

**GATE 2020
QUESTION PAPER & ANSWER KEY**

**ELECTRONICS AND COMMUNICATION (EC)
ENGINEERING**

**OHM INSTITUTE FOR ELECTRICAL
AND ELECTRONICS ENGINEERING**



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GATE-2020

Question Paper with Answer Key

Stream: EC

General Ability

1. It is quarter past three in your watch. The angle between the hour hand and minute hand is

(a) 00 (b) 7.50 (c) 150 (d) 22.50

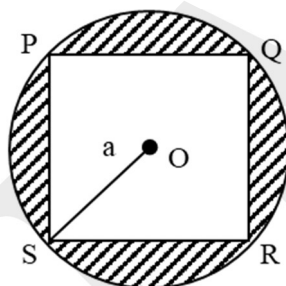
Answer: (b)

2. a, b, c are real numbers. The quadratic equation $ax^2 - bx + c = 0$ has equal roots, which is β , then

(a) $\beta^2 = ac$ (b) $\beta = b/a$ (c) $\beta^3 = bc/(2a)^2$ (d) $b^2 \neq 4ac$

Answer: (No options match with the answer)

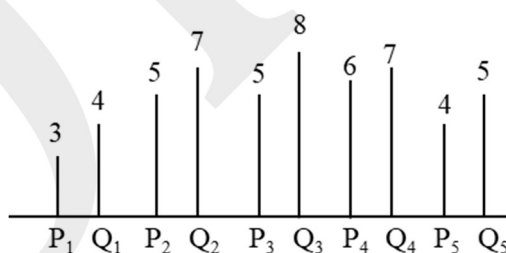
3. A circle with center 'O' is shown in the figure. A rectangle PQRS of maximum possible area is inserted in the circle. If the radius of the circle is a , then the area of the shaded portion is



(a) $\pi a^2 - a^2$ (b) $\pi a^2 - 3a^2$ (c) $\pi a^2 - \sqrt{2}a^2$ (d) $\pi a^2 - 2a^2$

Answer: (d)

4. The following figure shows the data of students enrolled in 5 years (2014 to 2018) for 2 schools P and Q. During this period, the ratio of the number of students enrolled in school P to the average of the difference of the number of students enrolled in school P and Q is _____



(a) 31:23 (b) 8:23 (c) 23:31 (d) 23:8

Answer: (d)

5. He is not only accused of theft _____ of conspiracy.

(a) rather (b) rather than
(c) but even (d) but also

Answer: (d)



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Question Paper with Answer Key

Stream: EC

6. Global financial crisis is considered to be the most serious world-wide financial crisis, which started with subprime lending crisis in USA in 2007. The subprime lending crisis led to the banking crisis in 2008 with the collapse of Lehmann Brothers in 2008. The subprime lending refers to the provision of loans to those borrowers who may have difficulties in repaying loans, and it rises because of excess liquidity following the east Asian crisis.

Which of the following sequences shows the correct precedence as per the given passage?

- (a) banking crisis → subprime lending crisis → global financial crisis → east Asian crisis
- (b) global financial crisis → east Asian crisis → banking crisis → subprime lending crisis
- (c) subprime lending crisis → global financial crisis → banking crisis → east Asian crisis
- (d) east Asian crisis → subprime lending crisis → banking crisis → global financial crisis

Answer: (d)

7. The untimely loss of life is a cause of serious global concern as thousands of people get killed ____ accidents and other die ____ diseases like cancer

- (a) during, from
- (b) in, of
- (c) from, of
- (d) from, from

Answer: (b)

8. Given a super additive function $f(x_1 + x_2) > f(x_1) + f(x_2)$ for $x > 1$, which of the following satisfies the given function?

- (a) e^x
- (b) $\frac{1}{\sqrt{x}}$
- (c) e^{-x}
- (d) $\frac{1}{x}$

Answer: (a)

9. Explicit : Implicit then Express : ?

- (a) Impress
- (b) Supress
- (c) Repress
- (d) Compress

Answer: (b)

10. The Canadian constitution requires equal importance to English and French. Last year air Canada lost a lawsuit and had to pay a six figure fine to French speaking couple after they filed a complaint about formal in-flight announcements in English last in 15 sec as opposed to informal 5 sec message in French.

The French speaking couples were upset at ____.

- (a) The English announcements being long than French once
- (b) The English announcements being clear than French
- (c) Equal importance given to English and French
- (d) The in-flight announcement being made in English

Answer: (a)



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Question Paper with Answer Key

Stream: EC

Electronics and Communication Engineering

1. Consider the following equations,

$$x_1 + 2x_2 = b_1,$$

$$2x_1 + 4x_2 = b_2,$$

$$3x_1 + 7x_2 = b_3,$$

$$3x_1 + 9x_2 = b_4$$

For the above system of equations to have consistent solution, then

(a) $b_2 = 2b_1$ and $6b_1 - 3b_3 + b_4 = 0$

(b) $b_2 = 2b_1$ and $3b_1 - 6b_3 + b_4 = 0$

(c) $b_3 = 2b_1$ and $3b_1 - 6b_3 + b_4 = 0$

(d) $b_3 = 2b_1$ and $6b_1 - 3b_2 + b_4 = 0$

Answer: (a)

2. 1100 represented in sign-magnitude, 1's complement and 2's complement form is P, Q, R respectively then $P + Q + R$ in 2's complement form in 6bits = _____

Answer: 110101

3. X is a random variable which is uniformly distributed in $[-2, 10]$. If $Y = 2X - 6$ is another random variable. Then $P(Y \leq 7 | X \geq 5) =$ _____.

