SECTION A - Nano Science NNST

Question No.1 (Question Id - 3)

Identify the incorrect option about the wave function :

(A) ○ Continuous
(B) ○ **Infinite (Correct Answer)**
(C) ○ Quantized
(D) ○ Finite

Question No.2 (Question Id - 6)

$RCONH_2 \xrightarrow{A} RNH_2$

Identify A

(A) ○ Br_2/NaCl
(B) ○ **Br_2/NaOH (Correct Answer)**
(C) ○ I_2/NaCl
(D) ○ I_2/NaOH

Question No.3 (Question Id - 29)

Ability to eat away pathogen is feature of :

(A) ○ Red blood cell
(B) ○ **White blood cell (Correct Answer)**
(C) ○ Liver
(D) ○ Plasma

Question No.4 (Question Id - 41)

Aceton in vapor phase is decomposed by light having a wavelength 320 nm yield products is :

(A) ○ $CO_2 + CH_4$
(B) ○ **$CO + \cdot CH_3$ (Correct Answer)**
(C) ○ $C + CH_4$
(D) ○ $CO + CH_4$

Question No.5 (Question Id - 65)

Which among the following is **correct** about Viruses ?

(A) ○ They have DNA only
(B) ○ They have RNA only
(C) ○ They have both DNA & RNA
(D) ○ **They have either DNA or RNA (Correct Answer)**

Question No.6 (Question Id - 11)

When the separation between two charges is increased, the electric potential energy of the charges :

(A) ○ decreases
(B) ○ increases
(C) ○ remains the same
(D) ○ **may increase or decrease (Correct Answer)**

Question No.7 (Question Id - 38)

In a reaction between A and B, the initial rate of reaction (r_o) was measured for different initial concentrations of A and B as given below :

A (mol L^{-1})	0.20	0.20	0.40
B (mol L^{-1})	0.30	0.10	0.05
r_0 (mol L^{-1} s^{-1})	5.07×10^{-5}	5.07×10^{-5}	1.014×10^{-4}

The order of reaction with respect to A and B are :

(D) ○ arbitrary

uestion No.9 (Question Id - 30)

The smallest unit of inheritance is called :

(A) ○ **gene (Correct Answer)**

(B) ○ allele

(C) ○ chromosome

(D) ○ RNA

Question No.10 (Question Id - 48)

A point charge 1 is a distance 5 cm directly above the centre of square of side 10 cm. What is the magnitude of the electric flux through the square. (ε_0 = permittivity of free space).

(A) ○ q/25

(B) ○ q/ε_0

(C) ○ $q/(5\ \varepsilon_0)$

(D) ○ **$q/(6\ \varepsilon_0)$ (Correct Answer)**

Question No.11 (Question Id - 58)

What is the composition of nucleoside ?

(A) ○ a sugar + a phosphate

(B) ○ **a base + a sugar (Correct Answer)**

(C) ○ a base + a phosphate

(D) ○ a base + a sugar + phosphate

Question No.12 (Question Id - 26)

Name the cells which lost their control of the regulated division, differentiation and apoptosis.

(A) ○ **Tumor cell (Correct Answer)**

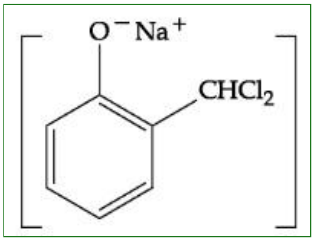
(B) ○ Immune cell

(C) ○ Platelets

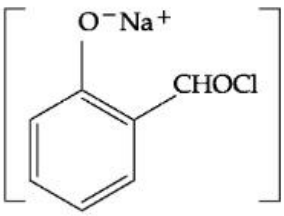
(D) ○ Stem cells

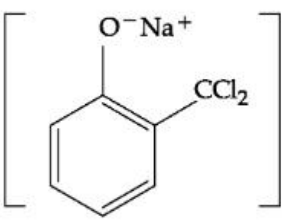
Question No.13 (Question Id - 39)

Identify the intermediate in Reimer-Tiemann reaction :

(A) ○ 

(Correct Answer)

(B) ○ 

(C) ○ 

(D) ○

(C) ○ inherited metabolism disease
(D) ○ sex-linked recessive disease due to defect in red cone of eye
(D) ○ none of these

Question No.15 (Question Id - 46)
X-rays of wavelength λ = a are reflected from the (100) plane of a simple cubic lattice. If the lattice constant is a, the corresponding Bragg angle (in radian) is :

(A) ○ π/4
(B) ○ π/3
(C) ○ π/5
(D) ○ **π/6 (Correct Answer)**

Question No.16 (Question Id - 59)
Which of the following antibody gives a primary immune reaction ?

