22

QUESTION BOOKLET – 2018

Subject : Paper I : Mathematics

Question Booklet Version	Roll No.	(Write this number on your Answer Sheet) 2055141	Question Booklet Sr. No.
22 (Write this number on your Answer Sheet)			
	Answer Sheet No.		

Duration: 1 Hour 30 Minutes

Total Marks : 100

This is to certify that, the entries of Roll Number and Answer Sheet Number have been correctly written and verified.

Candidate's Signature

Invigilator's Signature

Instructions to Candidates

1. This question booklet contains 50 Objective Type Questions (Single Best Response Type) in the subject of Mathematics.
2. The question paper and OMR (Optical Mark Reader) Answer Sheet are issued to examinees separately at the beginning of the examination session.
3. Choice and sequence for attempting questions will be as per the convenience of the candidate.
4. Candidate should carefully read the instructions printed on the Question Booklet and Answer Sheet and make the correct entries on the Answer Sheet. As Answer Sheets are designed to suit the OPTICAL MARK READER (OMR) SYSTEM, special care should be taken to mark the appropriate entries/answers correctly. Special care should be taken to fill QUESTION BOOKLET VERSION, SERIAL No. and Roll No. accurately. The correctness of entries has to be cross-checked by the invigilators. **The candidate must sign on the Answer Sheet and Question Booklet.**
5. Read each question carefully.
6. Determine the correct answer from out of the four available options given for each question.
7. Fill the appropriate circle completely like this ●, for answering the particular question, with Black ink ball point pen only, in the OMR Answer Sheet.
8. Each answer with correct response shall be awarded **two (2) marks**. There **is no Negative Marking**. If the examinee has marked two or more answers or has done scratching and overwriting in the Answer Sheet in response to any question, or has marked the circles inappropriately e.g. half circle, dot, tick mark, cross etc, mark/s shall NOT be awarded for such answer/s, as these may not be read by the scanner. Answer sheet of each candidate will be evaluated by computerized scanning method only (Optical Mark Reader) and there will not be any manual checking during evaluation or verification.
9. Use of whitener or any other material to erase/hide the circle once filled is not permitted. Avoid overwriting and/or striking of answers once marked.
10. Rough work should be done only on the blank space provided on the Question Booklet. **Rough work should not be done on the Answer Sheet.**
11. The required mathematical tables (Log etc.) are provided within the question booklet.
12. Immediately after the prescribed examination time is over, the Answer Sheet is to be returned to the Invigilator. Confirm that both the Candidate and Invigilator have signed on question booklet and answer sheet.
13. No candidate is allowed to leave the examination hall till the examination session is over.

MATHEMATICS

1. If $\int_0^K \frac{dx}{2+18x^2} = \frac{\pi}{24}$, then the value of K is

A) 3. B) 4 C) $\frac{1}{3}$ D) $\frac{1}{4}$

2. The cartesian co-ordinates of the point on the parabola $y^2 = -16x$, whose parameter is $\frac{1}{2}$, are

A) $(-2, 4)$ B) $(4, -1)$ C) $(-1, -4)$ D) $(-1, 4)$

3. $\int \frac{1}{\sin x . \cos^2 x} dx =$

A) $\sec x + \log|\sec x + \tan x| + c$ B) $\sec x . \tan x + c$
C) $\sec x + \log|\sec x - \tan x| + c$ D) $\sec x + \log|\operatorname{cosec} x - \cot x| + c$

4. If $\log_{10}\left(\frac{x^3 - y^3}{x^3 + y^3}\right) = 2$ then $\frac{dy}{dx} =$

A) $\frac{x}{y}$ B) $-\frac{y}{x}$ C) $-\frac{x}{y}$ D) $\frac{y}{x}$

5. If $f : R - \{2\} \to R$ is a function defined by $f(x) = \frac{x^2 - 4}{x - 2}$, then its range is

A) R B) $R - \{2\}$ C) $R - \{4\}$ D) $R - \{-2, 2\}$

SPACE FOR ROUGH WORK

6. If $f(x) = x^2 + \alpha$ for $x \geq 0$

$= 2\sqrt{x^2+1} + \beta$ for $x < 0$

is continuous at $x = 0$ and $f\left(\frac{1}{2}\right) = 2$ then $\alpha^2 + \beta^2$ is