Answer: 0.3

4. In 8085 microprocessor, the number of address lines required to map 16 k byte memory are _____.

Answer: 14

5. If V_1 to V_6 are 6 vectors in R^4 space then which of the following statements is false?

(a) any 4 vectors can form R^4 basis

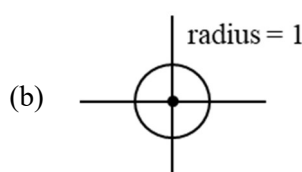
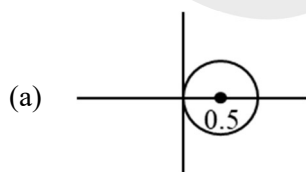
(b) any 4 vectors can span R^4 space

(c) V_1, V_3, V_5, V_6 vectors if they span R^4 then they are basis vectors

(d) V_1 to V_6 vectors are not linearly independent

Answer: (a)

6. A transmission line is terminated by a load of impedance $Z = jX$ where $X = [-\infty, \infty]$, the smith chart for the given load is



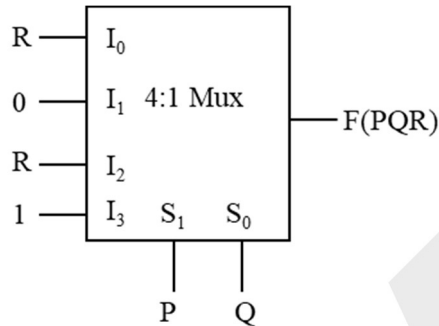
(c) a straight line

(d) a point at origin

Answer: (b)



7. For the digital circuit shown below



$F(PQR) = \underline{\hspace{2cm}}$

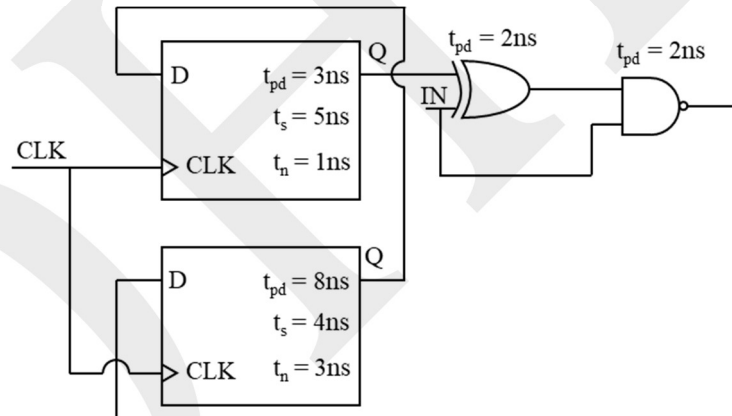
- (a) $PQ + \bar{Q}R$ (b) $\bar{Q} + PR$ (c) $P\bar{Q}R + \bar{P}Q$ (d) $P + Q\bar{R}$

Answer: (a)

8. Magnetic field of a uniform plane wave in vacuum is $H = (\hat{a}_x + 2\hat{a}_y + b\hat{a}_z)\cos(\omega t + 3x - y - z)$ then $b = \underline{\hspace{2cm}}$.

Answer: 1

9. Consider the digital circuit shown below



t_{pd} = propagation delay

t_s = setup time t_h = hold time

The maximum frequency at which the above counter is operated is _____ MHz. [rounded off to nearest integer]

Answer: 76

10. A 50Ω transmission line of length $3\lambda/4$ is terminated by a load of 400Ω , Z_{in} (input impedance) of the transmission line is _____ Ω .

Answer: 6.25



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11. Characteristic equation for a differential equation is $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0$, the solution for the differential equation is _____.

- (a) $(C_1 + C_2x)e^{3x}$ (b) $(C_1 + C_2x)e^{-3x}$ (c) $C_1e^{3x} + C_2e^{-3x}$ (d) C_1e^{3x}

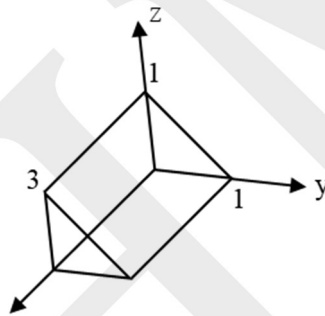
Answer: (a)

12. A function $f(x, y, z) = e^{1-x\cos y} + xze^{-\frac{1}{1+y^2}}$ then $\frac{\partial f}{\partial x}(1, 0, e) =$ _____.

