GATE-IN-2008

EE25BTECH11002 - Achat Parth Kalpesh

Questions 1-20 (1 mark each)

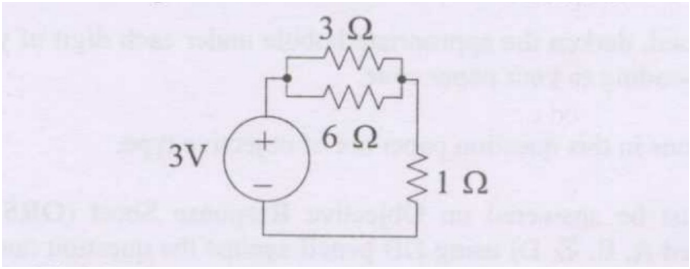
Q.1 Given $y = x^2 + 2x + 10$, the value of $\left.\frac{dy}{dx}\right|_{x=1}$ is equal to (GATE-IN-2008 EE 2025)

a) 0
b) 4
c) 12
d) 13

Q.2 $\lim_{x\to 0} \frac{\sin x}{x}$ is (GATE-IN-2008 EE 2025)

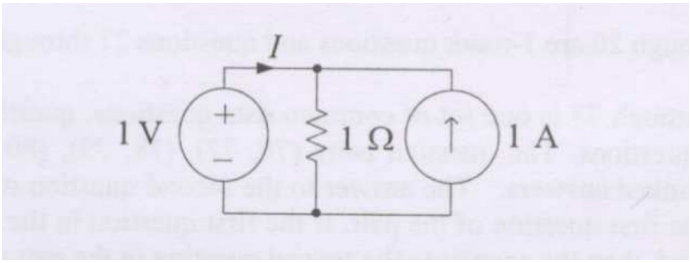
a) indeterminate
b) 0
c) 1
d) ∞

Q.3 The power supplied by the dc voltage source in the circuit shown below is (GATE-IN-2008 EE 2025)



a) 0 W
b) 1.0 W
c) 2.5 W
d) 3.0 W

Q.4 The current I supplied by the dc voltage source in the circuit shown below is (GATE-IN-2008 EE 2025)



a) 0 A
b) 0.5 A
c) 1 A
d) 2 A

Q.5 For signal conditioning of a piezoelectric type transducer we require (GATE-IN-2008 EE 2025)

a) a charge amplifier
b) a differential amplifier
c) an instrumentation amplifier
d) a transconductance amplifier

Q.6 A linear variable differential transformer (LVDT) is (GATE-IN-2008 EE 2025)

a) a displacement transducer
b) an impedance matching transformer
c) a differential temperature sensor
d) an auto transformer

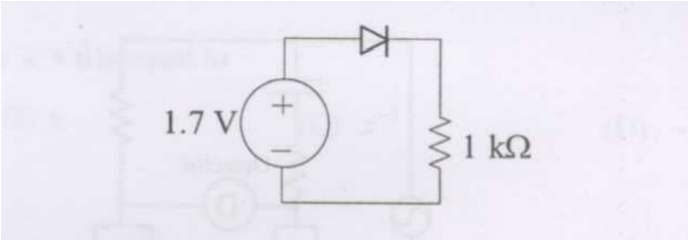
Q.7 The temperature being sensed by a negative temperature coefficient (NTC) type thermistor is linearly increasing. Its resistance will (GATE-IN-2008 EE 2025)

a) linearly increase with temperature
b) exponentially increase with temperature
c) linearly decrease with temperature
d) exponentially decrease with temperature

Q.8 For a single stage BJT common base amplifier,(GATE-IN-2008 EE 2025)

a) current gain as well as voltage gain can be greater than unity
b) current gain can be greater than unity but voltage gain is always less than unit
c) voltage gain can be greater than unity but current gain is always less than unity
d) current gain as well as voltage gain is always less than unity

Q.9 In the circuit shown below, the ideality factor n of the diode is unity and the voltage drop across it (GATE-IN-2008 EE 2025) is 0.7 V. The dynamic resistance of the diode at room temperature is approximately voltage gain can be greater than unity but current gain is always less than unity(GATE-IN-2008 EE 2025)

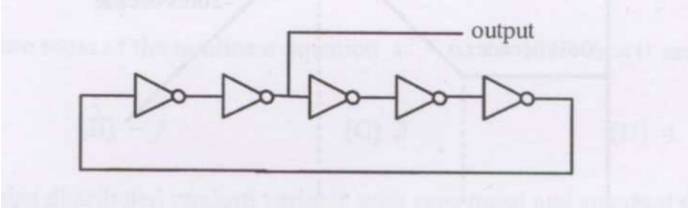


a) 15
b) 25
c) 50
d) 700

Q.10 An ideal op-amp has the characteristics of an ideal (GATE-IN-2008 EE 2025)

a) voltage controlled voltage source
b) voltage controlled current source
c) current controlled voltage source
d) curremt controlled current source

Q.11 The inverters in the ring oscillator circuit shown below are identical. If the output waveform has a frequency of 10 MHz, the propagation delay of each inverter is (GATE-IN-2008 EE 2025)



a) 5 ns
b) 10 ns
c) 20 ns
d) 50 ns

Q.12 A 2K×8 bit RAM is interfaced to an 8-bit microprocessor. If the address of the first memory (GATE-IN-2008 EE 2025) location in the RAM is 0800H, the address of the last memory location will be (GATE-IN-2008 EE 2025)

a) 1000H
b) 0FFFH
c) 4800H
d) 47FFH

Q.13 The fundamental period of the discrete-time signal $x[n] = e^{j(\frac{5\pi}{6})n}$ is (GATE-IN-2008 EE 2025)

a) $\frac{6}{5\pi}$
b) $\frac{12}{5}$
c) 6
d) 12

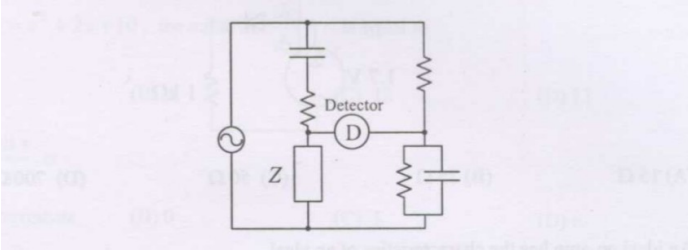
Q.14 Which one of the following discrete-time systems is time invariant? (GATE-IN-2008 EE 2025)

a) $y[n] = nx[n]$
b) $y[n] = x[3n]$
c) $y[n] = x[-n]$
d) $y[n] = x[n-3]$

Q.15 If a curent of $[-6\sqrt{2}\sin(100\pi t) + 6\sqrt{2}\cos(300\pi t + \frac{\pi}{4}) + 6\sqrt{2}]A$ is passed through RMS ammeter , the meter reading will be (GATE-IN-2008 EE 2025)

