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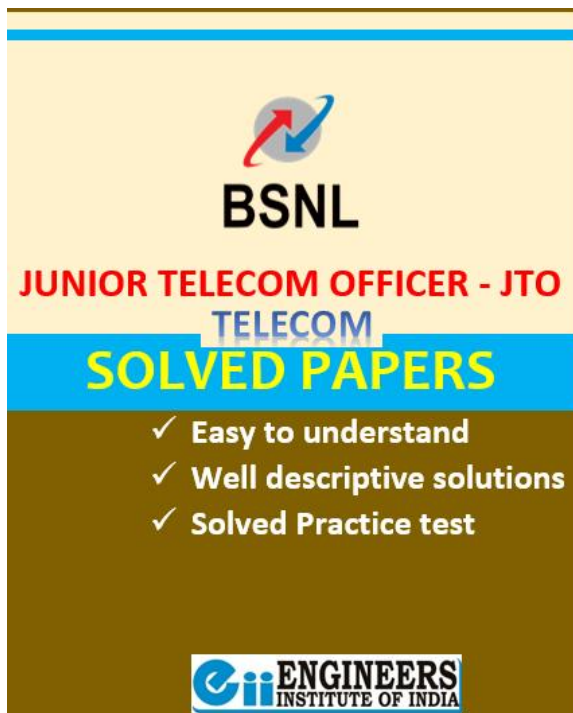
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Section – I : Technical

CT1

(1.) Figure function corresponding to the Bode plot of the Figure below is
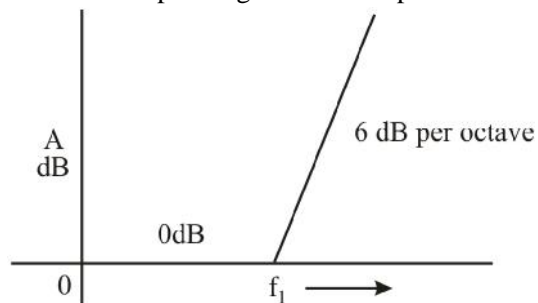
(a) $A = j\, f / f_1$

(b) $\dfrac{A = 1}{(1 - j\, f_1 / f\,)}$

(c) $\dfrac{A = 1}{(1 + j\, f_1 / f\,)}$

(d) $A = 1 + j\, f / f_1$

NT1

(2.) A fixed capacitor or reactance –j0.02Ω is connected in parallel across a series combination of a fixed inductor of reactance j0.01Ω and a variable resistance R. As R is varied from zero to infinity, the locus diagram of the admittance of this L-C-R circuit will be

(a) A semi-circle of diameter j 100 and center at zero

(b) A semi circle of diameter j50 and center at zero

(c) A straight line inclined at an angle

(d) A straight line parallel to the x-axis

NT1

(3.) The voltage phasor of a circuit is $10\underline{|15°}$ V and the current phasor is $2\underline{|-45°}$ A. The active and the reactive powers in the circuit respectively are.

(a) 10W and 17.32 VAr

(b) 5W and 8.66 VAr

(c) 20W and 60 VAr

(d) 20√2 W and 10√2 VAr

MI1

(4.) A current of $\left[2\sqrt{2}\sin(314t+30)+2\sqrt{2}\cos(952t+45)\right]$ is measured with a thermocouple type, 5 A full scale, class I meter. The meter reading would lie in the range.

(a) $5A \pm 1\%$

(b) $(2+3\sqrt{2})A \pm 1\%$

(c) $3A \pm 1.7\%$

(d) $2A \pm 2.5\%$

DE1

(5.) A dual-slope analog-to digital converter uses an N-bit counter. When the input signal V_a is being integrated, the counter is allowed to count up to a value

(a) equal to $2^N - 2$

(b) equal to $2^N - 1$

(c) proportional to V_a

(d) inversely proportional to V_a

PE1

(6.) A step down chopper operate from a dc voltage source V_s, and feeds a dc motor armature with a back emf E_b. From oscilloscope traces, it is found that the current increases for time t_r, falls to zero over time t_f, and remains zero for time t_0, in every chopping cycle. Then the average dc voltage across the freewheeling diode is

(a) $\dfrac{V_s\, t_r}{(t_r + t_f + t_0)}$

(b) $\dfrac{(V_s\, t_r + E_b\, t_f)}{(t_r + t_f + t_0)}$

(c) $\dfrac{(V_s\, t_r + E_b\, t_0)}{(t_r + t_f + t_0)}$

(d) $\dfrac{V_s\, t_r + E_b\,[t_f + t_0]}{(t_r + t_f + t_0)}$

CT1

(7.) The characteristic equal of a feedback control system is

$$2s^4 + s^3 + 3s^2 + 5s + 10 = 0$$

The number of roots in the right half of s-plane are

(a) 0

(b) 1

(c) 2

(d) 3

CT1

(8.) Maximum phase-lead of the compensator $D(s) = \dfrac{(0.5s + 1)}{(0.05s + 1)}$, is

(a) 52 deg at 4 rad/sec

(b) 52 deg at 10 rad/sec

(c) 55 deg at 12 rad/sec

(d) None of these

DE1

(9.) An 8 bit successive approximation analog to digital converter has a full scale reading of 2.55V and its conversion time for an analog input of 1V is 20µs. The conversion time for a 2V input will be

(a) 10µs

(b) 20µs

(c) 40µs

(d) 50µs

CS1

(10.) The amplitude modulated waveform $s(t) = A_c[1 + K_a m(t)]\cos \check{S}_c t$ is fed to an ideal envelop detector. The maximum magnitude of $K_a m(t)$ is greater than 1. Which of the following could be the detector output?

(a) $A_c m(t)$

(b) $A_c^2[1 + K_a m(t)]^2$

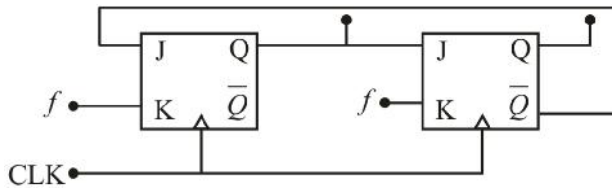(c) $\left| A_c[1 + K_a m(t)] \right|$

(d) $A_c[1 + K_a m(t)]^2$

EMT1

(11.) The time averaged Poynting vector, in W/m², for a wave with

$\vec{E} = 24 e^{j(\Gamma x + \check{S} y)}$ V/m in free space is

(a) $-\dfrac{2.4}{f}\vec{a}_z$

(b) $\dfrac{2.4}{f}\vec{a}_z$

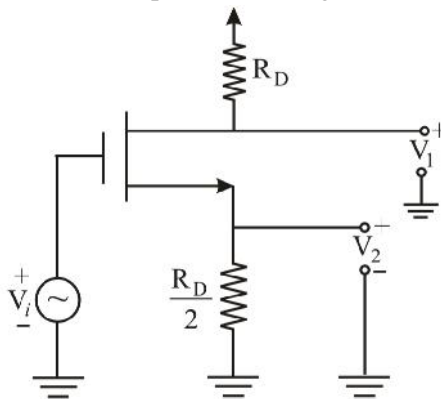(c) $\dfrac{4.8}{f}\vec{a}_z$

(d) $-\dfrac{4.8}{f}\vec{a}_z$

DE1

(12.) Figure given below shows a mod-K counter, Here K is equal to
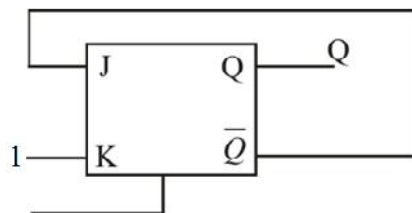

(a) 1
(b) 2
(c) 3
(d) 4
AE1

(13.) In the MOSFET amplifier of the figure below the signal outputs V_1 and V_2 obey the relationship

(a) $V_1 = V_2/2$
(b) $V_1 = -V_2/2$
(c) $V_1 = 2V_2$
(d) $V_1 = -2V_2$
DE1

(14.) In a J-K flip-flop we have J and K = 1. Assuming the flip flop was initially cleared and then clocked for 6 pulses, the sequence at the Q output will be

