# EC: ELECTRONICS AND COMMUNICATION ENGINEERING - 2013

EE25BTECH11037 - Divyansh

1) A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles

   a) an AND gate  b) an OR gate  c) an XOR gate  d) a NAND gate

(GATE EC 2013)

2) Consider a vector field $\mathbf{A}(\mathbf{r})$. The closed loop line integral $\oint \mathbf{A} \cdot d\mathbf{l}$ can be expressed as
   a) $\iint_{\text{closed surface}} (\nabla \times \mathbf{A}) \cdot d\mathbf{s}$
   b) $\iiint_{\text{closed volume}} (\nabla \cdot \mathbf{A})\ dv$
   c) $\iiint_{\text{open volume}} (\nabla \cdot \mathbf{A})\ dv$
   d) $\iint_{\text{open surface}} (\nabla \times \mathbf{A}) \cdot d\mathbf{s}$

(GATE EC 2013)

3) Two systems with impulse responses $h_1(t)$ and $h_2(t)$ are connected in cascade. Then the overall impulse response of the cascaded system is given by
   a) product of $h_1(t)$ and $h_2(t)$
   b) sum of $h_1(t)$ and $h_2(t)$
   c) convolution of $h_1(t)$ and $h_2(t)$
   d) subtraction of $h_2(t)$ from $h_1(t)$

(GATE EC 2013)

4) In a forward biased pn junction diode, the sequence of events that best describes the mechanism of current flow is
   a) injection, and subsequent diffusion and recombination of minority carriers
   b) injection, and subsequent drift and generation of minority carriers
   c) extraction, and subsequent diffusion and generation of minority carriers
   d) extraction, and subsequent drift and recombination of minority carriers

(GATE EC 2013)

5) In IC technology, dry oxidation (using dry oxygen) as compared to wet oxidation ($using steam or water vapor$) produces
   a) superior quality oxide with a higher growth rate
   b) inferior quality oxide with a higher growth rate
   c) inferior quality oxide with a lower growth rate
   d) superior quality oxide with a lower growth rate

(GATE EC 2013)

6) The maximum value of $\theta$ until which the approximation $\sin\theta \approx \theta$ holds within the 10% error is

   a) $10^\circ$  b) $18^\circ$  c) $50^\circ$  d) $90^\circ$

(GATE EC 2013)

7) The divergence of the vector field $\mathbf{A} = x\hat{a}_x + y\hat{a}_y + z\hat{a}_z$ is

a) 0 b) 1/3 c) 1 d) 3

(GATE EC 2013)

8) The impulse response of a system is $h(t) = tu(t)$. For an input $u(t-1)$, the output is

a) $\frac{t^2}{2}u(t)$ b) $\frac{t(t-1)}{2}u(t-1)$ c) $\frac{(t-1)^2}{2}u(t-1)$ d) $\frac{t^2-1}{2}u(t-1)$

(GATE EC 2013)

9) The Bode plot of a transfer function $G(s)$ is shown in the $Fig$. 1 below.

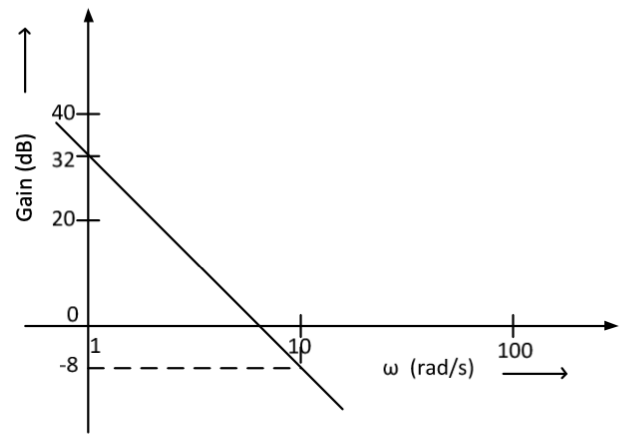


Fig. 1. for q-9

The gain $(20\log|G(s)|)$ is $32dB$ and $-8dB$ at $1rad/s$ and $10rad/s$ respectively. The phase is negative for all $\omega$. Then $G(s)$ is

a) $\frac{39.8}{s}$ b) $\frac{39.8}{s^2}$ c) $\frac{32}{s}$ d) $\frac{32}{s^2}$

(GATE EC 2013)

10) In the circuit shown below in $Fig$. 2 what is the output voltage ($V_{out}$) if a silicon transistor $Q$ and an ideal op-amp are used?

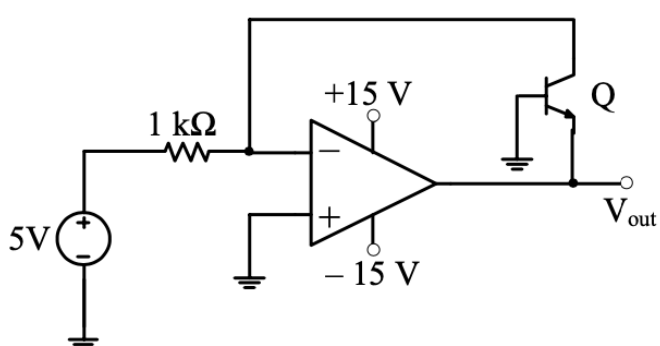


Fig. 2. for q-10

a) $-15V$ b) $-0.7V$ c) $+0.7V$ d) $+15V$

(GATE EC 2013)

