FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – I
PAPER –2
TEST DATE: 26-12-2024

Time Allotted: 3 Hours   **Maximum Marks: 180**

General Instructions:

- The test consists of total 51 questions.
- Each subject (PCM) has 17 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Three Sections**: **Section-A, Section-B & Section-C**.

  Section – A *(01 – 04, 18 – 21, 35 – 38):* This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

  Section – A *(05 –07, 22 – 24, 39 – 41):* This section contains **NINE (09)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

  Section – B *(08 – 13, 25 – 30, 42 – 47):* This section contains **EIGHTEEN (18)** numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.

  Section – C *(14 –17, 31 – 34, 48 – 51):* This section contains **SIX (06) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

MARKING SCHEME		
Section – A (Single Correct): Answer to each question will be evaluated according to the following marking scheme:		
Full Marks	+3	If ONLY the correct option is chosen.
Zero Marks	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	−1	In all other cases.
Section – A (One or More than One Correct): 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 Marks	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	−2	In all other cases.
Section – B: Answer to each question will be evaluated according to the following marking scheme:		
Full Marks	+4	If ONLY the correct integer is entered;
Zero Marks	0	Question is unanswered;
Negative Marks	0	In all other cases.
Section – C: Answer to each question will be evaluated according to the following marking scheme:		
Full Marks	+3	If ONLY the correct integer is entered;
Zero Marks	0	Question is unanswered;
Negative Marks	0	In all other cases.

Physics   **PART – I**

### SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

1. A cubical container of side 'a' and wall thickness x (x << a) is suspended in air and filled n moles of diatomic gas (adiabatic exponent γ) in a room where room temperature is T_0. If at time t = 0 gas temperature is T_1 ($T_1 > T_0$), the temperature of gas 'T' at time 't' is

   (A) $T = T_0 + T_1 e^{-\frac{6ka^2(\gamma-1)}{nRx}t}$

   (B) $T = T_0 - (T_1 - T_0)e^{-\frac{6ka^2(\gamma-1)}{nRx}t}$

   (C) $T = T_0 + (T_1 + T_0)e^{-\frac{6ka^2(\gamma+1)}{nRx}t}$

   (D) $T = T_0 + (T_1 - T_0)e^{\frac{6ka^2(\gamma-1)}{nRx}t}$

2. A uniform rod of length 'l' is pivoted at point 'A'. It is struck by a horizontal force which delivers an impulse 'J' at a distance 'x' from point 'A' as shown in figure, impulse delivered by pivot is zero if 'x' is equal to

   (A) $\dfrac{l}{2}$ (B) $\dfrac{l}{3}$

   (C) $\dfrac{2l}{3}$ (D) $\dfrac{3l}{4}$
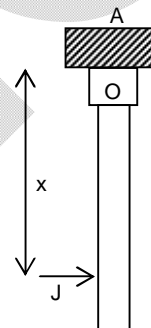
3. A planet revolves around the sun in an elliptical orbit of eccentricity *e*. If *T* is the time period of the planet, then the time spent by the planet between the ends of the minor axis and major axis close to the sun is

   (A) $T\left(\dfrac{1}{4} - \dfrac{e}{2\pi}\right)$ (B) $\dfrac{T.e}{2\pi}$

   (C) $T\left(\dfrac{2e}{\pi} - 1\right)$ (D) $\dfrac{T\pi}{2e}$

4. Force acting on a particle moving in a straight line varies with the velocity of the particle as $F = \dfrac{k}{v}$, where k is a constant. The work done by this force in time t is:

   (A) $\dfrac{k}{v^2}t$ (B) 2kt

   (C) kt   (D) $\dfrac{2kt}{v^2}$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

5. If the dimensions of length are expressed as $G^x c^y h^z$; where G, c and h are the universal gravitational constant, speed of light and Planck's constant respectively, then

    (A) $x = \dfrac{1}{2}, y = \dfrac{1}{2}$

    (B) $x = \dfrac{1}{2}, z = \dfrac{1}{2}$

    (C) $y = \dfrac{1}{2}, z = \dfrac{3}{2}$

    (D) $y = -\dfrac{3}{2}, z = \dfrac{1}{2}$

6. A point charge is placed at a distance r from center of a conducting neutral sphere of radius R (r > R). The potential at any point P inside the sphere at a distance r_1 from point charge due to induced charge of the sphere is given by