(A) ○ IgG
(B) ○ **IgM (Correct Answer)**
(C) ○ IgA
(D) ○ IgE

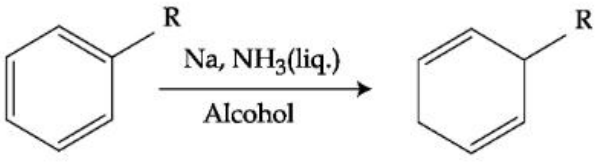
Question No.17 (Question Id - 20)
Following phenomenon can be explained only by particle nature of light :
(A) ○ Reflection
(B) ○ Refraction
(C) ○ Interference
(D) ○ **Compton scattering (Correct Answer)**

Question No.18 (Question Id - 28)
What is true about genetic material of a prokaryotic cell ?
(A) ○ lacks histones
(B) ○ not enveloped by nuclear membrane
(C) ○ composed of a single circular DNA molecule
(D) ○ **all of these (Correct Answer)**

Question No.19 (Question Id - 1)
Laplacian operator is :
(A) ○ $\partial/\partial x^2 + \partial/\partial y^2 + \partial/\partial z^2$
(B) ○ $\partial^2/\partial xy + \partial^2/\partial yz + \partial^2/\partial xz$
(C) ○ **$\partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2/\partial z^2$ (Correct Answer)**
(D) ○ $\partial^2/\partial x + \partial^2/\partial y + \partial^2/\partial z$

Question No.20 (Question Id - 5)

This reaction is an example of :



(A) ○ **Birch Reaction (Correct Answer)**
(B) ○ Cannizzaro Reaction
(C) ○ Bouveault Reduction
(D) ○ Clemmensen Reduction

Question No.21 (Question Id - 9)
All of the following is true statements concerning catalysts except :
(A) ○ A catalyst will speed the rate-determining step
(B) ○ **A catalyst will be used up in a reaction (Correct Answer)**

Question No.23 (Question Id - 21)

n-clotting of blood is caused by deficiency of

(A) ○ Vitamin A

(B) ○ Vitamin C

(C) ○ Vitamin E

(D) ○ **Vitamin K (Correct Answer)**

Question No.24 (Question Id - 53)

Match **List - I** with **List - II** :

List - I	List - II
A. Laws of motion	I. Galileo
B. Unification of electricity and magnetism	II. Maxwell
C. Unification of space and time	III. Newton
D. Law of inertia	IV. Einstein

Choose the **correct** answer from the options given below :

(A) ○ A -I, B - IV, C - III, D - II

(B) ○ A - III, B - IV, C - II, D - I

(C) ○ A - I, B - II, C - III, D - IV

(D) ○ **A - III, B - II, C - IV, D - I (Correct Answer)**

Question No.25 (Question Id - 63)

Bacteria which have ability to convert milk sugar in to lactic acid is called :

(A) ○ ***Lactobacillus* (Correct Answer)**

(B) ○ *Streptococcus*

(C) ○ *E. coli*

(D) ○ *Salmonella*

Question No.26 (Question Id - 27)

Name the enzyme which catalyzes the oxidation-reduction reaction.

(A) ○ Transaminase

(B) ○ Glutamine synthetase

(C) ○ Phosphofructokinase

(D) ○ **Oxidoreductase (Correct Answer)**

Question No.27 (Question Id - 24)

Which ratio is constant for DNA ?

(A) ○ **A + G/T + C (Correct Answer)**

(B) ○ A + T/G + C

(C) ○ A + C/U + G

(D) ○ A + U/G + C

Question No.28 (Question Id - 32)

For the oxidation of iron

$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

Entropy change is - 549.4 J K^{-1} mol^{-1} at 298 K. Total entropy change for this reaction is :

($\Delta_r H^{\ominus}$ = - 1648 x 10^3 J mol^{-1})

(A) ○ **4.98 kJ K^{-1} mol^{-1} (Correct Answer)**

(B) ○ 5.53 kJ K^{-1} mol^{-1}

(C) ○ 6.07 kJ K^{-1} mol^{-1}

(D) ○ 5.23 kJ K^{-1} mol^{-1}

Question No.29 (Question Id - 43)

Let P and E denote the linear momentum and energy of a photon. If the wavelength is decreased,

(A) ○ **Both P and E increase (Correct Answer)**

(B) ○ P increases and E decreases

(C) ○ P decreases and E increases

Question No.31 (Question Id - 17)
With increase in temperature, the orientation polarization in general :
(A) ○ increases
(B) ○ **decreases (Correct Answer)**
(C) ○ is constant
(D) ○ none of these

Question No.32 (Question Id - 44)
Width of one-dimensional infinite potential well is decreased by half, what is the effect on its energy levels.

(A) ○ Energy levels do not change
(B) ○ Energy of the levels is doubled
(C) ○ **Energy of the levels is quadrupled (Correct Answer)**
(D) ○ Energy of the levels is halved

Question No.33 (Question Id - 25)
Which of the following promotes hypoglycemia ?
(A) ○ Epinephrine
(B) ○ **Insulin (Correct Answer)**
(C) ○ Norepinephrine
(D) ○ Growth hormone

Question No.34 (Question Id - 33)
In tetrathionate ion ($S_4O_6^{2-}$), the oxidation numbers of sulphurs is/are :

(A) ○ **0, + 5 (Correct Answer)**
(B) ○ 2.5
(C) ○ + 2, + 3
(D) ○ + 3

Question No.35 (Question Id - 64)
Law of thermodynamics which states that energy can neither be created nor be destroyed is _____.

