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BCS–012

BACHELOR OF COMPUTER APPLICATIONS (BCS/BCA)
Term-End Examination
June, 2025

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours *Maximum Marks : 100*

Note : *Question No.* ***1*** *is compulsory. Attempt any* ***three*** *questions from the remaining questions.*

1. (a) Show that : 5

$$\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$

(b) If :

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$$

find $f(A)$, where $f(x) = x^2 - 5x + 6$. 5

(c) Use the principle of mathematical induction to show that :

$$1+2+2^2+.....+2^{n-1}=2^n-1$$

for each $n \in \mathbf{N}$, where N is a set of natural numbers. 5

(d) If $|z-1|=|z-i|$, show that Re $(z)=\text{Im}(z)$. 5

(e) Find the sum to n terms of the series : 5

$$9+99+999+.....$$

(f) If α and β are roots of the equation $2x^2-8x-5=0$, find a quadratic equation whose roots are α^2 and β^2. 5

(g) Kiaan wants to buy some colour boxes and books to donate to an orphanage. He wishes to buy at least 4 books and 4 colour boxes. A colour box costs ₹ 200 whereas a book costs ₹ 400. How many colour boxes and books should he buy so that the expenditure does not exceed ₹ 4,000 and at the same time he can buy maximum number of items ? 10

2. (a) Using elementary row operations, find inverse of the matrix : 5

$$\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

(b) If $x = 3 + 2i$, find the value of $x^4 - 4x^3 + 4x^2 + 8x + 40$. 5

(c) Find the sum of an infinite G. P. whose first term is 15 and the fourth term is 3/25. 5

(d) If α and β are roots of $x^2 - 4x + 5 = 0$, find the quadratic equation whose roots are $\alpha^2 + 3$ and $\beta^2 + 3$. 5

3. (a) Find : 5

$$\lim_{x \to 0} \frac{\sqrt{x+5} - \sqrt{5}}{\sqrt{x}}$$

(b) If : 5

$$y = \left[x(x-1)(x+2) \right]^{5/7},$$

find $\frac{dy}{dx}$.

(c) Find the local extrema of : 5

$$f(x) = \frac{3}{4}x^4 - 8x^3 + \frac{45}{2}x^2 + 105$$

(d) If : 5

$$y = ax + \frac{b}{x},$$

show that :

$$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0.$$

4. (a) Evaluate : 5

$$\int x\sqrt{x+2}\,dx$$

(b) Evaluate : 5

$$\int_0^1 \frac{x}{\sqrt{1-x^2}}\,dx$$

(c) Find length of the curve $y = 4 + 3x$, from (0, 4) to (2, 10). 5

(d) Show that : 5

$$\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right) =$$

$$\left(\vec{a}.\vec{c}\right)\left(\vec{b}.\vec{d}\right) - \left(\vec{a}.\vec{d}\right)\left(\vec{b}.\vec{c}\right)$$

5. (a) Find the shortest distance between the lines : 5

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

and $\frac{x+1}{5} = \frac{y-2}{1} = \frac{z-2}{0}$.

(b) Solve the inequality $\left|\frac{2x-1}{3}\right| \leq 2$. 5

(c) Using determinants, show that the points A $(a, b+c)$, B$(b, c+a)$ and C $(c, a+b)$ are collinear. 5

(d) If : 5

$$y = 2e^x + e^{-x}$$

and $\frac{d^2y}{dx^2} = ky,$

find k.

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