11) Consider a delta connection of resistors and its equivalent star connection as shown below in $Fig$. 3. If all elements of the delta connection are scaled by a factor $k$, $k > 0$, the elements of the corresponding star equivalent will be scaled by a factor of


Fig. 3. for q-11

a) $k^2$ b) $k$ c) $\frac{1}{k}$ d) $\sqrt{k}$

(GATE EC 2013)

12) For 8085 microprocessor, the following program is executed.

```
    MVI A, 05H;
    MVI B, 05H;
PTR:ADD B;
    DCR B;
    JNZ PTR;
    ADI 03H;
    HLT;
```

At the end of program, accumulator contains

a) $17H$ b) $20H$ c) $23H$ d) $05H$

(GATE EC 2013)

13) The bit rate of a digital communication system is $R\ kbits/s$. The modulation used is $32 - QAM$. The minimum bandwidth required for ISI free transmission is

a) $R/10\ Hz$ b) $R/10\ kHz$ c) $R/5\ Hz$ d) $R/5\ kHz$

(GATE EC 2013)

14) For a periodic signal $v(t) = 30\sin 100t + 10\cos 300t + 6\sin(500t + \pi/4)$ , the fundamental frequency in $rad/s$ is

a) 100 b) 300 c) 500 d) 1500

(GATE EC 2013)

15) In a voltage-voltage feedback as shown below in the $Fig$. **??**, which one of the following statements is TRUE if the gain $k$ is increased?

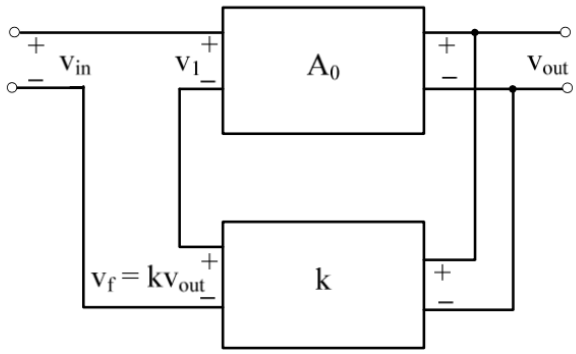


Fig. 4. for q-15

a) The input impedance increases and output impedance decreases.
b) The input impedance increases and output impedance also increases.
c) The input impedance decreases and output impedance also decreases.
d) The input impedance decreases and output impedance increases.

(GATE EC 2013)

16) A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency which is not valid is

a) $5kHz$ b) $12kHz$ c) $15kHz$ d) $20kHz$

(GATE EC 2013)

17) In a MOSFET operating in the saturation region, the channel length modulation effect causes

a) an increase in the gate-source capacitance
b) a decrease in the transconductance
c) a decrease in the unity-gain cutoff frequency
d) a decrease in the output resistance

(GATE EC 2013)

18) Which one of the following statements is NOT TRUE for a continuous time causal and stable LTI system?

a) All the poles of the system must lie on the left side of the $j\omega$ axis
b) Zeros of the system can lie anywhere in the $s-plane$
c) All the poles must lie within $|s| = 1$
d) All the roots of the characteristic equation must be located on the left side of the $j\omega$ axis

(GATE EC 2013)

19) The minimum eigenvalue of the following matrix is

$$\begin{pmatrix} 3 & 5 & 2 \\ 5 & 12 & 7 \\ 2 & 7 & 5 \end{pmatrix}$$

a) 0 b) 1 c) 2 d) 3

(GATE EC 2013)

20) A polynomial $f(x) = a_4x^4 + a_3x^3 + a_2x^2 + ax - a_0$ with all coefficients positive has

a) no real roots
b) no negative real root
c) odd number of real roots
d) at least one positive and one negative real root

(GATE EC 2013)

21) Assuming zero initial condition, the response $y(t)$ of the system given below in the $Fig$. 5 to a unit step input $u(t)$ is

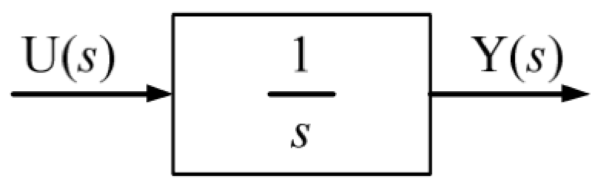


Fig. 5. for q-21

a) $u(t)$
b) $tu(t)$
c) $\frac{t^2}{2}u(t)$
d) $e^{-t}u(t)$

(GATE EC 2013)

22) The transfer function $\frac{V_2(s)}{V_1(s)}$ of the circuit shown below in $Fig$. 6 is

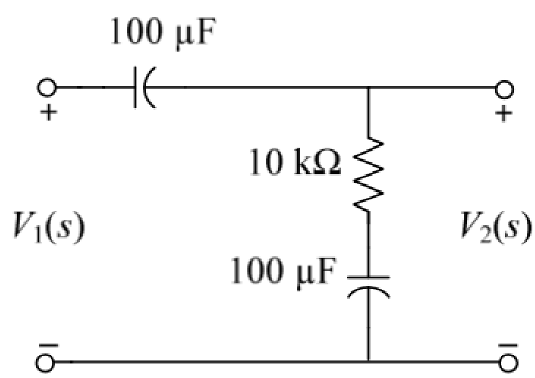


Fig. 6. for q-22

a) $\frac{0.5s+1}{s+1}$
b) $\frac{3s+6}{s+2}$
c) $\frac{s+2}{s+1}$
d) $\frac{s+2}{s+2}$

(GATE EC 2013)