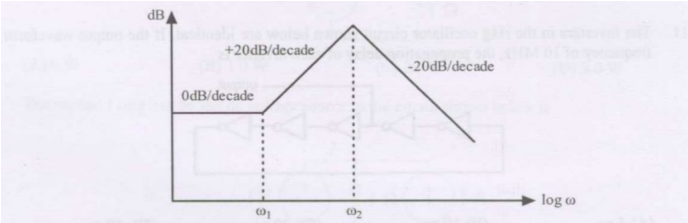
a) $6\sqrt{2}$ A
b) $\sqrt{126}$ A
c) 12 A
d) $\sqrt{216}$ A

Q.16 If the ac bridge circuit shown below is balanced, the element Z can be a (GATE-IN-2008 EE 2025)



a) pure capacitor
b) pure inductor
c) R-L series combination
d) R-L parallel combination

Q.17 The Bode asymptotic plot of a transfer function is given below. In the frequency range shown, the transfer function has (GATE-IN-2008 EE 2025)



a) 3 poles and 1 zero
b) 1 pole and 2 zeros
c) 2 poles and 1 zero
d) 2 poles and 2 zeros

Q.18 For radioisotope imaging, an Anger camera is fitted with a parallel hole collimator. If the thickness of the collimator is increased, the camera(GATE-IN-2008 EE 2025)

a) resolution and sensitivity will increase
b) resolution and sensitivity will decrease
c) resolution will increase and sensitivity will decrease
d) resolution will decrease and sensitivity will increase

Q.19 In the standard 12-lead ECG recording system, the minimum number of electrodes required to be attached to a human subject for recording any one of the unipolar chest lead signals is (GATE-IN-2008 EE 2025)

a) 1
b) 2
c) 4
d) 5

Q.20 A laser light with a wavelength of 633 nm is passed through 1 cm length of tissue and 2 cm length of glass. The refractive indices of tissue and glass are 1.33 and 1.5 respectively. The velocities of laser light in the tissue and in the glass are in the ratio of (GATE-IN-2008 EE 2025)

a) 1.33: 0.75
b) 1.33: 3.0
c) 1.33: 1.5
d) 1.5: 1.33

Questions 21-75 (2 marks each)

Q.21 The expression $e^{-\ln x}$ for $x > 0$ is equal to (GATE-IN-2008 EE 2025)

a) $-x$
b) x
c) $x^{-}1$
d) $-x^{-}1$

Q.22 Consider the differential equation $\frac{dy}{dx} = 1 + y^2$. Which one of the following can be a particular solution of this differential equation? (GATE-IN-2008 EE 2025)

a) $y = tan(x + 3)$
b) $y = tanx + 3$
c) $x = tan(y + 3)$
d) $x = tany + 3$

Q.23 Consider the function $y = x^2 - 6x + 9$.The maximum value of y obtained when x varies over the interval 2 to 5 is (GATE-IN-2008 EE 2025)

a) 1
b) 3
c) 4
d) 9

Q.24 It is known that two roots of the nonlinear equation $x^3 - 6x^2 + 11x - 6 = 0$ are 1 and 3. The third root will be (GATE-IN-2008 EE 2025)

a) j
b) $-j$
c) 2
d) 4

Q.25 Consider a Gaussian distributed random variable with zero mean and standard deviation σ . The value of its cumulative distribution function at the origin will be (GATE-IN-2008 EE 2025)

a) 0
b) 0.5
c) 1
d) 10 σ

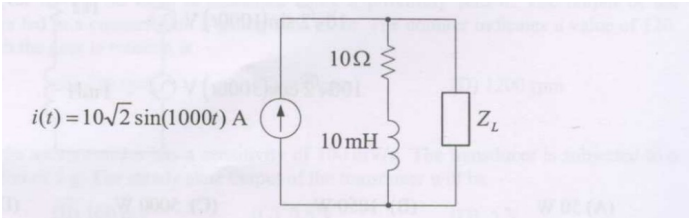
Q.26 A random variable is uniformly distributed over the interval 2 to 10. Its variance will be (GATE-IN-2008 EE 2025)

a) $\frac{16}{3}$
b) 6
c) $\frac{256}{9}$
d) 36

Q.27 The Fourier transform of $x(t) = e^{-at}u(-t)$, where $u(t)$is the unit step function,(GATE-IN-2008 EE 2025)

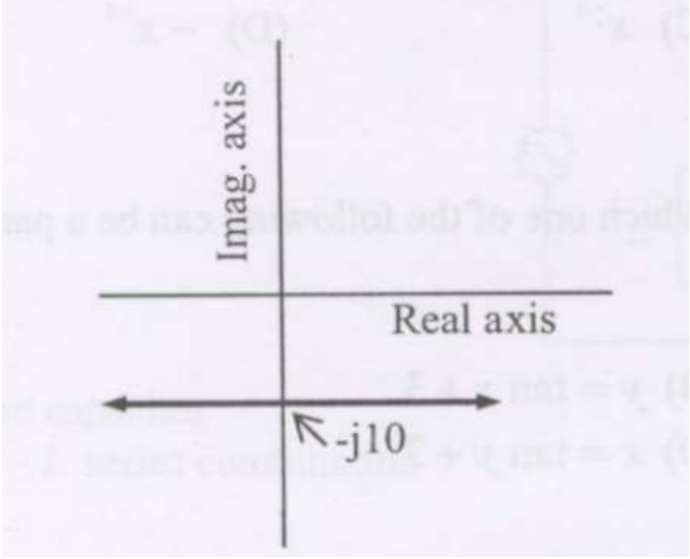
a) exists for any real value of a
b) does not exist for any real value of a
c) exists if the real value of a is strictly negative
d) exists if the real value of a is strictly positive

Q.28 In the circuit shown below the maximum power that can be transferred to the load Z_L is (GATE-IN-2008 EE 2025)