A) 3 B) $\frac{8}{25}$ C) $\frac{25}{8}$ D) $\frac{1}{3}$

7. If $y = \left(\tan^{-1} x\right)^2$ then $\left(x^2+1\right)^2 \frac{d^2y}{dx^2} + 2x\left(x^2+1\right)\frac{dy}{dx} =$

A) 4 B) 2 C) 1 D) 0

8. The line $5x + y - 1 = 0$ coincides with one of the lines given by $5x^2 + xy - kx - 2y + 2 = 0$ then the value of k is

A) -11 B) 31 C) 11 D) -31

9. If $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$ then $(A^2 - 5A)A^{-1} =$

A) $\begin{bmatrix} 4 & 2 & 3 \\ -1 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$ B) $\begin{bmatrix} -4 & 2 & 3 \\ -1 & -4 & 2 \\ 1 & 2 & -1 \end{bmatrix}$ C) $\begin{bmatrix} -4 & -1 & 1 \\ 2 & -4 & 2 \\ 3 & 2 & -1 \end{bmatrix}$ D) $\begin{bmatrix} -1 & -2 & 1 \\ 4 & -2 & -3 \\ 1 & 4 & -2 \end{bmatrix}$

SPACE FOR ROUGH WORK

10. The equation of line passing through (3, –1, 2) and perpendicular to the lines $\bar{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(2\hat{i} - 2\hat{j} + \hat{k})$ and $\bar{r} = (2\hat{i} + \hat{j} - 3\hat{k}) + \mu(\hat{i} - 2\hat{j} + 2\hat{k})$ is

A) $\frac{x+3}{2} = \frac{y+1}{3} = \frac{z-2}{2}$ B) $\frac{x-3}{3} = \frac{y+1}{2} = \frac{z-2}{2}$

C) $\frac{x-3}{2} = \frac{y+1}{3} = \frac{z-2}{2}$ D) $\frac{x-3}{2} = \frac{y+1}{2} = \frac{z-2}{3}$

11. Letters in the word HULULULU are rearranged. The probability of all three L being together is

A) $\frac{3}{20}$ B) $\frac{2}{5}$ C) $\frac{3}{28}$ D) $\frac{5}{23}$

12. The sum of the first 10 terms of the series 9 + 99 + 999 +..., is

A) $\frac{9}{8}(9^{10} - 1)$ B) $\frac{100}{9}(10^9 - 1)$ C) $10^9 - 1$ D) $\frac{100}{9}(10^{10} - 1)$

13. If A, B, C are the angles of ΔABC then cotA. cotB + cotB. cotC + cotC. cotA =

A) 0 B) 1 C) 2 D) – 1

14. If $\int \frac{dx}{\sqrt{16 - 9x^2}} = A\sin^{-1}(Bx) + C$ then A + B =

A) $\frac{9}{4}$ B) $\frac{19}{4}$ C) $\frac{3}{4}$ D) $\frac{13}{12}$

SPACE FOR ROUGH WORK

15. $\int e^x \left[\frac{2+\sin 2x}{1+\cos 2x}\right] dx =$

A) $e^x \tan x + c$ B) $e^x + \tan x + c$ C) $2e^x \tan x + c$ D) $e^x \tan 2x + c$

16. A coin is tossed three times. If X denotes the absolute difference between the number of heads and the number of tails then $P(X = 1) =$

A) $\frac{1}{2}$ B) $\frac{2}{3}$ C) $\frac{1}{6}$ D) $\frac{3}{4}$

17. If $2 \sin\left(\theta + \frac{\pi}{3}\right) = \cos\left(\theta - \frac{\pi}{6}\right)$, then $\tan\theta =$

A) $\sqrt{3}$ B) $-\frac{1}{\sqrt{3}}$ C) $\frac{1}{\sqrt{3}}$ D) $-\sqrt{3}$

18. The area of the region bounded by $x^2 = 4y$, $y = 1$, $y = 4$ and the y-axis lying in the first quadrant is _____ square units.

