CODE:2801- AG-FC-1-23-24 पजियन क्रमांक **REG.NO:-TMC -D/79/89/36**

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

CLASS – XI | **MATHEMATICS**

Sr. No.	SECTION – A **This section comprises of very short answer type-questions (VSA) of 2 marks each**	Marks
Q.1	If $\cos A = m\cos B$, then (a) $\cot\frac{A+B}{2}=\frac{m+1}{m-1}\tan\frac{B-A}{2}$ (b) $\tan\frac{A+B}{2}=\frac{m+1}{m-1}\cot\frac{B-A}{2}$ (c) $\cot\frac{A+B}{2}=\frac{m+1}{m-1}\tan\frac{A-B}{2}$ (d) None of these	1
Q.2	If $\frac{2x-3}{4}+9\geq 3+\frac{4x}{3}$ then $x \in$ (a) $\left[-\infty, \frac{63}{10}\right]$ (b) $\left(-\infty, \frac{63}{10}\right)$ (c) $\left(-\infty, \frac{63}{10}\right]$ (d) $\left[\frac{63}{10}, \infty\right)$	1
Q.3	If in a chess tournament each contest plays once against each of the others and in all 45 games are played, then the number of participants is (a) 9 (b) 10 (c) 15 (d) none of these	1
Q.4	If the foci and vertices of an ellipse be $(\pm 1, 0)$ and $(\pm 2, 0)$, then the minor axis of the ellipse is (a) $2\sqrt{5}$ (b) 2 (c) 4 (d) $2\sqrt{3}$	1
Q.5	If the 9^{th} term of an A.P. be zero, then the ratio of its 29^{th} and 19^{th} term is	1

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	(a)1 : 2(b)2 : 1(c)1 : 3(d)3 : 1	
Q.6	The centers of the circles $x^2+y^2=1$, $x^2+y^2+6x-2y=1$ and $x^2+y^2-12x+4y=1$ are (a) Same (b) Collinear (c) Non-collinear (d) None of these	1
Q.7	Two dice are thrown simultaneously. What is the probability of obtaining a multiple of 2 on one of them and a multiple of 3 on the other (a) $\frac{5}{36}$ (b) $\frac{11}{36}$ (c) $\frac{1}{6}$ (d) $\frac{1}{3}$	1
Q.8	If the eccentricity of an ellipse be 5/8 and the distance between its foci be 10, then its latus rectum is (a) 39/4 (b) 12 (c) 15 (d) 37/2	1
Q.9	$\sqrt{2+\sqrt{2+2\cos 4\theta}}=$ (a) $\cos\theta$ (b) $\sin\theta$ (c) $2\cos\theta$ (d) $2\sin\theta$	1
Q.10	$\left\lvert(1+i)\frac{(2+i)}{(3+i)}\right\rvert=$ (a) $-\frac{1}{2}$ (b) $\frac{1}{2}$ (c) 1 (d) -1	1
Q.11	If a set A has n elements, then the total number of subsets of A is (a) n (b) n^2 (c) 2^n (d) $2n$	1
Q.12	If the 5^{th} term of a G.P. is $\frac{1}{3}$ and 9^{th} term is $\frac{16}{243}$, then the 4^{th} term will be (a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{2}{5}$	1
Q.13	If distance between the directrices be thrice the distance between the foci, then eccentricity of ellipse is (a) 1/2 (b) 2/3 (c) $1/\sqrt{3}$ (d) 4/5	1
Q.14	The value of $1^2+2^2+3^2+....+n^2=$ for all $n\in N$ (a) n^2 (b) $\frac{n(n+1)(2n-1)}{6}$ (c) $\frac{n(n+1)(2n+1)}{6}$ (d) $\frac{n(n+1)}{2}$	1
Q.15	If $A=\{1,2,3,4,5\}$, then the number of proper subsets of A (a) 120 (b) 30 (c) 31 (d) 32	1
Q.16	If the variance of observations $x_1, x_2, ... x_n$ is σ^2, then the variance of $ax_1, ax_2 ....., ax_n$, $\alpha\neq 0$ is (a) σ^2 (b) $a\sigma^2$ (c) $a^2\sigma^2$ (d) $\frac{\sigma^2}{a^2}$	1

Q.17	The number of non-zero integral solutions of the equation $\|1-i\|^x = 2^x$ is (a) Infinite(b)1(c)2(d)None of these	1
Q.18	n^{th} term of the series $\frac{1^3}{1}+\frac{1^3+2^3}{1+3}+\frac{1^3+2^3+3^3}{1+3+5}+\ldots\ldots$ will be (a) n^2+2n+1 (b) $\frac{n^2+2n+1}{8}$ (c) $\frac{n^2+2n+1}{4}$ (d) $\frac{n^2-2n+1}{4}$	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) :** If $(x+a)^6$ is expanded then the number of terms are there is 7 . **Reason (R) :** Total number of term in the expansion $(x+a)^n$ is n .	1
Q.20	**Assertion (A) :** A straight line through $P(1, 2)$ is such that its intercept between the axes is bisected at P. Its equation is $2x+y-4=0$. **Reason (R):** The length of perpendicular from $P(x_1, y_1)$ on $ax + by + c = 0$ is $\left\|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\|$.	1
	SECTION – B **This section comprises of very short answer type-questions (VSA) of 2 marks each**	
Q.21	If p is any real number and if the middle term in the expansion of $\left(\frac{p}{2}+2\right)^8$ is 1120. evaluate p.	2
Q.22	Solve the following equation: $\sqrt{3}x^2-\sqrt{2}x+3\sqrt{3}=0$. **OR** Find real values of θ for which $\left(\frac{3+2i\sin\theta}{1-2i\sin\theta}\right)$ is purely real.	2
Q.23	Differentiate the with respect to x $\sqrt{\sin(2x+3)}$.	2
Q.24	Let R be the relation on the set N of natural number defined by $R=\{(x, y): x+3y=12 \ \& \ x, y \in N$. (i) Write R in the roster form. (ii) Find domain of R (ii) Find range of R. **OR**	2

