VANI INSTITUTE GATE/IES
HYDERABAD * BANGALORE * PUNE * CHENNAI * KOCHI * KOLKATA

GATE 2015 EXAMINATION

ELECTRONICS AND COMMUNICATION ENGINEERING

Section Name: General Aptitude

01. Choose the appropriate word/Phrase, Out of the four Options given bellow, to complete the following sentence

Frogs_____

(A) Croak (B) Roar (C) Hiss (D) Patter

Ans : A

02. If $\log_x(5/7) = -1/3$, then the value of x is

(A) 343/125 (B) 125/343 (C) – 25/49 (D) – 49/25

Ans : A

03. Operators $\square$, $\lozenge$ and $\rightarrow$ are defined by : $a \square b = \frac{a-b}{a+b}$; $a \lozenge b = \frac{a+b}{a-b}$; $a \rightarrow b = ab$. Find the value of $(66 \square 6) \rightarrow (66 \lozenge 6)$.

(A) – 2 (B) –1 (C) 1 (D) 2

Ans :C

04. Choose the word most similar in meaning to the given word:

Educe

(A) Exert (B) Educate (C) Extract (D) Extend

Ans : C

05. Choose the most appropriate word from the option given below to complete the following Sentence.

The principle presented the chief guest with a _____ as token of appreciation

(A) Momento (B) Memento (C) Momentum (D) Moment

Ans : B

06. The following question presents a sentence, part of which is underlined beneath the sentence you find four ways of phrasing the underlined part. Following the requirements of the standard written English. Select the answer that produces the most effective sentence

Tuberculosis, together with its effects, ranks one of the leading causes of death in India

(A) Ranks as one of the leading causes of death

(B) Rank as one of the leading causes of death

(C) Has the rank of one of the leading causes of death

(D) Are one of the leading causes of death

Ans : A

07. Humpty Dumpty sits on a wall every day while having lunch the wal sometimes breaks. A person sitting on the wall falls if the wall breaks.

Which one of the statements below is logically valid and can be inferred from the above sentences?

(A) Humpty Dumpty always falls while having lunch

(B) Humpty Dumpty does not fall sometimes while having lunch

(C) Humpty Dumpty never falls during dinner

(D) When Humpty Dumpty does not sit on the wall does not break

Ans : B

08. A cube of side 3 units is formed using a set of smaller cubes of side 1 unit. Find the proportion of the number of faces of the smaller cubes visible to those which are NOT visible.

(A) 1:4 (B) 1:3 (C) 1:2 (D) 2:3

Ans : C

09. Fill the missing value

Ans : 3

10. Read the following paragraph and choose the correct statement

Climate change has reduced human security and threatened human well being. An ignored really of human progress is that human security largely depends upon environmental security. But on the contrary, human progress seems contra dictionary to environmental security. To keep up both at the required level is a challenge to be addressed by one and all. One of the ways to curb the climate change may be suitable scientific innovations, while the other may be the Gandhian perspective on small progress with focus on sustainability.

(A) Human progress and security are positively associated with environmental security.

(B) Human progress is contradictory to environmental security.

(C) Human security is contradictory to environmental security.

(D) Human progress depends upon environmental security.

Ans : D

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ELECTRONICS AND COMMUNICATION

01. A silicon sample uniformly doped with donor type impurities with a concentration of $10^{16}/cm^3$. The electron and hole mobilities in the sample are 1200 cm^2/V-s and 400 cm^2/V-s respectively. Assume complete ionization of impurities. The charge of an electron is $1.6x10^{-19}$C. The resistivity of the sample (in Ω-cm) is _____