23) A source $v(t) = V\cos(100\pi t)$ has an internal impedance of $(4 + j3)\,\Omega$. If a purely resistive load connected to this source has to extract the maximum power out of the source, its value in $\Omega$ should be

a) 3
b) 4
c) 5
d) 7

(GATE EC 2013)

24) The return loss of a device is found to be 20 dB. The voltage standing wave ratio ($VSWR$) and magnitude of reflection coefficient are respectively

a) $1.22$ *and* $0.1$ b) $0.81$ *and* $0.1$ c) $-1.22$ *and* $0.1$ d) $2.44$ *and* $0.2$

(GATE EC 2013)

25) Let $g(t) = e^{-\pi t^2}$, and $h(t)$ is a filter matched to $g(t)$. If $g(t)$ is applied as input to $h(t)$, then the Fourier transform of the output is

a) $e^{-\pi f^2}$ b) $e^{-\pi f^2/2}$ c) $e^{-\pi|f|}$ d) $e^{-2\pi f^2}$

(GATE EC 2013)

26) Let $U$ and $V$ be two independent zero mean Gaussian random variables of variances 1 and $\frac{4}{9}$ respectively. The probability $P(3V \geq 2U)$ is

a) $\frac{4}{9}$ b) $\frac{1}{2}$ c) $\frac{2}{3}$ d) $\frac{5}{9}$

(GATE EC 2013)

27) Let $A$ be an $m \times n$ matrix and $B$ an $n \times m$ matrix. It is given that $\det(I_m + AB) = \det(I_m + AB)$. Using this property, the determinant of the matrix $\begin{pmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{pmatrix}$ is

a) 2 b) 5 c) 8 d) 16

(GATE EC 2013)

28) In the circuit shown below in $Fig.$ 7, if the source voltage $V_s = 100\angle 253.13°$ V, then the Thevenin's equivalent voltage in Volts as seen by the load resistance $R_L$ is

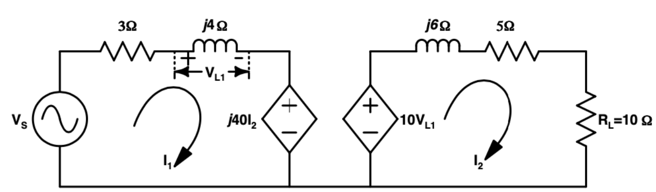


Fig. 7. for q-28

a) $100\angle 90°$ b) $800\angle 0°$ c) $800\angle 90°$ d) $100\angle 60°$

(GATE EC 2013)

29) The open-loop transfer function of a DC motor is given as. $\frac{\theta(s)}{V_a(s)} = \frac{10}{1+10s}$. When connected in feedback, the approximate value of $K_a$ that will reduce the time constant of the closed-loop system by one hundred times compared to the open-loop system is

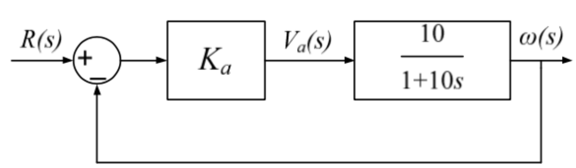


Fig. 8. for q-29

a) 1 b) 5 c) 10 d) 100

(GATE EC 2013)

30) In the circuit shown below in $Fig$. 9, the knee current of the ideal Zener diode is $10mA$. To maintain $5V$ across $R_L$, the minimum value of $R_L$ in $\Omega$ and the minimum power rating of the Zener diode in $mW$, respectively, are

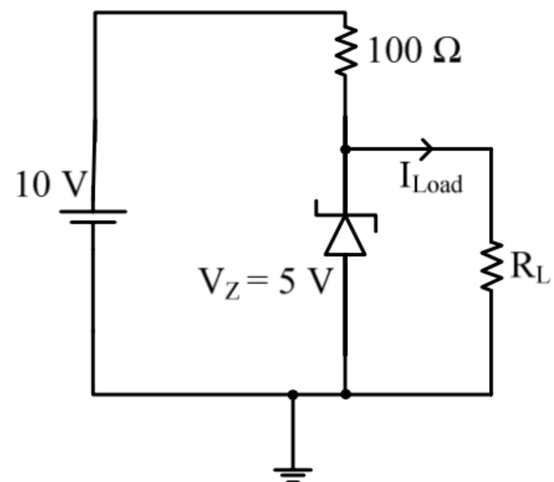


Fig. 9. for q-30

a) 125 and 125
b) 125 and 250
c) 250 and 125
d) 250 and 250

(GATE EC 2013)

31) The following arrangement consists of an ideal transformer and an attenuator which attenuates by a factor of 0.8. An AC voltage $V_{WX1} = 100V$ is applied across $WX$ to get an open circuit voltage $V_{YZ1}$ across $YZ$. Next, an AC voltage $V_{YZ2}$ = 100 V is applied across $YZ$ to get an open circuit voltage $V_{WX2}$ across $WX$. Then, $V_{YZ1}/V_{WX1}$ and $V_{WX2}/V_{YZ2}$ are respectively

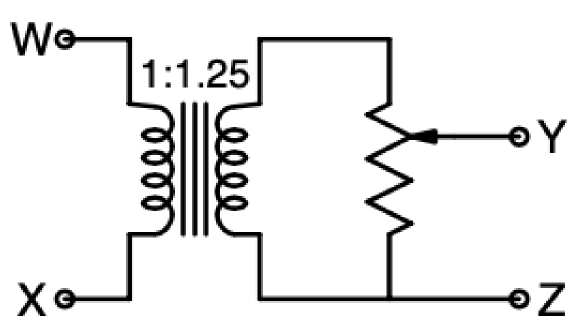


Fig. 10. for q-31

a) 125/100 and 80/100
b) 100/100 and 80/100
c) 100/100 and 100/100
d) 80/100 and 80/100