(a) 010000
(b) 011001
(c) 010010
(d) 010101
DE1

(15.) The decoding circuit shown in the figure below has been used to generate the active low chip select signal for a microprocessor peripheral. (The address lines are designated as A0 to A7 for I-O addresses)
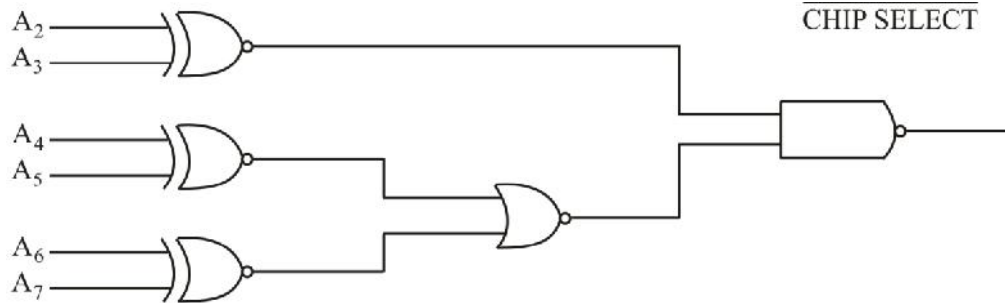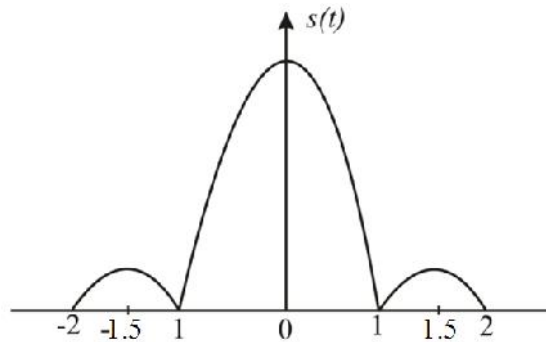

The peripheral will correspond to IO address in the range
(a) 60H to 63H
(b) A4H to A7H
(c) 30H to 33H
(d) 70H to 73H
  CS1

(16.) A deterministic signal has the power spectrum given in the figure below. The minimum sampling rate needed to completely represent this signal is

(a) 1kHz
(b) 2kHz
(c) 3kHz
(d) None of these
  EMT1

(17.) A rectangular air-filled waveguide has cross section of 4cm×10cm. The minimum frequency which can propagate in the waveguide is
(a) 1.5GHz
(b) 2.0GHz
(c) 2.5Ghz
(d) 3.0GHz
  MW1

(18.) A 1km long microwave link uses two antennas each having 30dB gain. If the power transmitted by one antenna is 1W at 3GHz, the power received by the other antenna is approximately
(a) 98.6 μW

(b) 76.8 μW

(c) 63.4 μW

(d) 55.2 μW

MP1

(19.) The following sequence of instruction are executed by an 8085 microprocessor

1000	LXI	SP,	27FF
1003	CALL	1006	
1006	POP H		

The contents of the stack pointer (SP) and the HL, register pair on completion of execution of these instruction are

(a) SP = 27 FF, HL = 1003

(b) SP = 27 FD, HL = 1003

(c) SP = 27 FF, HL = 1006

(d) SP = 27 FD, HL = 1006

AE1

(20.) Value of R in the oscillator circuit shown in the Figure below, is so chosen that is just oscillates at an angular frequency of ω. The value of ω and the required value of R will respectively be
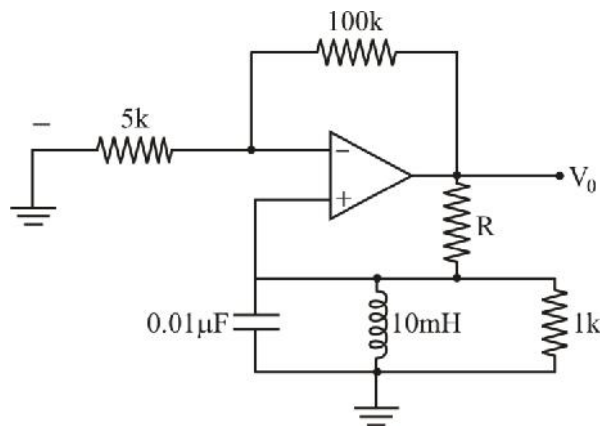
(a) 10^5 rad/sec, 2×10^4 Ω

(b) 2×10^4 rad/sec, 2×10^4 Ω

(c) 2×10^4 rad/sec, 10^5 Ω

(d) 10^5 rad/sec, 10^5 Ω

EDC1

(21.) A silicon n MOSFET has a threshold voltage of 1 V and oxide thickness of $400\,A°\,[v_r(SiO_2) = 3.9$, $v_0 = 8.854 \times 10^{-14}\,F/cm$, $q = 1.6 \times 10^{-19}\,C]$.

The region under the gate is ion implanted for threshold voltage tailoring. The dose and type of the implant (assumed to be a sheet charge at the interface) required to shift the threshold voltage to –1 V are

(a) $1.08 \times 10^{12}/cm^2$, p – type

(b) $1.08 \times 10^{12}/cm^2$, n – type

(c) $5.4 \times 10^{11} / \text{cm}^2$, p – type

(d) $5.4 \times 10^{11} / \text{cm}^2$, n – type

EMT1

(22.) A uniform plane wave in air is normally incident on an infinitely thick slab. If the refractive index of the glass slab is 1.5 then the percentage of the incident power that is reflected from the air-glass interface is

(a) 0%

(b) 4%

(c) 20%

(d) 100%

DE1

(23.) A 12-bit ADC is operating with a 1 μ sec clock period and the total conversion time is seen to be 14 μ secs. The ADC must be of the
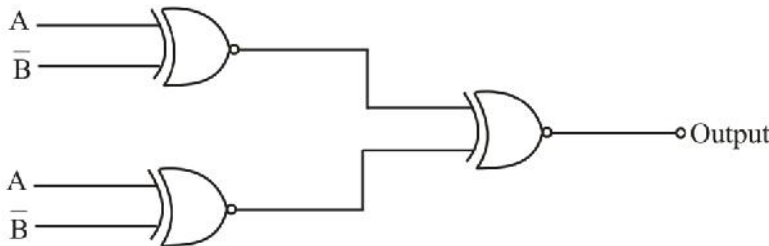
(a) Flash type

(b) Counting type

(c) Integrating type

(d) Successive approximation type

DE1

(24.) The output of the circuit shown the figure below is equal to

(a) 0

(b) 1

(c) $\overline{A} B = A \overline{B}$

(d) $(\overline{A*B}) * (\overline{A*B})$

EDC1

(25.) The diffusion potential across a P-N junction

(a) Decreases with increasing doping concentration

(b) Increases with decreasing band gap

(c) Does not depend on doping concentrations

(d) Increases with increase in doping concentrations

EDC1

(26.) The drift velocity of electrons, in silicon

(a) Is proportional to the electric field for all values of electric field

(b) Is independent of the electric field

(c) Increases at low values of electric field and decreases at high values of electric field exhibiting negative differential resistance

(d) Increase linearly with electric field at low values of electric field and gradually saturates at higher values of electric field

CS1

(27.) $v(t) = 55[\cos(10^6 f\, t) - \sin(10^3 f\, t) \times \sin(10^6 f\, t)]$ represents

(a) DSB suppressed carrier signal

(b) AM signal

(c) SSB upper sideband signal

(d) Narrow band FM signal

EDC1

(28.) A small concentration of minority carries is injected into a homogenous semiconductor crystal at one point. An electric field of 10 V / cm is applied across the crystal and this moves the minority carries a distance of 1 cm is 20 μ sec. The mobility (in cm^2/volt. sec)