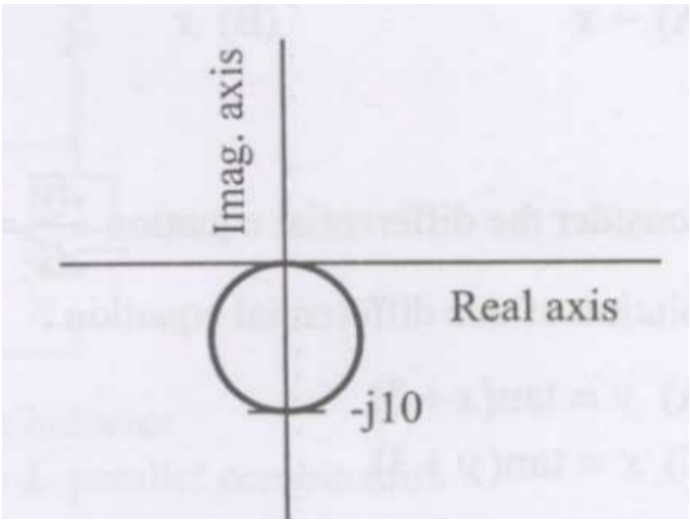


a) 250 W
b) 500 W
c) 1000 W
d) 2000 W

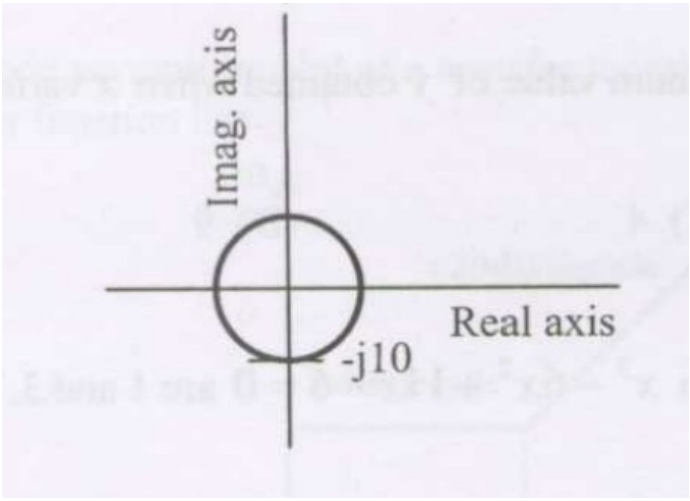
Q.29 A complex variable $Z = x + j0.1$ has its real part x varying in the range $-\infty$ to ∞ . Which of the following is the locus (shown in thick lines) of $\frac{1}{Z}$ in the complex plane ? (GATE-IN-2008 EE 2025)


Imag. axis
Real axis
-j10

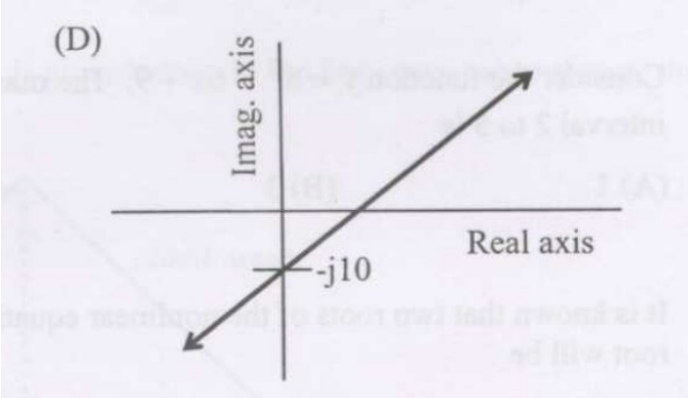
a)


Imag. axis
Real axis
-j10

b)

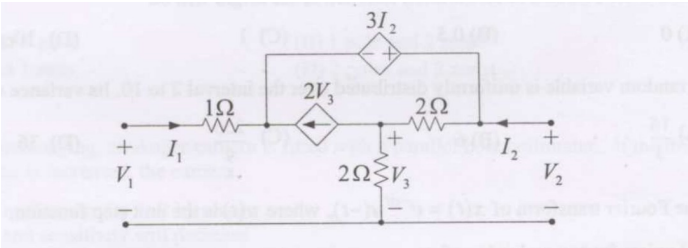

Imag. axis
Real axis
-j10

c)



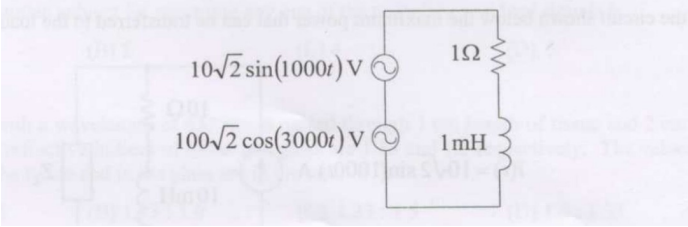
d)

Q.30 For the circuit shown below the input resistance $R_{11} = \frac{V_1}{I_1}\Big|_{I_2=0}$ is (GATE-IN-2008 EE 2025)



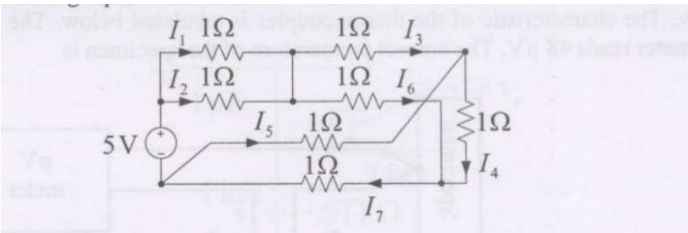
a) -3 Ω
b) 2 Ω
c) 3 Ω
d) 13 Ω

Q.31 In the circuit shown below the average power consumed by the 1Ω resistor is (GATE-IN-2008 EE 2025)



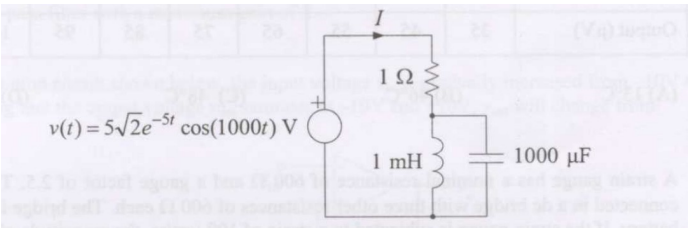
a) 50 W
b) 1050 W
c) 5000 W
d) 10100 W

Q.32 Which one of the following equations is valid for the circuit shown below? (GATE-IN-2008 EE 2025)



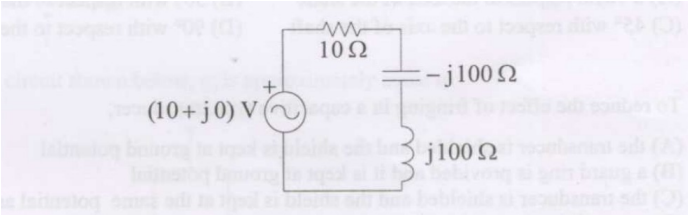
a) $I_3 + I_5 - I_6 + I_7 = 0$
b) $I_3 - I_5 + I_6 + I_7 = 0$
c) $I_3 + I_5 + I_6 + I_7 = 0$
d) $I_3 + I_5 + I_6 - I_7 = 0$

Q.33 For the circuit shown below the steady-state current I is (GATE-IN-2008 EE 2025)



a) 0 A
b) $5\sqrt{2}\cos(1000t)A$
c) $5\sqrt{2}\cos(1000t - \frac{\pi}{4})A$
d) $5\sqrt{2}A$