(GATE EC 2013)

32) Two magnetically uncoupled inductive coils have $Q$ factors $q_1$ and $q_2$ at the chosen operating frequency. Their respective resistances are $R_1$ and $R_2$. When connected in series, their effective $Q$ factor at the same operating frequency is

a) $q_1 + q_2$
b) $\left(\frac{1}{q_1}\right) + \left(\frac{1}{q_2}\right)$
c) $\frac{(q_1 R_1 + q_2 R_2)}{(R_1 + R_2)}$
d) $\frac{(q_1 R_2 + q_2 R_1)}{R_1 + R_2}$

(GATE EC 2013)

33) The impulse response of a continuous-time system is given by $h(t) = \delta(t-1) + \delta(t-3)$. The value of the step response at $t = 2$ is

a) 0
b) 1
c) 2
d) 3

(GATE EC 2013)

34) The small-signal resistance (i.e., $dV_B/dI_D$) in k$\Omega$ offered by the n-channel MOSFET $M$ shown in the $Fig$. 11 below, at a bias point of $V_B = 2$ V is (device data for $M$: transconductance parameter $K_N = \mu_n C_{ox}(W/L) = 40\ \mu$A/V$^2$, threshold voltage $V_{TN} = 1$ V, neglect body effect and channel length modulation).

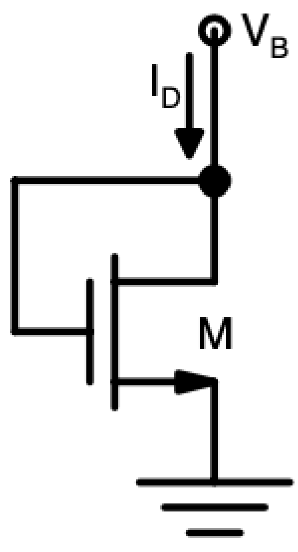


Fig. 11. for q-34

a) 12.5
b) 25
c) 50
d) 100

(GATE EC 2013)

35) The ac schematic of an NMOS common-source stage is shown below in $Fig$. 12, where part of the biasing circuits has been omitted for simplicity. For the n-channel MOSFET $M$, the transconductance $g_m = 1\ mA/V$ , and body effect and channel length modulation effect are to be neglected. The lower cutoff frequency in Hz of the circuit is approximately

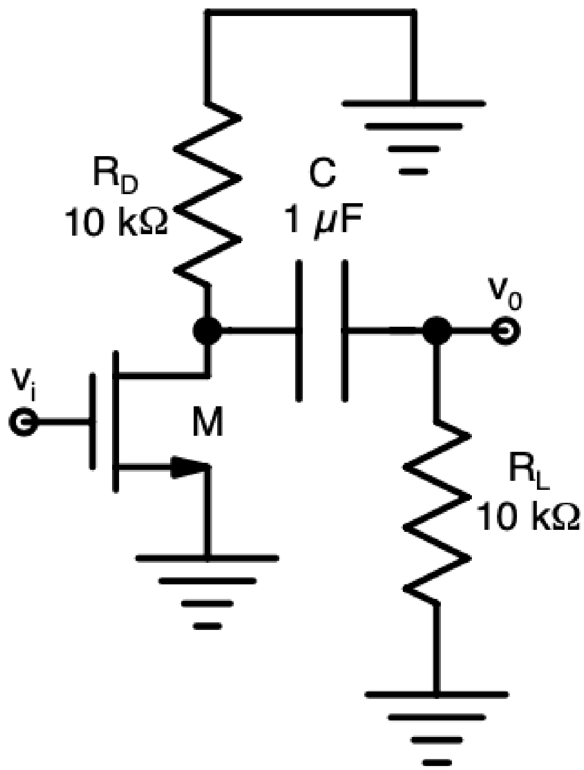


Fig. 12. for q-35

a) 8 b) 32 c) 50 d) 200

(GATE EC 2013)

36) A system is described by the differential equation $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y(t) = x(t)$ Let $(x(t))$ be a rectangular pulse given by $x(t) = \begin{cases} 10, & 0 < t < 2 \\ 0, & \text{otherwise} \end{cases}$
Assuming $(y(0) = 0)$ and $\left(\frac{dy}{dt} = 0\right)$ at $(t = 0)$, the Laplace transform of $(y(t))$ is

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

(GATE EC 2013)

37) A system described by a linear, constant coefficient, ordinary, first order differential equation has an exact solution given by $(y(t))$ for $(t > 0)$, when the forcing function is $(x(t))$ and the initial condition is $(y(0))$. If one wishes to modify the system so that the solution becomes $(-2y(t))$for $(t > 0)$, we need to

a) change the initial condition to -y(0) and the forcing function to 2x($t$)
b) change the initial condition to 2y(0) and the forcing function to -x($t$)
c) change the initial condition to $j\sqrt{2}y(0)$ and the forcing function to $j\sqrt{2}x(t)$
d) change the initial condition to -2y(0) and the forcing function to -2x($t$)

(GATE EC 2013)