Ans : 0.5208

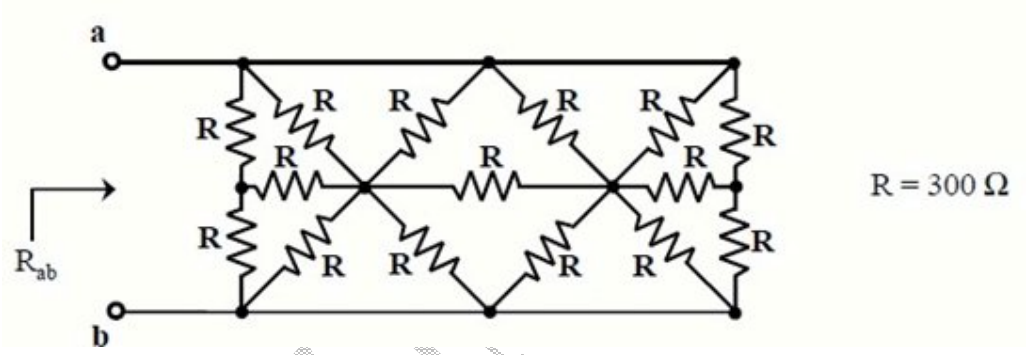
02. Negative feedback in a closed-loop control system **DOES NOT**

(A) Reduce the overall gain (B) Reduce bandwidth

(C) Improve disturbance (D) Reduce sensitivity to parameter variation

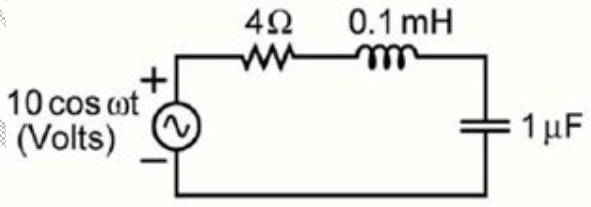
Ans : B

03. In the network shown in the figure, all resistors are identical with R=300Ω. The resistance R_{ab}(Ω) of the network is _____.



Ans : 100

04. In the circuit shown, at resonance, the amplitude of the sinusoidal voltage (in volts) across the capacitor is _____



Ans : 25

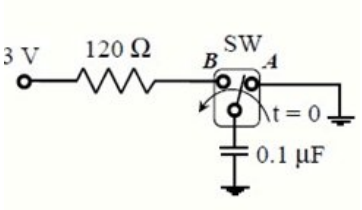
05. Suppose A and B are tow independent event with probabilities P(A)≠0 and P(B)≠0. Let $\overline{A}$ and $\overline{B}$ be their. Compliments. Which one of the following statements is FALSE?

(A) $P(A \cap B) = P(A)P(B)$ (B) $P(A|B) = P(A)$

(C) $P(A \cup B) = P(A) + P(B)$ (D) $P(\overline{A} \cap \overline{B}) = P(\overline{A})P(\overline{B})$

Ans : C

06. In the circuit shown, the switch SW is thrown from position A to position B at time t=0. The energy (inμJ) taken from the 3V source to charge the 0.1μF capacitor from 0V to 3V is



(A) 0.3 (B) 0.45 (C) 09 (D) 3

Ans : C

07. Let Z = x+iy be a complex variable. Consider that contour integration is performed along the unit circle in anticlockwise direction. Which of the following statements is **NOT TRUE**