(a) 1,000

(b) 2,000

(c) 5,000

(d) 5,00,000

CT1

(29.) The 3-dB bandwidth of a typical second-order system with the transfer function
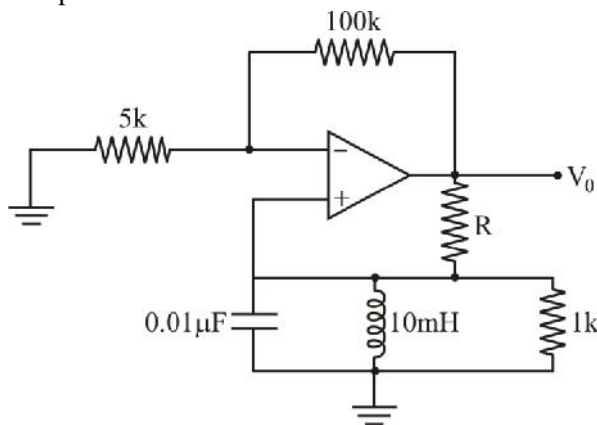
$$\frac{C(s)}{R(s)} = \frac{\check{S}_n^2}{s^2 + 2\prime\, \check{S}_n{}^s + \check{S}_n^2} \text{ is given by}$$

(a) $\check{S}_n \sqrt{1 - 2\prime{}^{\,2}}$

(b) $\check{S}_n \sqrt{(1 - 2\prime{}^{\,2}) + \sqrt{\prime{}^{\,4} - \prime{}^{\,2} + 1}}$

(c) $\check{S}_n \sqrt{(1 - \prime{}^{\,2}) + \sqrt{4\prime{}^{\,4} - 4\prime{}^{\,2} + 2}}$

(d) $\check{S}_n \sqrt{(2 - 2\prime{}^{\,2}) + \sqrt{4\prime{}^{\,2} - \prime{}^{\,2} + 2}}$

AE1

(30.) In the given circuit, C_0 is the distributed capacitance of the coil and C is the tuning capacitor. If C = C_1 for the fundamental frequency and C = C_2 for the second harmonic, then the value of C_0 can be expressed as
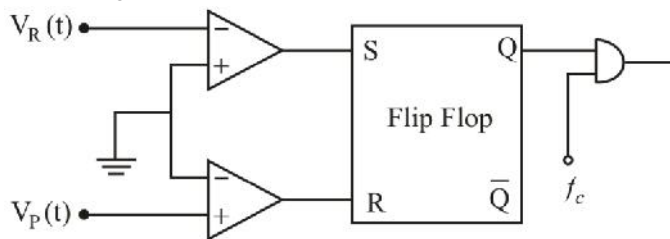
(a) $C_0 = \dfrac{C_1 - 2C_2}{3}$

(b) $C_0 = \dfrac{C_1 - 4C_2}{3}$

(c) $C_0 = \dfrac{C_1 - C_2}{3}$

(d) $C_0 = C_1 - 2C_2$

DE1

(31.) A digital phase meter is shown in the figure below. If the input signals are $V_R(t) = V_R \sin \omega t$ and $V_P(t) = V_P \sin(\omega t + 30^\circ)$
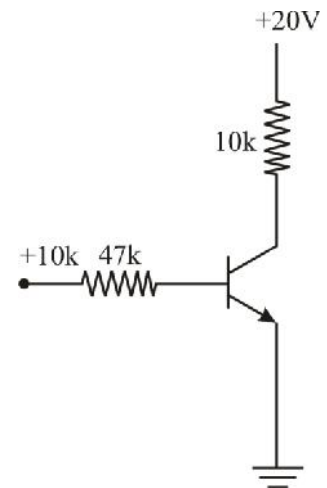
the reading of the meter will be


(a) 30º

(b) 330º

(c) 150º

(d) 210º

AE1

(32.) In the transistor circuit shown in the figure below, collector-to-ground voltage is +20V. Which of the following is the probable cause of error?

(a) Collector-emitter terminals shorted

(b) Emitter to ground connection open

(c) 10 kΩ resistor open

(d) Collector-base terminals shorted

MI1

(33.) A Lissajous pattern, as shown in the figure below, is observed on the screen of a CRO when voltages of frequencies f_x and f_y are applied to the x and y plates respectively. $f_x : f_y$ is then equal to
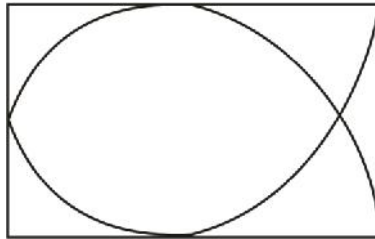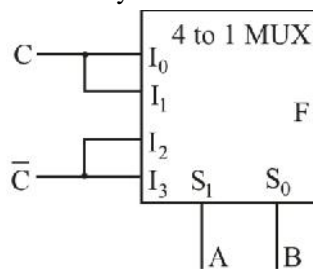
(a) 3 : 2
(b) 1 : 2
(c) 2 : 3
(d) 2 : 1
   MW1

(34.) In a multicavity magnetron, strapping is employed primarily
   (a) To prevent mode jumping
   (b) To increase the separation between the resonant frequencies in the π-mode and in the adjacent modes
   (c) To reduce the back heating of the cathode
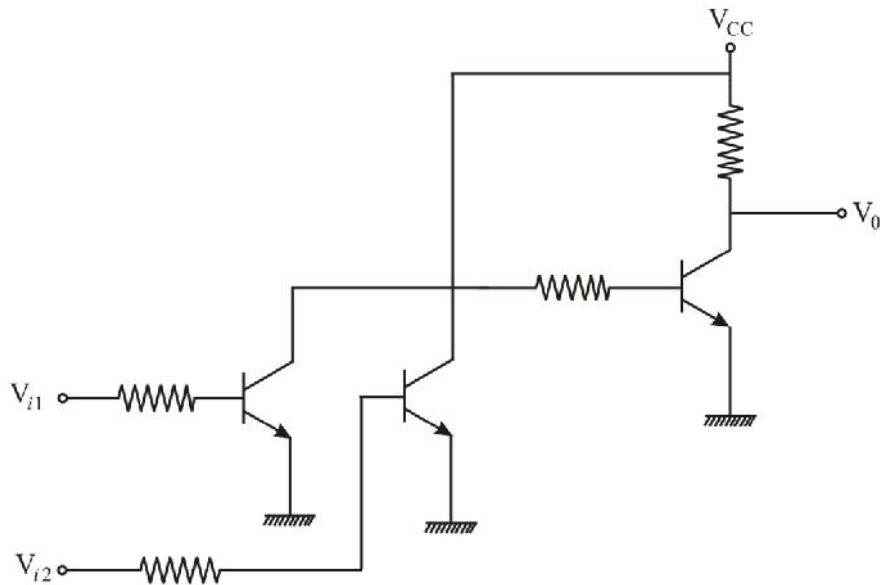   (d) To increase the output of the magnetron
   DE1

(35.) The logic realized by the circuit shown in the figure is

   (a) $F = A.C$
   (b) $F = A \oplus C$
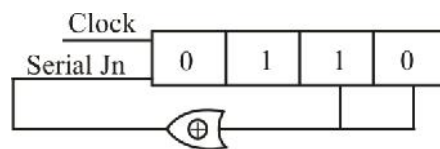   (c) $F = B.C$
   (d) $F = B + C$
   DE1

(36.) Figure below shows the circuit of a gate in the Resistor Transistor Logic (RTL) family. The circuit represents

(a) NAND
(b) AND
(c) NOR
(d) OR
    DE1

(37.) The initial contents of the 4-bit serial-in-parallel out, right-shift, Shift Register shown in, Figure is 0110. After three clock pulses are applied, the contents of the Shift Register will be

(a) 0000
(b) 0101
(c) 1010
(d) 1111
    EDC1

(38.) A silicon sample is uniformly doped with 10^{16} phosphorus atoms/cm^3 and 2×10^{16} boron atoms/cm^3. If all the dopants are full ionized, the material is
(a) n-type with carrier concentration of 10^{16}/cm^3
(b) p-type with carrier concentration of 10^{16}/cm^3
(c) p-type with carrier concentration of 2×10^{16}/cm^3
(d) T_2-will get damaged and T_1 will be safe
    CT1

(39.) The open-loop transfer function of a feedback control system is

$$G(s)H(s) = \frac{1}{(s+1)^3}.$$

The gain margin of the system is

(a) 2

(b) 4

(c) 8

(d) 16

CT1

(40.) A second-order system has a transfer function given by $G(s) = \dfrac{25}{8s^2 + 8s + 25}$. If the system initially at rest is subjected to a unit step input at t = 0, the second peak in the response will occur at

(a) f sec

(b) $\dfrac{f}{3}$ sec

(c) $\dfrac{2f}{3}$ sec

(d) $\dfrac{f}{2}$ sec

EMT1

(41.) Two isotropic antennas are separated by a distance of two wavelengths. If both the antennas are fed with currents of equal phase and magnitude, the number of lobes in the radiation pattern in the horizontal plane are

(a) 2

(b) 4

(c) 6

(d) 8

EMT1

(42.) Which of the following field equations indicate that the magnetic charges do not exist?

