VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

Mock JEE Advanced-2 (CBT) | Paper – 2 | JEE 2024

Maximum Marks: 180

Timing: 2:30 PM to 5:30 PM **Duration : 3.0 Hours**

General Instructions

1. The question paper consists of 3 Subject (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**).

Each Part has **three** sections (Section 1, Section 2 & Section 3).

2. **Section 1** contains **6 Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

Section 2 contains **4 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

Section 3 contains **8 Single Digit Integer Type Questions** ranging from **0 to 9**, Both Inclusive. For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

3. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

MARKING SCHEME

SECTION – 1 | (Maximum Marks: 24)

- This section consists of **Six (06)** Questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks: +4 If only (all) the correct option(s) is(are) chosen

Partial Marks: +3 If all the four options are correct but ONLY three options are chosen

Partial Marks: +2 If three or more options are correct but ONLY two options are chosen and both of which are correct

Partial Marks: +1 If two or more options are correct but ONLY one option is chosen, and it is a correct option

Zero Mark: 0 if none of the options is chosen (i.e. the question is unanswered)

Negative Marks: –2 In all other cases.

SECTION – 2 | (Maximum Marks: 12)

- This section contains **FOUR (04)** Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks: +3 If only (all) the correct option(s) is(are) chosen

Zero Mark: 0 if none of the options is chosen (i.e. the question is unanswered)

Negative Marks: –1 In all other cases.

SECTION – 3 | (Maximum Marks: 24)

- **Section 1** contains **8 Single Digit Integer Type Questions** ranging from **0 to 9**, Both Inclusive. For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks: +3 **ONLY** the correct integer is entered.

Zero Mark: 0 If the questions is unanswered.

Negative Marks: –1 In all other cases.

SUBJECT I : PHYSICS 60 MARKS

SECTION 1

MULTIPLE CORRECT ANSWERS TYPE

This Section contains **6 Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

1. A region in space contains a total positive charge Q that is distributed spherically such that the volume charge density $\rho(r)$ is given by (r is distance from the center of the sphere):

$\rho(r)=\alpha$ for $r \le \frac{R}{2}$

$\rho(r)=2\alpha\left(1-\frac{r}{R}\right)$ for $\frac{R}{2} \le r \le R$

$\rho(r)=0$ for $r \ge R$

Here α is a positive constant having units of C/m^3. Choose the correct options.

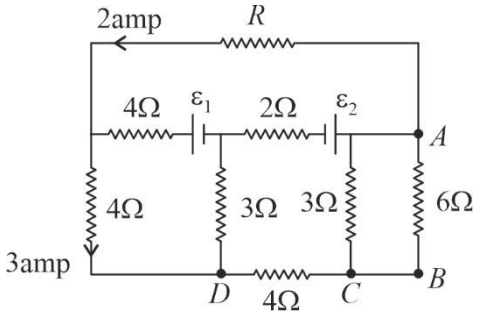
(A) Charge enclosed in Region $\frac{R}{2} \le r \le R$ is $\frac{11\alpha\pi R^3}{24}$

(B) Value of α is $\frac{4Q}{5\pi R^3}$

(C) Charge enclosed in region $r \le \frac{R}{2}$ is $\frac{\alpha\pi R^3}{6}$

(D) Electric field at a point in the region $r \le \frac{R}{2}$ is given by $\frac{8Qr}{15\pi\varepsilon_0 R^3}$

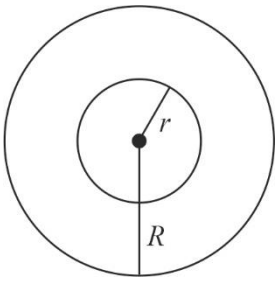
2. In the circuit shown, ε_1 and ε_2 are two ideal sources of unknown emfs. Some currents are shown in some branches of the circuit. Potential difference appearing across resistance 6Ω is $V_A - V_B = 10V$. Choose the correct options.



(A) The current in the CD branch is 5 amp. **(B)** The unknown emf ε_1 is 40 volts.