Q.34 For the circuit shown below the voltage across the capacitor is (GATE-IN-2008 EE 2025)



a) (10+j0) V
b) (100+ j0) V
c) (0+j100) V
d) (0-j100) V

Q.35 The speed of a gear having 60 teeth is measured using a proximity sensor. The output of the proximity sensor is fed to a counter with a gating time of 1s. The counter indicates a value of 120. The speed at which the gear is rotating is (GATE-IN-2008 EE 2025)

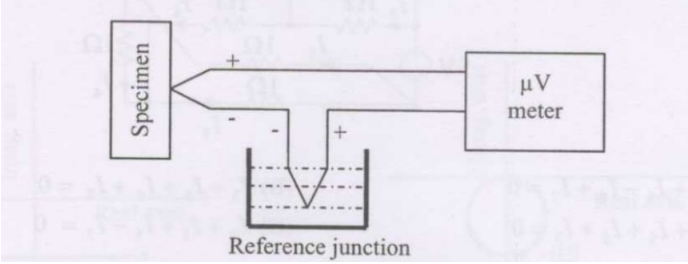
a) 60 rpm
b) 120 rpm
c) 600 rpm
d) 1200 rpm

Q.36 A piezoelectric type accelerometer has a sensitivity of 100 mV/g. The transducer is subjected to a constant acceleration of 5 g. The steady state output of the transducer will be (GATE-IN-2008 EE 2025)

a) 0 V
b) 100 mV

c) 0.5 V
d) 5 V

Q.37 A pair of identical thermocouples is employed for measuring the temperature of a specimen as shown below. The characteristic of the thermocouples is tabulated below. The reference junction is at 2°C. The meter reads 48 μV. The correct temperature of the specimen is (GATE-IN-2008 EE 2025)



Temperature ($°C$)	0	10	20	30	40	50	60	70	80	90
Output (μV)	35	45	55	65	75	85	95	105	115	125

a) 13°C
b) 46°C
c) 48°C
d) 50°C

Q.38 A strain gauge has a nominal resistance of 600Ω and a gauge factor of 2.5. The strain gauge is connected in a dc bridge with three other resistances of 600Ω each. The bridge is excited by a 4 V battery. If the strain gauge is subjected to a strain of 100 μm/m, the magnitude of the bridge output will be (GATE-IN-2008 EE 2025)

a) $0V$
b) 250 μV
c) 500 μV
d) 750 μV

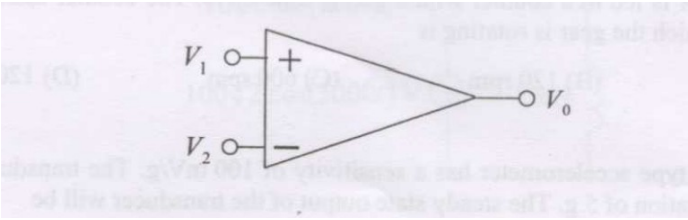
Q.39 The torque in a rotating shaft is measured using strain gauges. The strain gauges must be positioned on the shaft such that the axes of the strain gauges Ã¥re at (GATE-IN-2008 EE 2025)

a) 0° with respect to the axis of the shaft
b) 30° with respect to the axis of the shaft
c) 45° with respect to the axis of the shaft
d) 90° with respect to the axis of the shaft

Q.40 To reduce the effect of fringing in a capacitive type transducer, (GATE-IN-2008 EE 2025)

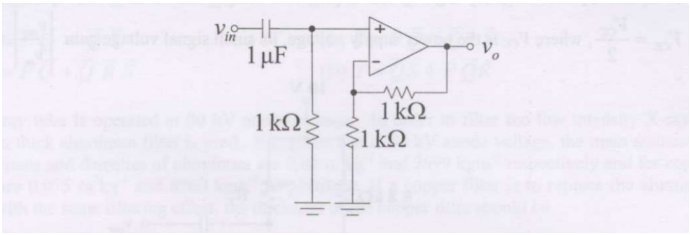
a) the transducer is shielded and the shield is kept at ground potential
b) a guard ring is provided and it is kept at ground potential
c) the transducer is shielded and the shield is kept at the same potential as the moving plate
d) a guard ring is provided and it is kept at the same potential as the moving plate

Q.41 A differential amplifier shown below has a differential mode gain of 100 and a CMRR of 40 dB. If V_1= 0.55V and V_2 = 0.45 V, the output V_0 is (GATE-IN-2008 EE 2025)



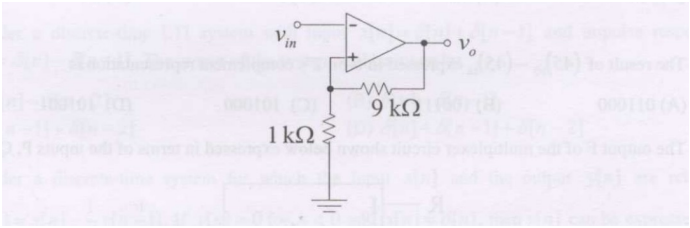
a) 10 V
b) 10.5 V
c) 11 V
d) 15 V

Q.42 The op-amp circuit shown below is that of a (GATE-IN-2008 EE 2025)



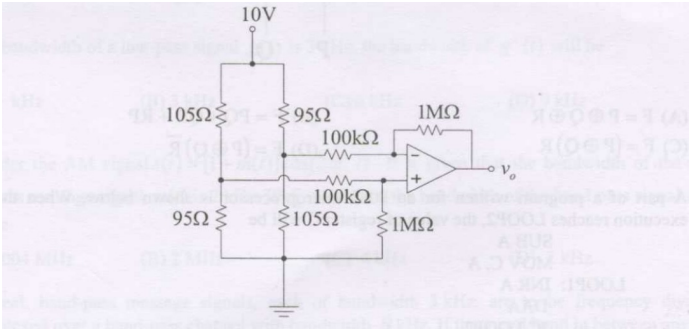
a) low-pass filter with a maximum gain of 1
b) low-pass filter with a maximum gain of 2
c) high-pass filter with a maximum gain of 1
d) high-pass filter with a maximum gain of 2

Q.43 In the op-amp circuit shown below, the input voltage v_{in} is gradually increased from -10V to +10V.Assuming that the output voltage v_{out} saturates at -10V and +10V, V_{out} will change from (GATE-IN-2008 EE 2025)