(A) ○ The second law of thermodynamics
(B) ○ Third law of thermodynamics
(C) ○ **First law of thermodynamics (Correct Answer)**
(D) ○ Zero-order kinetics

Question No.36 (Question Id - 23)
Programmed cell death can be termed as :
(A) ○ Oxidative stress
(B) ○ **Apoptosis (Correct Answer)**
(C) ○ Cell division
(D) ○ Cell cycle

Question No.37 (Question Id - 50)
In the polarization vs field strength for a ferroelectric material, P_s stands for :

(A) ○ Space charge polarization
(B) ○ **Spontaneous polarization (Correct Answer)**
(C) ○ Saturation polarization
(D) ○ None of these

Question No.38 (Question Id - 54)
If the sequence of bases in one strand of DNA is ATGCATGCA, what would be the sequence of bases on

(B) ○ Curie-Weiss temperature
(C) ○ **Neel temperature (Correct Answer)**
(D) ○ Debye temperature

Question No.40 (Question Id - 2)
Which of the following molecule is trigonal pyramid shape ?
(A) ○ H_2O
(B) ○ CO_2
(C) ○ **NH_3 (Correct Answer)**
(D) ○ BF_3

Question No.41 (Question Id - 19)
If heat is supplied to an ideal gas in an isothermal process,
(A) ○ the internal energy of the gas will decrease
(B) ○ **the gas will do positive work (Correct Answer)**
(C) ○ the gas will do negative work
(D) ○ the said process is not possible

Question No.42 (Question Id - 34)
The molar solubility of $Ni(OH)_2$ in 0.1 M NaOH is (ionic product of $Ni(OH)_2 = 2.0 \times 10^{-15}$) :
(A) ○ 1.0×10^{-12} M
(B) ○ **2.0×10^{-13} M (Correct Answer)**
(C) ○ 5.0×10^{-12} M
(D) ○ 4.0×10^{-13} M

Question No.43 (Question Id - 37)
Given below are two statements : one is labelled as Assertion **A** and the other is labelled as Reason **R** :

Assertion A:

Redox couple is the combination of oxidized and reduced form of a substance involved in an oxidation or reduction half cell.

Reason R:

In the representation $E^{\ominus}(Fe^{3+}/Fe^{2+})$ and $E^{\ominus}(Cu^{2+}/Cu)$, (Fe^{3+}/Fe^{2+}) and (Cu^{2+}/Cu) are redox couple.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

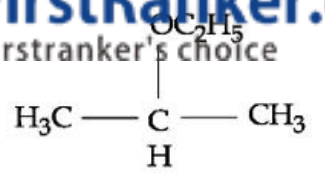
(A) ○ Both **A** and **R** are correct and **R** is the correct explanation of **A**
(B) ○ **Both A and R are correct but R is NOT the correct explanation of A (Correct Answer)**
(C) ○ **A** is correct but **R** is not correct
(D) ○ **A** is not correct but **R** is correct

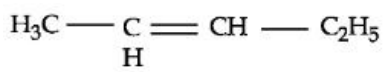
Question No.44 (Question Id - 55)
Inner membrane of which organelle forms infolding called cristae ?
(A) ○ ribosomes
(B) ○ **mitochondria (Correct Answer)**
(C) ○ golgi apparatus
(D) ○ cell wall

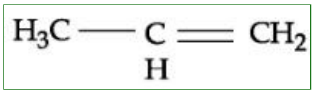
Question No.45 (Question Id - 8)
Identify the oxide of alkaline earth metal which is essentially covalent in nature :
(A) ○ **BeO (Correct Answer)**
(B) ○ MgO
(C) ○ CaO
(D) ○ SrO

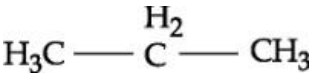
Question No.46 (Question Id - 14)
Acceptor type impurity in Si is formed by adding impurity of valency :

where X is :

(A) 

(B) 

(C)  **(Correct Answer)**

(D) 

Question No.48 (Question Id - 42)

When a photon stimulates the emission of another photon, the two photons have :

A. Same direction

B. Same energy

C. Same phase

D. Same wavelength

Choose the **correct** answer from the options given below :

(A) A and C Only
(B) D and A Only
(C) C and B Only
(D) **A, B, C and D (Correct Answer)**

Question No.49 (Question Id - 52)

The internal energy of an ideal gas decreases by the same amount as the work done by the system.

A. The process must be adiabatic

B. The process must be isothermal

C. The process must be isobaric

D. The temperature must decrease

Choose the **correct** answer from the options given below :

(A) A Only
(B) B Only
(C) C Only
(D) **A and D Only (Correct Answer)**

Question No.50 (Question Id - 22)

Vaccine against tuberculosis is called :

(A) Mycobacterium
(B) **Bacille Calmette Guerin (BCG) (Correct Answer)**
(C) S. typhi
(D) Francisellatularensis

Question No.51 (Question Id - 35)

pH of a solution of a strong acid is 5.0. The pH of the solution obtained after diluting the given solution a 100 times is :
(log 2 = 0.301)

(A) **6.699 (Correct Answer)**
(B) 7.001
(C) 5.501

Question No.53 (Question Id - 47)

A normalized wave function is given by $\Psi = \frac{1}{\sqrt{3}}\varphi_0 + \sqrt{\frac{2}{3}}\varphi_1$ where φ_0 and φ_1 are normalized Eigen functions with energies E_0 and E_1, corresponding to ground state and first excited state respectively. What is the probability of getting E_0 when energy is measured ?