(C) The unknown emf ε_2 is 68 volts. **(D)** The unknown resistance R is 9Ω

3. A soap bubble of radius r is formed inside another soap bubble of radius $R(>r)$. The atmospheric pressure is P_0 and surface tension of the soap solution is T. Now the bigger bubble bursts. Assume that the excess pressure inside a bubble is small compared to P_0. For the smaller bubble, choose the correct options.



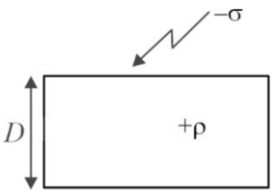
(A) The bubble will shrink

(B) The bubble will expand

(C) Change in its radius is $\frac{4Tr}{3P_0R}$

(D) Change in its radius is $\frac{3Tr}{4P_0R}$

4. We have an infinite non-conducting sheet of negligible thickness carrying a uniform surface charge density $-\sigma$ and next to it, an infinite parallel slab of thickness D with uniform volume charge density $+\rho$. All charges are fixed. Choose the correct options.



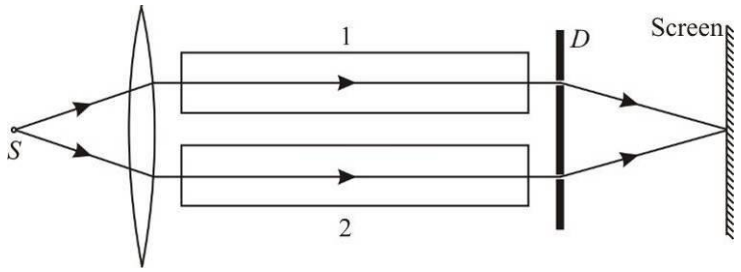
(A) Magnitude of electric field at a distance h above the negatively charged sheet is $\frac{\rho D-\sigma}{2\varepsilon_0}$

(B) Magnitude of electric field inside the slab at a distance h below the negatively charged sheet (h < D) is $\frac{\sigma+\rho(D-2h)}{2\varepsilon_0}$

(C) Magnitude of electric field at a distance h below the bottom of the slab $\frac{\rho D-\sigma}{4\varepsilon_0}$

(D) Magnitude of electric field at a distance h below the bottom of the slab is $\frac{\rho D-\sigma}{2\varepsilon_0}$

5. Interference is obtained on a screen using a setup as shown in figure. *S* is a narrow slit illuminated by monochromatic light of wavelength λ, and 1 & 2 are identical tubes of length *l* filled with air. The diaphragm *D* has two slits as shown. If tube 1 is now filled with ammonia gas (Refractive index μ), then choose the correct options.



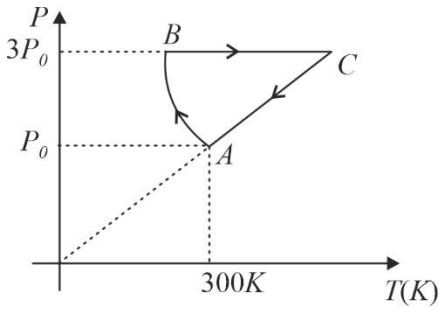
(A) Interference pattern will shift upwards

(B) Interference pattern will shift downwards

(C) Interference pattern will shift by $\frac{\omega}{\lambda}\mu l,$ where ω is width of fringes obtained on screen

(D) Interference pattern will shift by $\frac{\omega}{\lambda}(\mu-1)\, l,$ where ω is width of fringes obtained on screen

6. One mole of a monoatomic gas is taken through a cyclic process ABC as shown in PT diagram, in which process $A \to B$ is defined as PT = constant. Choose the correct options.