38) Consider two identically distributed zero-mean random variables $U$ and $V$. Let the cumulative distribution functions of $U$ and $U$ be $F(x)$ and $G(x)$ respectively. Then, for all values of $x$

a) $F(x) - G(x) \leq 0$
b) $F(x) - G(x) \geq 0$
c) $(F(x) - G(x)) \cdot x \leq 0$
d) $(F(x) - G(x)) \cdot x \geq 0$

(GATE EC 2013)

39) The DFT of a vector $\begin{pmatrix} a & b & c & d \end{pmatrix}$ is the vector $\begin{pmatrix} A & B & Y & \Theta \end{pmatrix}$. Consider the product

$$\begin{pmatrix} p & q & r & s \end{pmatrix} = \begin{pmatrix} a & b & c & d \end{pmatrix} \cdot \begin{pmatrix} a & b & c & d \\ d & a & b & c \\ c & d & a & b \\ b & c & d & a \end{pmatrix}$$

The DFT of the vector $\begin{pmatrix} p & q & r & s \end{pmatrix}$ is a scaled version of

a) $\begin{pmatrix} \alpha^2 & \beta^2 & \gamma^2 & \delta^2 \end{pmatrix}$
b) $\begin{pmatrix} \alpha+\beta & \beta+\delta & \delta+\gamma & \gamma+\alpha \end{pmatrix}$
c) $\begin{pmatrix} \sqrt{\alpha} & \sqrt{\beta} & \sqrt{\gamma} & \sqrt{\delta} \end{pmatrix}$
d) $\begin{pmatrix} \alpha & \beta & \gamma & \delta \end{pmatrix}$

(GATE EC 2013)

40) The signal flow graph for a system is given below in *Fig*. 13. The transfer function $\left(\frac{Y(s)}{U(s)}\right)$ for this system is

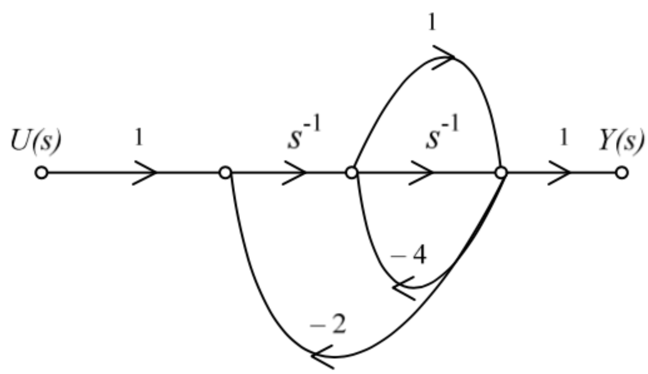


Fig. 13. for q-40

a) $\frac{1}{s^2+6s+2}$
b) $\frac{1}{5s^2+6s+2}$
c) $\frac{s+1}{s^2+6s+2}$
d) $\frac{s+1}{5s^2+6s+2}$

(GATE EC 2013)

41) In the circuit shown below in *Fig*. 14 the op-amps are ideal. Then $V_{\text{out}}$ in Volts is

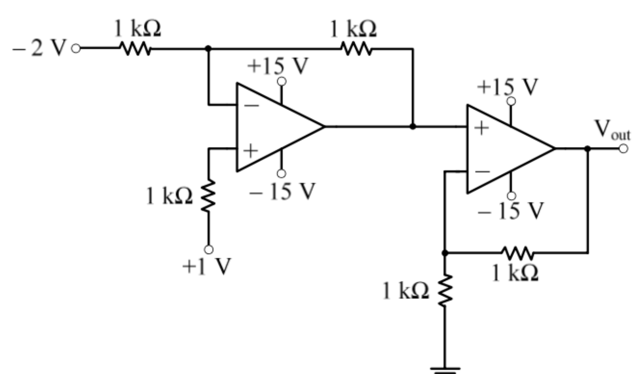


Fig. 14. for q-41

a) 4 b) 6 c) 8 d) 10

(GATE EC 2013)

42) In the circuit shown below in *Fig*. 15, $Q1$ has negligible collector-to-emitter saturation voltage and the diode drops negligible voltage across it under forward bias. If $V_{cc}$ is $+5V$,$X$ and $Y$ are digital signals with $0V$ as logic 0 and $V_{cc}$ as logic 1, then the Boolean expression for $Z$ is

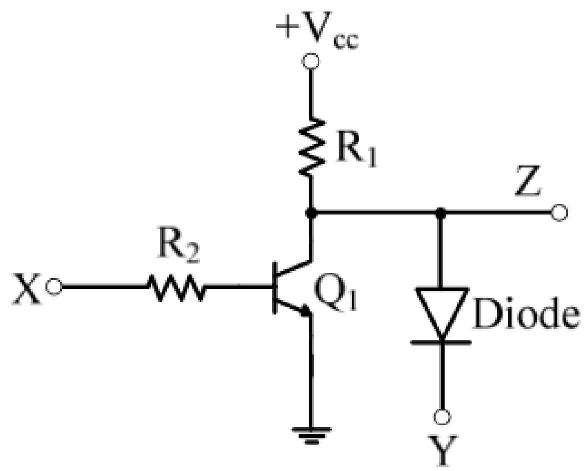


Fig. 15. for q-42

a) $XY$ b) $\overline{XY}$ c) $X+Y$ d) $\overline{X+Y}$

(GATE EC 2013)

43) A voltage $1000\sin\omega t$ Volts is applied across $YZ$. Assuming ideal diodes, the voltage measured across $WX$ in Volts is

