2023/TDC(CBCS)/EVEN/SEM/
ECOHCC–202T/154

TDC (CBCS) Even Semester Exam., 2023

ECONOMICS

(Honours)

(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

Section—A

nswer any *ten* of the following questions : 2×10=20

1. What are differential equations?

2. Express the general formula for first-order differential equation.

3. Specify the order and degree of the following differential equations :

$$\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3=12x$$

4. If $A = \begin{bmatrix} 2 & 3 & 2 \\ 4 & 0 & 1 \end{bmatrix}$, find A'.

5. Show that $(A')' = A$.

6. Mention the important properties of matrix inversion.

7. What is homogeneous function?

8. Determine whether the following function is homogeneous :

$$f(x, y) = \sqrt{xy}$$

9. Find the total differentiation of $z = \sqrt{x+y}$.

10. Mention one characteristic of quasi-converse function.

11. For a multivariate function $y = f(x_1, x_2)$, what are the 1st order and 2nd order conditions for optimization?

12. Given the total cost function of a firm $TC = 4Q^2 + 7Q + 81$, find the marginal cost function.

13. Distinguish between closed input-output model and open input-output model.

14. What is input coefficient matrix?

15. Mention two limitations of input-output model.

SECTION—B

Answer any *five* of the following questions : 10×5=50

16. Find general solution for the following : 5+5=10

(a) $\frac{dy}{dt}+3t^2y=t^2$

(b) $2\frac{dy}{dt}-2t^2y=gt^2$

17. Solve the following exact equations : 5+5=10

(a) $(12y+7t+6)dy+(7y+4t-9)dt=0$

(b) $(12y^2t^2+10y)dy+(18y^3t)dt=0$

18. (a) If $A=\begin{bmatrix}4 & 0 & 1\\ 3 & 2 & 1\\ 1 & 5 & 2\end{bmatrix}$, find the inverse of A. 5

(b) Given $V_1=\begin{bmatrix}3\\4\end{bmatrix}$ $V_2=\begin{bmatrix}9\\1\end{bmatrix}$, $V_3=\begin{bmatrix}2\\5\end{bmatrix}$, find $(V_1+V_2)-V_3$. 3

(c) Prove that any two scalars g and k, $(g+k)A=gA+kA$. 2

19. (a) Solve the following market model : 5

$$Q_d = Q_s,\ Q_s = -3 + 0\cdot6\,p,\ Q_d = 10 - 0\cdot4\,p$$

(b) In a three-sector economy model, the economies being denoted by 1, 2, 3 respectively

$Y_1 = C_1 + (X_1 - M_1) + 100$ $\qquad$ $Y_2 = C_2 + (X_2 - M_2) + 1200$

$C_1 = 0\cdot8\,Y_1$ $\qquad$ $C_2 = 0\cdot7\,Y_2$

$M_1 = 0\cdot2\,Y_1$ $\qquad$ $M_2 = 0\cdot18\,Y_2$

$X_1 = 0\cdot15\,Y_2 + 0\cdot1\,Y_3$ $\qquad$ $X_2 = 0\cdot12\,Y_1 + 0\cdot15\,Y_3$

and $Y_3 = C_3 + (X_3 - M_3) + 900$

$C_3 = 0\cdot75\,Y_3$

$M_3 = 0\cdot25\,Y_3$

$X_3 = 0\cdot2\,Y_1 + 0\cdot25\,Y$

where Y, C, M and X represent national income, consumption, import and export. Find the equilibrium income. 5

20. Prove that given the linearly homogeneous production function $Q = f(K, L)$ the marginal physical product of labour and capital (MPP_L and MPP_K) can be expressed as the function of K alone.

21. (a) Find the total derivative $\frac{dy}{dt}$, given $y = 2x_1^2 - 5x_1x_2 - 6x_2^2$, where $x_1 = 3t^2$, $x_2 = 5 - 2t$. 5

(b) Find $\frac{\partial y}{\partial x_1}$ and $\frac{\partial y}{\partial x_2}$ of the following functions : 2+3=5

(i) $y = (x_1x_2 + 2x_2^2)(x_1^3 - 5x_1^2x_2)$

(ii) $y = \sqrt{3x_1^2 + 10x_1x_2^2 + x_2^4}$

22. Using Lagrange multiplication method, find the extreme value of the function

$$y = x_1^2 + x_1x_2 + \frac{3}{2}x_2^2$$

23. Derive the 1st order and 2nd order conditions in order to show that indifference curve is negatively sloped and convex to the origin taking the utility function $U = f(x, y)$ where U = total utility, x and y are the quantities of two commodities.

(Turn Over)

24. Find the consistent output level of a three-sector economy X_1, X_2 and X_3, given the input coefficient matrix (A), capital matrix (B), diagonal matrix of sectoral growth rate (G) and final demand vector (F).

$$A = \begin{bmatrix} 0 \cdot 2 & 0 \cdot 1 & 0 \cdot 2 \\ 0 \cdot 3 & 0 \cdot 3 & 0 \cdot 2 \\ 0 \cdot 2 & 0 \cdot 2 & 0 \cdot 2 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \cdot 1 & 0 \cdot 2 & 0 \cdot 1 \\ 0 \cdot 2 & 0 \cdot 1 & 0 \cdot 2 \\ 0 \cdot 1 & 0 \cdot 1 & 0 \cdot 1 \end{bmatrix}$$

$$G = \begin{bmatrix} 0 \cdot 02 & 0 & 0 \\ 0 & 0 \cdot 63 & 0 \\ 0 & 0 & 0 \cdot 02 \end{bmatrix}, \quad F = \begin{bmatrix} 2 & 0 & 0 \\ 3 & 0 & 0 \\ 2 & 5 & 0 \end{bmatrix}$$

25. (a) What do you mean by Hawkins-Simon condition? Explain.

(b) If input-output model generated input-coefficient matrix is given by

$$B = \begin{bmatrix} 0 \cdot 64 & 1 \cdot 2 \\ 0 \cdot 06 & 0 \cdot 8 \end{bmatrix}$$

test whether Hawkins-Simon condition is satisfied.

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