(A) Work done in process *AB* is $-400R$

(B) Heat supplied to gas in process *BC* is 2000R

(C) Change in internal energy in process *CA* is $-900R$

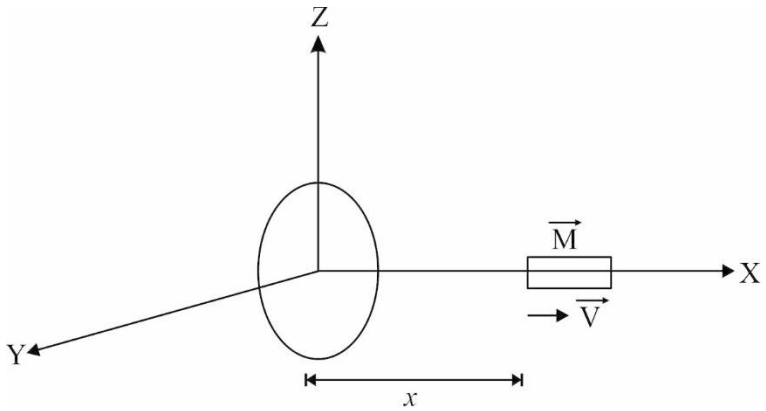
(D) Work done in process BC is 800*R*

SECTION - 2

SINGLE CHOICE CORRECT TYPE

Section 3 contains **4 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

7. An infinitesimally small bar magnet of dipole moment M is pointing and moving with speed V in x-direction. A small closed circular conducting loop of radius a is placed in y-z plane with its centre at x = 0, and its axis coinciding with x-axis. Resistance of loop is R. Assume that the distance *x* of magnetic dipole from the centre of loop is much greater than a. Induced current in circular loop at this moment is:



(A) $\frac{3\mu_0 Ma^2V}{2x^4R}$ **(B)** $\frac{\mu_0 Ma^2V}{2x^4R}$ **(C)** $\frac{\mu_0 Ma^2V}{x^4R}$ **(D)** $\frac{2\mu_0 Ma^2V}{x^4R}$

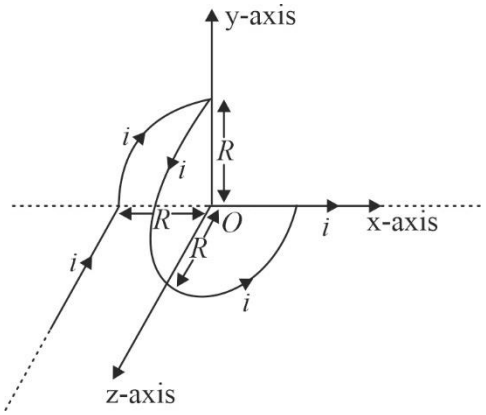
8. A small metal plate (work function ϕ) is kept at a distance *d* from a singly ionized fixed ion. A monochromatic light beam is incident on the metal plate and photoelectrons are emitted. Find the maximum wavelength of light so that the photoelectrons may go round the ions along a circle. $\left(k = \frac{1}{4\pi\varepsilon_0}\right)$

(A) $\frac{2hcd}{ke^2 + 2d\phi}$ **(B)** $\frac{\sqrt{5}hcd}{ke^2 + 2d\phi}$ **(C)** $\frac{2hc}{ke^2 + d\phi}$ **(D)** $\frac{\sqrt{5}hc}{ke^2 d + \phi}$

9. A screw gauge with a pitch of 0.5 mm and a circular scale with 50 divisions is used to measure the thickness of a thin sheet of aluminium. Before starting the measurement it is found that when the two jaws of the screw gauge are brought in contact the 45^{th} division coincides with the main scale line and that the zero of the main scale is not visible. What is the thickness of the sheet if the main scale reading is 0.5 mm and the 25^{th} division coincides with the main scale line?