- (a) $1/e$ (b) 1 (c) 0 (d) -1

Answer: (c)

13. $\iiint x \, dx \, dy \, dz =$ _____; where v is the volume enclosed by the following region



Answer: 2.25

14. A 10-bit DAC has range of 0 to 10 V. If input is 13A H then output = _____ V.

Answer: 3.0694

15. Which of the following statements is false?

- (a) If \vec{A} is irrotational, $\nabla^2 A = 0$ (b) If \vec{A} is solenoidal, $\vec{\nabla} \cdot \vec{A} = 0$
(c) $\nabla \times (\nabla \times A) = \nabla(\nabla \cdot A) - \nabla^2 A$ (d) $\vec{\nabla} \times \vec{A}$ is vector field

Answer: (a)

16. The outcome of a fair coin being tossed is 0 or 1. M and N are first and second outcomes of the coin tossed twice and $X = \min(M, N)$ then expectation of X is $E(X) =$ _____.

Answer: 0.25

17. The open-loop transfer function of a feedback system is $G(s)H(s) = \frac{k(s+11)}{s(s+2)(s+8)}$. The value of 'k' for marginally stable is _____.

Answer: 160

OUR CORE TEAM



B SURENDRA REDDY

Education

M.Tech in Power Electronics from IIT-BOMBAY

Experience/Achievements

- 8 years of experience in GATE|ESE|PSUs coaching
- AIR 82 in GATE-2010
- Worked as faculty in ACE Engineering academy, TIME and VEDA
- Worked as Asst Professor in GITAM Univ, Hyd
- Worked as Field Engineer in GE Industries Ltd

Subjects taught

- **Electrical Machines**

GOUTHAM

Education

- **B.Tech (ECE) from IIIT, Hyd**
- **M.Tech (Microelectronics & VLSI) from IIT-Madras**

Experience/Achievements

- 5 years of experience in GATE|ESE|PSUs coaching
- Worked as faculty in ACE Engineering academy
- Rank 18 in GATE 2012
- Worked as RFIC Design engineer in QUALCOMM, Hyderabad
- Worked as Analog Design Engineer at TEXAS Instruments, Bangalore

Subjects taught

- **Analog Electronics, EDC, VLSI, Network theory (Circuit Theory)**



KNS HEMANTH

Education

- **Integrated Masters from BITS PILANI**

Experience/Achievements

- 4 years of experience in GATE|ESE|PSUs coaching
- All India 4th ranker in UPSC ESE 2015(IES)
- AP Transco-2017 5th Ranker
- All India 4th (Airforce) ranker in UPSC CDS(I) 2013
- All India 6th (Army) ranker in UPSC CDS(I) 2013
- Worked as faculty in ACE Engineering Academy for GATE|ESE|PSUs
- Worked as Management Trainee in Steel Authority of India Ltd (SAIL)
- Worked in ST-Ericson in DFT (Design for Testability)

Subjects taught

- **Digital Electronics, EMFT**

MY

Education

- **B.E (Hons) from BITS-Pilani**

Experience/Achievements

- 4 years of experience in GATE|ESE|PSUs coaching
- Worked as faculty in leading GATE institutes across India
- AIR1 in ESE
- AIR26 in GATE
- Industry experience in commissioning large scale Instrumentation projects
- Expert in latest Telecommunication technologies

Subjects taught

- **Signals and Systems, Communication Systems and Measurements**

BNSS SHANKAR

Education

**M.Tech in Electrical Engineering
from IIT-Kanpur**

Experience/Achievements

- 11 years of experience in GATE|ESE|PSUs coaching
- Worked as Technologist in General Electric, Hyd
- Six-sigma certified on quality control in GE
- Worked as faculty in ACE Engineering academy, Gate forum, TIME, Saimeedha across India.

Subjects taught

- **Power Electronics**
- **Control Systems**



JY GIRI

Education

**M.Tech in Electrical Engineering
from IIT-Kanpur**

Experience/Achievements

- 10 years of experience in GATE|ESE|PSUs coaching
- Worked as faculty in ACE Engineering academy, Gate forum
- Rank 1 in APCPDCL 2010
- GATE AIR 110
- Worked as Asst professor in Kalinga university
- Worked as AE in APCPDCL
- Worked as R & D Engg in ABB

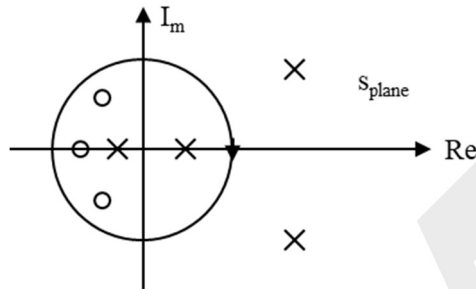
Subjects taught

- **Power Systems**





18. Pole-zero plot of $G(s)$ is shown in the figure. Closed contour Γ is mapped into $G(s)$ plane, mapping in circles



- (a) point $(-1 + j0)$ of $G(s)$ once in CW (b) point $(-1 + j0)$ of $G(s)$ once in CCW
(c) origin of $G(s)$ once in CW (d) origin of $G(s)$ once in CCW

Answer: (c)

19. Characteristic equation of a control system is given by $s^3 + 3s^2 + (k + 2)s + 3k = 0$. In the Root locus plot, as K varies from 0 to ∞ , breakaway/break in point lies within