    [k = $\dfrac{1}{4\pi\varepsilon_0}$]

    (A) kq/r_1

    (B) kq/r

    (C) $kq/r - kq/r_1$

    (D) $-kq/R$

7. An ammeter has a resistance of 50 Ω and a full scale deflection current of 50 μA. It can be used as a voltmeter or as a higher range ammeter provided that a resistance is added to it. Choose the correct range and resistance combination from the following
    (A) 20 V range with approximately 400 kΩ resistance in series.
    (B) 100 V range with approximately 2 × $10^6 \Omega$ resistance in series.
    (C) 1 mA range with 50 Ω resistance in parallel.
   (D) 0.1 mA range with 50 Ω resistance in parallel.
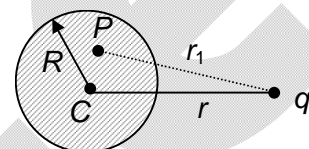
SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

8. The given figure shows a YDSE apparatus. Parallel monochromatic coherent light rays are incident on slits S_1 and S_2 $(S_1S_2 = \dfrac{2}{3}$ mm$)$ at an angle 30° with the horizontal. The medium on left side of the slits is water $(\mu_w = 4/3)$. To obtain the central maxima at point P, a glass slab $(\mu_g = 3/2)$ inside water is introduced in front of slit S_1. The thickness of the glass slab required for this purpose (in mm) is $\dfrac{x}{3}$, then find the value of 'x'.
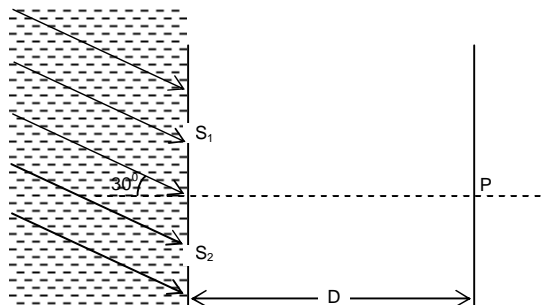
9. In the circuit given below, both batteries are ideal. EMF E_1 of battery 1 has a fixed value, but emf E_2 of battery 2 can be varied between 1.0 V and 10.0 V. The graph gives the currents through the two batteries as a function of E_2, but are not marked as which plot corresponds to which battery. But for both plots current is assumed to be negative when the direction of the current through the battery is opposite the direction of that battery's emf. (direction of emf is from negative to positive)
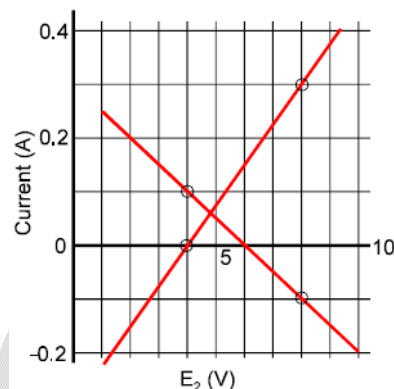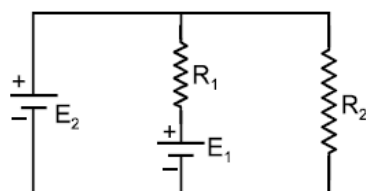

The value of emf E_1 (in V) is:

10. A system of coordinates is drawn in a medium whose refractive index varies as $\mu = \dfrac{2}{1 + y^2}$, where $0 \le y \le 1$. A ray of light is incident at origin at an angle 60^0 with y –axis as shown in the figure. At point P ray becomes parallel to x-axis. The value of H is $\left\{ \left(\dfrac{x}{\sqrt{3}} \right) - 1 \right\}^{1/2}$, then find the value of 'x'.
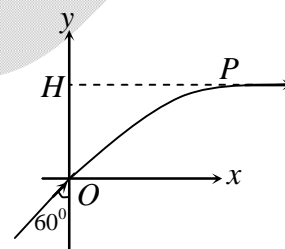
11. A point mass of 1 kg collides elastically with a stationary point mass of 5 kg. After their collision, the 1 kg mass reverses its direction and moves with a speed of 2 ms^{-1}. Then kinetic energy on centre of mass for the system of these two masses is x, then the value of 4x is