(A) 0.75 mm **(B)** 0.80 mm **(C)** 0.70 mm **(D)** 0.50 mm

10. Consider the current configuration as shown. The curved parts are quarter circles of radii R in xy, yz, zx planes centered at origin. Magnetic field at O is:



(A) $\frac{\mu_0 i}{8R}\left[\hat{i}-\hat{k}+\hat{j}\left(1-\frac{2}{\pi}\right)\right]$ **(B)** $\frac{\mu_0 i}{8R}\left[\hat{i}+\hat{k}+\hat{j}\left(\frac{2}{\pi}-1\right)\right]$

(C) $\frac{\mu_0 i}{8R}\left[\hat{i}-\hat{j}+\hat{k}\right]$ **(D)** Zero

SECTION 3

SINGLE DIGIT INTEGER TYPE

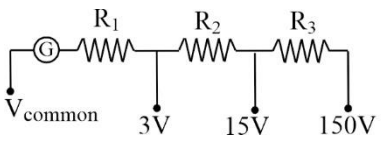
This section contains **8 Single Digit Integer Type Questions** ranging from **0 to 9**, Both Inclusive. For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

1. A particle is moving in the *x-y* plane. At certain instant of time, the components of its velocity and acceleration are as follows:

$v_x = 3ms^{-1}, v_y = 4ms^{-1}, a_x = 2ms^{-2}$ and $a_y = 1ms^{-2}$. The rate of change of speed at this moment is _____ ms^{-2}.

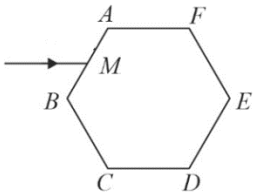
2. $^{238}_{92}U$ atom disintegrates to $^{214}_{84}Po$ with a half life of 4.5×10^9 years by emitting six alpha particles and n electrons. Here n is _____.

3. A voltmeter of variable ranges $3V$, $15V$, $150V$ is to be designed by connecting resistances R_1, R_2, R_3 in series with a galvanometer of resistance $G = 20\Omega$, as shown in Fig. The galvanometer gives full pass through its coil, for a current of 1 *mA*. Then, find approximate value of $R_2 - R_1$ (in kilo ohms rounded off to nearest integer).

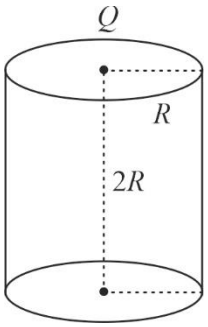


4. A neutron star with magnetic moment of magnitude m is spinning with angular velocity ω about its magnetic axis. The electromagnetic power P radiated by it is given by $\mu_0^x m^y \omega^z c^u$, where μ_0 and c are the permeability and speed of light in free space, respectively. Then $x+y+z$ is _____.

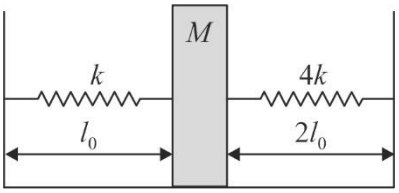
5. The cross section of a prism is a regular hexagon. A narrow beam of light strikes a face of the prism just below the midpoint (M) of the edge AB. The beam is parallel to the top and bottom faces of the prism. the minimum value of refractive index of the material of the prism for which the emergent beam will be parallel to the incident beam is $\sqrt{\frac{m}{n}}$, find the value of $m-n$. (m and n are coprimes)



6. A charge Q is placed at the centre of the open end of a cylindrical vessel of radius R and height $2R$ as shown in figure. The flux of the electric field through the surface (curved surface + base) of the vessel is $\frac{3Q}{x\varepsilon_0}$, then the value of x is _____.



7. A block of mass M is kept on a smooth surface and touches the two springs as shown in the figure but not attached to the springs. Initially springs are in their natural length. Now, the block is shifted ($l_0/2$) from the given position in such a way that it compresses a spring and released. The time-period of oscillation of mass is $n\pi\sqrt{\frac{M}{4k}}$, the value of n is _____.



8. A uniform rod of length l = 1 m is free to move and rotate in gravity-free space. When an impulse is given to one end of the rod, perpendicular to its length, its centre of mass moves with velocity $v = 1\,m/s$. What will be its angular velocity (in rad/s) about its centre of mass?

SUBJECT II : CHEMISTRY 60 MARKS

SECTION 1

MULTIPLE CORRECT ANSWERS TYPE

This Section contains **6 Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

1. An organic compound (X) contains 49.3% of carbon, 6.84% of hydrogen. The vapour density of the compound is 73. Which of the following is/are correct for compound (X).