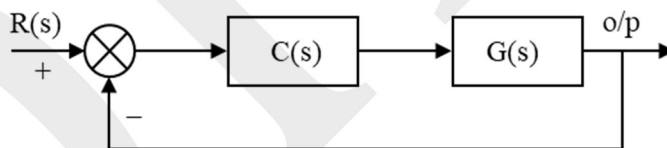
- (a) $(-2, -1)$ (b) $-\infty, -3$ (c) $(-1, 0)$ (d) $(-3, -2)$

Answer: (c)

20. If $G(s) = \frac{1}{(s+1)(s+a)}$; $a > 0$. The given input is $5 \cos 3t$ and output is $\frac{1}{\sqrt{10}} \cos[3t - 1.892]$. Then the value of 'a' is _____.

Answer: 4

21. Consider the control system shown in figure.



$G(s) = \frac{1}{s(s+1)}$; $C(s) = \frac{K(s+1)}{s+3}$ and steady-state error (e_{ss}) for ramp input is 0.1. The value of K is _____.

Answer: 30

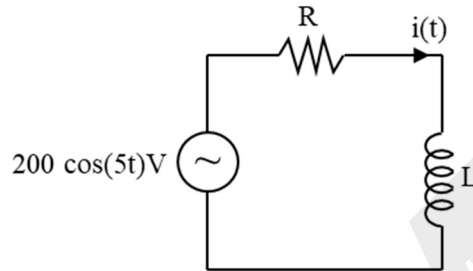
22. If $\frac{dy}{dx} = (y-1)x$ has 2 solutions, then the solutions are

- (a) $\ln|y-1| = 2x^2 + c, y = 1$ (b) $\ln|y-1| = \frac{1}{2}x^2 + c, y = -1$
(c) $\ln|y-1| = 2x^2 + c, y = -1$ (d) $\ln|y-1| = \frac{1}{2}x^2 + c, y = 1$

Answer: (d)

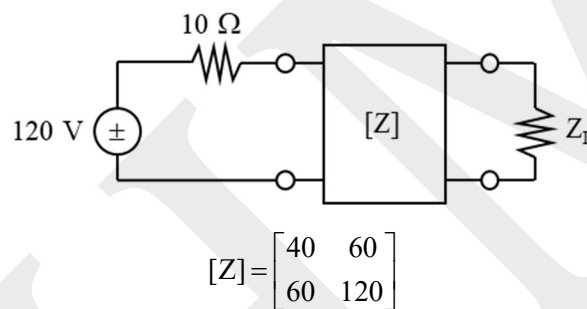


23. The current in the R-L series circuit is $i(t) = 10 \cos(5t - \frac{\pi}{4})$ A. A value of L is _____ H.



Answer: 2.83

- 24.



Value of Z_L for which maximum power is delivered to load is _____ Ω

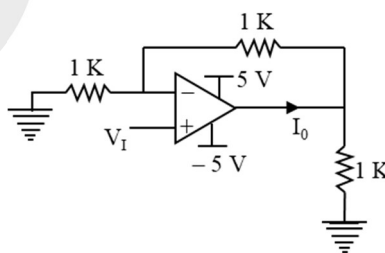
Answer: 48

25. A single crystal intrinsic semiconductor is at R.T with effective density of states for holes twice of states for electrons $V_T = 26$ mV. Intrinsic fermi level is shifted from mid gap energy level by

(a) 9.01 meV (b) 26.90 meV (c) 18.02 meV (d) 13.45 meV

Answer: (a)

- 26.

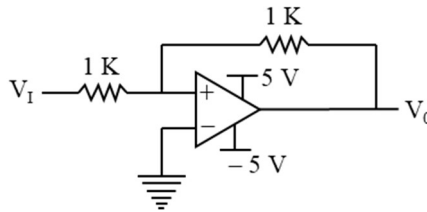


$V_I = 2V$, $I_0 =$ _____ mA.

Answer: 6



27.

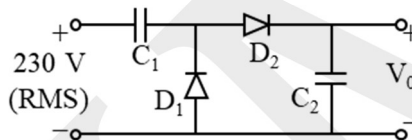


If $V_I = 1 \text{ V} \sin(\omega t)$, then V_O is _____

- (a) a constant of either +5V or -5V (b) $2 \text{ V} \sin(\omega t)$
(c) $-1 \text{ V} \sin(\omega t)$ (d) square wave of 5V amplifier

Answer: (a)

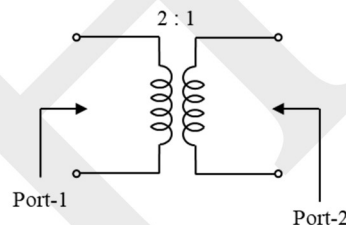
28.



