



**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 :  $2 \times 2 = 4$**

(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.



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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 :  $2 \times 2 = 4$

(a) Write any two properties of determinant.

(b) Define null matrix and identity matrix.

(c) Define symmetric matrix with an example.

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4. Answer any one of the following : 10

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

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

(ii) State and prove any two properties of determinant.  $2\frac{1}{2} + 2\frac{1}{2} = 5$

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

$$Y = C + 2000$$

$$C = 500 + 0.3(Y - T)$$

$$T = 100 + 0.2Y$$

UNIT—III

5. Answer any two of the following :  $2 \times 2 = 4$

(a) What is homothetic function?

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

(c) Draw a graph of constant function.



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

(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 :  $2 \times 2 = 4$

(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  $TR = 30Q - Q^2$ .

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( Continued )

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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 :

$$\text{Optimize : } y = 2x_1 + 2x_1x_2 + x_2$$

subject to

$$2x_1 + 3x_2 = 18$$

UNIT—V

9. Answer any two of the following :  $2 \times 2 = 4$

(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 :

$$A = \begin{bmatrix} 0.3 & 0.2 & 0.3 \\ 0.1 & 0.3 & 0.4 \\ 0.2 & 0.3 & 0 \end{bmatrix} \text{ and } F = \begin{bmatrix} 500 \\ 700 \\ 600 \end{bmatrix}$$

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

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( Turn Over )





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- (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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