12. A string is wrapped on a wheel of moment of inertia 0.20 kg m^2 and radius 10 cm and goes through a light pulley to support a block of mass 2.0 kg as shown in figure. If g = 10 m/s^2, then the acceleration of the block (in m/s^2) is $\dfrac{2x}{11}$, then calculate the value of 'x'.
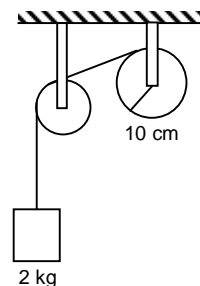
13. Two bubbles contain same ideal gas such that one is trapped inside other. System is kept in vacuum. Ratio of densities of inner and middle gas is x and the ratio of number of moles is y then value of $\dfrac{x}{y}$ is (Assume temperature of both regions are same)
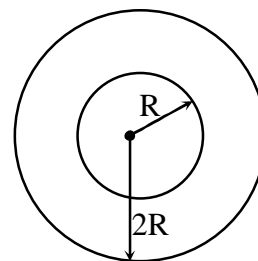

SECTION – C
(Numerical Answer Type)

*This section contains **TWO (02) paragraphs**. Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX)**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 14 and 15

A large metal plate having area 1 m^2 is exposed to light of intensity 6.62 W/m^2. Frequency of light is 3.2×10^{15} Hz which is greater than threshold value of photoemission. Emitted electrons are swept away immediately after emission. ($h = 6.62 \times 10^{-34}$)
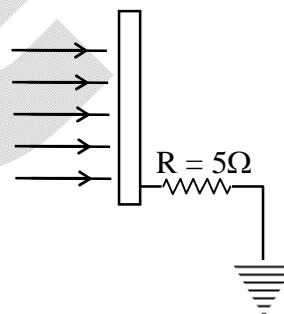
14. The current through resistor in steady state in ampere is……….

15. The potential of plate in steady state in volt is ……….

Paragraph for Question Nos. 16 and 17

Two identical sources of light are placed at λ separation from third identical source collinearly as shown in the figure. Their light superimposed and screen placed at very large distance. Wavelength of light emitted by each source is λ.
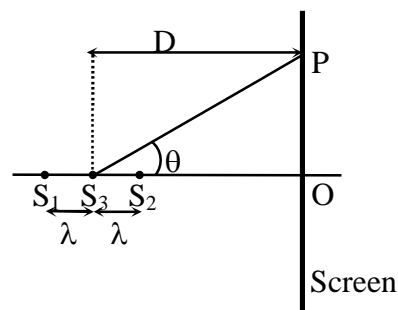
16. If intensity at centre 'O' is I_0 and intensity at $\theta = 60°$ is αI_0. Then find value of α.

17. If wavelength of each source becomes 8 times then intensity at centre 'O' is N times due to the intensity of each source. Find N.
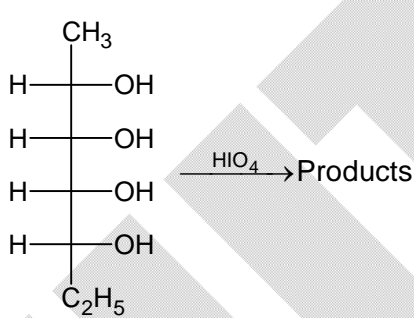
Chemistry PART – II

SECTION – A
(One Options Correct Type)
*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

18. x eV of energy is required to excite the electron of a ground state hydrogen atom to it's second orbit. What is the energy of the electron in the ground state?

    (A) $-\dfrac{x}{3}$
    (B) $-\dfrac{4x}{3}$

    (C) $-\dfrac{x}{4}$
    (D) $-\dfrac{3x}{4}$

19. In Maxwell's distribution of velocity of ideal gases the fraction of gas molecules having velocity in the range of C to C + dC is plotted versus temperature. For which of the following gas the range of distribution of velocity is maximum.
    (A) CH_4
    (B) SO_2
    (C) C_5H_{12}
    (D) CO_2

20. The specific conductance of 0.02 M solution of an electrolyte is 4×10^{-3} ohm^{-1} cm^{-1}. What will be its molar conductance in ohm^{-1}cm^{2}mol^{-1} unit?
    (A) 100
    (B) 200
    (C) 400
    (D) 800

21.