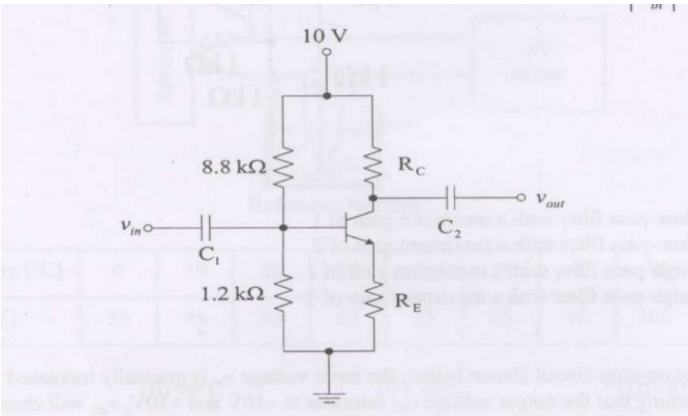
a) -10 V to +10 V when v_{in} =-1 V
b) -10 V to +10 V when v_{in} = +1 V
c) +10 V to -10 V when v_{in}=-1 V
d) +10 V to -10 V when v_{in} = +1 V

Q.44 For the op-amp circuit shown below, v_0 is approximately equal to (GATE-IN-2008 EE 2025)



a) -10 V
b) -5 V
c) +5 V
d) +10 V

Q.45 In the amplifier circuit shown below, assume V_{BE} = 0.7 V and the β of the transistor and the values of C_1 and C_2 are extremely high. If the amplifier is designed such that at the quiescent point its $V_{CE}=\frac{V_{CC}}{2}$ where V_{CC} is the power supply voltage, its small signal voltage gain $|\frac{V_{out}}{V_{in}}|$ will be (GATE-IN-2008 EE 2025)

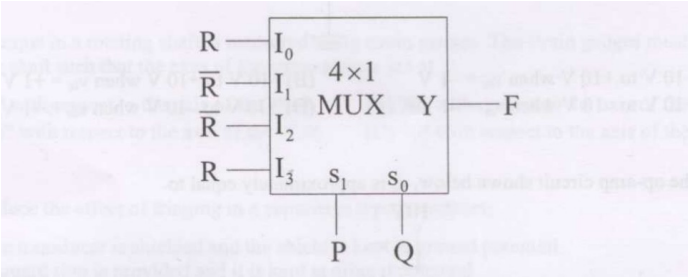


a) 3.75
b) 4.5
c) 9
d) 19

Q.46 The result of $(45)_{10}$ - $(45)_{16}$ expressed in 6-bit 2's complement representation is (GATE-IN-2008 EE 2025)

a) 011000
b) 100111
c) 101000
d) 101001

Q.47 The output F of the multiplexer circuit shown below expressed in terms of the inputs P, Q and R is (GATE-IN-2008 EE 2025)



a) F= P⊕Q⊕R
b) F = PQ + QR + RP
c) F= (P⊕Q)R
d) F =(P⊕Q) $\bar{R}$

Q.48 A part of a program written for an 8085 microprocessor is shown below. When the program execution reaches LOOP2, the value of register C will be

```
SUB A
MOV C, A
LOOP1: INR A
DAA
```

JC LOOP2
INR C
JNC LOOP1
LOOP2: NOP
(GATE-IN-2008 EE 2025)

a) 63 H
b) 64 H
c) 99 H
d) 100 H

Q.49 The minimum sum of products form of the Boolean expression Y = $\bar{P}\bar{Q}\bar{R}\bar{S}$ + P$\bar{Q}\bar{R}\bar{S}$ + P$\bar{Q}\bar{R}$S + P$\bar{Q}$RS + P$\bar{Q}$R$\bar{S}$ + $\bar{P}\bar{Q}$R$\bar{S}$ (GATE-IN-2008 EE 2025)

a) Y = P$\bar{Q}$ + $\bar{Q}\bar{S}$
b) Y = P$\bar{Q}$ + $\bar{Q}$R$\bar{S}$
c) Y = P$\bar{Q}$ + $\bar{Q}\bar{R}\bar{S}$
d) Y = $\bar{Q}\bar{S}$ + P$\bar{Q}$R

Q.50 An X-ray tube is operated at 80 kV anode voltage. In order to filter the low intensity X-rays, a 2.5 mm thick aluminum filter is used. It is given that at 80 kV anode voltage, the mass attenuation coefficients and densities of aluminum are 0.02 $m^2\,kg^{-1}$ and 2699 $kg\,m^{-3}$ respectively and for copper these are 0.075 $m^2\,kg^{-1}$ and 8960 $kg\,m^{-3}$ respectively. If a copper filter is to replace the aluminum filter with the same filtering effect, the thickness of the copper filter should be (GATE-IN-2008 EE 2025)

a) 0.2 mm
b) 0.66 mm
c) 1.5 mm
d) 5 mm

Q.51 A 5 MHz acoustic pulse travels from a transducer through a 2 cm thick fat tissue before it encounters an interface with a liver tissue at normal incidence. The amplitude attenuation factors of fat and liver are 0.075 $Np\,cm^{-1}/MHz$ and 0.1 $Np\,cm^{-1}/MHz$ respectively. The amplitude reflectivity coefficient of fat-liver interface is 0.1. Taking both attenuation and reflection losses into account, the amplitude loss (in dB) of echo pulse when it returns to the transducer is (GATE-IN-2008 EE 2025)

a) 0.74
b) -2.6
c) -6
d) -33

Q.52 Consider a discrete-time LTI system with input $x[n] = \delta[n] + \delta[n-1]$ and impulse response $h[n] = \delta[n] - \delta[n-1]$. The output of the system will be given by (GATE-IN-2008 EE 2025)

a) $\delta[n] - \delta[n-2]$
b) $\delta[n] - \delta[n-1]$
c) $\delta[n-1] + \delta[n-2]$
d) $\delta[n] + \delta[n-1] + \delta[n-2]$

Q.53 Consider a discrete-time system for which the input $x[n]$ and the output $y[n]$ are related as $y[n] = x[n] - \frac{1}{3}y[n-1]$. If $y[n] = 0$ for $n < 0$ and $x[n] = \delta[n]$, then $y[n]$ can be expressed in terms of the unit step $u[n]$ (GATE-IN-2008 EE 2025)

a) $(\frac{-1}{3})^n\ u[n]$
b) $(\frac{1}{3})^n\ u[n]$
c) $(3)^n\ u[n]$
d) $(-3)^n\ u[n]$

Q.54 If the bandwidth of a low-pass signal g(t) is 3 kHz, the bandwidth of $g^2(t)$ will be (GATE-IN-2008