(A) ○ **1/3 (Correct Answer)**
(B) ○ 1/√3
(C) ○ 1
(D) ○ 0

Question No.54 (Question Id - 4)

Which of the reaction is not a part of Sandmeyer reaction ?

(A) ○ $ArN_2^+X^- \xrightarrow{Cu_2Cl_2/HCl} ArCl + N_2$

(B) ○ $ArN_2^+X^- \xrightarrow{Cu_2Cl_2/HBr} ArBr + N_2$

(C) ○ $ArN_2^+X^- \xrightarrow{Cu/HCl} ArCl + N_2 + CuX$ **(Correct Answer)**

(D) ○ $ArN_2^+X^- \xrightarrow{CuCN/KCN} ArCN + N_2$

Question No.55 (Question Id - 61)

Match the object in **PART - A** with their size in **PART - B**.

PART - A	PART - B
A. Nanoshell	I. 100 nm
B. Hydrogen atom	II. 2000 nm
C. E. coli bacterium	III. 90 nm
D. Transistor	IV. 0.1 nm

Choose the **correct** answer from the options given below :

(A) ○ A - I, B - III, C - IV, D - II
(B) ○ A - II, B - I, C - III, D - IV
(C) ○ **A - I, B - IV, C - II, D - III (Correct Answer)**
(D) ○ A - III, B - IV, C - II, D - I

Question No.56 (Question Id - 7)

For one component system, the phase rule is :

(A) ○ **F = 3 - p (Correct Answer)**
(B) ○ F = 2 - p
(C) ○ F = 1 - p
(D) ○ F = 1

Question No.57 (Question Id - 10)

With the rise in temperature the conductance of a solution of an electrolyte generally :

(A) ○ Decreases
(B) ○ **Increases (Correct Answer)**
(C) ○ Remain constant
(D) ○ A small decrease

Question No.58 (Question Id - 18)

Let n_p and n_e be the number of holes and conduction electrons in an intrinsic semiconductor.

(A) ○ $n_p > n_e$
(B) ○ **$n_p = n_e$ (Correct Answer)**
(C) ○ $n_p < n_e$
(D) ○ $n_p \neq n_e$

Question No.59 (Question Id - 36)

(C) ○ crystal violet and safranin (Correct Answer)
(B) ○ crystal violet and carbol fuschin
(D) ○ safranin and methylene blue

Question No.61 (Question Id - 51)
In an extrinsic semiconductor, in the region where mobility variation with temperature is evident, the slope of log (conductivity) vs. 1/T plot is :

(A) ○ negative
(B) ○ **positive (Correct Answer)**
(C) ○ 0
(D) ○ infinite

Question No.62 (Question Id - 60)
Polio can lead to :
(A) ○ paralysis
(B) ○ nervous system distracted
(C) ○ **both 1 and 2 (Correct Answer)**
(D) ○ eye diseases

Question No.63 (Question Id - 62)
Mode of DNA replication is :
(A) ○ Conservative and bidirectional
(B) ○ Semiconservative and unidirectional
(C) ○ **Semiconservative and bidirectional (Correct Answer)**
(D) ○ Conservative and unidirectional

Question No.64 (Question Id - 49)
Magnetic field at a distance r from a long thin straight wire carrying current I is (μ_0 is susceptibility, ϵ_0 is permittivity of free space)

(A) ○ $I/(4\pi\epsilon_0 r^2)$
(B) ○ $I.r/\epsilon_0$
(C) ○ $I^2/(4\pi\epsilon_0 r)$
(D) ○ **$\mu_0 I/(2\pi r)$ (Correct Answer)**

Question No.65 (Question Id - 12)
When dielectric slab of dielectric constant K is inserted fully between plates of a capacitor, its capacitance :

(A) ○ **increases by a factor of K (Correct Answer)**
(B) ○ decreases by a factor of K
(C) ○ remains constant
(D) ○ none of these

SECTION 2 - Nano Electronics

Question No.1 (Question Id - 70)
An 8-bits flash ADC is to be built. What is the minimum number of comparators required to build this circuit :
(A) ○ 8
(B) ○ 63
(C) ○ **255 (Correct Answer)**
(D) ○ 256

Question No.2 (Question Id - 123)

(D) ○ 101

Question No.3 (Question Id - 75)

In Intel 8085 microprocessor,

(A) ○ the total addressable memory size is 512 KB

(B) ○ the total addressable memory size is 256 KB

(C) ○ the total addressable memory size is 128 KB

(D) ○ **the total addressable memory size is 64 KB (Correct Answer)**

Question No.4 (Question Id - 82)

In a semiconductor diode, the barrier potential offers opposition to only :

(A) ○ **majority carriers in both regions (Correct Answer)**

(B) ○ minority carriers in both regions

(C) ○ free electrons in the N region

(D) ○ holes in the P region

Question No.5 (Question Id - 69)

The base-to-emitter voltage (V_{BE}) is 0.7 V and the collector-to-base voltage (V_{CB}) is 0.2 V is given for a silicon n-p-n transistor, then the transistor is operating in :

(A) ○ **normal active mode (Correct Answer)**

(B) ○ saturation mode

(C) ○ inverse active mode

(D) ○ cutoff mode

Question No.6 (Question Id - 86)

The current I_{CBO} flows in :

(A) ○ the emitter, base and collector leads

(B) ○ the emitter and base leads

(C) ○ the emitter and collector leads

(D) ○ **the collector and base leads (Correct Answer)**

Question No.7 (Question Id - 102)

Consider the following statements S1 and S2 :

Statement I:

S1 : At the resonant frequency the impedance of a series RLC circuit is zero.