(A) The residue of $\frac{z}{z^2-1}$ at z=1 is 1/2

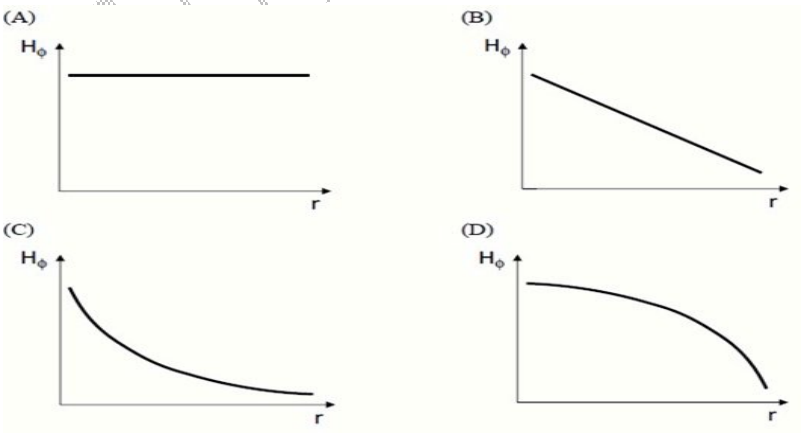
(B) $\oint_C z^2 dz=0$

(C) $\frac{1}{2\pi i}\oint_C \frac{1}{z} dz=1$

(D) $\bar{z}$ (complex conjugate of z) is analyitical function

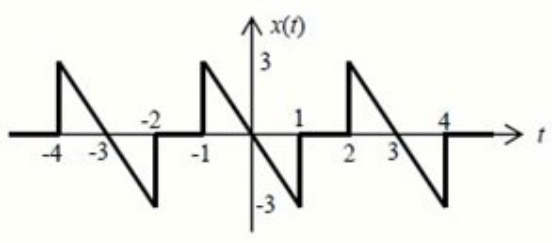
Ans : 4

08. Consider the a straight, Infinitely long , current carrying conductor lying on the z-axis. Which one of the following plots (in linear scale) qualitatively represents the depends of H_ϕ on r, where H_ϕ is the magnitude of the azimuthal component of magnetic field outside the conductor and r is the radial distance from the conductor?



Ans : C

09. The waveform of a periodic signal x(t) is shown in the figure.



A signal g(t) is defined by g(t) = $x\left(\frac{t-1}{2}\right)$. This average power of g(t) is _____

Ans : 2

10. Consider a system of linear equations

x-2y+3z=-1,

x-3y+4z=1, and

-2x+4y-6z=k.

The value of k for which the system has infinitely many solution is _____.

Ans : 2

11. A function f(x) = $1-x^2+x^3$ is defined in the closed interval [-1,1]. The value of x, in the open interval (-1,1) for which the mean value theorem is satisfied, is

(A) – 1/2 (B) – 1/3 (C) 1/3 (D) 1/2

Ans : B

12. A Sinusoidal signal of 2kHz frequency is applied to a delta modulator. The sampling rate and step-sizeΔ of the delta modulator are 20,000 samples per second and 0.1V, respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal(in volts) is

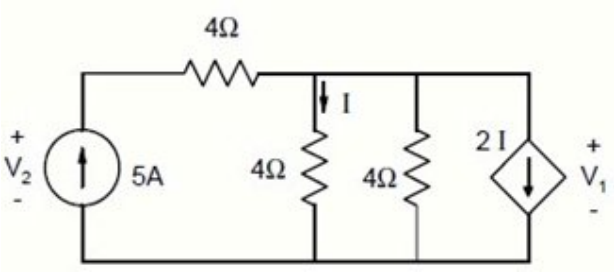
(A) $\frac{1}{2\pi}$ (B) $\frac{1}{\pi}$ (C) $\frac{2}{\pi}$ (D) π

Ans : A

13. The electric field component of a plane wave traveling in a lossless dielectric medium is given by $\vec{E}(z,t)=\bar{a}_y 2\cos\left(10^s t-\frac{z}{\sqrt{2}}\right)$ V/m . The wavelength (in m) for the wave is _____

Ans : 8.8857

14. In the given circuit, the value of V_1 and V_2 respectively are



(A) 5V, 25V (B) 10V, 30V (C) 15V, 35V (D) 0V, 20V

Ans :A

15. Consider a four bit D to A converter. The analog value corresponding to digital signals of values 0000 and 0001 or 0V and 0.0625 V respectively. The analog value (in volts) corresponding to the digital signal 111 is _____.

Ans : 0.9375

16. In an 8085 microprocessor, the shift registers which store the result of an addition and the overflow bit are, respectively

(A) B and F (B) A and F (C) H and F (D) A and C

Ans : 4

17. A region of negative differential resistance is observed in the current voltage characteristics of a silicon PN junction if

(A) both the P-region and the N-region are heavily doped

(B) the N-region is heavily doped compared to the P-region

(C) the P-region is heavily doped compared to the N-region

(D) an intrinsic silicon region is inserted between the P-region and the N-region

Ans : A

18. Consider the signal $s(t) = m(t)\cos(2\pi f_c t) + m(t)\sin(2\pi f_c t)$ where in (t) denotes the Hilbert transform of m(t0 and the bandwidth of m(t0 is very small compared to f_c. The signal s(t) is a