(A) The empirical formula of the compound is $C_3H_5O_2$

(B) One mole of an isomer of compound X reacts with two moles of Grignard reagent

(C) None of the isomer of compound X is optically active

(D) The empirical formula of the compound is $C_4H_6O_3$

2. Which of the following statement(s) about entropy is(are) correct:

(A) Entropy of graphite is more than that of diamond.

(B) For the reaction $I_{2(s)} + Cl_{2(g)} \longrightarrow 2ICl_{(g)}$

Entropy increases on formation of ICl from I_2 and Cl_2

(C) For isothermal reversible process

$\underset{\text{system}}{\Delta S} = -nR\ln\frac{P_2}{P_1}$ {Where P_2 and P_1 and final are initial pressure}

(D) Adiabatic reversible process is isoentropic process

3. Which of the following statements is/are correct?

(A) Borax produces $B_2O_3, NaBO_2$ and H_2O on strong heating

(B) Boron always forms covalent compound with halogens

(C) In Borax, all boron are involved in Back Bonding

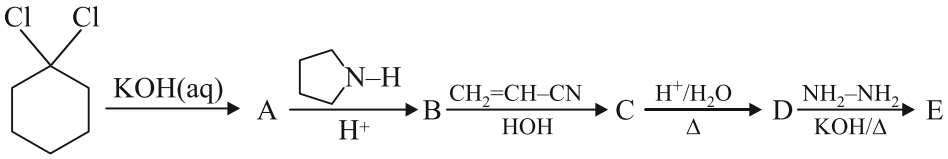
(D) All boron atom in borax are sp^3 hybridised

4. Which of the following reactions is/are the main reaction during partial roasting of chalcopyrite in a blast furnace?

(A) $Cu_2S + \frac{3}{2}O_2 \rightarrow Cu_2O + SO_2\uparrow$ **(B)** $FeS + \frac{3}{2}O_2 \rightarrow FeO + SO_2$

(C) $FeO + SiO_2 \rightarrow FeSiO_3$ **(D)** $Cu_2O + SiO_2 \rightarrow Cu_2SiO_3$

5. Considering the following reaction sequence, the correct statement(s) is/are:



(A) Compound E is carboxylic acid

(B) A on treatment with dil NaOH produces β -hydroxy ketone

(C) D contains eight methylene groups

(D) B exhibits tautomerism

6. Which of the following statements are correct?

(A) Dacron is a fibre

(B) Polystyrene is a thermoplastic

(C) Natural rubber behaves as thermosetting polymer

(D) Polyester is not a copolymer

SECTION - 2

SINGLE CHOICE CORRECT TYPE

Section 3 contains **4 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

7. In a face centred cubic lattice, atom A occupies the corner position and atom B occupies the face-centre positions. If one atom of B is missing from one of the face-centered lattice points then the formula of the compound is:

(A) A_2B_5 **(B)** A_2B_3 **(C)** AB_2 **(D)** A_2B

8. The reaction of hot and concentrated NaOH with chlorine gas gives a compound X. Decomposition of X produces a paramagnetic gas along with salt, compound X is:

(A) NaOCl **(B)** $NaClO_2$ **(C)** $NaClO_3$ **(D)** NaCl

9. If $Zn^{+2}, Cd^{+2}, Al^{+3}, Cu^{+2}$ and Pb^{+2} radicals are present in aqueous solution, when it reacts with H_2S in acidic medium produce precipitate. Solution (X) obtained after removal of precipitate is treated with NaOH (excess) then:

(A) Blue ppt and two radicals are in the form of soluble complex

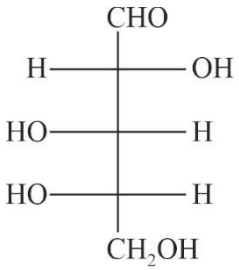
(B) Clear solution in which two radicals are present as soluble complex