	Let A = {9, 10, 11, 12, 13} and let f : $A \to N$ be defined by $f(n)$ = the highest prime factor of n. Find the range of f.	
Q.25	In the first four papers each of 100 marks. Rishi got 95, 72, 73, 83, marks. If he wants an average of greater than or equal to 75 marks and less than 80 marks , find the range of marks he should score in the fifth paper.	2
	SECTION – C **(This section comprises of short answer type questions (SA) of 3 marks each)**	
Q.26	Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains (i) all Kings (ii) 3 Kings (iii) at least 3 Kings.	3
Q.27	The slope of a line is double of the slope of another line. If tangent of the angle between them is 1/3, find the slopes of the lines. **OR** 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 .	3
Q.28	Suppose f(x) $= \begin{cases} 2a - 3bx & x < 3 \\ 4 & x = 3 \\ 5b - 3ax & x > 3 \end{cases}$ and if $\lim_{x \to 3} f(x) = f(3)$ what are possible value of a and b?	3
Q.29	A committee of 3 persons is to be constituted from a group of 2 men and 3 women. In how many ways can this be done? How many of these committees would consist of 1 man and 2 women? **OR** How many numbers greater than 1000, but not greater than 4000 can be formed with the digits 0, 1, 2, 3, 4, if (i) repetition of digits is allowed (ii) repetition of digits is not allowed .	3
Q.30	Prove that : $\sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \frac{5\pi}{8} + \sin^4 \frac{7\pi}{8} = \frac{3}{2}$.	3
Q.31	If x and y are any two distinct integers, then prove by using binomial that $(x^n - y^n)$ is divisible by (x – y) for all $n \in N$. **OR** Prove by the principle of mathematical induction : $\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \ldots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{6n+4}$.	3
	SECTION – D **(This section comprises of long answer-type questions (LA) of 5 marks each)**	
Q.32	Find the domain and range of $f(x) = \sqrt{x^2 - 16}$. **OR** A college warded 38 medals in football, 15 in basketball and 20 in cricket. If these	5

	medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports ?	
Q.33	Find the standard deviation for the following data : x_i: 3, 8, 13, 18, 23 f_i: 7, 10, 15, 10, 6	5
Q.34	Draw the following linear programming problem graphically:subject to the constraints: $x + 2y \geq 10$; $3x + 4y \leq 24$; $x \geq 0, y \geq 0$	5
Q.35	Find the sum up to n term: 1+ 5 + 13 + 29 +…… . OR Find the equation of a circle which touches y-axis at a distance of 5 units from the origin and cuts an intercept of 24 units along the positive direction of x-axis.	5
	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** If the letters of the word **"HINDUSTAN"**	
i.	How many of these arrangements begin and end with a vowel (a) 15120 (b) 7560 (c) 5040 (d) none of these	1
ii.	How many of these arrangements, all the vowels come together (a) 7560 (b) 15120 (c) 5040 (d) none of these	1
iii.	how many of these arrangements, none of the vowels come together (a) 75600 (b) 37800 (c) 151200(d) none of these **OR** How many of these arrangements, do the vowels and the consonants occupy the same relative positions (a) 2160 (b) 4320 (c)360 (d) none of these	2
Q.37	**Case Study based-2** Solve for x and y .	
i.	If $(1-i)x + (1+i)y = 1 - 3i$, then $(x, y) =$ (a) $(2,-1)$ (b) $(-2,1)$ (c) $(-2,-1)$ (d) $(2, 1)$	1
ii.	The real values of x and y for which the equation is $(x + iy)(2-3i) = 4 + i$ is satisfied, are (a) $x = \frac{5}{13}, y = \frac{8}{13}$ (b) $x = \frac{8}{13}, y = \frac{5}{13}$ (c) $x = \frac{5}{13}, y = \frac{14}{13}$ (d) None of these	1
iii.	The values of x and y for which the numbers $3 + ix^2y$ and $x^2 + y + 4i$ are	2

	conjugate complex can be (a) $(-2,-1)$ or $(2,-1)$ (b) $(-1, 2)$ or $(-2, 1)$ (c) $(1, 2)$ or $(-1,-2)$ (d)None of these **OR** The real values of x and y for which the equation $(x^4 + 2xi) - (3x^2 + yi) = (3 - 5i) + (1 + 2yi)$ is satisfied, are (a) $x = 2, y = 3$ (b) $x = -2, y = \frac{1}{3}$ (c)Both (a) and (b) (d) None of these	
Q.38	**Case Study based-3** If the point (2, 3) is the focus and x = 2y + 6 is the directrix of a parabola, find	
i.	The equation of the axis	1
ii.	The co-ordinates of the vertex	1
iii	Length of the latus rectum OR Equation of the latus rectum	2