Statement II:

S2 : In a parallel GLC circuit, increasing the conductance G results in increase in its Q factor.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(A) ○ Both **Statement I** and **Statement II** are true

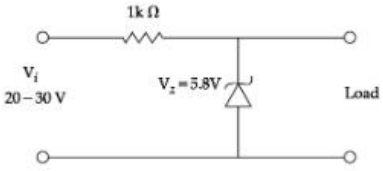
(B) ○ **Both Statement I and Statement II are false (Correct Answer)**

(C) ○ **Statement I** is correct but **Statement II** is false

(D) ○ **Statement I** is incorrect but **Statement II** is true

Question No.8 (Question Id - 118)

The Zener diode in the regulator circuit here in the figure has a Zener voltage of 5.8 volts and a zener knee current of 0.5 mA. The maximum load current drawn from this current ensuring proper functioning over the input voltage range between 20 and 30 volts, is :



(A) ○ **23.7 mA (Correct Answer)**

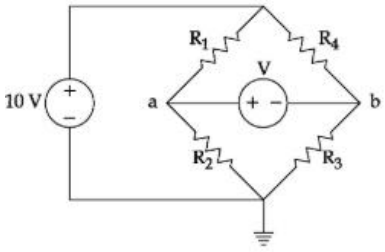
(B) ○ 14.2 mA

(C) ○ 13.7 mA

(D) ○ 20 μF

Question No.10 (Question Id - 116)

If $R_1 = R_2 = R_4 = R$ and $R_3 = 1.1R$ in the bridge circuit shown in the figure, then the reading in the ideal voltmeter connected between a and b is :



(A) ○ 1.238 V
(B) ○ 1.138 V
(C) ○ **- 0.238 V (Correct Answer)**
(D) ○ 1.28 V

Question No.11 (Question Id - 110)

A master - slave flip flop has the characteristic that :

(A) ○ change in the output immediately reflected in the output
(B) ○ change in the output occurs when the state of the master is affected
(C) ○ **change in the output occurs when the state of the slave is affected (Correct Answer)**
(D) ○ both the master and the slave states are affected at the same time

Question No.12 (Question Id - 101)

A 4 bit ripple counter and a bit synchronous counter are made using flip flops having a propagation delay of 10 ns each. If the worst case delay in the ripple counter and the synchronous counter be R and S respectively, then :

(A) ○ R = 10 ns, S = 40 ns
(B) ○ **R = 40 ns, S = 10 ns (Correct Answer)**
(C) ○ R = 10 ns, S = 30 ns
(D) ○ R = 30 ns, S = 10 ns

Question No.13 (Question Id - 121)

The Boolean expression for the truth table shown is :

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

(A) ○ $B(A + C)(\overline{A} + \overline{C})$ **(Correct Answer)**
(B) ○ $B(A + \overline{C})(\overline{A} + C)$
(C) ○ $\overline{B}(A + \overline{C})(\overline{A} + C)$
(D) ○ $\overline{B}(A + C)(\overline{A} + \overline{C})$

Question No.14 (Question Id - 120)

In a p-type Si sample, the hole concentration is $2.25 \times 10^{15}/cm^3$. The intrinsic carrier concentration is 1.5 x

(A) ○ main frame
(B) ○ super computers
(C) ○ high performance machine (Correct Answer)
(D) ○ mini and micro computers

Question No.16 (Question Id - 97)

Match items in **List-I** with items in **List-II**, most suitably.

List-I	List-II
A. LED	I. Heavy doping
B. Avalanche photo diode	II. Coherent radiation
C. Tunnel diode	III. Spontaneous emission
D. LASER	IV. Current gain

Choose the **correct** answer from the options given below :

(A) ○ A - I, B - II, C - IV, D - III
(B) ○ A - II, B - III, C - I, D - IV
(C) ○ **A - III, B - IV, C - I, D - II (Correct Answer)**
(D) ○ A - II, B - I, C - IV, D - III

Question No.17 (Question Id - 89)

Calculate the gain of a negative feedback amplifier with an internal gain, A=100 and feedback factor β = 1/10.

(A) ○ 0.909
(B) ○ 1.09
(C) ○ **9.09 (Correct Answer)**
(D) ○ 0.99

Question No.18 (Question Id - 109)

Choose the correct one from among the alternatives A, B, C after matching an item from Group 1 most appropriate item in Group 2.