(A) high pass signal

(B) low-pass signal

(C) band-pass signal

(D) double side band suppressed carrier signal

Ans : C

19. The polar of the transfer function $G(s)=\frac{10(s+1)}{s+10}$ *for* $0 \le \omega < \infty$ will be in the

(A) first quadrant

(B) second quadrant

(C) third quadrant

(D) fourth quadrant

Ans : A

20. The result of the convolution $x(-t)*\delta(-t-t_0)$ *is*

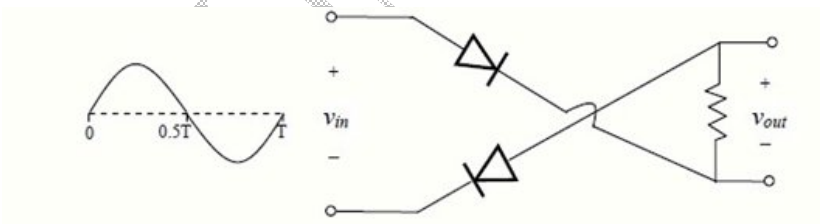
(A) $x(t+t_0)$ (B) $x(t-t_0)$ (C) $x(-t+t_0)$x (D) $x(-t-t_0)$

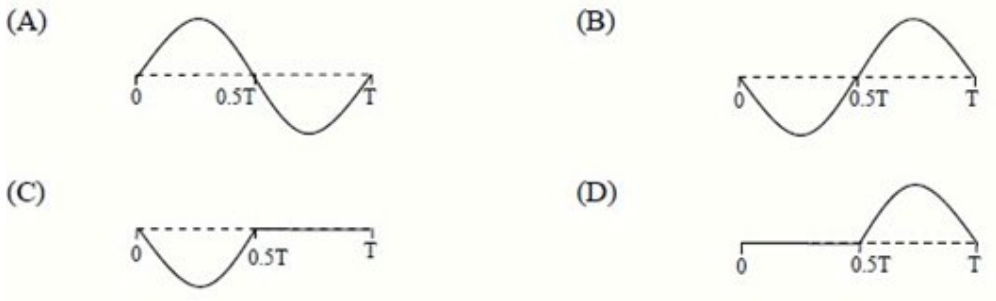
Ans : D

21. A 16Kb(=16,384 bit) memory array is designed as a square with an aspect ratio of one (number of rows is equal to the number of columns). The minimum number of address lines needed for the row decoder is_____

Ans : 14

22. For the circuit with ideal diodes shown in the figure .the shape of the output (v_{out}) for the given sine wave input (v_{in}) will be



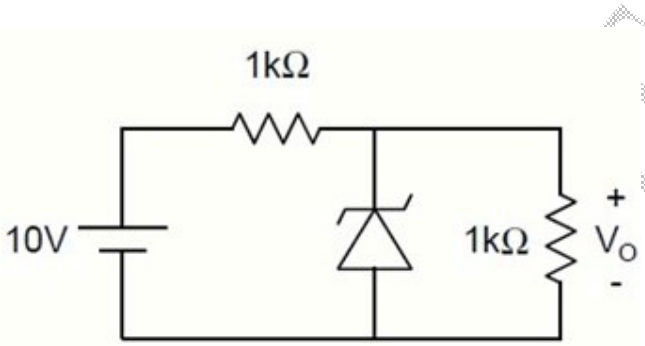


Ans : C

23. The value of P such that vector $\begin{bmatrix}1\\2\\3\end{bmatrix}$ is an eigenvector of the matrix $\begin{bmatrix}4 & 1 & 2\\ P & 2 & 1\\ 14 & -4 & 10\end{bmatrix}$ is ___

Ans : 17

24. In the circuit shown below, the Zener diode is ideal and the Zener voltage is 6V. The output voltage V_o (in volts) is _____



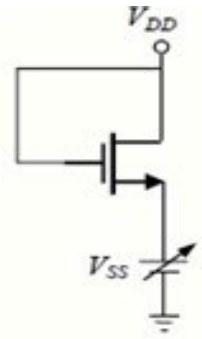
Ans : 5

25. A unity negative feedback system has the open-loop transfer function $G(S)=\frac{K}{s(s+1)(s+3)}$

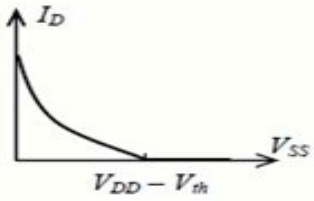
the valu of the gain k(>0) at which the root locus crosses the imaginary axis is _____

