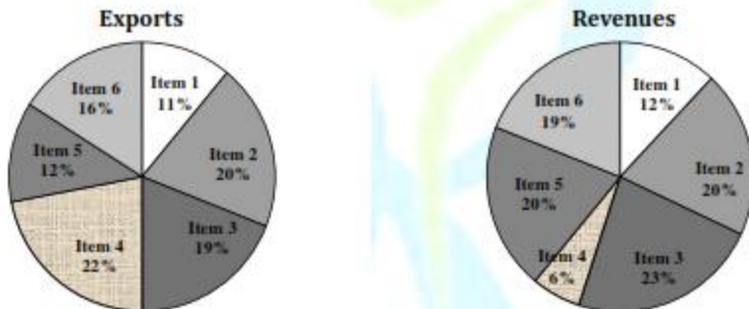
(A) 1:2   (B) 2:1   (C) 1:4   (D) 4:1

Q.9   X is 1 km northeast of Y. Y is 1 km southeast of Z. W is 1 km west of Z. P is 1 km south of W. Q is 1 km east of P. What is the distance between X and Q in km?

(A) 1   (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) 2

Q.10   10% of the population in a town is HIV$^+$. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV$^+$ individuals 95% of the time, and HIV$^-$ individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is _____

END OF THE QUESTION PAPER