EE 2025)

a) $\frac{3}{2}$ MHz
b) 3 MHz
c) 6 kHz
d) 9 kHz

Q.55 Consider the AM signal $s(t) = [1 + m(t)] \cos 2\pi f t$. It is given that the bandwidth of the real, low-pass message signal $m(t)$ is 2 kHz. If f_c = 2 MHz, the bandwidth of the band-pass signal $s(t)$ will be (GATE-IN-2008 EE 2025)

a) 2.004 MHz
b) 2 MHz
c) 4 kHz
d) 2 kHz

Q.56 Ten real, band-pass message signals, each of bandwidth 3 kHz, are to be frequency division multiplexed over a band-pass channel with bandwidth B kHz. If the guard band in between any two adjacent signals should be of 500 Hz width and there is no need to provide any guard band at the edges of the band-pass channel, the value of B should be at least (GATE-IN-2008 EE 2025)

a) 30
b) 34.5
c) 35
d) 35.5

Q.57 The region of convergence of the z-transform of the discrete-time signal $x[n] = 2^n\, u[n]$ will be (GATE-IN-2008 EE 2025)

a) $|z| > 2$
b) $|z| < 2$
c) $|z| > \frac{1}{2}$
d) $|z| < \frac{1}{2}$

Q.58 The step response of a linear time invariant system is $y(t) = 5\ e^{-10t}\ u(t)$, where $u(t)$) is the unit step function. If the output of the system corresponding to an impulse input $\delta(t)$ is $h(t)$, then $h(t)$ is (GATE-IN-2008 EE 2025)

a) $-50\ e^{-10t}\ u(t)$
b) $5\ e^{-10t}\ \delta(t)$
c) $5u(t)\ -50\ e^{-10t}\ \delta(t)$
d) $5\delta(t)\ -50\ e^{-10t}\ u(t)$

Q.59 A 2 A full-scale PMMC type dc ammeter has a voltage drop of 100 mV at 2 A. The meter can be converted into a 10 A full-scale dc ammeter by connecting a (GATE-IN-2008 EE 2025)

a) 12.5 mΩ resistor in parallel with the meter
b) 12.5 mΩ resistor in series with the meter
c) 50.0 mΩ resistor in parallel with the meter
d) 50.0 mΩ resistor in series with the meter

Q.60 A $3\frac{1}{2}$ digit, 200 mV full scale DVM has an accuracy specification of ± 0.5% of reading plus 5 counts. When the meter reads 100 mV, the voltage being measured is (GATE-IN-2008 EE 2025)

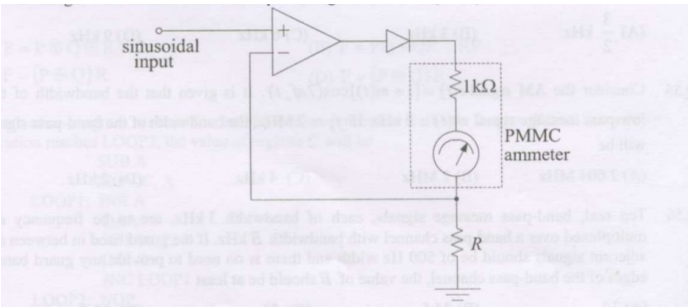
a) any value between 99.5 mV and 100.5 mV
b) any value between 99.5 mV and 100.5 mV
c) exactly 99.5 mV
d) exactly 100 mV

Q.61 A 230 V, 5 A, 50 Hz single phase house service energy meter has a meter constant of 360 rev/kWhr. The meter takes 50 s for making 51 revolutions of the disc when connected to a 10 kW, unity power

factor load. The error in the reading of the meter is (GATE-IN-2008 EE 2025)

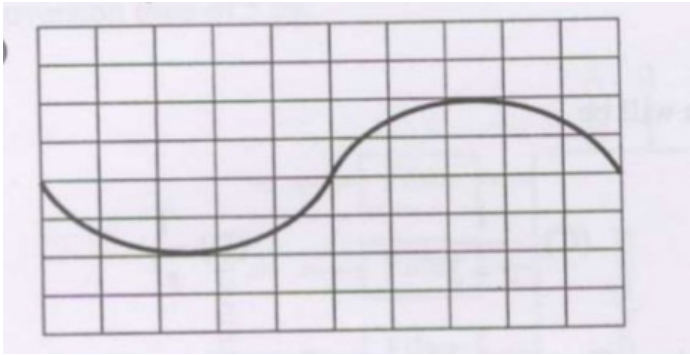
a) 0 %
b) +0.5 %
c) -2.0 %
d) +2.0 %

Q.62 The op-amp based circuit of a half wave rectifier electronic voltmeter shown below uses a *PMMC* ammeter with a full scale deflection (FSD) current of 1 mA and a coil resistance of 1 kΩ. The value of R that gives FSD for a sinusoidal input voltage of 100 mV (RMS) is (GATE-IN-2008 EE 2025)

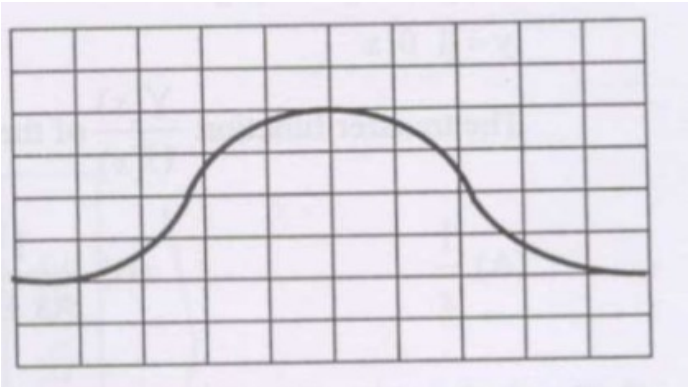


a) 45 Ω
b) 67.5 Ω
c) 100 Ω
d) 144.4 Ω

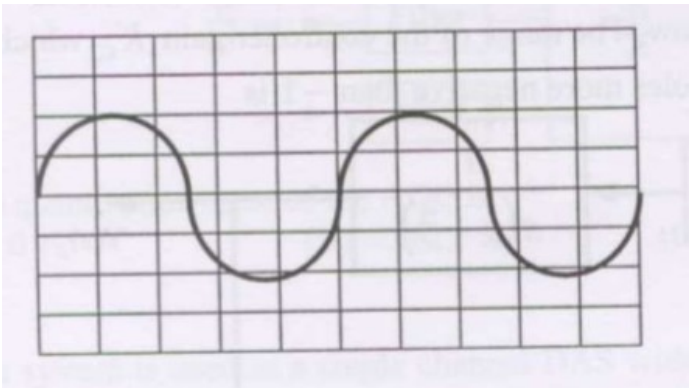
Q.63 The x and y sensitivities of an analog oscilloscope are set as 2 ms/cm and 1V/cm respectively. The trigger is set at $0V$ with negative slope. An input of $2\cos(100\pi t + 30^0)$ V is fed to the y input of the oscilloscope. The waveform seen on the oscilloscope will be (GATE-IN-2008 EE 2025)