Ans : 12

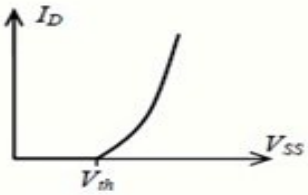
26. For the NMOSFET in the circuit shown, the threshold voltage is V_{th}, where $V_{th}>0$. The source voltage V_{ss} is varied from 0 to V_{DD}. Neglecting the channel length modulation, the drain current I_D as a function of V_{ss} is represented by



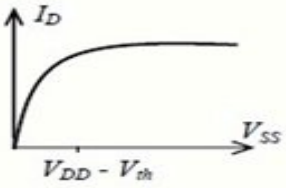
(A)



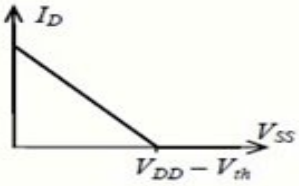
(B)



(C)



(D)



Ans : A

27. The longitudinal component of the magnetic field inside an air-filled rectangular waveguide made of a perfect electric conductor is given by the following expression

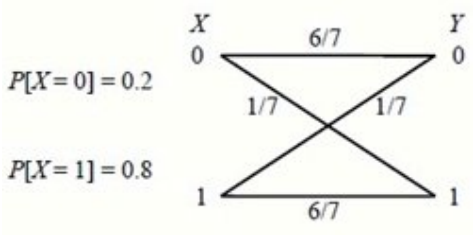
$$H_z(x, y, z, t) = 0.1\cos(25\pi x)\cos(30.3\pi y)\cos(12\pi \times 10^9 t - \beta z)(A/m)$$

The cross-sectional dimensions of the waveguide are given as a=0.08m and b=0.033m. The mode of propagation inside the waveguide is

(A) TM_{12} (B) TM_{21} (C) TE_{21} (D) TE_{12}

Ans : C

28. The input X to the binary symmetric channel (BSC) shown in the figure is '1' with probability 0.8 the cross-over probability is 1/7. If the received bit Y=0, the conditional probability that '1' was transmitted is_____



Ans : 0.6

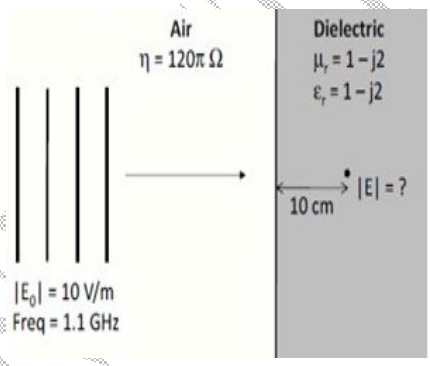
29. The transmitted signal in a GSM system is of 200kHz bandwidth and 8 users share a common bandwidth using TDMA. If at a given time 12 users are talking in a cell, the total bandwidth of the signal received by the base station of the cell will be at least (in kHz) _____

Ans : 400

30. A lend compensator network includes a parallel combination of R and C in the feed-forward path if the transfer function of the compensator is $G_t(s)=\frac{s+2}{s+4}$, the value of RC is _____

Ans : 0.5

31. Consider a uniform plane wave with amplitude (E_0) of 10v/m and 1.1 GHz frequency travelling in air, and incident normally on a dielectric medium with complex relative permitivity (ε_r) and permeability (μ_r) as shown in the figure



The megnitude of the transmitted electric field component (inv/m) after it has travelled a distance of 10cm inside the dielectric region is_____

Ans : 0.03156

32. For a silicon diode with long P and N regions, the accepter and doner impurity concentrations are $1\times10^{17}\,cm^{-3}$ and $1\times10^{15}cm^{-3}$, respectively. The lifetimes of electrons in P region and holes in N region are both $100\,\mu s$. The electron and hole diffusion coefficients are 49 cm^2/s and 36 cm^2/s, respectively. Assume kT/q=26mV, the intrinsic carrier concentration is $1\times10^{10}\,cm^{-3}$, and $q=1.6\times10^{-19}C$. when a forward voltage of 208 mV is applied across the diode, the hole current density (m nA/cm^2) injected from P region to N region is_____