Magnitude of steady state output V_O is _____ V

Answer: 650.44 V

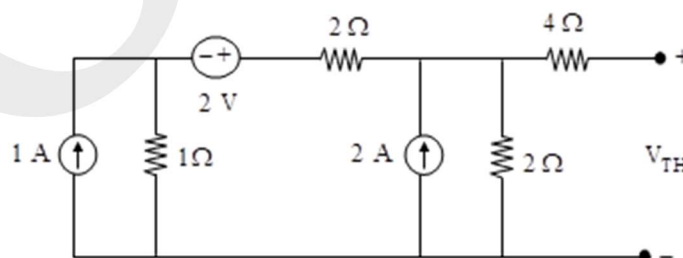
29.



For the above 2-port network consisting of an ideal lossless transformer, parameter S_{21} for a reference impedance of 10Ω is _____ (2 decimals).

Answer: (0.8)

30. In the circuit shown below, Thevenin's voltage V_{TH} is

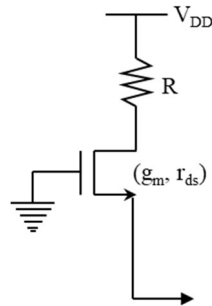


- (a) 2.8 V (b) 2.4 V (c) 4.5 V (d) 3.6 V

Answer: (d)



31.

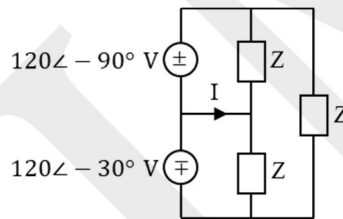


Find Norton equivalent resistance of the circuit looking into source.

- (a) $\frac{r_{ds} + R}{1 + g_m r_{ds}}$ (b) $r_{ds} + R$ (c) $r_{ds} + R + \frac{1}{g_m}$ (d) $r_{ds} + R + g_m r_{ds} R$

Answer: (a)

32.



$Z = 80 - j35 \Omega$, Find I

- (a) $2.38 \angle 143.63^\circ \text{ A}$ (b) $2.38 \angle -23.63^\circ \text{ A}$
(c) 0 A (d) $2.38 \angle -96.37^\circ \text{ A}$

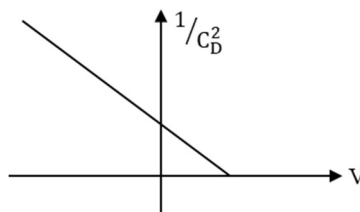
Answer: (a)

33. A PN junction solar cell area 1 cm^2 illuminated uniformly with 100 mW cm^{-2} has the following parameters : efficiency = 15%, open circuit voltage = 0.7V, tilt factor = 0.8 and thickness = $200 \mu\text{m}$ average optical generation rate (in $\text{cm}^{-3} \text{ s}^{-1}$) is

- (a) 83.60×10^{19} (b) 5.57×10^{19} (c) 0.84×10^{19} (d) 1.04×10^{19}

Answer: (c)

34. For a one sided abrupt PN junction depletion capacitance C_D is 50 PF at a reverse bias of 0.2 V. Slope of the plot between $\frac{1}{C_D^2}$ and applied voltage V is $____ \times 10^{20} \text{ F}^{-2} \text{ V}^{-1}$.

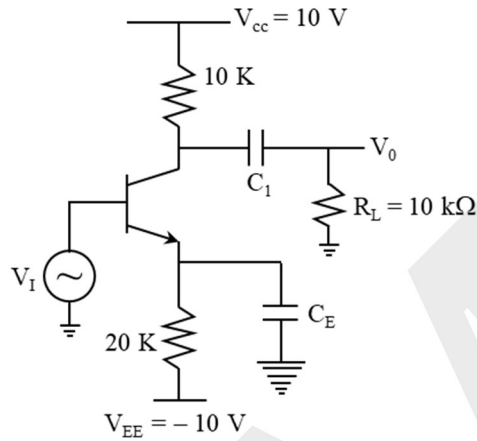


- (a) -5.7 (b) -1.2 (c) -3.8 (d) -0.4

Answer: Data Insufficient



35.



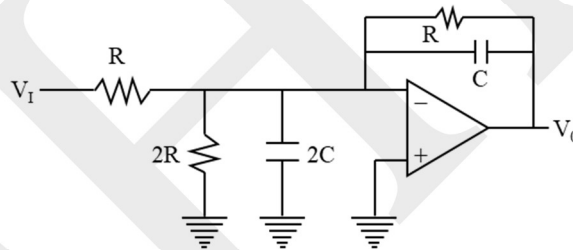
$V_{on} = 0.7 \text{ V}$, $\beta \rightarrow \infty$, $r_0 \rightarrow \infty$

Capacitors behave as S.C at the signal frequency. Find V_O/V_I .

- (a) -128.21 (b) -178.85 (c) -256.42 (d) -89.42

Answer: (d)

36.



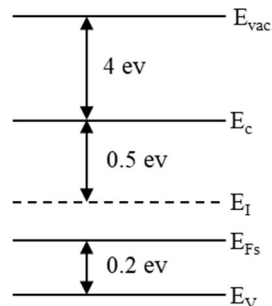
$R = 2 \text{ k}\Omega$; $C = 1 \text{ }\mu\text{F}$

3dB frequency of the circuit is _____ Hz.

