General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.

2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.

3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.

4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.

5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.

6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
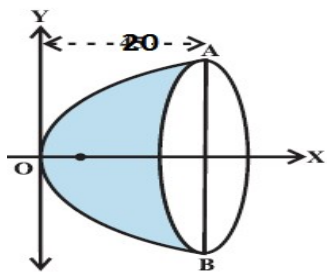
EXAMINATION 2023 -24

Time : 3 Hours   Maximum Marks : 80

Sr. No.	SECTION – A	Marks
	This section comprises of very short answer type-questions (VSA) of 2 marks each	
Q.1	$\dfrac{\sin^2 A - \sin^2 B}{\sin A \cos A - \sin B \cos B} =$ (a) $\tan(A - B)$ (b) $\tan(A + B)$ (c) $\cot(A - B)$ (d) $\cot(A + B)$	1
Q.2	If (2, 0) is the vertex and y-axis the directrix of a parabola, then its focus is (a) (2, 0) (b)(–2, 0) (c) (4, 0) (d) (–4, 0)	1
Q.3	$\dfrac{d}{dx}(x^2 e^x \sin x) =$ (a) $x\,e^x(2\sin x + x\sin x + x\cos x)$ (b) $x\,e^x(2\sin x + x\sin x - \cos x)$ (c) $x\,e^x(2\sin x + x\sin x + \cos x)$ (d) None of these	1
Q.4	The minimum value of $3\cos x + 4\sin x + 5 =$ (a) 5 (b) 9 (c) 7 (d) 0	1
Q.5	$\displaystyle\lim_{x \to \frac{\pi}{6}} \dfrac{\cot^2 x - 3}{\cos ec\,x - 2}.$ a) - 4 (b) 4 (c) 2 (d) None of these	1
Q.6	If $a^2 + b^2 = 1,$ then $\dfrac{1 + b + ia}{1 + b - ia} =$ (a) 1 (b) 2 (c) $b + ia$ (d) $a + ib$	1
Q.7	The probability that an ordinary or a non-leap year has 53 Sunday, is (a) $\frac{2}{7}$ (b) $\frac{1}{7}$ (c) $\frac{3}{7}$ (d) None of these	1
Q.8	Let A = {x ∈ W : x < 2}, B = {x ∈ N : 1 < x ≤ 4} and C = {3, 5}. find the number of elements in cartesian product of set A × (B ∪ C) (i) 7 (ii) 6 (iii) 8 (iv) none	1
Q.9	The number of arrangements which can be made out of the letters of the word **ALGEBRA**, without changing the relative order (positions) of vowels and consonants, is (a)72(b)54 (c)36 (d) None of these	1
Q.10	The distance between the foci of an ellipse is 16 and eccentricity is $\frac{1}{2}$. Length of the major axis of the ellipse is (a) 8 (b) 64 (c) 16 (d) 32	1
Q.11	The number of terms in the expansion of $\{(2x + 3y)^9 + (2x - 3y)^9\}$ is (a) 10 (b) 8 (c) 4 (d) 5	1
Q.12	If A and B are any two sets, then $A \cap (A \cup B)$ is equal to	1

	(a) A (b)B(c) A^c (d) B^c	
Q.13	$\dfrac{d}{dx}(\log \tan x) =$ (a) $2 \sec 2x$ (b) $2 \csc 2x$ (c) $\sec 2x$ (d) $\csc 2x$	1
Q.14	Out of 6 boys and 4 girls, a group of 7 is to be formed. In how many ways can this be done if the group is to have a majority of boys (a) 120 (b)90(c) 100 (d) 80	1
Q.15	A solution of 9% acid is to be diluted by adding 3% acid solution to it resulting mixtures is to be more than 5% but less than 7%. If there is 460 litres of 9% solution. How Many litres of 3% solution will have to be added (a) more than 230 litres but less than 920 litres (b) more than 200 litres but less than 900 litres © more than 320 litres but less than 920 litres (d)more than 230 litres but less than 900 litres	1
Q.16	The sum of $1^3 + 2^3 + 3^3 + 4^3 + ... + 15^3$,is (a)22000(b)10,000(c) 14,400 (d)15,000	1
Q.17	The inclination of the line joining the points A (x , -3) and B (2 , 5) is 135°. Then, the value of x is (a) 8 (b) –8 (c) 10 (d) –10	1
Q.18	The quadratic equation whose one roots are $\dfrac{-1+i\sqrt{3}}{2}$ (a) $x^2 + x + 1 = 0$ (b) $x^2 - x + 1 = 0$ (c) $x^2 + x - 1 = 0$ (d) none	1
	ASSERTION-REASON BASED QUESTIONS In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	
Q.19	**Assertion (A) :** The point on the z-axis which is equidistant from the points A(1, 5, 7) and B(5, 1, -4) is (0,0,1.5). **Reason (R):** The distance between two points $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$ is given by $AB = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2]}$.	1
Q.20	**Assertion (A) :** The expansion of $(x+a)^n$ if the sum of odd terms be P and sum of even terms be Q, then $P^2 - Q^2 = (x^2 - a^2)^n$. **Reason (R):** If n is a positive integer then $(x+y)^n = {}^nC_0 x^{n-0} y^0 + {}^nC_1 x^{n-1} y^1 + {}^nC_2 x^{n-2} y^2 + ... + {}^nC_r x^{n-r} y^r + ... + {}^nC_n x^0 y^n$.	1

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This section comprises of very short answer type-questions (VSA) of 2 marks each

Q.21 Prove that : $\dfrac{1+\cos 4x}{\cot x - \tan x} = \dfrac{1}{2}\sin 4x$. | 2

Q.22 Find the axes, eccentricity, latus rectum and the coordinates of the foci of the hyperbola $25x^2 - 36y^2 = 225$. | 2

OR

A rod of length 12 cm moves with its ends always touching the coordinate axes. Determine the equation of the locus of a point P on the rod, which is 3 cm from the end in contact with the x-axis.