(a) $H = \dfrac{1}{\sim}(\nabla \times A)$

(b) $H = \int \dfrac{Id\,I \times r}{4f\,R^2}$

(c) $\nabla . H = 0$

(d) $\nabla \times H = J$

CS1

(43.) A 4 GHz carrier is DSB SC modulated by a low pass message signal with maximum frequency of 2MHz. The resultant signal is to be ideally sampled. The minimum frequency of the sampling in train should be

(a) 4 MHz

(b) 8 MHz

(c) 8 GHz

(d) 8.004 GHz

CS1

(44.) Zero mean white noise is passed through an ideal low pass filter with cut off at W Hz. The filter output will be uncorrelated at time instants spaced

(a) $\dfrac{1}{2W}$ sec apart

(b) $\dfrac{m}{2W}$ sec apart, m = 1, 2, 3 .....

(c) $\dfrac{1}{4mW}$ sec apart, m = 1, 2, 3 .....

(d) $\left(\dfrac{1}{2mW}\right)^2$ sec apart, m = 1, 2, 3 .....

EDC1

(45.) LEDs have response time of the order of

(a) 0.1 ns

(b) 1 ns

(c) 100 ns

(d) 1 us

EDC1

(46.) In a uniformly doped abrupt p-n junction, the doping level of the n-side is four times the doping level of the p-side. The ratio of the depletion layer width is

(a) 0.25

(b) 0.5

(c) 1.0

(d) 2.0

CT1

(47.) An electromechanical closed-loop control system has the following characteristic equation

$s^3 + 6Ks^2 + (K+2)s + 8 = 0$

Where K is the forward gain of the system. The condition for closed loop stability is

(a) K = 0.528

(b) K = 2

(c) K = 0

(d) K = –2.528

CT1

(48.) The impulse response and the excitation function of a linear time invariant causal systems are shown in Figures (a) and (b) respectively. The output of the system at t = 2 sec is equal to
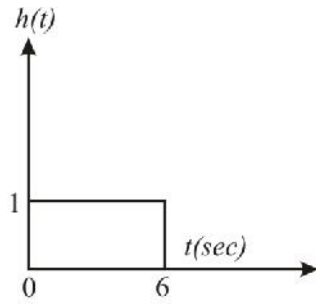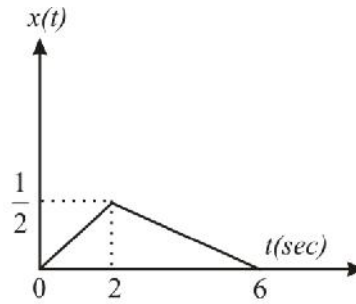
Figure (a)   Figure (b)

(a) 0

(b) $\dfrac{1}{2}$

(c) $\dfrac{3}{2}$

(d) 2

NT1

(49.) The open circuit impedance matrix of the 2-port network shown in the figure is
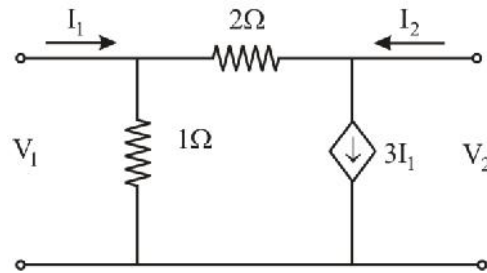
(a) $\begin{bmatrix} -2 & 1 \\ -8 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} -2 & -8 \\ 1 & 3 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & -8 \\ -1 & 3 \end{bmatrix}$

NT1

(50.) The response of an initially relaxed linear constant parameter network to a unit impulse applied at t = 0 is $4e^{-2t} u(t)$. The response of this network to a unit step function will be

(a) $2[1 - e^{2t} u(t)]$

(b) $4[e^{t} - e^{2t}] u(t)$

(c) $\sin 2t$

(d) $(1 - 4e^{-4t}) u(t)$

EMT1

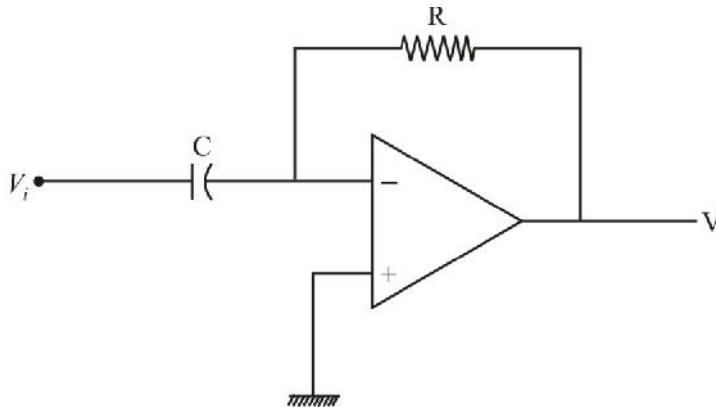**(51.)** In a twin-wire transmission line in air, the adjacent voltage maxima are at 12.5 cm and 27.5 cm. The operating frequency is
(a) 300 MHz
(b) 1 GHz
(c) 2 GHz
(d) 6.28 GHz
AE1

(52.) Assume that the op-amp of the given Figure is ideal. If $2[1 - e^{2t} u(t)]$ is a triangular wave, then v_0 will be

(a) Square wave
(b) Triangular wave
(c) Parabolic wave
(d) Sine wave

EMT1

(53.) A 75 ohm transmission line is first short terminated and the minima locations are noted. When the short is replaced by a resistive load R_L, the minima locations are not altered and VSWR is measured to be 3. What is the value of R_L?
(a) 25 ohms
(b) 50 ohms
(c) 225 ohms
(d) 250 ohms
EMT1

(54.) On a resistively terminated high frequency lossless transmission line fed by a 500 MHz source, the VSWR is found to be equal to 2 and the first voltage minimum is measured at 30 cm from the load end. What is the value of the "normalized" load resistance?
(a) 3
(b) 2
(c) $\frac{1}{2}$

(d) $\dfrac{1}{4}$

MW1

(55.) The slow-wave structure of a TWT is provided with an attenuator. Which one of the following is the function of such an attenuator ?

(a) It prevents of RF power from reaching the output of the device when the beam is switched on

(b) It prevents oscillations in the device

(c) It reduces the noise level of the device

(d) It is used to broadband the device

MW1

(56.) Which one of the following is a transferred electron device ?