    $\begin{array}{c}
    CH_3 \\
    H\!\!-\!\!\!-\!\!OH \\
    H\!\!-\!\!\!-\!\!OH \\
    H\!\!-\!\!\!-\!\!OH \\
    H\!\!-\!\!\!-\!\!OH \\
    C_2H_5
    \end{array} \xrightarrow{\ HIO_4\ } Products$

    The products include
    (A) one mole of formic acid
    (B) one mole of propanic acid
    (C) one mole of a substance which responds to iodoform test
    (D) two moles of a substance which on oxidation form CH_3COOH

SECTION – A
(One or More than one correct type)
*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

22. Which of the following nucleophile(s) can form products that show functional isomerism?
    (A) CN^-
    (B) SH^-
   (C) NO_2^-
    (D) NH_3

23. $Zn(s) \,|\, Zn^{2+}(C_1) \,||\, Ag^+(C_2) \,|\, Ag(s)$
Under which of the following conditions, E_{Cell} will be equal to E_{Cell}^0 ?

(A) $C_1 = C_2 = 1$ M

(B) $C_2 = \sqrt{C_1}$

(C) $C_1 = C_2 = 0.1$ M

(D) $C_2 - C_1 = 1$ M

24.   The correct statement(s) regarding the halides of boron is/are
(A) BI_3 undergo the easiest hydrolysis than the other halides
(B) $BF_3 + BCl_3 \longrightarrow BF_2Cl + BFCl_2$
(C) Inorganic benzene is formed when BCl_3 reacts with NH_4Cl followed by reaction with $NaBH_4$
(D) Lewis acidity order: $BBr_3 > BCl_3 > BF_3$

SECTION – B

(Numerical Answer Type)

This section contains **SIX (06)** *Numerical based questions. The answer to each question is a* ***NON-NEGATIVE INTEGER VALUE***.

25.   The kinetic energy of a moving electron is 50 kJ. If the de-Broglie wavelength associated with the electron motion is expressed as 0.22×10^{-z} m. What is the value of z?
[Assume that $m_e = 9 \times 10^{-31}$ kg and $h = 6.6 \times 10^{-34}$ Js]

26.   Reaction of phenol(PhOH) with bromine water(Br_2/H_2O) forms a precipitate. What is the molar mass of the precipitate in g mol^{-1} unit?
[Atomic mass of bromine = 80]

27.   One mole of ethylene glycol was dissolved in 640 g water and the resulting solution was cooled to -3.72°C temperature. How many gram of ice is formed due to freezing of water?
[$K_f = 1.86$ K kg mol^{-1}]

28.   Treatment of NaCl with acidified solution of (X) forms a red vapour(Y). Treatment of (Y) with aqueous NaOH forms a yellow solution(Z). $Pb(CH_3COO)_2$ gives a yellow precipitate when treated with solution of (Z). What is the molar mass of (Y) in g mol^{-1} unit?
[At. Mass of Cr = 52]

29.   If x coulomb of electricity is passed through $CuSO_4$ in order to deposit 190.5 g copper on the unattacked cathode, what is the value of $(x \times 10^{-3})$? [At.wt. of Cu = 63.5 g mol^{-1}]

30.   How many aromatic functional isomer(s) is/are possible for benzyl alcohol,

—CH_2OH ?
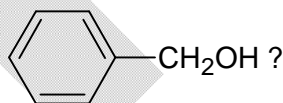
(Do not count benzyl alcohol as an isomer in your list)

SECTION – C
(Numerical Answer Type)

*This section contains **TWO (02) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*
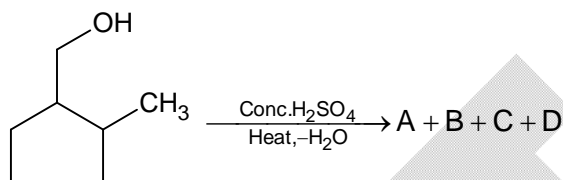
Paragraph for Question Nos. 31 and 32

A container contains 400 mL of 0.01 M CH_3COOH at 298 K. The pH of the acid is x. Now 100 mL of water was added to the solution and the moles of CH_3COOH was found to be y. Now 500 mL of 0.01 M NaOH solution was added to the diluted acid solution and the pH was found to be z. [K_a of CH_3COOH = 10^{-5}][Assume 1 - α = 1, where α is the degree of dissociation of CH_3COOH]
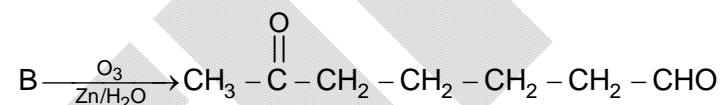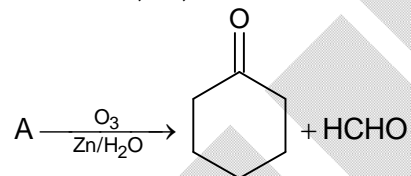Answer the following questions.