(C) One of the radical form ppt. and one radical present as soluble complex

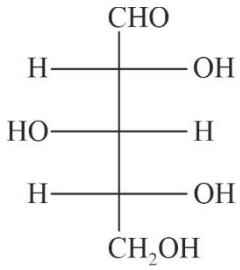
(D) No radical present in solution (X)

10. Which L-sugar on oxidation gives an optically active dibasic acid?

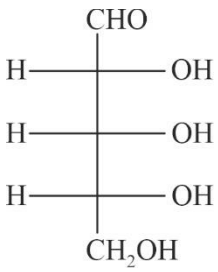
(A)



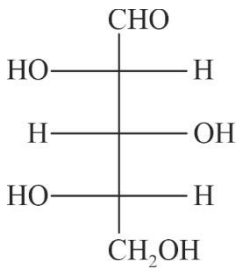
(B)



(C)



(D)



SECTION 3

SINGLE DIGIT INTEGER TYPE

This section contains **8 Single Digit Integer Type Questions** ranging from **0 to 9**, Both Inclusive. For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

1. The number of mole of AgI which may be dissolved in 1.0 litre of 1.0 M KCN solution is $x \times 10^{-1}$. Given K_{sp} for AgI and K_c for $Ag(CN)_2^-$ are $1.2 \times 10^{-17} M^2$ and $7.58 \times 10^{19} M^{-2}$ respectively. The value of *x* is _____.

2. 19.5 g of FCH_2COOH (Fluoroacetic acid) is dissolved in 500g of water. The depression in the freezing point of water is observed to be 1.22°C. The dissociation constant for fluoroacetic acid is $y \times 10^{-2}$. The value of y is _____.

K_f for water is $1.86\,K\,Kg\,mol^{-1}$

3. $\wedge_m^\infty [H^+] = 0.04 Sm^2 mol^{-1}$ and $\wedge_m^\infty [x^-] = 0.01 Sm^2 mol^{-1}$, then find pK_a of HX, if conductivity of an aqueous solution of 0.1M HX is $5 \times 10^{-4} Sm^{-1}$

4. The reaction of XeF_4 with O_2F_2 at 143K gives a compound of xenon P. The number of moles of NaOH required for complete hydrolysis of 1 mol of P is _____.

5. The decomposition of ammonium nitrite produces a gas. The total number of electrons present in the antibonding molecular orbitals of the gas formed from the 2P atomic orbitals are _____.

6. The maximum number of stereoisomers present in a compound that can be formed from the following reaction sequence is _____.

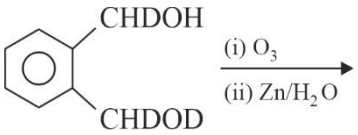
$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH=CH-CH_3 \xrightarrow[(ii)\,H_2SO_4,\Delta]{(i)\,Br_2/CCl_4} 'P'$$

7. The number of sp^3 hybridised carbon in the product formed (F) from the following reaction sequence is _____.

$$CH_3-CH_2-CH_3 \xrightarrow{Br_2/h\nu} \underset{\text{(Major)}}{(A)} \xrightarrow{aq.KOH} (B) \xrightarrow{Na} (C)$$

$$CH_3-CH_2-CH_3 \xrightarrow{Br_2/h\nu} \underset{\text{(Major)}}{(A)} \xrightarrow{alc.KOH} (D) \xrightarrow{NBS} (E) \xrightarrow{+(C)} (F)$$

8. The total number of different chiral molecules including stereo isomers are possible to form from complete ozonolysis of the following molecule is _____.



SUBJECT III : MATHEMATICS 60 MARKS

SECTION 1

MULTIPLE CORRECT ANSWERS TYPE

This Section contains **6 Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

1. In ΔABC, the internal bisector *AD* of the angle *A* is equal to:

(A) $\left(\frac{2bc}{b+c}\right)\cos\frac{A}{2}$ **(B)** $\left(\frac{b+c}{2bc}\right)\cos\frac{C}{2}$

(C) $\frac{b\sin C}{\sin\left[B+\left(A/2\right)\right]}$ **(D)** $\frac{b\sin C}{\sin\left[A+\left(B/2\right)\right]}$

2. α is a natural number, such that $\sum_{k=1}^{\alpha}\cos^4\frac{k\pi}{2\alpha+1}=\frac{55}{16}$ and $f\left(x\right)=2^{x^2+\alpha x+2}+2^{\alpha-\alpha x-x^2}$, then which of following is correct.