(a) BARITT diode

(b) IMPATT diode

(c) Gunn diode

(d) Step recovery diode

CS1

(57.) The capacity of an analog communication channel with 4 kHz bandwidth and 15 dB SNR is approximately

(a) 20,000 bps

(b) 16,000 bps

(c) 10,000 bps

(d) 8,000 bps

DE1

(58.) The input pulses to the different stage of the counter shown in the following Figure must be of
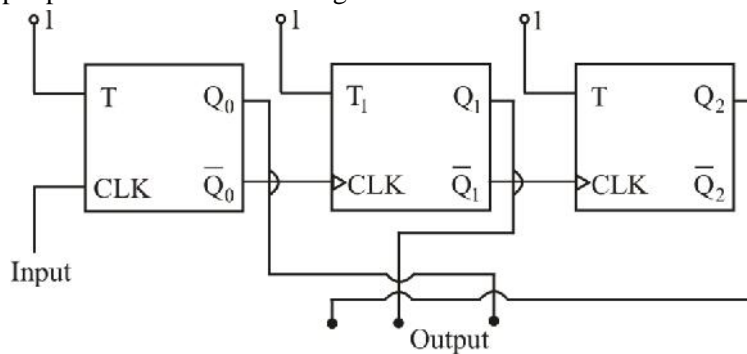
(a) Constant frequency and constant width

(b) Constant frequency but variable width

(c) Variable frequency but constant width

(d) Variable frequency as well as variable width

AE1

(59.) The circuit shown in the given Figure is a

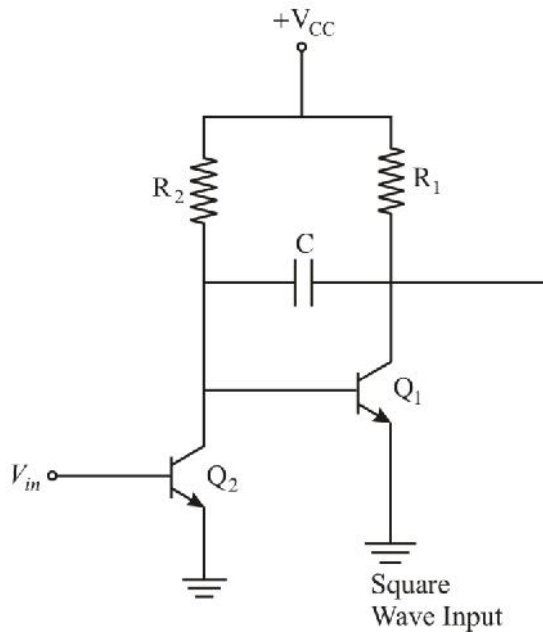(a) Monostable multivibrator

(b) Frequency division circuit

(c) Miller sweep circuit

(d) Bootstrap sweep circuit

EDC1

(60.) Measurement of Hall coefficient in a semiconductor provides information on the

(a) Sign and mass of charge carries

(b) Mass and concentration of charge carriers

(c) Sign of charge carriers alone

(d) Sign and concentration of charge carriers

EDC1

(61.) According to a classical free electron theory, the relaxation time and mean free path for aluminium are respectively 0.75×10^{-14} s and 0.88 mm. Given that the density of aluminium is 2700 kg/m^3 and the atomic weight of aluminium is 26.98, the resistivity of aluminium is

(a) $1.73 \times 10^{-8}\,\Omega m$

(b) $1.47 \times 10^{-8}\,\Omega m$

(c) $2.62 \times 10^{-8}\,\Omega m$

(d) $4.32 \times 10^{-8}\,\Omega m$

NT1

(62.) In the graph shown in the Figure, for the tree with braches b, d and f, the fundamental loops would include
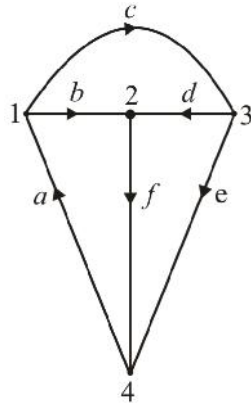
1, 2, 3, 4 are nodes

a, b, c, d, e f are braches

(a) abc, def, bdea

(b) cea, bdea, abc

(c) cdb, def, bfa

(d) adbe, def, cdb

MW1

(63.) In cavity magnetron, strapping is used to

(a) Prevent mode jumping

(b) Prevent cathode back hearting

(c) Ensure bunching

(d) Improve the phase focusing effect

EMT1

(64.) An antenna of input resistance 73 ohm is connected to a 50-ohm line. If losses are ignored, then its efficiency will be nearly

(a) 0.19

(b) 0.81

(c) 0.97

(d) 1.19

EMT1

(65.) A, B and C are three parallel plates condensers with similar surface area of plates and similar separation. A contains air is dielectric, B contains glass as dielectric and C contains Polythene. If the electric field intensities in air, glass and polythene are respectively E_1, E_1 and E_3 then (assume that the plates are filled with the given dielectrics)

(a) $E_1 = E_2 = E_3$

(b) $E_1 = E_2 > E_3$

(c) $E_1 > E_2 > E_3$

(d) $E_1 < E_2 > E_3$

AE1

(66.) The circuit diagram of an op-amp based amplifier is shown in the given figure. The ratio V_{out}/V_{in} is equal to
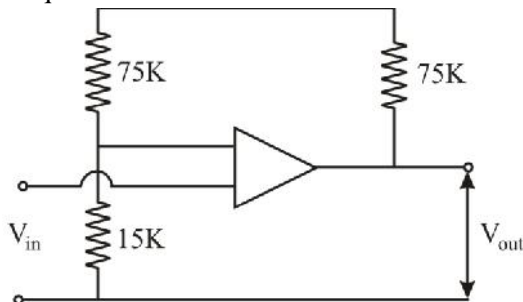
(a) 9

(b) 11

(c) 10

(d) 21

    MW1

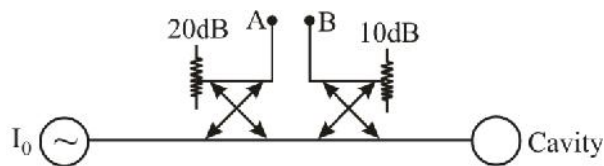**(67.)** The given figure shows a reflectometer arrangement to measure the parameters of an over coupled one port cavity resonator of f_0. With 100 mW of input power, the output power at B is 6.4 mW. What is the value of the coupling coefficient represent?

(a) 9

(b) 6.4

(c) 5

(d) 2.5

    EMT1

(68.) A TE_{10} rectangular waveguide is to be designed for operation over 25-35 GHz and the band centre is 1.5 times the cutoff frequency. What should be the dimension of the broad side?

(a) 15 mm

(b) 10 mm

(c) 9 mm

(d) 7.5 mm

    MW1

(69.) In π mode operation of magnetron, the spokes due to phase focusing effect rotate at an angular velocity corresponding to

(a) One poly/cycle

(b) Two poly/cycle

(c) Four poles/cycle

(d) Six poly/cycle

    CT1

(70.) What is the slope change at ω = 10 of the magnitude v/s frequency characteristic of a unity feedback system with the following open-loop transfer function?

$$G(j\check{S}) = \frac{5(1 + j0.1\check{S})}{j\check{S}(1 + j0.5\check{S})[1 + j0.6(\check{S}/50) + (j\check{S}/50)^2]}$$

(a) $-40\text{dB/dec to} -20\text{dB/dec}$

(b) $40\text{dB/dec to } 20\text{dB/dec}$

(c) $-20\text{dB/dec to} -40\text{dB/dec}$

(d) $40\text{dB/dec to} -20\text{dB/dec}$

AE1

(71.) An amplifier operating over the frequency range of 18 to 20 MHz has a 10kΩ input resistance. The RMS noise voltage at the input to the amplifier at ambient temperature of 27ºC is (Assume the Boltzman constant value as 1.38×10^{-23} J/K)

(a) 18.2 microvolts

(b) 17.2 microvolts

(c) 16.2 microvolts

(d) 14.2 microvolts

CT1

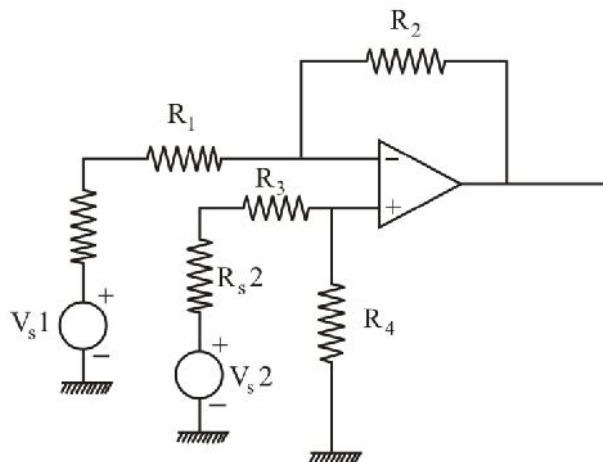**(72.)** In the root-locus for open-loop transfer function $G(s) = \dfrac{K(s+6)}{(s+3)(s+5)}$, the break away and break

in points are located respectively at

(a) –2 and –1

(b) –2.47 and –3.77

(c) –4.27 and –7.73

(d) –7.73 and –4.27

AE1

(73.) Under what condition will the instrumentation amplifier circuit given in the Figure possess highest CMRR?