31.   What is the value of x?

32.   What is the value of (x + z)?

Paragraph for Question Nos. 33 and 34

$$\text{(cyclopentane with } CH_2OH \text{ and } CH_3 \text{ substituents)} \xrightarrow[\text{Heat,}-H_2O]{\text{Conc.}H_2SO_4} A + B + C + D$$

Each of A, B , C & D contain six-membered rings

$$A \xrightarrow[\text{Zn/}H_2O]{O_3} \text{(cyclohexanone)} + HCHO$$

$$B \xrightarrow[\text{Zn/}H_2O]{O_3} CH_3 - \overset{\overset{\textstyle O}{\|}}{C} - CH_2 - CH_2 - CH_2 - CH_2 - CHO$$

'C' contains a methyl substituent at allylic position

x gram of 'A' produces six gram of HCHO and
y gram of D contains 33.6 g of carbon

33.   What is the value of x?

34.   What is the value of y?

Mathematics   PART – III

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

35. Let $y = y(x), y(1) = 1$ and $y(e) = e^2$. Consider $J = \int \dfrac{x+y}{xy} dy, I = \int \dfrac{x+y}{x^2} dx, J - I = g(x)$ and $g(1) = 1$, then the value of $g(e)$ is
    (A) $3e + 1$ (B) $e + 1$
    (C) $e^2 - e + 2$ (D) $e^2 + e - 2$

36. Let $f : R \to R$ be a twice differentiable function satisfying $f(2) = 1, f'(2) = 4$ and $\int_{2}^{3}(3-x)f''(x)dx = 7$, then the value of $f(3)$ lies in the interval
    (A) $(0, e)$ (B) (e, e^2)
    (C) (e^2, e^3) (D) (e^3, e^4)

37. If PQ is a double ordinate of the hyperbola $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$ such that OPQ is an equilateral triangle, O being the centre of the hyperbola. Then the eccentricity e of the hyperbola, satisfies
    (A) $1 < e < \dfrac{2}{\sqrt{3}}$ (B) $e = \dfrac{2}{\sqrt{3}}$
    (C) $e = \dfrac{\sqrt{3}}{2}$ (D) $e > \dfrac{2}{\sqrt{3}}$

38. The vertices of a with sides (3, 4, 5) right triangle are the centres of three mutually externally tangent circles, as shown. What is the sum of the area of the three circles?
    (A) 14π
    (B) $\dfrac{25\pi}{2}$
    (C) 13π
    (D) $\dfrac{27\pi}{2}$
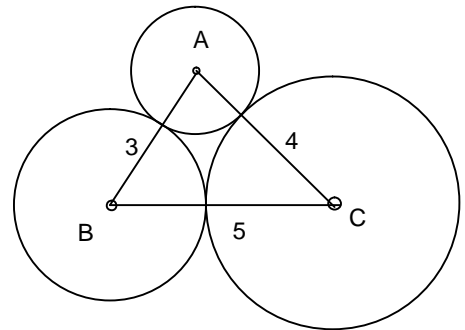
SECTION – A
(One or More than one correct type)
*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

39. Given, $f(x) - 2\int_0^{\frac{\pi}{4}} \frac{\sin^2 x}{\cos^5 x} \cdot \cos t \cdot f(t) dt = \frac{\sin^2 x}{\cos^5 x}$, then which of the following is (are) correct?

    (A) $\lim\limits_{x \to \frac{\pi}{3}} f(x) = 72$

    (B) $f(x)$ is periodic with period π

    (C) The equation of normal to the graph of $f(x)$ at point M whose abscissa is π is given by $x - \pi = 0$.

    (D) Number of solutions of the equation $f(x) = 0$ in $(0, 3)$ is one.