- (a) 59.68 (b) 79.58 (c) 34.46 (d) 17.92

Answer: (b)

37. A MOS capacitor is fabricated on a p-type substrate and its band diagram is shown below.





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$$E_g = 1 \text{ eV}; V_{TH} = -0.16 \text{ V}$$

$$C_{ox} = 100 \text{ nF/cm}^2$$

$$\phi_m = 3.87 \text{ eV}$$

No charge within the oxide. If voltage across the cap is V_{TH} , magnitude of depletion charge per unit area (in C/cm^2) is

(a) 1.7×10^{-8}

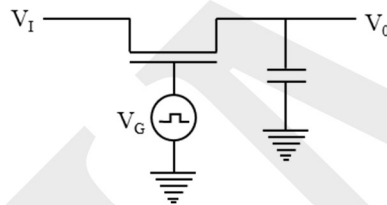
(b) 1.41×10^{-8}

(c) 0.93×10^{-8}

(d) 0.52×10^{-8}

Answer: (a)

38.



$V_{TH} = 3 \text{ V}$, $V_{SUB} = -10 \text{ V}$, $V_I : (-10 \text{ V}, +10 \text{ V})$ minimum and maximum values of V_a for proper sampling and holding respectively are

(a) 10 V and -10 V

(b) 3 V and -3 V

(c) -3 V and -3 V

(d) 13 V and -7 V

Answer: (d)

39. If the input-output relation for a system with input $x(n)$ and output $y(n)$ is given by $y[n] = \max |x[k]|$, where $-\infty \leq k \leq n$

The unit impulse response of the system is _____

(a) $u(n)$

(b) $\delta(n)$

(c) 1 for all n

(d) 0 for all n

Answer: (a)

40. A digital communication system is used to transmit a block of N bits, the probability of a signal bit error is given by α . The block of N bits is received as error if at least 1-bit error occurs. The probability of error in transmission is _____

(a) $1 - (1 - \alpha)^N$

(b) $1 - \alpha^N$

(c) α^N

(d) $N(1 - \alpha)$

Answer: (a)

UPCOMING BATCHES

Date of Commencement	Batch Name	Branch	Duration	Fee
27-Mar-2020	LTGEC-1	ECE	6 Months	45,999/- 36,999/-
25-Apr-2020	LTGEC-2	ECE	6 Months	45,999/-
10-May-2020	LTGEC-3	ECE	6 Months	45,999/-
24-May-2020	LTGEC-4	ECE	6 Months	45,999/-
7-Jun-2020	LTGEC-5	ECE	6 Months	45,999/-

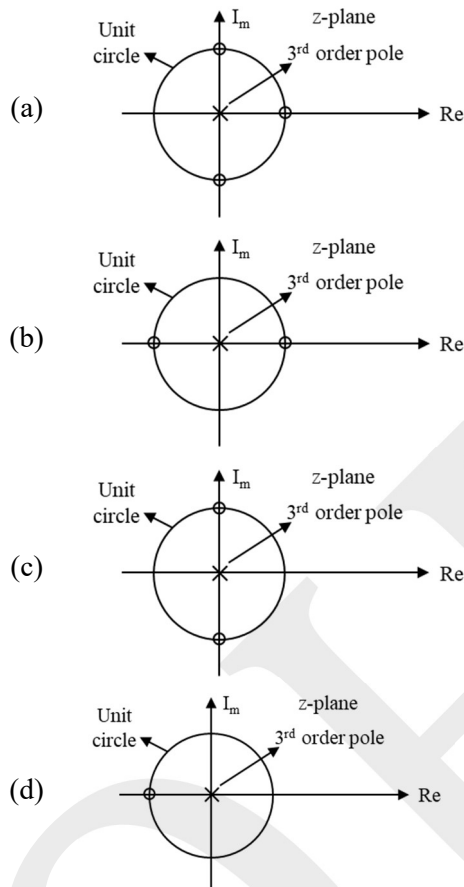
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41. Pole zero plot of the transfer function of a system with input $x[n]$ and output $y[n]$ related by the input-output equation

$$y[n] = \sum_{k=0}^3 (-1)^k x[n-k] \text{ Will be}$$



Answer:(a)

42. Let a random variable Y be defined as

$$Y = \int_{-\infty}^{+\infty} w(t)\phi(t)dt$$

Where $\phi(t) = 1 \quad 5 \leq t \leq 7$

$\phi(t) = 0$ otherwise

Where $w(t)$ is a real white gaussian noise process with 2-sided power spectral density $S_w(f) = 3$ Watts/Hz. The variance of random variable Y is ____

Answer: 6

43. Consider a binary random variable X which can take values $+2$ or -2 . If probability $P(X = +2) = \alpha$. The value of α for which entropy of X is maximum is ____

Answer: 0.5



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44. In a digital communication system, four symbols S_1, S_2, S_3, S_4 are transmitted. The symbol values are $S_1=-3, S_2=-1, S_3=+1$ and $S_4=+2$. If the receiver receives $Y=S+W$ where W is zero mean, unit variance, gaussian random variable. If P_i is the conditional probability of symbol error for ML decoding when $S=S_i$, then the value of i for which conditional symbol probability of error is highest is ____