(R_{s1} and R_{s2} source resistance)

(a) $\dfrac{R_1}{R_2} = \dfrac{R_3}{R_4}$

(b) $\dfrac{R_{s1} + R_1}{R_2} = \dfrac{R_{s2} + R_3}{R_4}$

(c) $\dfrac{R_{s1} + R_2}{R_1} = \dfrac{R_{s2} + R4}{R_3}$

(d) $\dfrac{R_{s1}}{R_2} = \dfrac{R_{s2}}{R_4}$

EMT1

(74.) A square waveguide carries TE_{11} mode whose axial magnetic field is given by

$H_z = H_0 \cos \dfrac{f\,x}{\sqrt{8}} \cos \dfrac{f\,y}{\sqrt{8}}$ A/cm where the waveguide dimensions are in centimeters. What is the cut-off frequency of the mode?

(a) 5 GHz

(b) 7.5 GHz

(c) 6.5 GHz

(d) 8 GHz

CS1

(75.) Noise temperature (T), and gain (G) are two important parameter of satellite antennas. Which one of the following antennas has the largest G/T ratio?

(a) Parabolic reflector

(b) Cassegranian antenna

(c) Pyramidal horn antenna

(d) Dipole antenna

EDC1

(76.) The semiconductor diode which can be used in switching circuits at microwave range is

(a) PIN diode

(b) Varactor diode

(c) Tunnel diode

(d) Gunn diode

EDC1

(77.) A conductor having surface density σ is embedded in a dielectric medium of permittivity ε. The electric field in the medium is E. If it is known that the pressure p on the conductor surface is equal to the electric energy density in the medium, then p (in SI units) is given by

(a) $\dfrac{\dagger^2}{2}$

(b) $\dfrac{\dagger}{2 \in}$

(c) $\dfrac{\dagger}{4f \in}$

(d) $\dfrac{\dagger^2}{2 \in}$

CS1

(78.) Which one of the following is the Fourier transform of the signal given in Figure (b) if the Fourier transform of the signal in Figure (a) is given by $2\dfrac{\sin\check{S}T_1}{\check{S}}$?
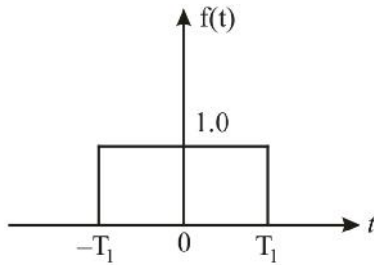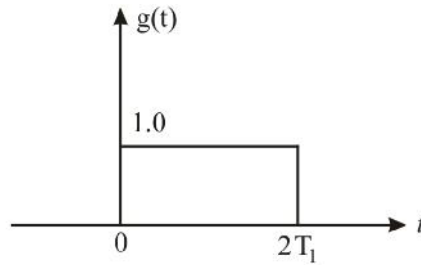

Figure (a)   Figure (b)

(a) $2\dfrac{\sin\check{S}T_1}{\check{S}}e^{+j\check{S}T_1}$

(b) $2\dfrac{\sin\check{S}T_1}{\check{S}}e^{-j\check{S}T_1}$

(c) $\dfrac{\sin\check{S}T_1}{\check{S}}e^{-j\check{S}T_1}$

(d) $\dfrac{\sin\check{S}T_1}{\check{S}}e^{+j\check{S}(T_1-2)}$

MW1

(79.) Microwave antenna aperture efficiency depends on
(a) Feed pattern
(b) Antenna aperture
(c) Surface losses
(d) Low side lobe level

MW1

(80.) A parabolic dish has a diameter of 10m. The maximum possible (ideal) gain of the antenna at λ = 3.14 cm will be
(a) 30 dB
(b) 40 dB
(c) 50 dB
(d) 60 dB

EMT1

(81.) The demarcation between Fresnel region and Fraunhofer region fairly approximated by minimum distance between antennas for pattern measurement is (given that R = distance between antennas, D = largest aperture dimension and λ = wavelength)
(a) $R = \lambda/D^2$

(b) $R = \lambda^2/2D^2$

(c) $R = 2D^2/\lambda$

(d) $R = 2D^2/\lambda^2$

CT1

(82.) A control system is as shown in the given Figure. The maximum value of gain K for which the system is stable is
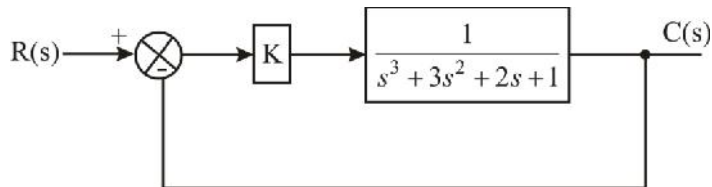
(a) $\sqrt{3}$

(b) 3

(c) 4

(d) 5

DE1

(83.) The logic circuit given below converts a binary code $y_1y_2y_3$ into

(a) Excess-3 code

(b) Gray code

(c) BCD code

(d) Hamming code

NT1

(84.) Which of the following oriented graphs have the same fundamental loop matrix?
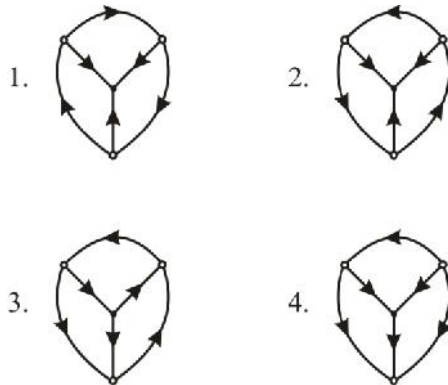
Select the correct answer using the codes given below

(a) 1 and 2

(b) 2 and 3

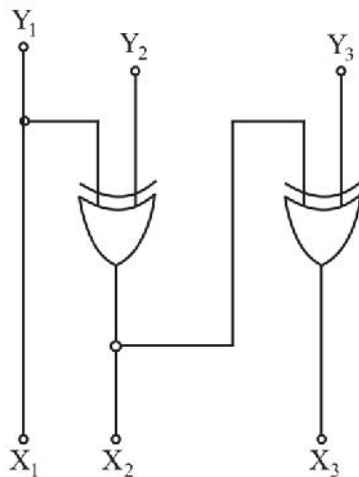(c) 1, 3 and 4

(d) 2, 3 and 4

MI1

(85.) The Q of a radio coil

(a) Is independent of frequency

(b) Increase monotonically as frequency increases

(c) Decreases monotonically as frequency increases

(d) Increases upto a certain frequency and then decreases beyond that frequency

MI1

(86.) The arrangement shown in the given figure represents an RC potentiometer for measuring and voltage. What should be the value of C so that V_0/V_{in} is independent of the frequency of the input signal?