Group 1	Group 2
A. Shift register	I. Frequency division
B. Counter	II. Addressing in memory chips
C. Decoder	III. Serial to parallel data conversion

Choose the **correct** answer from the options given below :

(A) ○ A - III, B - II, C - I
(B) ○ **A - III, B - I, C - II (Correct Answer)**
(C) ○ A - II, B - I, C - III
(D) ○ A - I, B - II, C - III

Question No.19 (Question Id - 106)

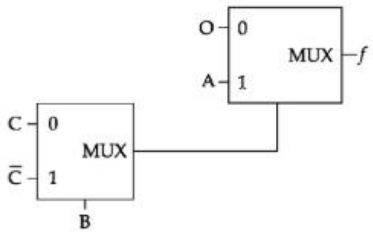
A series circuit R-L-C circuit has a Q of 100 and an impedance of (100 + j0) Ω at its resonant angular frequency of 10^7 radian/sec. The value of R and L are respectively as :

(A) ○ R = 100 Ω, L = 5 mH
(B) ○ R = 50 Ω, L = 5 mH
(C) ○ **R = 100 Ω, L = 1 mH (Correct Answer)**
(D) ○ R = 100 Ω, L = 15 mH

Question No.20 (Question Id - 105)

Question No.21 (Question Id - 112)

The Boolean function f implemented in the figure using two input multiplexers is :



(A) ○ $A\bar{B}C + AB\bar{C}$ **(Correct Answer)**

(B) ○ $ABC + A\bar{B}\bar{C}$

(C) ○ $\bar{A}BC + \bar{A}\bar{B}\bar{C}$

(D) ○ $\bar{A}\bar{B}C + \bar{A}B\bar{C}$

Question No.22 (Question Id - 74)

What is a microprocessor ?

(A) ○ A manually controlled device

(B) ○ Can be either manually controlled or program controlled

(C) ○ **A program-controlled device (Correct Answer)**

(D) ○ None of these

Question No.23 (Question Id - 129)

Group I lists four different semiconductor devices. Match each device in **Group - I** with its characteristic property in **Group - II** :

Group - I	**Group - II**
A. BJT	I. Population inversion
B. MOS capacitor	II. Pinch-off voltage
C. LASER diode	III. Early effect
D. JFET	IV. Flat-band voltage

Choose the **correct** answer from the options given below :

(A) ○ A - III, B - I, C - IV, D - II

(B) ○ A - I, B - IV, C - III, D - II

(C) ○ **A - III, B - IV, C - I, D - II (Correct Answer)**

(D) ○ A - III, B -II , C - I, D - IV

Question No.24 (Question Id - 111)

The bandgap of Silicon at 300 K is :

(A) ○ 1.3 eV

(B) ○ 0.7 eV

(C) ○ **1.1 eV (Correct Answer)**

(D) ○ 1.4 eV

Question No.25 (Question Id - 66)

n-type silicon is obtained by doping silicon with :

(A) ○ Germanium

(B) ○ **Phosphorus (Correct Answer)**

(C) ○ Aluminium

(D) ○ Boron

Question No.26 (Question Id - 124)

(B) ◯ $V_R = +5$ V (Correct Answer)
(C) ◯ $0 \text{ V} \le V_R < 5 \text{ V}$
(D) ◯ $-5 \text{ V} \le V_R < 0 \text{ V}$

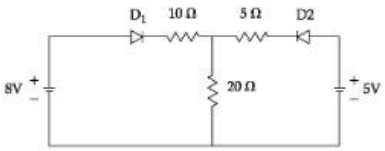
Question No.27 (Question Id - 103)

An AM news broadcasting station uses a carrier signal of 1 MHz. If the speech signal has frequency component upto 8 kHz, then what is the lowest frequency, highest frequency present in the AM signal ? Also what is the bandwidth of the AM signal ?

(A) ◯ 0.9 MHz; 1.1 MHz; 32 kHz
(B) ◯ 1.91 MHz; 1.23 MHz; 16 kHz
(C) ◯ **0.992 MHz; 1.008 MHz; 16 kHz (Correct Answer)**
(D) ◯ 0.992 MHz; 1.008 MHz; 32 kHz

Question No.28 (Question Id - 72)

In the circuit shown here which of the diode/diodes is/are in ON state ? The diodes have cut-in voltage of 0.6 V.



(A) ◯ Only D_1
(B) ◯ Only D_2
(C) ◯ **Both D_1 and D_2 (Correct Answer)**
(D) ◯ None of D_1 and D_2

Question No.29 (Question Id - 128)

The DC current gain β of a BJT is 50. Assuming that the emitter injection efficiency is 0.995, the base transport factor is :

(A) ◯ 0.980
(B) ◯ **0.985 (Correct Answer)**
(C) ◯ 0.990
(D) ◯ 0.995

Question No.30 (Question Id - 94)

Which one of the following is analog ?

(A) ◯ PCM
(B) ◯ **PWM (Correct Answer)**
(C) ◯ differential PCM
(D) ◯ delta modulation

Question No.31 (Question Id - 73)

Given that $(203)_5 = (125)_R$ what is the value of radix "R" ?