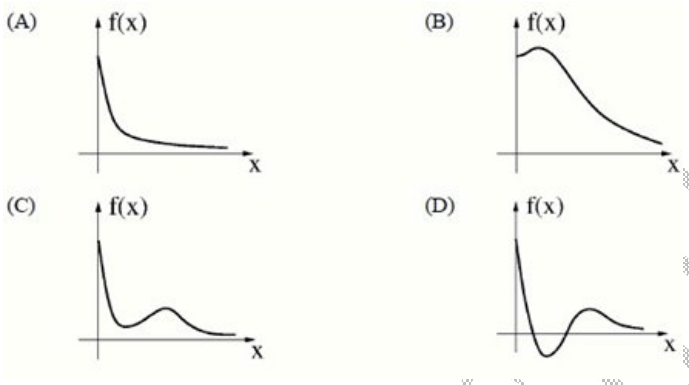
Ans : 28.6171

33. A plant transfer function is given as $G(s)=\left(K_p+\frac{K_I}{s}\right)\frac{1}{s(s+2)}$, when the plant operates in a unity feedback configuration, the condition for the stability of the closed loop system is

(A) $K_p > \frac{K_I}{2} > 0$ (B) $2K_I > K_p > 0$ (C) $2K_I < K_p$ (D) $2K_I > K_p$

Ans : A

34. Which one of the following graphs describes the function $f(x)= e^{-x}(x^2+x+1)$?



Ans : B

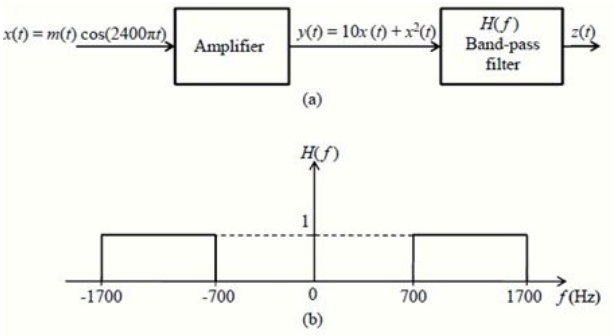
35. A 3- input majority gate is defined by the logic functions M(a.b.c) = ab+bc+ca. which one of the following gates is represented by the function M($\overline{M(a,b,c)}$, M(a,b,$\bar{c}$),c)?

(A) 3-input NAND gate (B) 3-input XOR gate

(C) 3- input NOR gate (D) 3- inputX NOR gate

Ans : D

36. In the system shown in figure(a), m(t) is a low-pass signal with bandwidth W Hz. The frequency response of the band-pass filter H(f) is shown in figure(b). if it is desired that the output signal z(t) = 10x(t), the maximum value of W(in Hz) should be strictly less than_____

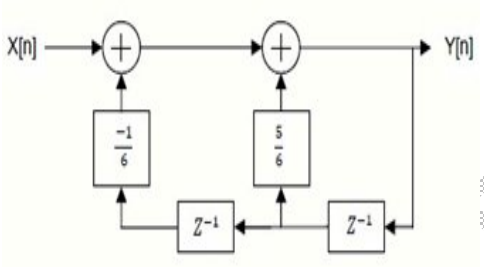


Ans : 350

37. A MOSFET in saturation has a drain current of 1 mA for V_{DS}=0.5V. If the channel length modulation coefficient is $0.05V^{-1}$, the output resistance (in kΩ) of the MOSFET is _____

Ans : 20

38. For the discrete-time system shown in the figure, the poles of the system transfer function are located at



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

Ans : C

39. A vector $\vec{p}$ is given by $\vec{P} = x^3y\vec{a}_x - x^2y^2\vec{a}_y - x^2yz\vec{a}_z$. Which one of the following statements is TRUE?

(A) $\vec{p}$ is solenoidal, but not irrotational

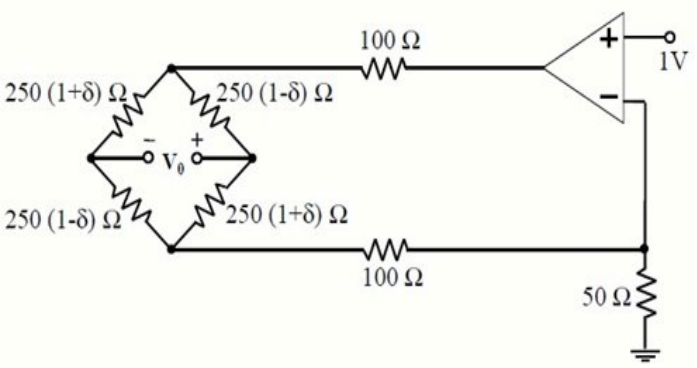
(B) $\vec{p}$ is irrotational, but not solenoidal

