2024/TDC (CBCS)/EVEN/SEM/
ECOHCC-202T/270

TDC (CBCS) Even Semester Exam., 2024

ECONOMICS

(2nd Semester)

Course No. : ECOHCC-202T

(Mathematical Methods in Economics—II)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following : 2×2=4

(a) What are differential equations?

(b) What do you mean by order and degree of a differential equation?

(c) Write the forms of a homogeneous and a non-homogeneous differential equation.

2. Answer any *one* of the following : 10

(a) Solve the following differential equations : 5+5=10

(i) $\frac{dy}{dx}+5y=8$

(ii) $2\frac{dy}{dx}+4y=14$

(b) Given the market model

$$Q_d = 7-4P-\frac{1}{3}\frac{dP}{dt}$$
$$Q_s = -10+3P$$
$$\frac{dP}{dt} = 5(Q_d - Q_s)$$

Obtain the time path of price P_t. Also test whether the time path is dynamically stable or not.

UNIT—II

3. Answer any *two* of the following : 2×2=4

(a) Write any two properties of determinant.

(b) Define null matrix and identity matrix.

(c) Define symmetric matrix with an example.

4. Answer any *one* of the following : 10

(a) *(i)* Find AB and BA, if

$$A=\begin{bmatrix}4 & 1 & 0\\ 0 & 2 & 3\end{bmatrix} \text{ and } B=\begin{bmatrix}5 & 3\\ 2 & 1\\ 0 & 4\end{bmatrix}$$ 2½+2½=5

(ii) State and prove any two properties of determinant. 2½+2½=5

(b) Solve the following national income model by using Cramer's rule :

$$Y = C+2000$$
$$C = 500+0\cdot3(Y-T)$$
$$T = 100+0\cdot2Y$$

UNIT—III

5. Answer any *two* of the following : 2×2=4

(a) What is homothetic function?

(b) Find $\frac{dy}{dx}$, if $y=x^x$.

(c) Draw a graph of constant function.

6. Answer any *one* of the following : 10

(a) The demand function of a firm is $P = 500 - 4Q$ and its cost function is $C = 500 + 125Q$, where P is price, C is cost and Q is output. Find—

(i) the output at which profit of the firm is maximum;

(ii) equilibrium price of the firm;

(iii) maximum profit. 5+2+3=10

(b) *(i)* Find the second-order derivative of the following functions : 2+3=5

(1) $y = \log(x^2 + 2x)$

(2) $y = \dfrac{5x^2 - 2}{x^2 - 5x}$

(ii) Find the extreme values of the following function : 5

$$y = \frac{1}{3}x^3 - 3x^2 + 5x + 3$$

UNIT—IV

7. Answer any *two* of the following : 2×2=4

(a) Write any two properties of a convex function.

(b) What are the conditions of maximization of a function involving two explanatory variables?

(c) Find MR, when $TR = 30Q - Q^2$.

8. Answer any *one* of the following : 10

(a) Find the optimum value of the following function :

$$y = x_1^2 + x_1x_2 + 2x_2^2 - 10x_1 - 5x_2 + 30$$

(b) Find the extreme values of the following function :

Optimize : $y = 2x_1 + 2x_1x_2 + x_2$

subject to

$$2x_1 + 3x_2 = 18$$

UNIT—V

9. Answer any *two* of the following : 2×2=4

(a) Define Hawkins-Simon condition.

(b) Write any two uses of input-output model.

(c) How is the open input-output model differ from closed input-output model?

10. Answer any *one* of the following : 10

(a) In a three-sector economy, the input coefficient matrix and final demand vector are given below :

$$A = \begin{bmatrix} 0{\cdot}3 & 0{\cdot}2 & 0{\cdot}3 \\ 0{\cdot}1 & 0{\cdot}3 & 0{\cdot}4 \\ 0{\cdot}2 & 0{\cdot}3 & 0 \end{bmatrix} \quad \text{and} \quad F = \begin{bmatrix} 500 \\ 700 \\ 600 \end{bmatrix}$$

Find the sectoral output x_1, x_2 and x_3 by using matrix algebra.

(b) (i) Write any three features of input-output analysis.

(ii) Write any four limitations of input-output model.

(iii) Write any three characteristics of input coefficient matrix.

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