40. If A_i is the area bounded by $|x - a_i| + |y| = b_i, i \in N$, where $a_i + 1 = a_i + \frac{3}{2} b_i$ and

    $b_{i+1} = \frac{b_i}{2}, a_1 = 0, b_1 = 32,$ then

    (A) $A_3 = 128$ (B) $A_3 = 256$

    (C) $\lim\limits_{n \to \infty} \sum\limits_{i=1}^n A_i = \frac{8}{3}(32)^2$ (D) $\lim\limits_{n \to \infty} \sum\limits_{i=1}^n A_i = \frac{4}{3}(16)^2$

41. If S_n denotes the sum to n terms of the series $(1 \le n \le 9) 1 + 22 + 333 + ... + \underbrace{999....9}_{9 \text{ times}}$

    then for $n \ge 2$

    (A) $S_n - S_{n-1} = \frac{1}{9}(10^n - n^2 + n)$ (B) $S_n = (10^n - n^2 + 2n - 2)$

    (C) $9(S_n - S_{n-1}) = n(10^n - 1)$ (D) $S_3 = 356$

SECTION – B

(Numerical Answer Type)
*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

42. Given the equation of the ellipse $\frac{(x-3)^2}{16} + \frac{(y-4)^2}{49} = 1$, a parabola is such that its vertex is the lowest point of the ellipse and it passes through the ends of the minor axis of the ellipse. The equation of the parabola is in the form $16y = A(x - H)^2 - K$. Determine the value of $\frac{A}{7} + \frac{H}{3} + \frac{K}{16}$ is equal to

43. There are 10 girls and 8 boys in a class room including Mr. Ravi, Ms. Rani and Ms. Radha. A list of speakers consisting of 8 girls and 6 boys has to be prepared. Mr. Ravi refuses to speak if Ms. Rani is a speaker. Ms. Rani refuses to speak if Ms. Radha is a speaker. The number of ways the list can be prepared is a 3 digit number $n_1 n_2 n_3$, then $|n_3 + n_2 - n_1| =$

44. If a, b, c are positive real numbers and the minimum value of
$$\frac{(a + 3c)}{(a + c + 2b)} + \frac{4b}{(a + b + 2c)} - \frac{8c}{(a + b + 3c)}$$ is $k\sqrt{2} - 17$ then k is

45. The triangle ABC, right angled at C, has median AD, BE and CF, AD lies along the line $y = x + 3$, BE lies along the line $y = 2x + 4$. If the length of the hypotenuse is 60, then the area of the triangle ABC (in sq. units)

46. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three non – zero non coplanar vectors and
$\vec{p} = \vec{a} + \vec{b} - 2\vec{c}$; $\vec{q} = 3\vec{a} - 2\vec{b} + \vec{c}$ and $\vec{r} = \vec{a} - 4\vec{b} + 2\vec{c}$ are three vectors such that the volumes of the parallelepiped formed by $\vec{a}, \vec{b}, \vec{c}$ and $\vec{p}, \vec{q}, \vec{r}$ as their coterminous edges are v_1 and v_2 respectively. Then $\dfrac{V_2}{V_1}$ is equal to

47. The lines $L_1, L_2, L_3, \ldots L_{20}$ are distinct. All the lines L_4, L_8, L_{12}, L_{16} and L_{20} are parallel. All the lines $L_1, L_5, L_9, L_{13}, L_{17}$ pass through a given point A. The maximum number of points of intersection of these 20 lines is

SECTION – C
(Numerical Answer Type)
*This section contains **TWO (02) paragraphs**. Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX)**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 48 and 49

Let $f(x)$ be a cubic polynomial with leading coefficient unity such that $f(a) = b$ and $f'(a) = f''(a) = 0$. Suppose $g(x) = f(x) - f(a) + (a - x)f'(x) + 3(x - a)^2$ for which conclusion of Rolle's theorem in $[a, b]$ holds at $x = 2$, where $2 \in (a, b)$.

48. The value of $f''(2)$ is equal to

49. The value of definite integral $64\int_a^b f(x)dx$ is equal to

Paragraph for Question Nos. 50 and 51

In a class of 10 students, probability of exactly i students passing an examination is directly proportional to i^2. Then, answer the following questions:

50. The probability that exactly five students passing an examination is P then $77P$ is

51. If a student selected at random is found to have passed the examination, then the probability that he was the only student who has passed the examination is P then $6050P$ is