(a) 10μF

(b) 11 μF

(c) 0.10μF
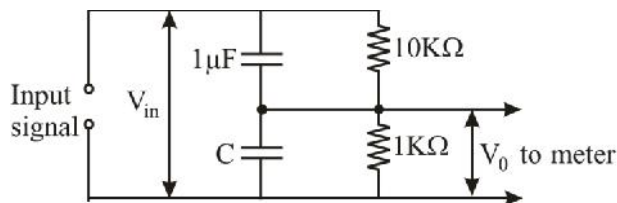
(d) 0.09μF

EMT1

(87.) In a rectangular cavity resonator having a = width, b = height and d = length. For a > b < d, the dominant mode is

(a) TE_{101}

(b) TM_{101}

(c) TE_{110}

(d) TM_{110}

EMT1

(88.) Two isotropic antennas are separated by a distance of two wavelengths. If both the antennas are with currents of equal phase and magnitude, the number of lobes in the radiation pattern in the horizontal plane is

(a) 2

(b) 4

(c) 6

(d) 8

EMT1

(89.) If the vector field

$\vec{A} = \vec{x} a_x + \vec{y} a_y + \vec{k} z a_z$ represents a magnetic field, then the value of k must be

(a) 1

(b) 2

(c) –1

(d) –2

EMT1

(90.) An infinite number of concentric rings carry a charge Q each alternately positive and negative. Their radii are 1, 2, 4 8 ….. meters in geometric progression as shown. The potential at the center of the will be

(a) Zero

(b) $\dfrac{Q}{12f \in_0}$

(c) $\dfrac{Q}{8f \in_0}$
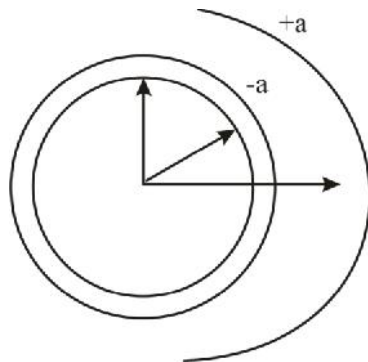
(d) $\dfrac{Q}{6f \in_0}$

EMT1

(91.) Two concentric square loops A and B carry equal currents in the same direction. The magnetic field at O due to the two loops A and B will be in the ratio
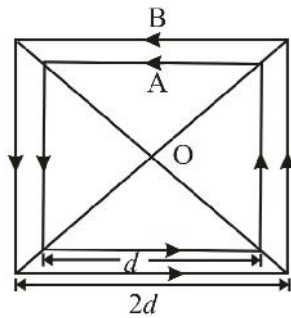
(a) 1 : 1.414
(b) 1 : 1
(c) 1.414 : 1
(d) 2 : 1
   NT1

(92.) In the circuit shown in the Figure below X in an element which always absorbs power. During a particular operations, it sets up a current of 1 amp in the direction shown and absorbs a power P_x. It is possible that X can absorb the same P_x for another current I, the value of this current is
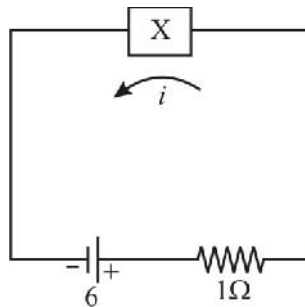
(a) $(3 - \sqrt{14})$ amps

(b) $(3 + \sqrt{14})$ amps

(c) 5 amps

(d) None of these
   PE1

(93.) A water boiler at home is switched on to a.c. mains supplying power at 230 V/50 Hz. The frequency of instantaneous power consumed by the boiler is
(a) 0 Hz
(b) 50 Hz
(c) 100 Hz
(d) 150 Hz
CT1

(94.) For the system shown in the figure below with a damping ratio ζ of 0.7 and an undamped natural frequency ω_n of 4rad/sec, the values of K and a are

(a) K = 4, a = 0.35
(b) K = 8, a = 0.455
(c) K = 16, a = 0.225
(d) K = 64, a = 0.9

MISCELLANEOUS

(95.) Gauss-Seidel iterative method can be used for solving set of
(a) Linear differential equations only
(b) Linear algebraic equations only
(c) Both linear and nonlinear algebraic equation
(d) Both linear and nonlinear differential equations

CT1

(96.) The phase lead compensation is used to
(a) Increase rise time and decrease overshoot
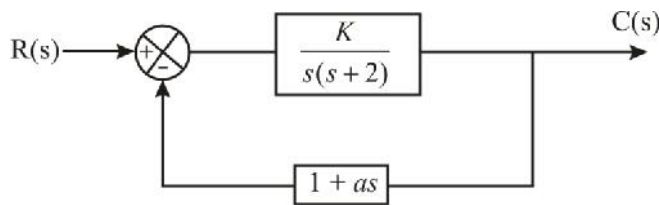(b) Decrease both rise time and overshoot
(c) Increase both rise time and overshoot
(d) Decrease rise time and increase overshoot
NT1

(97.) Viewed from the terminals A, B the following circuit shown in the Figure below can be reduced to an equivalent circuit of a single voltage source in series with a single resistor with the follwong parameters
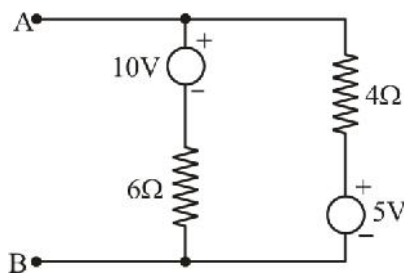
(a) 5 volt source in series with 10Ω resistor
(b) 7 volt source in series with 2.4Ω resistor
(c) 15 volt source in series with 2.4Ω resistor
(d) 1 volt source in series with 10Ω resistor
MI1

(98.) Figure below shows the input attenuator of a multimeter. The meter reads full scale with 12V at M, with the range switch at position 'q'. What is the required voltage M to obtain full scale deflection with the range switch a position 's'?
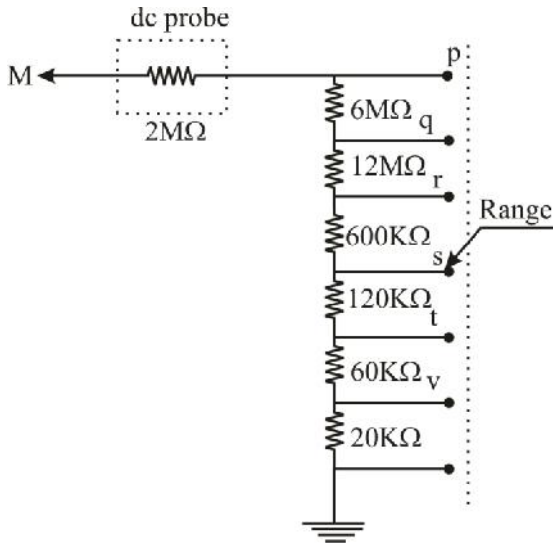
(a) 1V

(b) 150 V

(c) 120 V

(d) 147 V

MI1

(99.) Figure below shows the electrostatic vertical deflection system of CRT. Given that V_A is the accelerating voltage, the deflection sensitivity (deflection/volt) is proportional to
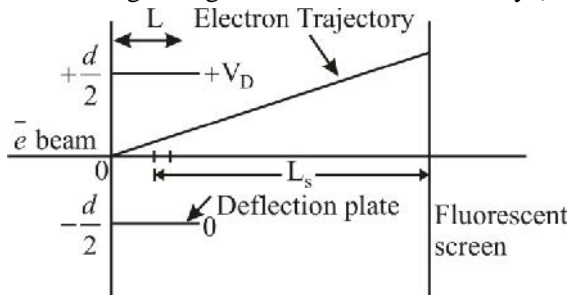
(a) $\dfrac{LL_s}{dV_A}$

(b) $\dfrac{LL_s V_D}{dV_A}$

(c) $\dfrac{LL_s}{V_A}$

(d) $\dfrac{dL_s}{LV_A}$

DE1

(100.) For a flip-flop formed from two NAND gates as shown in the figure below, the unusable state corresponds to
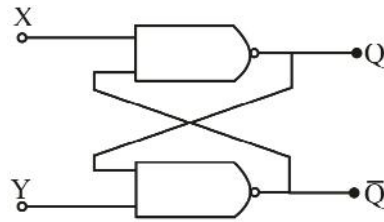
(a) X = 0, Y = 0
(b) X = 0, Y = 1
(c) X = 1, Y = 0
(d) X = 1, Y = 1

Section-II : General Study

(101.) One of the most important foreign exchange earning herbs used in the treatment of several kinds of chronic dynsentery is
(a) Tulsi
(b) Isabgol
(c) Madhuca
(d) Rauwolfia