A) $\frac{22}{3}$ B) $\frac{28}{3}$ C) 30 D) $\frac{21}{4}$

19. If $f(x) = \frac{e^{x^2} - \cos x}{x^2}$, for $x \neq 0$ is continuous at $x = 0$, then value of $f(0)$ is

A) $\frac{2}{3}$ B) $\frac{5}{2}$ C) 1 D) $\frac{3}{2}$

SPACE FOR ROUGH WORK

20. The maximum value of $2x + y$ subject to $3x + 5y \leq 26$ and $5x + 3y \leq 30$, $x \geq 0$, $y \geq 0$ is

A) 12 B) 11.5 C) 10 D) 17.33

21. If $\bar{a}$, $\bar{b}$, $\bar{c}$ are mutually perpendicular vectors having magnitudes 1, 2, 3 respectively, then $[\bar{a} + \bar{b} + \bar{c} \quad \bar{b} - \bar{a} \quad \bar{c}] =$

A) 0 B) 6 C) 12 D) 18

22. If points P(4, 5, x), Q(3, y, 4) and R(5, 8, 0) are collinear, then the value of $x + y$ is

A) -4 B) 3 C) 5 D) 4

23. If the slope of one of the lines given by $ax^2 + 2hxy + by^2 = 0$ is two times the other then

A) $8h^2 = 9ab$ B) $8h^2 = 9ab^2$ C) $8h = 9ab$ D) $8h = 9ab^2$

24. The equation of the line passing through the point $(-3, 1)$ and bisecting the angle between co-ordinate axes is

A) $x + y + 2 = 0$ B) $-x + y + 2 = 0$ C) $x - y + 4 = 0$ D) $2x + y + 5 = 0$

25. The negation of the statement : "Getting above 95% marks is necessary condition for Hema to get the admission in good college".

A) Hema gets above 95% marks but she does not get the admission in good college

B) Hema does not get above 95% marks and she gets admission in good college

C) If Hema does not get above 95% marks then she will not get the admission in good college

D) Hema does not get above 95% marks or she gets the admission in good college

SPACE FOR ROUGH WORK

26. $\cos 1° . \cos 2° . \cos 3° \ldots \cos 179° =$

A) 0 B) 1 C) $-\frac{1}{2}$ D) -1

27. If planes $x - cy - bz = 0$, $cx - y + az = 0$ and $bx + ay - z = 0$ pass through a straight line then $a^2 + b^2 + c^2 =$

A) $1 - abc$ B) $abc - 1$

C) $1 - 2abc$ D) $2abc - 1$

28. The point of intersection of lines represented by $x^2 - y^2 + x + 3y - 2 = 0$ is

A) $(1, 0)$ B) $(0, 2)$

C) $\left(-\frac{1}{2}, \frac{3}{2}\right)$ D) $\left(\frac{1}{2}, \frac{1}{2}\right)$

29. A die is rolled. If X denotes the number of positive divisors of the outcome then the range of the random variable X is

A) $\{1, 2, 3\}$

B) $\{1, 2, 3, 4\}$

C) $\{1, 2, 3, 4, 5, 6\}$

D) $\{1, 3, 5\}$

30. A die is thrown four times. The probability of getting perfect square in at least one throw is

A) $\frac{16}{81}$ B) $\frac{65}{81}$ C) $\frac{23}{81}$ D) $\frac{58}{81}$

SPACE FOR ROUGH WORK

31. $\int_0^{\pi/4} x.\sec^2 x\,dx =$

A) $\frac{\pi}{4}+\log\sqrt{2}$ B) $\frac{\pi}{4}-\log\sqrt{2}$ C) $1+\log\sqrt{2}$ D) $1-\frac{1}{2}\log 2$

32. In ΔABC, with usual notations, if a, b, c are in A.P. then $a\cos^2\left(\frac{C}{2}\right)+c\cos^2\left(\frac{A}{2}\right)=$

A) $3\frac{a}{2}$ B) $3\frac{c}{2}$ C) $3\frac{b}{2}$ D) $\frac{3abc}{2}$

33. If $x=e^{\theta}(\sin\theta-\cos\theta)$, $y=e^{\theta}(\sin\theta+\cos\theta)$ then $\frac{dy}{dx}$ at $\theta=\frac{\pi}{4}$ is

