



‘সমানো মন্ত্র: সমিতি: সমানী’

**UNIVERSITY OF NORTH BENGAL**  
B.Com. Honours 4th Semester Examination, 2023

**CC9-COMMERCE**  
**BUSINESS MATHEMATICS**

Time Allotted: 2 Hours

Full Marks: 60

*The figures in the margin indicate full marks.*

**GROUP-A**

Answer any *two* questions

12×2 = 24

1. (a) Show that

$$\begin{vmatrix} bc & a & a^2 \\ ca & b & b^2 \\ ab & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a) \cdot (ab+bc+ca)$$

6

(b) Solve by Inverse Matrix Method:

$$\begin{aligned} x + 2y - z &= 9 \\ 2x - y + 3z &= -2 \\ 3x + 2y + 3z &= 9 \end{aligned}$$

6

2. (a) Evaluate the following (any *two*):

3+3

$$(i) \lim_{x \rightarrow 0} \frac{e^{x^2} - 1}{x} \quad (ii) \lim_{x \rightarrow 0} \frac{\log(1+x) + x}{e^x - 1} \quad (iii) \lim_{n \rightarrow \infty} \frac{5n^{12} + 7n^9 + 12}{14n^{16} + 9n^2 - 3}$$

(b) A function is defined as follows:

3

$$\begin{aligned} f(x) &= 3x - 1 && \text{if } x < 2 \\ &= k && \text{if } x = 2 \\ &= 2x + 1 && \text{if } x > 2 \end{aligned}$$

For what value of  $k$ , the function  $f(x)$  is continuous when  $x = 2$ ?

(c) Find from the first principle the derivative of  $\sqrt{x}$ .

3

3. (a) The total cost function  $C$  for producing  $x$  units of an article per day is given by  $C = ₹(x^2 - 16x + 400)$ . Find the average cost function and level of output at which this function is minimum.

4

(b) Verify Euler's theorem for the function

4

$$F(x, y) = 2x^3 - 11x^2y + 3y^3$$

(c) If  $x^p \cdot y^q = (x + y)^{p+q}$ , show that  $\frac{dy}{dx} = y/x$ .

4

4. A firm produces two different products A and B. Each product has to undergo three operations— cutting, mixing and packaging. The maximum capacity available in cutting, mixing and packaging departments are 24 hours, 21 hours and 9 hours respectively. Each unit of product A takes 1 hour in cutting, 3 hours in mixing and 1 hour in packaging operations. One unit of product B takes 4 hours in cutting, 1 hour in mixing and 1 hour in packaging. Profit per unit of product A is Rs. 2 and that of product B is Rs. 5. Determine the optimum product-mix so that profit is maximum. Formulate the LPP and solve it by simplex method. 4+8

**GROUP-B**

5. Answer any **four** questions: 6×4 = 24
- (a) The difference between the simple and compound interest on a certain sum for 2 years at 5% p.a. is ₹75. Find the compound interest on the sum for 7 years at 8% p.a. (Given  $\log 1.05 = 0.0212$  and  $\log 1.08 = 0.0334$ ) 6
- (b) If  $u = \log(x^2 + y^2)$ , show that  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ . 6
- (c) A person is eligible to get pension at ₹2,40,000 p.a. after his retirement payable in half-yearly installment for the rest of his life. Reckoning his expectation of life to be 15 years and interest is at 10% p.a. payable half-yearly, what single sum is equivalent to his pension? 6
- (d) What are the basic assumptions of linear programming? 6
- (e) Evaluate: 6
- (i)  $\int_1^2 x \log x \, dx$  or (ii)  $\int \frac{x e^x}{(x+1)^2} \, dx$
- (f) If  $y^x = e^{y-x}$ , show that  $\frac{dy}{dx} = \frac{(\log ey)^2}{\log y}$ . 6

**GROUP-C**

6. Answer any **four** questions: 3×4 = 12
- (a) If  $x^2 + y^2 = a^2$ , show that  $\frac{d^2 y}{dx^2} = -a^2/y^3$ .
- (b) If  $f(x) = e^{ax+b}$ , prove that  $e^b f(x+y) = f(x) \cdot f(y)$ .
- (c) Find the amount if ₹1000 put out for 4 years @ 5% p.a. compound interest.
- (d) Define feasible solution and slack variables in LPP.
- (e) Evaluate  $\int (3x+4)^{5/3} \, dx$ .
- (f) Given  $A = \begin{bmatrix} 2 & -1 \\ -3 & 2 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix}$ . Find  $(AB)^T$ .

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