Answer: 3

45. For a message signal $m(t)$, phase and frequency modulated waveforms are given by,

$$S_{PM}(t) = \cos(1000\pi t + k_p m(t))$$

$$S_{FM}(t) = \cos(1000\pi t + k_f \int_{-\infty}^{+\infty} m(\tau) d\tau)$$

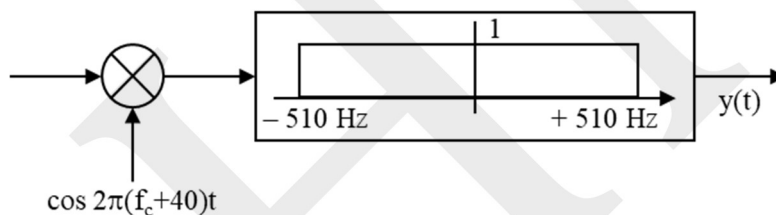
If the highest instantaneous frequency of S_{PM} and S_{FM} are same, then $\frac{k_p}{k_f} = \underline{\hspace{2cm}}$

Answer: 2

46. Consider

$$x(t) = m(t) \cos(2\pi f_c t)$$

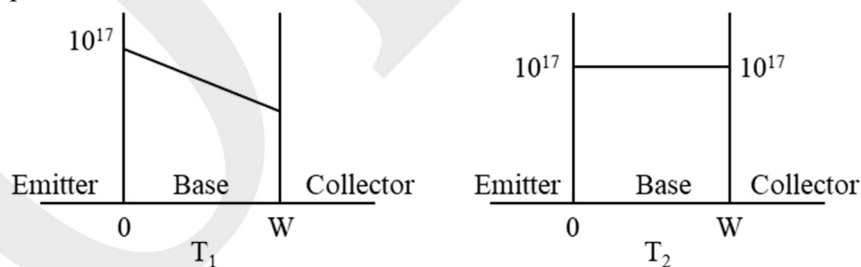
The output $y(t)$ of the block given below is ____



- (a) $\cos(1000\pi t)$ (b) $\cos(920\pi t)$ (c) $\cos(460\pi t)$ (d) $\cos(540\pi t)$

Answer: (b)

47. Concentration profile for two NPN transistors is shown below.



Common emitter current gain of T_2 is ____

- (a) Approximately 0.7 time of T_1
(b) Approximately 2.0 time of T_1
(c) Approximately 0.3 time of T_1
(d) Approximately 2.5 time of T_1

Answer: (either a or c) (will update)



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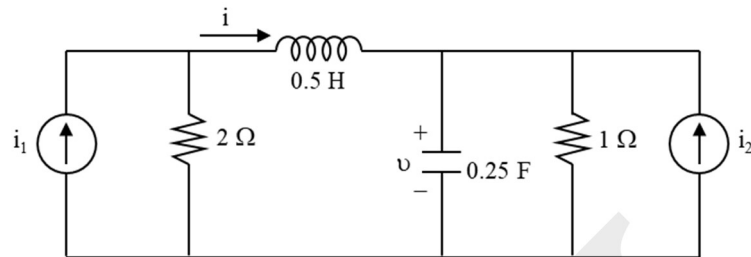
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48.

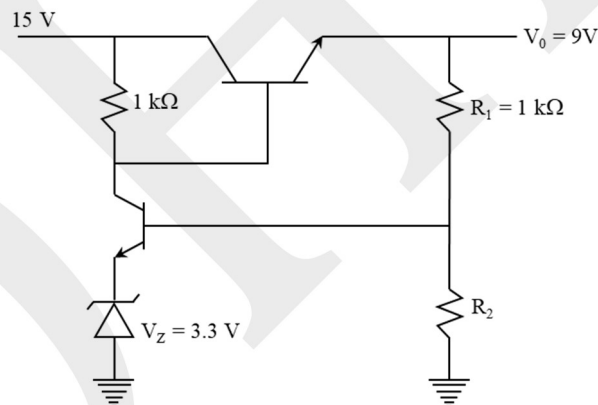


Which is the correct state equation for the above circuit?

- (a) $\frac{d}{dt} \begin{bmatrix} v \\ i \end{bmatrix} = \begin{bmatrix} 4 & -4 \\ -2 & -4 \end{bmatrix} \begin{bmatrix} v \\ i \end{bmatrix} + \begin{bmatrix} 0 & 4 \\ 4 & 4 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$
- (b) $\frac{d}{dt} \begin{bmatrix} v \\ i \end{bmatrix} = \begin{bmatrix} -4 & 4 \\ -2 & -4 \end{bmatrix} \begin{bmatrix} v \\ i \end{bmatrix} + \begin{bmatrix} 0 & 4 \\ 4 & 0 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$
- (c) $\frac{d}{dt} \begin{bmatrix} v \\ i \end{bmatrix} = \begin{bmatrix} -4 & -4 \\ -2 & 4 \end{bmatrix} \begin{bmatrix} v \\ i \end{bmatrix} + \begin{bmatrix} 4 & 4 \\ 4 & 0 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$
- (d) $\frac{d}{dt} \begin{bmatrix} v \\ i \end{bmatrix} = \begin{bmatrix} -4 & -4 \\ -2 & -4 \end{bmatrix} \begin{bmatrix} v \\ i \end{bmatrix} + \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$

Answer: (b)

49. For the voltage regulator shown below, if β of each transistor is large and $V_{on} = 0.7$ V, then $R_2 = \underline{\hspace{1cm}} \Omega$



Answer: 800

50. $X(t) = \cos(200\pi t)$ is sampled for $t = \frac{n}{400}$ where $n = 0, 1, 2, 3, 4, 5, 6, 7$

Consider the DFT $X(k)$ where

$$X(k) = \sum_{n=0}^7 x(n) e^{-j\frac{\pi}{2}nk}$$

Then which of the following statements is true?