(A) $\alpha=12$

(B) Minimum value of $f\left(x\right)$ is 2^7

(C) $\alpha=10$

(D) Minimum value of $f\left(x\right)$ is 2^8

3. Let *S* be the set of all complex numbers z satisfying $|z^2+z+1|=1$. Then which of the following statements is/are TRUE?

(A) $\left|z+\frac{1}{2}\right|\le\frac{1}{2}$ for all $z\in S$ **(B)** $|z|\le 2$ for all $z\in S$

(C) $\left|z+\frac{1}{2}\right|\ge\frac{1}{2}$ for all $z\in S$ **(D)** The set *S* has exactly four elements

4. Let PT be a tangent from the point $P\left(5,3+\sqrt{3}\right)$ to the circle $x^2+y^2+4x-6y-3=0$, with centre *C*, at T and AB is secant which passes through P such that *BT* is the normal at T. If $Ar\left(\Delta CAB\right)+Ar\left(\Delta CAT\right)=\frac{\lambda}{25}$, then $\left(\left[\sqrt{\lambda}\right]-15\right)$ is divisible by:

([.] denotes G.I.F).

(A) 2 **(B)** 3 **(C)** 4 **(D)** 5

5. Which of the following (are)correct? (where $\hat{a},\hat{b},\hat{c}$ are unit vectors).

(A) If $\left|\hat{a}+\hat{b}\right|<1$, then angle between $\vec{a}$ and $\vec{b}$ will be obtuse

(B) If $|\hat{a}-\hat{b}|^2+|\hat{b}-\hat{c}|^2+|\hat{c}-\hat{a}|^2=9$, then $\hat{a}\times\hat{b}=\hat{b}\times\hat{c}=\hat{c}\times\hat{a}$

(C) If $|\hat{a}-\hat{b}|^2+|\hat{b}-\hat{c}|^2+|\hat{c}-\hat{a}|^2=9$, Angle between $\hat{a}\,\&\,\hat{b}$ is 60°

(D) If $|\hat{a}-\hat{b}|^2+|\hat{b}-\hat{c}|^2+|\hat{c}-\hat{a}|^2=9$, $\left|3\hat{a}+5\hat{b}+5\hat{c}\right|=2$

6. A curve $y=f(x)$ satisfies the differential equation $\left(1+x^2\right)\frac{dy}{dx}+2yx=4x^2$ and passes through the origin then which of the following statements is/are TRUE?

(A) $y=f(x)$ is strictly increasing function $\forall x\in R$

(B) $x=1$ is point of inflection for $y=f\left(x\right)$

(C) $y=f\left(x\right)$ is Non monotonic function in its domain

(D) The area enclosed by $y=f^{-1}\left(x\right)$, the x axis and ordinate at $x=2/3$ is $\frac{2}{3}\ell n2$.

SECTION - 2

SINGLE CHOICE CORRECT TYPE

Section 3 contains **4 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

7. There are five different boxes and seven different balls. The number of ways in which these balls can be distributed so that box 2 and box 4 contains only 1 ball each and at least 1 box is empty is *N*. (Order of putting the balls in the boxes is NOT considered). Then the value of N is _____.