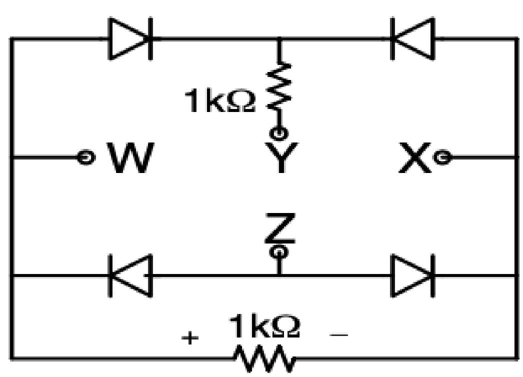


Fig. 16. for q-43

a) $\sin\omega t$
b) $\left(\frac{\sin\omega t+|\sin\omega t|}{2}\right)$
c) $\left(\frac{\sin\omega t-|\sin\omega t|}{2}\right)$
d) 0 for all $t$

(GATE EC 2013)

44) Three capacitors $C_1$, $C_2$ and $C_3$ whose values are 10 $\mu$F, 5 $\mu$F, and 2 $\mu$F respectively, have breakdown voltages of $10V$, $5V$, and $2V$ respectively. For the interconnection shown below, the maximum safe

voltage in Volts that can be applied across the combination, and the corresponding total charge in $\mu$C stored in the effective capacitance across the terminals are respectively

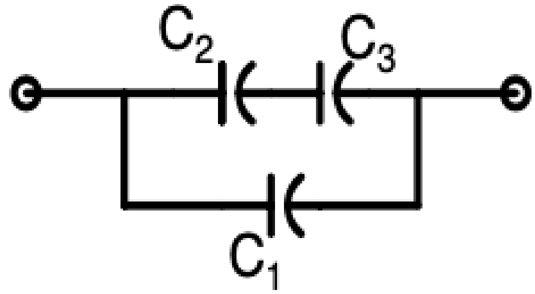


Fig. 17. for q-44

a) 2.8 and 36
b) 7 and 119
c) 2.8 and 32
d) 7 and 80

(GATE EC 2013)

45) There are four chips each of 1024 bytes connected to a $16-bit$ address bus as shown in the $Fig$. 18 below. RAMs 1, 2, 3 and 4 respectively are mapped to addresses

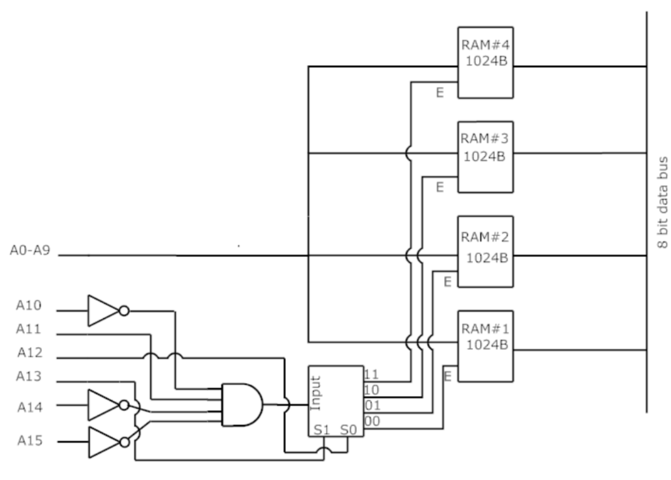


Fig. 18. for q-45

a) 0C00Hâ0FFFH, 1C00Hâ1FFFH, 2C00Hâ2FFFH, 3C00Hâ3FFFH
b) 1800Hâ1FFFH, 2800Hâ2FFFH, 3800Hâ3FFFH, 4800Hâ4FFFH
c) 0500Hâ08FFH, 1500Hâ18FFH, 3500Hâ38FFH, 5500Hâ58FFH
d) 0800Hâ0BFFH, 1800Hâ1BFFH, 2800Hâ2BFFH, 3800Hâ3BFFH

(GATE EC 2013)

46) In the circuit shown below in $Fig$. 19, the silicon npn transistor $Q$ has a very high value of $\beta$. The required value of $R_2$ in $k\Omega$ to produce $I_C = 1$ mA is

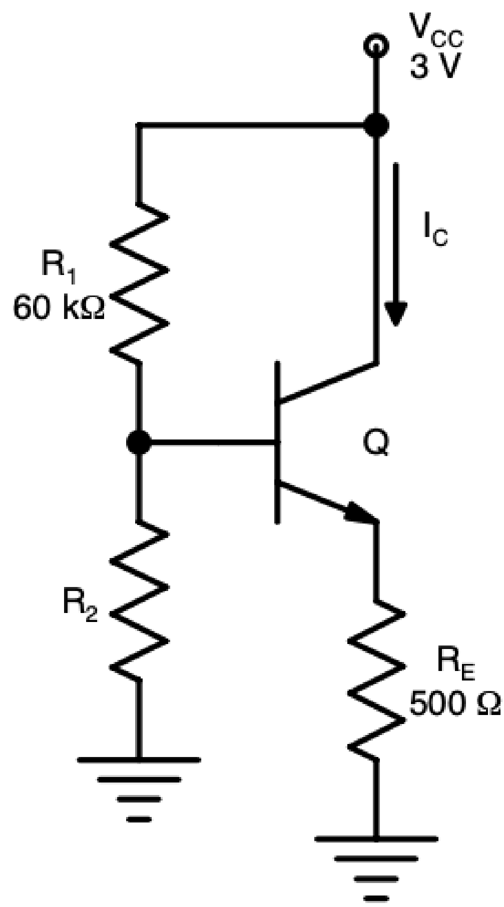


Fig. 19. for q-46

a) 20 b) 30 c) 40 d) 50

(GATE EC 2013)

47) Let $U$ and $V$ be two independent and identically distributed random variables such that $P(U = +1) = P(U = -1) = \frac{1}{2}$. The entropy $H(U + V)$ in bits is

a) $\frac{3}{4}$ b) 1 c) $\frac{3}{2}$ d) $\log_2 3$

(GATE EC 2013)

Common data for q-48 and q-49
Bits 1 and 0 are transmitted with equal probability. At the receiver, the pdf of the respective received signals for both bits are as shown below in $Fig$. 20.