- (a) $X(k)$ is non-zero for all k (b) $X(4)$ is non-zero
- (c) $X(2)$ and $X(6)$ are non-zero (d) $X(3)$ and $X(5)$ are non-zero

Answer: (c)



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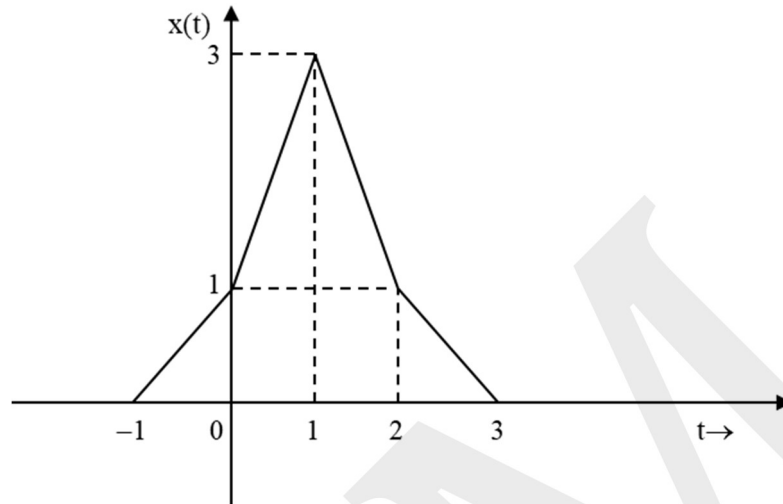
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Stream: EC

51. Consider $X(\omega)$ to be the Fourier transform of $x(t)$ given by



Then $\int_{-\infty}^{+\infty} |X(\omega)|^2 d\omega$ is ____

Answer: 58.64

52. The transfer function of a stable discrete time LTI system is

$$H(z) = \frac{K(z - \alpha)}{z + 0.5}, \text{ where } K \text{ and } \alpha \text{ are real numbers.}$$

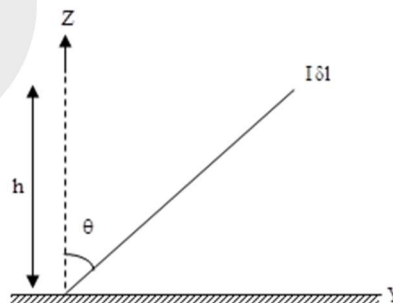
The value of α with $|\alpha| > 1$ for which magnitude of system is constant for all frequencies is ____

Answer: -2

53. For an infinitely small dipole in free space the electric field in the far field is proportional to

$$\left(\frac{e^{-jkr}}{r} \right) \sin \theta, \text{ where } k = \frac{2\pi}{\lambda}. \text{ A vertical infinitesimally small electric dipole } (|\delta l| \ll \lambda) \text{ is placed at a}$$

distance h ($h > 0$) above an infinite ideal conduction plane as shown in figure. The minimum value of h for which one of the maxima in the far field radiation pattern occurs at $\theta = 60^\circ$ is ____



(a) λ

(b) 2λ

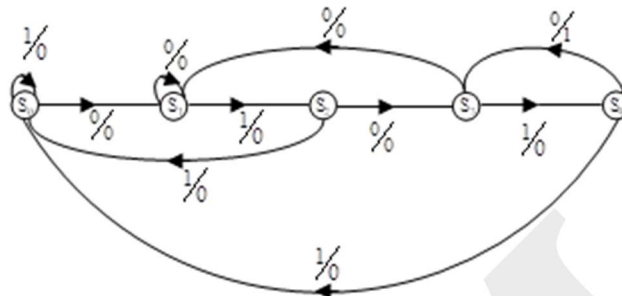
(c) $\lambda/4$

(d) $\lambda/2$

Answer: (d)



54. For the FSM shown below, the input pattern for which output is 1 is _____



(a) 01010

(b) 0101

(c) 10101

(d) 1010

Answer: (a)

55. Consider the recombination process via bulk traps in a forward biased PN homojunction diode. The maximum recombination rate is U_{\max} . If the e^- and hole capture cross-sections are equal, which one of the following is false

(a) U_{\max} occurs at the edges of the depletion region

(b) with all parameters unchanged U_{\max} increases if the thermal velocity of the carrier increases.

(c) U_{\max} decreases if the intrinsic carrier density is reduced

(d) U_{\max} depends exponentially on applied bias

Answer: (c)

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