A) 1 B) 0 C) $\frac{1}{\sqrt{2}}$ D) $\sqrt{2}$

34. The number of solutions of $\sin x + \sin 3x + \sin 5x = 0$ in the interval $\left[\frac{\pi}{2}, 3\frac{\pi}{2}\right]$ is

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

35. If $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, then x =

A) -1 B) $\frac{1}{3}$ C) $\frac{1}{6}$ D) $\frac{1}{2}$

SPACE FOR ROUGH WORK

36. Matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{bmatrix}$ then the value of $a_{31} A_{31} + a_{32} A_{32} + a_{33} A_{33}$ is

A) 1 B) 13 C) –1 D) –13

37. The contrapositive of the statement : "If the weather is fine then my friends will come and we go for a picnic."

A) The weather is fine but my friends will not come or we do not go for a picnic

B) If my friends do not come or we do not go for picnic then weather will not be fine

C) If the weather is not fine then my friends will not come or we do not go for a picnic

D) The weather is not fine but my friends will come and we go for a picnic

38. If $f(x) = \frac{x}{x^2 + 1}$ is increasing function then the value of x lies in

A) R B) $(-\infty, -1)$ C) $(1, \infty)$ D) $(-1, 1)$

39. If $X = \{4^n - 3n - 1 : n \in N\}$ and $Y = \{9(n-1) : n \in N\}$, then $X \cap Y =$

A) X B) Y C) ϕ D) {0}

40. The statement pattern $p \wedge (\sim p \wedge q)$ is

A) a tautology B) a contradiction

C) equivalent to $p \wedge q$ D) equivalent to $p \vee q$

SPACE FOR ROUGH WORK

41. If the line $y = 4x - 5$ touches to the curve $y^2 = ax^3 + b$ at the point $(2, 3)$ then $7a + 2b =$

A) 0 B) 1 C) -1 D) 2

42. The sides of a rectangle are given by $x = \pm a$ and $y = \pm b$. The equation of the circle passing through the vertices of the rectangle is

A) $x^2 + y^2 = a^2$

B) $x^2 + y^2 = a^2 + b^2$

C) $x^2 + y^2 = a^2 - b^2$

D) $(x - a)^2 + (y - b)^2 = a^2 + b^2$

43. The minimum value of the function $f(x) = x\log x$ is

A) $-\frac{1}{e}$ B) $-e$ C) $\frac{1}{e}$ D) e

44. If $X \sim B(n, p)$ with $n = 10$, $p = 0.4$ then $E(X^2) =$

A) 4 B) 2.4 C) 3.6 D) 18.4

45. The general solution of differential equation $\frac{dx}{dy} = \cos(x + y)$ is

A) $\tan\left(\frac{x+y}{2}\right) = y + c$ B) $\tan\left(\frac{x+y}{2}\right) = x + c$

C) $\cot\left(\frac{x+y}{2}\right) = y + c$ D) $\cot\left(\frac{x+y}{2}\right) = x + c$

SPACE FOR ROUGH WORK

46. If planes $\bar{r}.\left(p\hat{i}-\hat{j}+2\hat{k}\right)+3=0$ and $\bar{r}.\left(2\hat{i}-p\hat{j}-\hat{k}\right)-5=0$ include angle $\frac{\pi}{3}$ then the value of p is

A) $1, -3$ B) $-1, 3$ C) -3 D) 3

47. The order of the differential equation of all parabolas, whose latus rectum is 4a and axis parallel to the x-axis, is

A) one B) four
C) three D) two

48. If lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $x-3=\frac{y-k}{2}=z$ intersect then the value of k is

A) $\frac{9}{2}$ B) $\frac{1}{2}$ C) $\frac{5}{2}$ D) $\frac{7}{2}$

49. If a line makes angles 120° and 60° with the positive directions of X and Z axes respectively then the angle made by the line with positive Y-axis is

A) 150° B) 60° C) 135° D) 120°

50. L and M are two points with position vectors $2\bar{a}-\bar{b}$ and $\bar{a}+2\bar{b}$ respectively. The position vector of the point N which divides the line segment LM in the ratio 2 : 1 externally is

A) $3\bar{b}$ B) $4\bar{b}$ C) $5\bar{b}$ D) $3\bar{a}+4\bar{b}$

SPACE FOR ROUGH WORK