(C) $\vec{p}$ is neither solenoidal, nor irrotational

(D) $\vec{p}$ is both solenoidal and irrotational

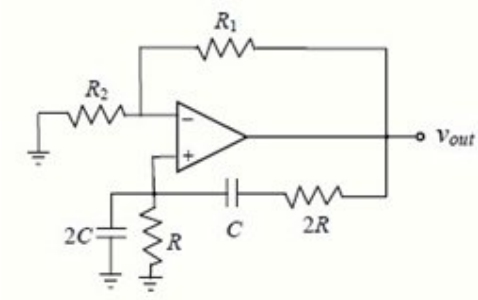
Ans : A

40. In the circuit shown, assume that the opamp is ideal. The bridge output voltage V_0(in mV) for $\delta = 0.05$ is _____



Ans : 20

41. The circuit shown in the figure has an ideal opamp. The oscillation frequency and the condition to sustain the oscillations, respectively, are



(A) $\frac{1}{CR}$ and $R_1 = R_2$

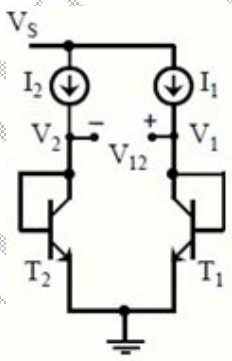
(B) $\frac{1}{CR}$ and $R_1 = 4R_2$

(C) $\frac{1}{2CR}$ and $R_1 = R_2$

(D) $\frac{1}{2CR}$ and $R_1 = 4R_2$

Ans : D

42. In the circuit shown I_1=80 mA and I_2=4 mA. Transistors T_1 and T_2 are identical Assume that the thermal voltage V_T is 26m V at 27^0C. At 50^0C, the value of the voltage V_{12}=V1-V2(in mV) is_____



Ans : 0.0778

43. The built-in potential of an abrupt p-n junction is 0.75v. If its junction capacitance(C_J) at a reverse bais (V_R) of 1.25V is 5 pF.the value of C_J(in pF) when V_R=7.25V is _____

Ans :2.5

44. The electric field intencity of a plane wave travelling in free space is given by the following expression

$$E(x,t) = a_y 24\pi \cos(\omega t - k_o x)(v/m)$$

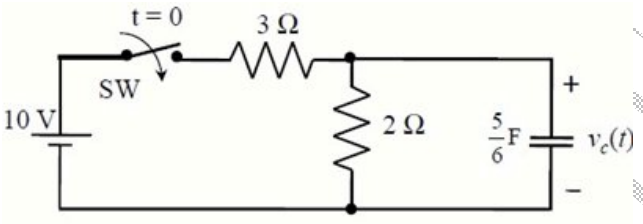
Tn this field, consider a square area 10cm x 10cm on a plane x+y=1. the total time averaged power (in mW) passing through the square area is_____

Ans : 37.699

45.The open-loop transfer function of a plant in a unity feedback configuration is given as G(s)=$\frac{K(s+4)}{(s+8)(s^2-9)}$. The value of the gain K(>0) for which -1+j2 lies on the root locus is

Ans : 25.5427

46.In the circuit shown, switch SW is closed at t=0. Assuming zero initial conditions, the value of $v_c(t)$ (in volts) at t=1 sec is_____



Ans : 2.5284

47.The solution of the different equation $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=0$ with y(0)=y'(0) = 1 is

(A) $(2-t)e^t$ (B) $(1+2t)e^{-t}$ (C) $(2+t)e^{-t}$ (D) $(1-2t)e^t$

Ans : B

48.The maximum area (in square units) of a rectangle whose vertices lie on the ellips $x^2+4y^2=1$is _____

Ans : 1

49.The boolean expression $F(X,Y,Z)=\overline{X}Y\overline{Z}+X\overline{Y}\overline{Z}+XY\overline{Z}+XYZ$ converted into the canonical product of sum(POS) form is

(A) $(X+Y+Z)(X+Y+\overline{Z})(X+\overline{Y}+\overline{Z})(\overline{X}+Y+\overline{Z})$