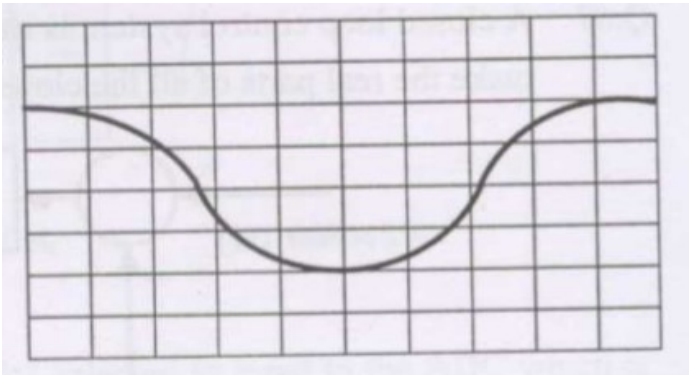
a)



b)



c)

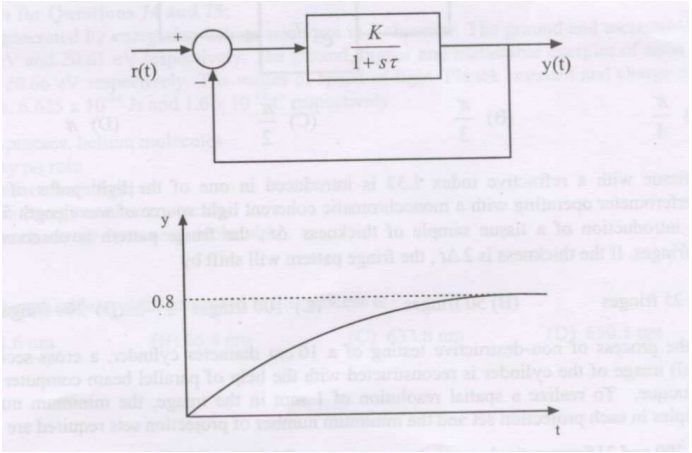


d)

Q.64 The open loop transfer function of a unity feedback system is $G(s) = \frac{K(s+2)}{(s+1+j1)(s+1-j1)}$ The root locus plot of the system has (GATE-IN-2008 EE 2025)

a) two breakaway points located at s = -0.59 and s = -3.41
b) one breakaway point located at s = -0.59
c) one breakaway point located at s =-3.41
d) one breakaway point located at s =-1.41

Q.65 If a first order system and its time response to a unit step input are as shown below, the gain K is (GATE-IN-2008 EE 2025)



a) 0.25
b) 0.8
c) 1
d) 4

Q.66 The state space representation of a system is given by

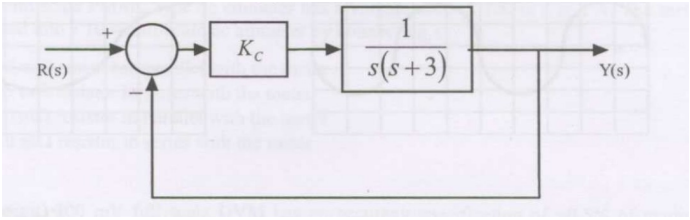
$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$$

The transfer function $\frac{Y(s)}{U(s)}$ of the system will be (GATE-IN-2008 EE 2025)

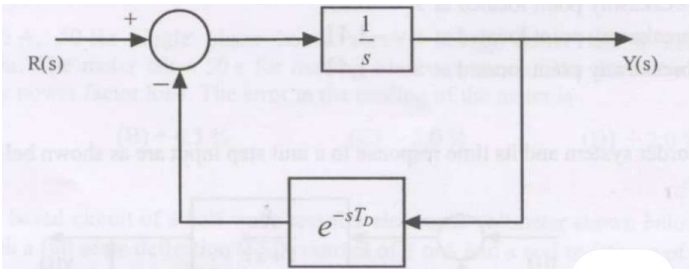
a) $\frac{1}{s}$
b) $\frac{1}{s(s+3)}$
c) $\frac{1}{s+3}$
d) $\frac{1}{s^2}$

Q.67 A closed loop control system is shown below. The range of the controller gain K_C which will make the real parts of all the closed loop poles more negative than -1 is (GATE-IN-2008 EE 2025)



a) $K_C > -4$
b) $K_C > 0$
c) $K_C > 2$
d) $K_C < 2$

Q.68 For the closed loop system shown below to be stable, the value of time delay T_D (in seconds) should be less than (GATE-IN-2008 EE 2025)



a) $\frac{\pi}{4}$
b) $\frac{\pi}{3}$
c) $\frac{\pi}{2}$
d) π

Q.69 A tissue with a refractive index 1.33 is introduced in one of the light paths of a Michelson interferometer operating with a monochromatic coherent light source of wavelength 589 nm. After the introduction of a tissue sample of thickness Δt, the fringe pattern is observed to shift by 50 fringes. If the thickness is 2 Δt , the fringe pattern will shift by (GATE-IN-2008 EE 2025)

a) 25 fringes
b) 50 fringes

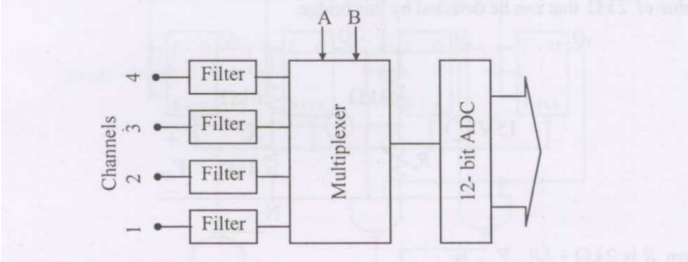
c) 100 fringes
d) 200 fringes

Q.70 In the process of non-destructive testing of a 10 cm diameter cylinder, a cross-sectional (transaxial) image of the cylinder is reconstructed with the help of parallel beam computer tomography technique. To realize a spatial resolution of 1 mm in the image, the minimum number of ray samples in each projection set and the minimum number of projection sets required are (GATE-IN-2008 EE 2025)

a) 200 and 315 respectively
b) 100 and 315 respectively
c) 200 and 629 respectively
d) 100 and 629 respectively

Common Data Questions

Common Data for Questions 71,72 and 73 A data acquisition system (DAS) shown below employs a successive approximation type 12-bit ADC having a conversion time of 5 μs.