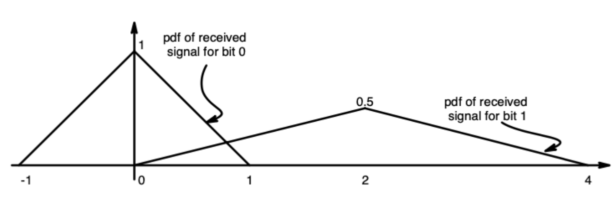


Fig. 20. for q-48 and 49

48) If the detection threshold is 1, the BER will be

a) $\frac{1}{2}$ b) $\frac{1}{4}$ c) $\frac{1}{8}$ d) $\frac{1}{16}$

(GATE EC 2013)

49) The optimum threshold to achieve minimum bit error rate ($BER$) is

a) $\frac{1}{2}$ b) $\frac{4}{5}$ c) 1 d) $\frac{3}{2}$

(GATE EC 2013)

Common data for q-50 and q-51
Consider the following $Fig$. 21.

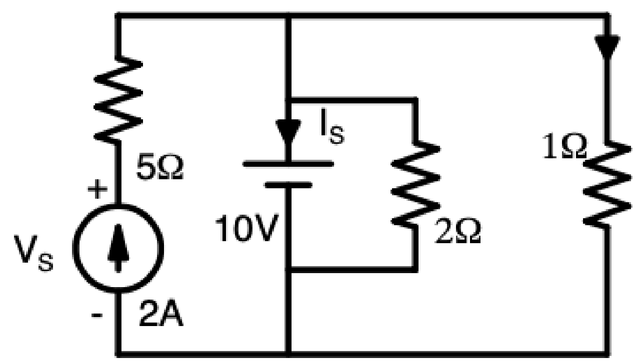


Fig. 21. for q-50 and 51

50) The current $I_s$ in Amps in the voltage source, and voltage $V_s$ in Volts across the current source respectively, are

a) $13, -20$ b) $8, -10$ c) $-8, 20$ d) $-13, 20$

(GATE EC 2013)

51) The current in the $1\Omega$ resistor in Amps is

a) 2 b) 3.33 c) 10 d) 12

(GATE EC 2013)

Common data for q52 and q53
A monochromatic plane wave of wavelength $\lambda = 600\mu m$ is propagating in the direction as shown in the $Fig$. 22 below. $\mathbf{E_i}$ , $\mathbf{E_r}$ , and $\mathbf{E_t}$ denote incident, reflected, and transmitted electric field vectors associated with the wave.

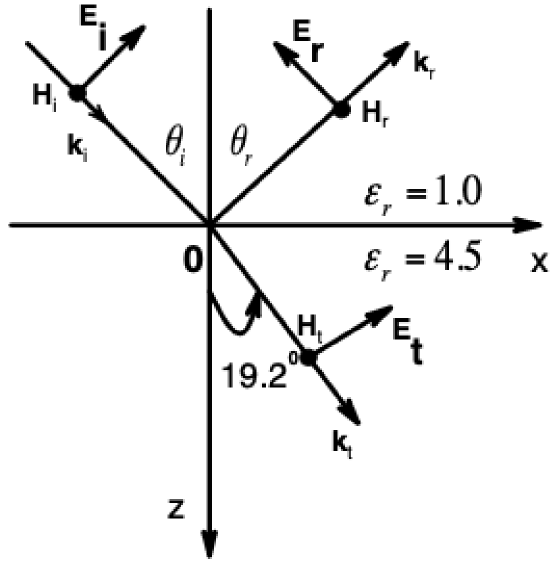


Fig. 22. for q-52 and 53

52) The angle of incidence $\theta_i$ and the expression for $\mathbf{E_i}$ is

a) $60^\circ$ and $\frac{E_o}{\sqrt{2}}(\hat{a}_x - \hat{a}_z)\, e^{-j\frac{\pi\times10^4(x+z)}{3\sqrt{2}}}\, V/m$

b) $45^\circ$ and $\frac{E_o}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)\, e^{-j\frac{\pi\times10^4 z}{3\sqrt{2}}}\, V/m$

c) $45^\circ$ and $\frac{E_o}{\sqrt{2}}(\hat{a}_x - \hat{a}_z)\, e^{-j\frac{\pi\times10^4(x+z)}{3\sqrt{2}}}\, V/m$

d) $60^\circ$ and $\frac{E_o}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)\, e^{-j\frac{\pi\times10^4 z}{3\sqrt{2}}}\, V/m$

