3 (Sem–3) ECO M 1

BIJNI COLLEGE LIBRARY
Dist.:Chirang
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2015

ECONOMICS

(Major)

Paper : 3.1

(Elementary Mathematics for Economics)

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer the following questions : 1×10=10

(a) Given the two sets, $S = \{1, 5, 9, b, c\}$ and $T = \{2, 5, 6, b, d\}$. Find—

(i) $S \cup T$

(ii) $S \cap T$

(b) Define a linearly homogeneous function.

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(c) State when two matrices A and B are said to be equal.

(d) Define a unit or identity matrix.

(e) State the product rule of differentiation.

(f) If

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix},$$

write the cofactor of the element a_{32}.

(g) What is 'domain' of a function?

(h) Find $\int \frac{1}{x^5} dx$

(i) If

$$A = \begin{bmatrix} 2 & 3 & -2 \\ 1 & 6 & 8 \end{bmatrix} \text{ and } B = \begin{bmatrix} -1 & 7 & -2 \\ 3 & 5 & 4 \end{bmatrix},$$

find $A - B$.

(j) Prove that $\int_0^2 (2x+6)\,dx = 16$

(Continued)

2. Answer the following questions : 2×5=10

(a) Define singular and non-singular matrix.

(b) If the function $f(x)$ is defined as

$$f(x) = \frac{1-x}{1+x}$$

show that $f\left(\frac{1-x}{1+x}\right) = x$.

(c) Evaluate the limit of the function

$$\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$$

(d) Define rank of a matrix with example.

(e) Examine whether the limit of the function

$$f(x) = \begin{cases} x^2 & \text{when } x > 1 \\ x^2 + 2 & \text{when } x < 1 \end{cases}$$

exists or not at the point $x = 1$.

3. Answer any *four* of the following : 5×4=20

(a) If

$$A = \begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & -2 \\ -1 & 3 \end{bmatrix}$$

prove that $AB = BA$.

(b) Evaluate the following determinant :

$$\begin{vmatrix} 5 & -1 & 2 \\ 3 & 0 & 1 \\ 4 & 2 & 3 \end{vmatrix}$$

(c) If

$$A = \begin{bmatrix} 2 & 0 \\ 3 & 4 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & 2 \\ 7 & 0 \end{bmatrix}$$

show that $(A-B)' = A' - B'$.

(d) Find $\frac{dy}{dx}$ if $y = \frac{1-\sqrt{x}}{1+\sqrt{x}}$

(e) If

$$z = \frac{x^2 - y}{x - y^2},$$

find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

(f) Evaluate $\int_0^2 (x^2 + 2)\,dx$

4. Answer any *four* of the following : 10×4=40

(a) (i) If

$$f(x) = \begin{cases} \frac{x^2 - x - 2}{x - 2} & \text{for } x \neq 2 \\ 3 & \text{for } x = 2 \end{cases}$$

show that $f(x)$ is continuous at $x = 2$.

(Continued)

(ii) Solve the following equation :

$$2x^2 + 5x + 3 = 0$$ 5+5=10

(b) Solve the following system of simultaneous equations by using Cramer's rule : 10

$$2x_1 + 3x_2 - x_3 = 15$$
$$4x_2 + 2x_3 = 16$$
$$3x_1 + 2x_2 = 18$$

(c) (i) If $y = x^2 \log x + \frac{2}{\sqrt{x}} + 3e^x + 4$,

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

(ii) If $z = y + 2y^2$ and $y = 2x^2 - 4$,

find $\frac{dz}{dx}$. 5+5=10

(d) Given $u = \log (x^2 + y^2)$.

Show that

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$ 10

(e) What is meant by input-output analysis? Explain its assumptions and limitations. 2+4+4=10

(f) (i) The matrix A is defined as follows :

$$A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$$

Suppose $f(x) = 2x^2 - 3x + 5$. Find $f(A)$.

(ii) Examine whether the matrix

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

satisfies the matrix equation $A^2 - 5A + 7I = 0$, where I and 0 denote respectively the identity matrix and null matrix of order 2×2. 5+5=10

(g) (i) Derive the total revenue function (TR) and average revenue function (AR), given the marginal revenue function MR $= 50 - 4Q$.

(ii) Find

$$\int \frac{1}{(2x+7)} dx$$

5+5=10

(Continued)

(h) Solve the following national income model using matrix inversion : 10

$$Y = C + I_0 + G_0$$
$$C = \alpha + \beta(Y - T) \quad \text{where } \alpha > 0, 0 < \beta < 1$$
$$T = \partial Y \quad \text{where } 0 < \partial < 1$$

Y, C, T, I_0 and G_0 denote aggregate income, consumption, income tax, investment and government expenditure respectively.

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