(A) ◯ 16
(B) ◯ 10
(C) ◯ 8
(D) ◯ **6 (Correct Answer)**

Question No.32 (Question Id - 83)

The capacitance of a reverse-biased PN-junction :

(A) ◯ **increases as the reverse bias is decreased. (Correct Answer)**
(B) ◯ increases as the reverse bias is increased.
(C) ◯ depends mainly on the reverse saturation current
(D) ◯ makes the PN junction more effective at high frequencies.

Question No.33 (Question Id - 98)

Avalanche photo diode are operated in X bias and Y bias respectively.

(A) ○ X : reverse, Y : reverse
(B) ○ X : reverse, Y : forward
(C) ○ **X : forward, Y : reverse (Correct Answer)**
(D) ○ X : forward, Y : forward

Question No.35 (Question Id - 87)

The transistor is said to be a quiescent state when ?

(A) ○ **no signal is applied to the input (Correct Answer)**
(B) ○ it is unbiased
(C) ○ no current are flowing
(D) ○ emitter-junction bias is just equal to collector-junction bias

Question No.36 (Question Id - 80)

What is the bandwidth between half power points for a circuit which resonates at 1MHz and has a Q of 100 ?

(A) ○ **10 kHz (Correct Answer)**
(B) ○ 100 kHz
(C) ○ 10 Hz
(D) ○ 100 Hz

Question No.37 (Question Id - 81)

The circuit analysis with nodal method is based on :

(A) ○ KVL and Ohm's Law
(B) ○ **KCL and Ohm's Law (Correct Answer)**
(C) ○ KCL and KVL
(D) ○ KCL, KVL and Ohm's Law

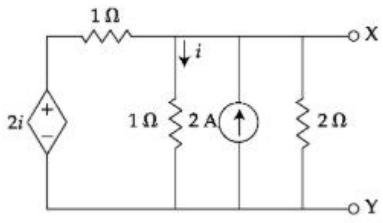
Question No.38 (Question Id - 67)

R = 2 kΩ, L = 1 H, and C = 1/400 μF are present in a series RLC circuit. What is the resonant frequency ?

(A) ○ 2×10^4 Hz
(B) ○ 10^4 Hz
(C) ○ **$(1/\pi)\ 10^4$ Hz (Correct Answer)**
(D) ○ $2\pi \times 10^4$ Hz

Question No.39 (Question Id - 127)

For the circuit shown in the figure, the Thevenin voltage and resistance looking into X - Y are :



(A) ○ 4/3 V , 2 Ω
(B) ○ 4 V , 2/3 Ω
(C) ○ 4/3 V , 2/3 Ω
(D) ○ **4 V , 2 Ω (Correct Answer)**

Question No.40 (Question Id - 84)

A Zener diode :

(A) ○ has a high forward-voltage rating
(B) ○ **has a sharp breakdown at low reverse voltage (Correct Answer)**
(C) ○ is useful as an amplifier
(D) ○ has a negative resistance

Question No.41 (Question Id - 92)

In the design of an analog circuit to avoid thermal run-away, the operating point of the BJT should be :

(B) ○ 3 (Correct Answer)
(C) ○ 4
(D) ○ 5

Question No.43 (Question Id - 100)
An ideal sawtooth voltages waveform of frequency of 500 Hz and amplitude 3 V is generated by charging a capacitor of 2 μF in every cycle. The charging requires :

(A) ○ Constant voltage source of 3 V for 1 ms
(B) ○ Constant voltage source of 3 V for 2 ms
(C) ○ Constant current source of 1 mA for 1 ms
(D) ○ **Constant current source of 3 mA for 2 ms (Correct Answer)**

Question No.44 (Question Id - 71)
Find the unit of Δ x H.
(A) ○ Ampere
(B) ○ **Ampere/meter^2 (Correct Answer)**
(C) ○ Ampere/meter
(D) ○ Ampere-meter

Question No.45 (Question Id - 90)
The current of bipolar transistor drops at higher frequencies because of :
(A) ○ **Transistor capacitance (Correct Answer)**
(B) ○ high current effect in base
(C) ○ parasitic inductance
(D) ○ the early effect

Question No.46 (Question Id - 107)
A 0 to 6 counter consists of 3 flip flops and a combination circuit of 2 input gate (s). The common circuit consists of :

(A) ○ one AND gate
(B) ○ one OR gate
(C) ○ one AND gate and one OR gate
(D) ○ **two AND gates (Correct Answer)**

Question No.47 (Question Id - 108)
A microprocessor with a 16-bit address bus is used in a linear memory selection configuration (i.e. Address bus lines are directly used as a chip select of memory chip) with 4 memory chips. The maximum addressable memory space is :

(A) ○ **64k (Correct Answer)**
(B) ○ 16k
(C) ○ 8k
(D) ○ 4k

Question No.48 (Question Id - 77)
Restart is a special type of CALL in which :
(A) ○ the address is programmed but not built into the hardware
(B) ○ the address is programmed and built into the hardware
(C) ○ **the address is not programmed but built into the hardware (Correct Answer)**
(D) ○ none of these

Question No.49 (Question Id - 76)
Once the information placed into a read-only memory, then :
(A) ○ it can be modified easily
(B) ○ it is continuously modified
(C) ○ **it cannot be modified easily (Correct Answer)**
(D) ○ none of these

Question No.51 (Question Id - 99)