Q.23 Find the 10th term in the binomial expansion of $\left(2x^2 + \dfrac{1}{x}\right)^{12}$. | 2

Q.24 Find the equation of the circle whose radius is 3 and which touches internally the circle $x^2 + y^2 - 4x - 6y - 12 = 0$ at the point $(-1, -1)$. | 2

OR

The focus of a parabolic mirror as shown in Fig is at a distance of 6 cm from its

vertex. If the mirror is 20 cm deep, find the distance AB .

Q.25 If 2 , x , y , z , $\dfrac{32}{81}$ are in G.P., find x , y , z. . | 2

(This section comprises of short answer type questions (SA) of 3 marks each)

Q.26 A boy has 3 library tickets and 8 books of his interest in the library. Of these 8, he does not want to borrow mathematics part II, unless mathematics part I is also borrowed. In how many ways can he choose the 3 books to be borrowed? . | 3

Q.27 If $\tan x = \dfrac{3}{4}$, $\pi < x < \dfrac{3\pi}{2}$, find the value of $\sin\dfrac{x}{2}$, $\cos\dfrac{x}{2}$ and $\tan\dfrac{x}{2}$. | 3

OR

Prove that $\cos^2 A + \cos^2(A + 120^0) + \cos^2(A - 120^0) = \dfrac{3}{2}$.

Q.28 The A.M of a and b is to their G.M are in the ratio m to n, show $a:b = m+\sqrt{m^2 - n^2} : m - \sqrt{m^2 - n^2}$. | 3

Q.29	Let U = { 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12 }, A = { 1, 3, 4, 7,11}, B = { 2, 4,5, 6, 8,12 } and C = {1, 3, 4, 5, 9 , 11 }. Verify that (i) $(A \cup B)^C = A^C \cap B^C$ (ii) $A - (B \cup C) = (A - B) \cap (A - C)$. **OR** Let A= {2, 3, 4, 5, 6, 7, 8, 9 } .Let R be the relation on A defined by $\{(x, y): x, y \in A \ \& \ x \ \text{divides y}\}$. Find (i) R in Roster form(ii)Domain of R (iii) Range R (iv) R^{-1} in roster form .	3
Q.30	Find the domain and range of $f(x) = \sqrt{25 - x^2}$.	3
Q.31	Solve the equation: $x^2 - (7-i)x + (18-i) = 0$. **OR** If $(x + iy)^{1/3} = (a + ib)$ then prove that:(i) $\dfrac{x}{a} + \dfrac{y}{b} = 4(a^2 - b^2)$ (ii) $\dfrac{x}{a} - \dfrac{y}{b} = -2(a^2 + b^2)$.	3

SECTION – D

(This section comprises of long answer-type questions (LA) of 5 marks each)

Q.32	Find the sum to n terms : 3 + 8 + 22 + 72 + 266 + 1036 + …………. OR If S_1, S_2, S_3 are the sum of first n natural numbers, their squares and their cubes, respectively, show that $9 S_2^2 = S_3(1 + 8 S_1)$.	5
Q.33	Two students' anil and ashima appeared in an examination. The probability that anil will qualify the examination is 0.05 and that ashima will qualify the examination is 0.10. the probability that both will qualify the examination is 0.02 find the probability that: (i)Both anil and ashima will not qualify the exam. (ii)At least one of them will not qualify the exam.(iii)Only one of them will qualify the exam	5
Q.34	**NOTE: ATTEMPT ANY TWO .** **(i)** Find mean deviation about the mean for the following data : | x_i:	2	5	6	8	10	12
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f_i:	2	8	10	7	8	5 | (ii) An experiment consists of tossing a coin and then throwing it second time if a head occurs. If a tail occurs on the first toss, then a die is rolled once. Find the sample space. (iii) If $\displaystyle \lim_{x \to 2} \dfrac{x^n - 2^n}{x - 2} = 80 \ and \ n \in N,$ find n .	5
Q.35	Find the equation of the line passing through the points (4 , 5) making equal angle with the lines 5x – 12 y + 6 = 0 and 3x = 4y + 7 . OR Find the co-ordinates of the orthocenter of the triangle whose vertices are	5

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	$A(5, -2)$, $B(-1, 2)$ and $C(1, 4)$.	
	SECTION – E (This section comprises of 3 case study / passage – based questions of 4 marks each with two sub parts (i),(ii),(iii) of marks 1, 1, 2 respectively.The third case study question has two sub – parts of 2 marks each.)	
Q.36	**Case Study based-1** State which of the following statements is true or false .	
i.	If $xy > 0$, then $x > 0$ and $y < 0$	1
ii.	If $x < y$ and $b < 0$, then $\dfrac{x}{b} < \dfrac{y}{b}$.	1
iii.	If $x > y$ and $b < 0$, then $bx < by$. **OR** If $x > 5$ and $x > 2$, then $x \in (5, \infty)$	2
Q.37	**Case Study based-2** If the 3rd, 4th and 5th terms in the expansion of $(x+a)^n$ are 84, 280 and 560 respectively	
i.	find x	1
ii.	find a	1
iii.	find n	2
Q.38	**Case Study based-3** Find the number of ways in which 5 boys and 6 girls be seated in a row so that	
i.	no two girls may sit together	2
ii.	all the girls are never together. OR all girls can sit together and all boys sit together.	2
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	"शिक्षा कभी भी व्यर्थ नहीं होती भले ही वो किसी भी तरह की ग्रहण की गई हो।"	

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