53) The expression for $\mathbf{E_r}$ is

a) $0.23\frac{E_o}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)\, e^{-j\frac{\pi\times10^4(x-z)}{3\sqrt{2}}}$

b) $-\frac{E_o}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)\, e^{-j\frac{\pi\times10^4 z}{3\sqrt{2}}}$

c) $0.44\frac{E_o}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)\, e^{-j\frac{\pi\times10^4(x-z)}{3\sqrt{2}}}$

d) $\frac{E_o}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)\, e^{-j\frac{\pi\times10^4(x+z)}{3\sqrt{2}}}$

Common Data for q-54 and q-55

The state diagram of a system is shown below in $Fig$. 23. A system is described by the state-variable equations

$$\dot{X} = AX + Bu; \qquad y = CX + Du$$

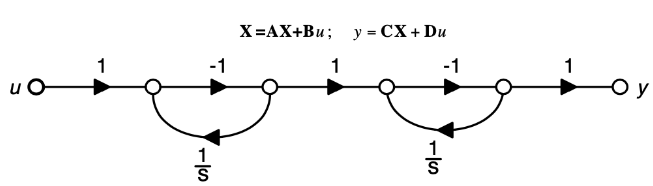


Fig. 23. for q-54 and 55

54) The state-variable equations of the system shown in the figure above are

a) $\dot{X} = \begin{pmatrix} -1 & 0 \\ 1 & -1 \end{pmatrix} X + \begin{pmatrix} -1 \\ 1 \end{pmatrix} u$
y=$\begin{pmatrix} 1 & -1 \end{pmatrix}$X + u

b) $\dot{X} = \begin{pmatrix} -1 & 0 \\ -1 & -1 \end{pmatrix} X + \begin{pmatrix} -1 \\ 1 \end{pmatrix} u$
y=$\begin{pmatrix} -1 & -1 \end{pmatrix}$X + u

c) $\dot{X} = \begin{pmatrix} -1 & 0 \\ -1 & -1 \end{pmatrix} X + \begin{pmatrix} -1 \\ 1 \end{pmatrix} u$
y=$\begin{pmatrix} -1 & -1 \end{pmatrix}$X - u

d) $\dot{X} = \begin{pmatrix} -1 & -1 \\ 0 & -1 \end{pmatrix} X + \begin{pmatrix} -1 \\ 1 \end{pmatrix} u$
y=$\begin{pmatrix} 1 & -1 \end{pmatrix}$X - u

55) The state transition matrix $e^{At}$ of the system shown in the figure above is

a) $\begin{pmatrix} e^{-t} & 0 \\ te^{-t} & e^{-t} \end{pmatrix}$
b) $\begin{pmatrix} e^{-t} & 0 \\ -te^{-t} & e^{-t} \end{pmatrix}$
c) $\begin{pmatrix} e^{-t} & 0 \\ e^{-t} & e^{-t} \end{pmatrix}$
d) $\begin{pmatrix} e^{-t} & -te^{-t} \\ 0 & e^{-t} \end{pmatrix}$

56) Choose the grammatically CORRECT sentence:
a) Two and two add four.
b) Two and two become four.
c) Two and two are four.
d) Two and two make four.

(GATE EC 2013)

57) Statement: You can always give me a ring whenever you need. Which one of the following is the best inference from the above statement?
a) Because I have a nice caller tune.
b) Because I have a better telephone facility.
c) Because a friend in need is a friend indeed.
d) Because you need not pay towards the telephone bills when you give me a ring.

(GATE EC 2013)

58) In the summer of 2012, in New Delhi, the mean temperature of Monday to Wednesday was 41°C and of Tuesday to Thursday was 43°C. If the temperature on Thursday was 15% higher than that of Monday, then the temperature in °C on Thursday was

a) 40
b) 43
c) 46
d) 49

(GATE EC 2013)

59) Complete the sentence: Dare __ mistakes.

a) commit
b) to commit
c) committed
d) committing

(GATE EC 2013)

60) They were requested not to **quarrel** with others. Which one of the following options is the closest in meaning to the word quarrel?

a) make out
b) call out
c) dig out
d) fall out

(GATE EC 2013)

61) A car travels 8 km in the first quarter of an hour, 6 km in the second quarter and 16 km in the third quarter. The average speed of the car in km per hour over the entire journey is

a) 30
b) 36
c) 40
d) 24

(GATE EC 2013)

62) Find the sum to $n$ terms of the series $10 + 84 + 734 + \ldots$

a) $\frac{9(9^n-1)}{10+1}$
b) $\frac{9(9^n-1)}{8+n}$
c) $\frac{9(9^n-1)}{8+n^2}$
d) $\frac{9(9^n-1)}{8}+n^2$

(GATE EC 2013)

63) **Statement:** There were different streams of freedom movements in colonial India carried out by the moderates, liberals, radicals, socialists, and so on. Which one of the following is the best inference from the above statement?
   a) The emergence of nationalism in colonial India led to our Independence.
   b) Nationalism in India emerged in the context of colonialism.
   c) Nationalism in India is homogeneous.
   d) Nationalism in India is heterogeneous.

(GATE EC 2013)

64) The set of values of $p$ for which the roots of the equation $3x^2 + 2x + p(p-1) = 0$ are of opposite sign is
   a) $(-\infty, 0)$
   b) $(0, 1)$
   c) $(1, \infty)$
   d) $(0, \infty)$

(GATE EC 2013)

65) What is the chance that a leap year, selected at random, will contain 53 Saturdays?
   a) $\frac{2}{7}$
   b) $\frac{3}{7}$
   c) $\frac{1}{7}$
   d) $\frac{5}{7}$

(GATE EC 2013)