Q.71 The quantization error of the ADC is (GATE-IN-2008 EE 2025)

a) 0
b) $\pm$ 0.012 %
c) $\pm$ 0.024 %
d) $\pm$ 0.048 %

Q.72 The system is used as a single channel DAS with channel 1 selected as input to the ADC which is set in the continuous conversion mode. For avoiding aliasing error, the cutoff frequency f_c of the filter in channel 1 should be (GATE-IN-2008 EE 2025)

a) $f_c < 100$ kHz
b) $f_c = 100$kHz
c) 100kHz $< f_c <$ 200kHz
d) $f_c = 200$ kHz

Q.73 If the multiplexer is controlled such that the channels are sequenced every 5 us as 1, 2, 1, 3, 1, 4, 1, 2, 1, 3, 1, 4, 1, ..., the input connected to channel 1 will be sampled at the rate of (GATE-IN-2008 EE 2025) (GATE-IN-2008 EE 2025)

a) 25k samples/s
b) 50k samples/s
c) 100k samples/s
d) 200k samples/s

Common Data for Questions 74 and 75

Laser light is generated by energizing helium-neon gas in a chamber. The ground and metastable states of helium are 0 eV and 20.61 eV respectively. The ground, higher and metastable energies of neon are 0 eV, 18.70 eV and 20.66 eV respectively. The values of speed of light, Planck constant and charge of electron are 3 x 10^8 m/s, 6.625 x 10^{-34} 4 Js and 1.6 x 10^{19} C respectively.

Q.74 In this process, helium molecules (GATE-IN-2008 EE 2025)

a) play no role
b) produce laser light
c) give energy to neon molecules
d) absorb energy from neon molecules

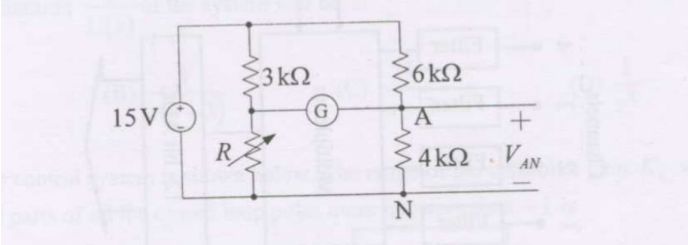
Q.75 Wavelength of laser light generated in this process is (GATE-IN-2008 EE 2025)

a) 61.6 nm
b) 66.4 nm
c) 633.8 nm
d) 650.3 nm

LINKED ANSWER QUESTIONS: Q.76 TO Q.85 CARRY TWO MARKS EACH

Statement for Linked Answer Questions 76 and 77:

In the Wheatstone bridge shown below the galvanometer G has a current sensitivity of 1 μA/mm, a resistance of 2.5 k$\Omega$and a scale resolution of 1 mm. Let ΔR be the minimum increase in R from its nominal value of 2kΩ that can be detected by this bridge.



Q.76 When R is 2kΩ + ΔR , V_{AN} is (GATE-IN-2008 EE 2025)

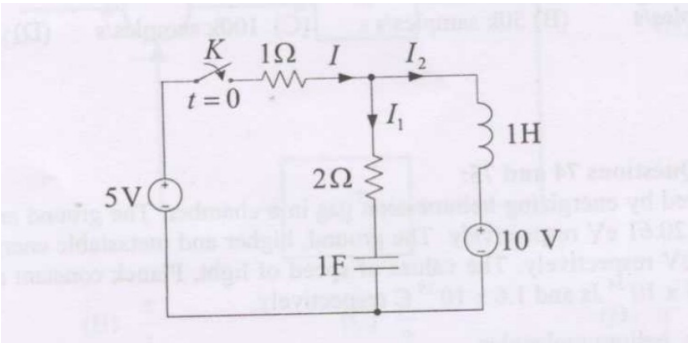
a) 6 V
b) 6.0024 V
c) 6.0038 V
d) 6.005 V

Q.77 The value of ΔR is approximately (GATE-IN-2008 EE 2025)

a) 2.8 Ω
b) 3.4 Ω
c) 5.2 Ω
d) 12 Ω

Statement for Linked Answer Questions 78 and 79:

In the circuit shown below the steady-state is reached with the switch K open. Subsequently the switch is closed at time t = 0.



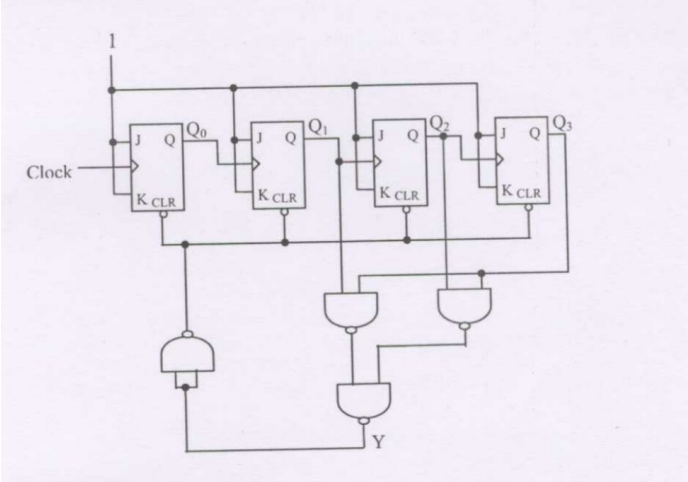
Q.78 At time t = 0^+, current I is (GATE-IN-2008 EE 2025)

a) $-\frac{5}{3}$ A
b) 0 A
c) $\frac{5}{3}$ A
d) ∞

Q.79 At time t = 0^+, $\frac{dI_2}{dt}$ (GATE-IN-2008 EE 2025)

a) -5 A/s
b) $-\frac{10}{3}$ A/s
c) 0 A/s
d) 5A/s

Statement for Linked Answer Questions 80 and 81 :
Consider the counter circuit shown below.



Q.80 In the above figure, Y can be expressed as (GATE-IN-2008 EE 2025)

a) $Q_3(Q_2 + Q_1)$
b) $\overline{Q_3 + Q_2Q_1}$
c) $\overline{Q_3(Q_2 + Q_1)}$
d) $\overline{Q_3 + Q_2Q_1}$

Q.81 The above circuit is a (GATE-IN-2008 EE 2025)

a) Mod-8 Counter
b) Mod-9 Counter
c) Mod-10 Counter
d) Mod-11 Counter

Statement for Linked Answer Questions 82 and 83 :
Consider a unity feedback system with open loop transfer function $G(s) = \frac{1+6s}{s^2(1+s)(1+2s)}$

Q.82 The phase crossover frequency of the system in radians per second is (GATE-IN-2008 EE 2025)

a) 0.125
b) 0.25
c) 0.5
d) 1

Q.83 The gain margin of the system is (GATE-IN-2008 EE 2025)

a) 0.125
b) 0.25
c) 0.5
d) 1

Statement for Linked Answer Questions 84 and 85 :

A unity feedback system has open loop transfer function $G(s) = \frac{100}{s(s+p)}$. The time at which the response to a unit step input reaches its peak is $\frac{\pi}{8}$ seconds.

Q.84 The damping coefficient for the closed loop system is (GATE-IN-2008 EE 2025)

a) 0.4
b) 0.6
c) 0.8
d) 1

Q.85 The value of p is (GATE-IN-2008 EE 2025)

a) 6
b) 12
c) 14
d) 16