(102.) Under-12 Wolrd Chess Championship in 1998 was won by
(a) Vijaylakshmi
(b) Konery Humpy
(c) Tejas Bakre
(d) Dibyendu Barua

(103.) Which one of the following is associated with the Gupta Age of Indian history?
(a) Visit of Chinese pilgrim Husan Tsang
(b) Significant contribution to Indian astronomy by Aryabhatta
(c) Significant contribution to poetry and literature by Banabhatta
(d) Macedonian invasion

(104.) The phenomenon of "midnight Sun" is caused by the
(a) Inclination of the earth's axis
(b) Sun sports
(c) Rotation of the earth on its axis
(d) Nuclear explosions

(105.) What does Angstrom measure
(a) Intensity of light
(b) Length of light waves
(c) Volume of liquids
(d) Speed at flowing water

(106.) India's fifth Atomic power platn is being constructed is
- (a) Kaiga (Karnataka)
- (b) Narora (U.P)
- (c) Kakrapar (Gujarat)
- (d) Rawatbhata (Rajasthan)

(107.) Chilka lake is situated in
- (a) Andhra Pradesh
- (b) Orissa
- (c) Assam
- (d) West Bengal

(108.) Hunter Commission was appointed by the British Government to probe into
- (a) Chauri Chaura incident
- (b) Demolition of Kanpur Mosque
- (c) Jalianwala Bagh Tragedy
- (d) Kakori train dacoity incident

(109.) Which one of the following rulers built the *Bibi Ka Makbara*?
- (a) Akbar
- (b) Jahangir
- (c) Shahjahan
- (d) Aurangzeb

(110.) "Dakshin Gangotri" is
- (a) First nuclear submarine acquired by India
- (b) The palace from where Ganga originates
- (c) India's permanent' station at Antarctica
- (d) A tributary or river Ganges

Direction (111-112): Each of the questions below consists of a word in capital letters, followed by five lettered words or phrases. Choose the lettered words or phrases that is most nearly opposite in meaning to the word in capital letters.

(111.) JETTISON
- (a) Salvage
- (b) Submerge
- (c) Descend
- (d) Decelerate

(112.) CARNAL
- (a) Impressive
- (b) Minute
- (c) Spiritual

(d) Actual

Directions (113-114): Each of the questions below consists of a word in capital letters, followed by four lettered words. Choose the lettered words or phrases that is most nearly opposite in meaning to the word in capital letters.

(113.) Incorrigible
    (a) Narrow
    (b) Straight
    (c) Inconceivable
    (d) Unreformable

(114.) Braggadocio
    (a) Weaponry
    (b) Boasting
    (c) Encounter
    (d) Position

Direction (115-116): In this Section a number of sentences are given. The sentences are underlined in three separate parts and each one is labeled (a), (b), (c). Read each sentence to find out whether there is an error in any underlined part. No sentence has more than one error. When you find an error in any one of the underlined part (a), (b) and (c), indicates your response on the spate Answer Sheet at the appropriate space. You may feel that there is no error in a sentence. In that case letter (d) will signify a 'No error' response.

(115.) An open administration will not help
        (a)
if government rules are complicated and incomprehensible
        (b)
For the affected public
        (c)
No error
      (d)

(116.) Perhaps the government too in its efforts
        (a)
To make the truth being know
        (b)
Should take some sinceresteps in that direction
        (c)
No error
      (d)

Directions (117-120): Read the passage that follows. The questions at the end of each passage are based on the content to the basage. Choose your answers from the choice mentioned.

The need for solar electricity is clear. It is safe, ecologically sound, efficient, continuously available, and it has no moving parts. The basic problem with the use of solar photovoltaic devices is economics, but until recently every little progress had been made towards the development of low cost photovoltaic deices. The larger part of research funas has been devoted to study of single-crystal silicon solar cells, despite the evidence, including that of the leading manufacturing of crystalline silicon, that this technique holds little promise. The reason for this pattern is understandable and historical. Crystalline silicon is the active element in the very successfully semiconductor industry and virtually all of the solid state devices contain silicon transistors and diodes. Crystalline silicon, however, is particularly unsuitable to terrestrial solar cells.

Crystalline silicon solar cells work well and are successfully used in the space programme, where cost is not an issue. While single crystal silicon has been proven in extraterrestrial use with efficiencies a high as 18% and other more expensive and scarce material such as gallium arsenide can have even higher efficiencies, costs must be reduced by a factor of more than 100 to make them practical for commercial uses. Besides the fact that the starting crystalling silicon is expensive, 95% of it is wasted and does not appear in the final device. Recently, there have been some imaginative attempts to make polycrystalline and ribbon silicon that are lower in cost than highquality single crystals; but to data the efficiencies of these apparently lower-cost arrays have been unacceptably small. Moreover, these materials are cheaper only because of the Introduction of disordering in crystalline semiconductors, and disorder degrades the efficiency of crystalline solar cells.

The dilemma can be avoided by preparing completely disordered or amorphous materials. Amorphous materials have disordered atomic structure as compared to crystalline materials, that is they have only short-range order rather than the long-range periodicity of crystals. The advantage of amorphous solar cells are impressive. Whereas crystals can be grown as wafers about 4 inches in diameter, amorphous materials can be grown over large areas in a single process. Whereas crystalline silicon must be made 200 microns thick to absorb a sufficient amount of sunlight for efficient energy conversion, only 1 micron of the proper amorphous materials is necessary. Crystalline silicon solar cells cost in excess of Rs. 100 per square foot, but amorphous films can be created at a cost of about 50 paise per square foot.

Although many scientists were aware of the very low cost of amorphous solar cells, they felt that they could never be manufactured with the efficiencies necessary to contribute significantly to the demand for electric power. This was based on a misconception about the feature which determines efficiency. For example, it s not the conductivity of the material in the dark that is relevant but only the photoconductivity, that is the conductivity in the presence of sunlight. Already, solar cells with efficiencies well above 6% have been developed using amorphous materials and further research will doubtless find even less costly amorphous material with higher efficiencies.

(117.) The author is primarily concerned with
    (a) Discussing the importance of solar energy
    (b) Explaining the functioning of solar cells
    (c) Presenting a history of research on energy sources
    (d) Describing a possible solution to the problem of the cost of photovoltaic cells

(118.) The tone of the passage can best be described as
    (a) Analytical and optimistic
    (b) Biased and unprofessional
    (c) Critical and discouraged
    (d) Tentative and inconclusive

(119.) The author mentions which of the following as advantages of amorphous materials for solar cells over silicon crystals?
    I. The relative thinness of amorphous materials
    II. The cost of amorphous material
    III. The size of solar cells which can be made of amorphous material
    (a) I only
    (b) II only
    (c) I and II only
    (d) II and III only

(120.) The material in the passage could best be used in an argument for
    (a) Discontinuing the space programme
    (b) Increased funding for research on amorphous materials
    (c) Further study of the history of silicon crystals
    (d) Increased reliance on solar energy

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
d	a	a	c	d	c	c	d	b	c
11	12	13	14	15	16	17	18	19	20
a	d	d	d	a	c	a	c	c	a
21	22	23	24	25	26	27	28	29	30
a	b	d	a	d	d	d	c	c	b
31	32	33	34	35	36	37	38	39	40
d	b	d	(a,b)	b	d	c	b	c	a
41	42	43	44	45	46	47	48	49	50
b	c	d	b	c	a	a	b	a	b
51	52	53	54	55	56	57	58	59	60
b	a	c	b	c	c	a	d	a	b
61	62	63	64	65	66	67	68	69	70
a	c	a	b	c	b	b	d	d	d
71	72	73	74	75	76	77	78	79	80
a	c	b	b	b	a	d	b	b	d
81	82	83	84	85	86	87	88	89	90

c	d	b	b	d	a	a	d	d	d
91	92	93	94	95	96	97	98	99	100
d	d	c	c	b	d	b	c	c	a
101	102	103	104	105	106	107	108	109	110
b	b	b	a	b	b	b	c	d	c
111	112	113	114	115	116	117	118	119	120
a	c	d	b	c	b	d	a	d	b

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