



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : BMN-101

BASIC MATHEMATICAL COMPUTATION

Time Allotted: 3 Hours

Full Marks: 70

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.*

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternative for *any ten* of the following:

1×10=10

- (i) The number of permutations that can be made out of the letters "COTTON" is
(a) 720 (b) 180
(c) 120 (d) 30
- (ii) The value of $\int \frac{\log x}{x^2} dx$ is
(a) $\log(x+1)+c$ (b) $-\frac{1}{x}\log(x+1)+c$
(c) $\log(x-1)+c$ (d) $\frac{1}{2}\log(x+1)+c$
- (iii) The function $f(x)=|x|$ is
(a) continuous and differentiable at $x=0$
(b) continuous everywhere but differentiable at $x=0$
(c) discontinuous and not differentiable at $x=0$
(d) None of the above
- (iv) $f(x, y) = |x| + |y|$ then $f_x(0,0)$ equal to
(a) 1 (b) 0
(c) does not exist (d) None of these

- (v) The value of y_3 , when $y = \left(\frac{x}{2} + 1\right)^8$ is
- (a) $42 \left(\frac{x}{2} + 1\right)^3$ (b) $336 \left(\frac{x}{2} + 1\right)^3$
 (c) $42 \left(\frac{x}{2} + 1\right)^5$ (d) $336 \left(\frac{x}{2} + 1\right)^5$
- (vi) The equation of the straight line passing through the point (4,3) and making intercepts on the coordinate axes whose sum is -1
- (a) $\frac{x}{2} + \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$ (b) $\frac{x}{2} - \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$
 (c) $\frac{x}{2} + \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$ (d) $\frac{x}{2} - \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$
- (vii) If $y = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$, then the value of $\frac{dy}{dx}$ at $x = -1$ is
- (a) 1 (b) 0
 (c) e (d) $1/e$
- (viii) If A be a matrix whose inverse exists then which of the following is not true?
- (a) $(A^T)^{-1} = (A^{-1})^T$ (b) $(A^2)^{-1} = (A^{-1})^2$
 (c) $A^{-1} = (\det A)^{-1}$ (d) None of these
- (ix) If $y = 2at$ and $x = at^2$ then $\frac{dy}{dx}$ at $t=2$ is
- (a) 1 (b) 2
 (c) $2a^2$ (d) $1/2$
- (x) Which of the following does not satisfy Rolle's theorem in $[-2,2]$?
- (a) x (b) $\frac{1}{x'}$
 (c) $\frac{1}{x-5'}$ (d) $x^2 - 5$
- (xi) The value of $\lim_{x \rightarrow 2} [x]$ is
- (a) 2 (b) 1
 (c) 3 (d) Does not exist
- (xii) The angle between the lines $y=x-3$ and $y=(2-\sqrt{3})x$ is
- (a) 30° (b) 45°
 (c) 60° (d) 90°

Group – B**(Short Answer Type Questions)****Answer any three of the following.****5×3=15**

2. How many license plates can be formed involving 3 English letters and 4 digits, if the letters must appear either in the beginning or in the end?
3. If $y = \cos \left(m \sin^{-1} x \right)$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2-n^2)y_n = 0$.
4. If $u = \tan^{-1} \frac{x^2-y^2}{x-y}$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \sin 2u$.
5. Solve the following system of linear equations by Cramer's Rule or Matrix Inversion method

$$\begin{aligned} 2x + 5y + 3z &= 5 \\ 3x + y + 2z &= 5 \\ x + 2y - z &= 0 \end{aligned}$$
6. Verify Rolle's theorem for the function $f(x) = |x-2|, 0 \leq x \leq 4$.

Group – C**(Long Answer Type Questions)****Answer any three of the following.****15×3=45**

7. (a) Find the 3rd term from end in the expansion of $\left(x^2 + \frac{1}{2x}\right)^{13}$
- (b) Find A^{-1} where $A = \begin{bmatrix} 2 & -1 & 0 \\ 3 & 2 & 1 \\ -2 & 1 & 5 \end{bmatrix}$
- (c) Evaluate $\int \frac{x^5 dx}{x^2+1}$
8. (a) If $\lim_{x \rightarrow 0} \frac{ae^x - b}{x} = 2$ then find the value of a, b .
- (b) Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$
- (c) Find the area bounded by $y = 2 - x^2$ and $x + y = 0$

9. (a) Expand $\log(1 + 2x)$ using Maclaurin's series.
 (b) The parabola $y^2 = 2ax$ passes through the center of the circle $4x^2 + 4y^2 - 8x + 12y - 7 = 0$.
 Find the focus and length of the latus-rectum of the parabola.
 (c) If $y = \frac{3x-1}{(x+3)(x-1)}$, find $\frac{dy}{dx}$.
10. (a) A straight line passes through the point (2,3) and the sum of its intercepts on X-axis and Y-axis is 10. Find the equation of the straight line.
 (b) A function $f(x)$ is defined as follows:
 $f(x) = x + 1$, when $x \geq 1$
 $= \frac{3}{2}$, when $x = 1$
 $= x$, when $x < 1$
 Draw the graph of $f(x)$ and examine the continuity of $f(x)$ at $x = \frac{1}{2}$.
 (c) Find the equation of the circle whose center $(\frac{5}{3}, -3)$ is and which touches the line $3x + 2y + 5 = 0$.
11. (a) Evaluate $\int_{-2}^2 |1 - x^2| dx$
 (b) Using MVT prove that $1 + \frac{x}{2\sqrt{1+x}} < \sqrt{1+x} < 1 + \frac{x}{2}$
 (c) Evaluate $\lim_{x \rightarrow \infty} \left[\frac{1}{2n+1} + \frac{1}{2n+2} + \dots + \frac{1}{2n+n} \right]$
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