(B) $(X+\overline{Y}+Z)(\overline{X}+Y+\overline{Z})(\overline{X}+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$

(C) $(X+Y+Z)(\overline{X}+Y+\overline{Z})(X+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$

(D) $(X+\overline{Y}+\overline{Z})(\overline{X}+Y+Z)(\overline{X}+\overline{Y}+Z)(X+Y+Z)$

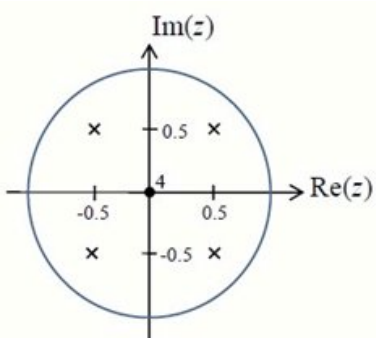
Ans :A

50.The damping ratio of a series RLC circuit cn be expressed as

(A) $\frac{R^2C}{2L}$ (B) $\frac{2L}{R^2C}$ (C) $\frac{R}{2}\sqrt{\frac{C}{L}}$ (D) $\frac{2}{R}\sqrt{\frac{L}{C}}$

Ans :C

51. The pole-zero diagram of a causal and stable discrete-time system is shown in the figure. The Zero at the origin has multiplicity 4. The impulse response of the system is h[n]. If h[0]=1, we can conclude



(A) h[n] is real for all n

(B) h[n] is purely imaginary for all n

(C) h[n] is real for only even n

(D) h[n] is purely imaginary for only odd n

Ans :C

52.Two Sequence [a,b,c] and [A,B,C] are releated as,

$$\begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & W_3^{-1} & W_3^{-2} \\ 1 & W_3^{-2} & W_3^{-4} \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} \text{ where } w_3 = e^{j\frac{2\pi}{3}}$$

If another sequence [p,q,r] is derived as,

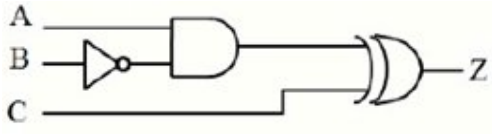
$$\begin{bmatrix} p \\ q \\ r \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & W_3^{1} & W_3^{2} \\ 1 & W_3^{2} & W_3^{4} \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & W_3^{2} & 0 \\ 0 & 0 & W_3^{4} \end{bmatrix} \begin{bmatrix} A/3 \\ B/3 \\ C/3 \end{bmatrix}$$

then the relationship between the sequences [p,q,r] and [a,b,c] is

(A) [p,q,r]=[b,a,c] (B) [p,q,r]=[b,c,a] (C) [p,q,r]=[c,a,b] (D) [p,q,r]=[c,b,a]

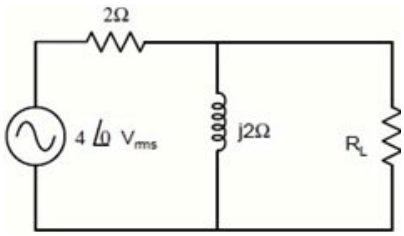
Ans :*

53.All the logic gates shown in the figure have a propagation delay of 20 ns. Let A=C=0 and B=1 until time t =0. At t=0, all the inputs flip (i.e, A=C=1 and B=0) and remain in that state. for t>0, output Z=1 for a duration (in ns) of



Ans : 40

54.In the given circuit, the maximum power (in wats) that can be transferred to the load R_L is_____



Ans : 0.25

55. A source emits bit 0 with probability $\frac{1}{3}$ and bit 1 with probability $\frac{2}{3}$. the emitted bits are communicated to the reciver. the reciver decides for either 0 or 1 based on the recived value R. It is given that the conditional density functions of R are as

$$f_{R|0}(r)=\begin{cases}\frac{1}{4}, -3\le x\le 1,\\ 0, \text{ otherwise,}\end{cases} \text{ and } f_{R|0}(r)=\begin{cases}\frac{1}{6}, -1\le x\le 5,\\ 0, \text{ otherwise,}\end{cases}$$

The minimum decision error probability is

(A) 0 (B) 1/12 (C) 1/9 (D) 1/6

Ans : *