When the gate-to-source voltage (V_{GS}) of a MOSFET with threshold voltage of 400 mV working in saturation is 900 mV, the drain current is observed to be 1 mA. Neglecting the channel width modulation effect and assuming that the MOSFET is operating at saturation, the drain current for an applied V_{GS} of 1400 mV is :

(A) ○ 0.5 mA
(B) ○ 2.0 mA
(C) ○ 3.5 mA
(D) ○ **4.0 mA (Correct Answer)**

Question No.52 (Question Id - 91)

The ideal op-amp has the following characteristics :

(A) ○ $R_{in} = 0$, $A = \infty$ and $R_o = 0$
(B) ○ **$R_{in} = \infty$, $A = \infty$ and $R_o = 0$ (Correct Answer)**
(C) ○ $R_{in} = 0$, $A = 0$ and $R_o = \infty$
(D) ○ $R_{in} = \infty$, $A = 0$ and $R_o = \infty$

Question No.53 (Question Id - 125)

The majority carriers in an n-type semiconductor have an average drift velocity v in a direction perpendicular to a uniform magnetic field B. The electric field E induced due to Hall effect acts in the direction :

(A) ○ v x B
(B) ○ **B x v (Correct Answer)**
(C) ○ along v
(D) ○ opposite to v

Question No.54 (Question Id - 126)

Find the correct match between **Group 1** and **Group 2** :

Group 1	Group 2
A. Varactor diode	I. Voltage reference
B. PIN diode	II. High frequency switch
C. Zener diode	III. Tuned circuits
D. Schottky diode	IV. Current controlled attenuator

Choose the **correct** answer from the options given below :

(A) ○ A - IV, B - II, C - I, D - III
(B) ○ **A - III, B - IV, C - I, D - II (Correct Answer)**
(C) ○ A - II, B - IV, C - I, D - III
(D) ○ A - I, B - III, C - II, D - IV

Question No.55 (Question Id - 114)

A multistage amplifier consists of three stages. The voltage gains of the stages are 30, 50 and 80. Calculate the overall voltage gain in dB.

(A) ○ 100.3 dB
(B) ○ 100.9 dB
(C) ○ **101.58 dB (Correct Answer)**
(D) ○ 160.0 dB

Question No.56 (Question Id - 95)

Class of amplifiers that operates with least distortion.

(A) ○ Class B
(B) ○ **Class A (Correct Answer)**
(C) ○ Class C
(D) ○ Class D

(B) ○ a flow of majority carriers (Correct Answer)
(C) ○ recombination
(D) ○ negative resistance

Question No.59 (Question Id - 85)

How β (beta) of a transistor is related to α (alpha) of the transistor :

(A) ○ $\beta = \frac{2\alpha}{1-\alpha}$

(B) ○ $\beta = \frac{\alpha}{1-2\alpha}$

(C) ○ $\beta = \frac{\alpha}{1-\alpha}$ **(Correct Answer)**

(D) ○ $\beta = \frac{2\alpha}{\alpha-1}$

Question No.60 (Question Id - 104)

A broadcast radio transmitter radiates 10 kilowatts when the modulation percentage is 60. How much of this is carrier power ?

(A) ○ 10 kilowatts

(B) ○ **8.47 kilowatts (Correct Answer)**

(C) ○ 4.47 kilowatts

(D) ○ 7.57 kilowatts

Question No.61 (Question Id - 96)

Twelve 1 Ω resistance are used as edges to form a cube. The resistance between two diagonally opposite corners of the cube is :

(A) ○ 6/5 Ω

(B) ○ 1Ω

(C) ○ **5/6 Ω (Correct Answer)**

(D) ○ 2/3 Ω

Question No.62 (Question Id - 122)

The present output Q_n of an edge triggered JK flip-flop is logic 0. If J = 1, then Q_{n+1} :

(A) ○ Cannot be determined

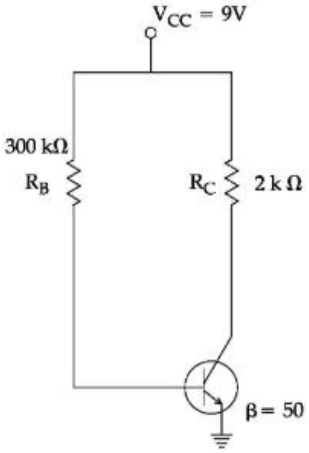
(B) ○ Will be logic 0

(C) ○ **will be logic 1 (Correct Answer)**

(D) ○ will race around

Question No.63 (Question Id - 113)

Calculate the collector current and the collector-to-emitter voltage for the circuit given in figure.



(A) ○ **I_C = 4.5 mA ; V_{CE} = 6 V (Correct Answer)**

(B) ○ I_C = 1.5 mA ; V_{CE} = 6.5 V

(C) ○ I_C = 2.5 mA ; V_{CE} = 6 V

(D) ○ I_C= 3.5 mA ; V_{CE} = 6.5 V

(A) ○ 5 V and 2 Ω
(B) ○ **7.5 V and 2.5 Ω (Correct Answer)**
(C) ○ 4 V and 2 Ω
(D) ○ 3 V and 2.5 Ω

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