(A) 3907 **(B)** 3906 **(C)** 3609 **(D)** 3960

8. Let $X=\begin{bmatrix}6 & -5\\ 2 & 1\end{bmatrix}$ and $Y=\begin{bmatrix}1 & 2\end{bmatrix}$. Let $n\left(X\right)$ denotes number of elements in matrix 'X'. If $Z=\left(YX\right)\left(XY^T\right)$ and $P=\left(XY^T\right)\left(YX\right)$, then the value of $\frac{n\left(P\right)\left(|P|^2+tr\left(Z\right)\right)}{|Z|}$ is (where $|Z|$ is determinant value of Z)

(A) 3 **(B)** 9 **(C)** 6 **(D)** 4

9. A pack of playing cards consist of 51 cards (one missing card). Cards are drawn one by one from the pack without replacement. If first 4 cards drawn consist of only one honour card, then the probability that the missing card being honour card is $\frac{a}{b}$ (where *a* and *b* are co-prime and all Jacks, Queens, Kings and Aces are considered as honour card) then $\frac{a}{b}$ is:

(A) $\frac{5}{16}$ **(B)** $\frac{3}{16}$ **(C)** $\frac{7}{16}$ **(D)** $\frac{9}{16}$

10. If $a=\lim\limits_{n\to\infty}\left(\frac{(2n)!}{n!n^n}\right)^{1/n}$ and $b=\lim\limits_{n\to\infty}\left(\left(1+\frac{1}{n^2}\right)^{\frac{2}{n^2}}\left(1+\frac{2^2}{n^2}\right)^{\frac{4}{n^2}}.....2^{\frac{2}{n}}\right)$ then $a+b=$

(A) $\frac{6}{e}$ **(B)** $\frac{8}{e}$ **(C)** $\frac{2}{e}$ **(D)** $\frac{4}{e}$

SECTION 3

SINGLE DIGIT INTEGER TYPE

This section contains **8 Single Digit Integer Type Questions** ranging from **0 to 9**, Both Inclusive. For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

1. Let $\sin(x-y)=\frac{1}{2}$, $\sin(y-z)=\frac{1}{6}$ and $\sin(z-x)=\frac{2}{3}$, then greatest integer less than or equal to $\left|\sin\left(\frac{x-y}{2}\right)\sin\left(\frac{y-z}{2}\right)\sin\left(\frac{z-x}{2}\right)\right|$ _____.

2. Let $p(x,y)=0$ is a solution of the differential equation $\frac{dy}{dx}=\frac{y-2x^3}{x+2yx^2}$, where $p(1,1)=3$. The number of divisors of *c* for which the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z+1}{1}$ intersects the curve $3p(x,y)=c$ on $x-y$ plane is _____.

3. The greatest integer less than or equal to $\int\limits_0^{\pi/2} e^{\sin x}dx+\int\limits_1^e \sin^{-1}(\ell nx)dx$ _____.

4. Number of solutions of the equation $\log_{x^2+6x+8}\left(\log_{2x^2+2x+3}\left(x^2-2x\right)\right)=0$ _____.

5. If $\alpha=\lim\limits_{x\to 0}\frac{e^{x^2}-\left(1-x^2\right)^{1/2}+\left(x^{3/2}-\sin x\right)[x]}{\sin^2 x}$, then 4α is _____.

Where [*x*] denote GIF.

6. If the matrix $A=\begin{bmatrix}2 & 1 & 1\\ 0 & 1 & 0\\ 1 & 1 & 2\end{bmatrix}$, then $\det\left(\left(A^3-5A^2+7A-3I\right)\left(A^2+A\right)\right)$_____.

7. Consider the hyperbola $\frac{x^2}{100}-\frac{y^2}{64}=1$

With foci at $S \& S'$ where *S* lies on positive x-axis. Let *P* be a point on hyperbola in first quadrant. Such that tangent at *P* divide the SS' in ratio 2 : 3 and normal at *P* cuts the transverse at *N*. Then greatest Integer less than equal to $\left(\frac{SN}{S'N}\right)\times\frac{SP}{S'P}=$

8. Let $f\left(x\right)$ be a continuous function given by

$$f\left(x\right)=\begin{cases}2x, & |x|\le 1\\ x^2+ax+b, & |x|>1\end{cases}$$

Find the greatest integral part of the area of the region in the third quadrant bounded by the curves $x=-2y^2$ and $y=f\left(x\right)$ lying on the left of the line $8x+1=0$