M. A. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2021
[2021 Admissions Regular and 2020 Admissions Improvement & Supplementary]
SEMESTER I - CORE COURSE (ECONOMICS)
EC1C05TM20 - MATHEMATICAL METHODS FOR ECONOMIC ANALYSIS

Time : 3 Hours   **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight   **(8x1=8)**

1. Define transpose of a matrix and state its properties.

2. Define a non-singular matrix. Give the expression for inverse of a non-singular matrix.

3. State the Hawkins-Simon conditions for the viability of an Input-Output system.

4. Show that Z = $x^2 + xy + y^2$ has maximum value at $x = 0, y = 0$.

5. Find the first order partial derivatives of Z = 12 - x^2 - y^2 + xy

6. Find the total revenue (TR) if the Marginal revenue function (MR) is given by
    MR = 8x – x^2 where x is the output

7. Integrate $\dfrac{1}{3x+7}$ with respect to x.

8. Obtain producers' surplus for the supply function Q = $\sqrt{(4p-4)}$

9. When is the solution of a Linear Programming Problem said to be unbounded?

10. What are slack and surplus variables?

Part B

II. Answer any Six questions. Each question carries 2 weight   **(6x2=12)**

11. Solve the following set of simultaneous equations 3x + y + z =8; x + y + z = 6; 2x + y – z = 1

12. Find adj A, where A = $\begin{bmatrix} 3 & 2 & -1 \\ 0 & 1 & 2 \\ 3 & 4 & 6 \end{bmatrix}$

13. Explain first and second order partial derivatives

14. In a perfectly competitive market, the total revenue R and total cost C of a firm is given by $R = 4x$ and $C = x^2 - 6x + 10$.
    Find (a) profit maximizing output,   (b) maximum profit

15. A commodity has price elasticity of demand given by $\dfrac{p}{2\,x^4}$. Find the demand function if the demand is 2 units when the price is 1.

16. The marginal cost of a product is given by MC = 0.03x^2 – 0.8x + 50. Find the total cost function given that the fixed cost is 80 units.

17. A dealer wishes to purchase a number of fans and sewing machines. He has only Rs.5760/- to invest and has space for atmost 20 items. A fan costs him Rs.360/- and a sewing machine Rs.240/-. His expectation is that he can sell a fan at a profit of Rs.22/- and a sewing machine at a profit of Rs.18/-. Assuming he can sell all the items that he buys, how should he invest in order to maximise the profit? Formulate this as a Linear Programming Problem.

18. Write down the dual of the following LPP

Maximise Z = 5x + 10y + 8z

Subject to   2x + 5y + 2z $\leq$ 7

             x + 3y $\leq$ 10

             x, y, z $\geq$ 0

Part C

III. Answer any Two questions. Each question carries 5 weight   **(2x5=10)**

19.

Given the technical co-efficient matrix of three industries A = $\begin{bmatrix} 0.4 & 0.1 & 0.2 \\ 0.1 & 0.3 & 0.3 \\ 0.2 & 0.1 & 0.2 \end{bmatrix}$ and the final demand vector

F = $\begin{bmatrix} 10 \\ 20 \\ 10 \end{bmatrix}$, obtain the gross output vector consistent with the final demands.

20. A firm has the following total cost and demand functions

$C = \dfrac{1}{3}Q^3 - 7Q^2 + 111Q + 50$

Q = 100 – P

      Find the maximum profit.

21.

A firm's marginal revenue function is MR = $20\left(1 - \dfrac{x}{10}\right) e^{-x/10}$. Find the corresponding demand

function.

22. Solve using the simplex method

Maximise Z = 2x + 5y

Subject to   x + 4y $\leq$ 24

             3x + y $\leq$ 21

             x + y $\leq$ 9

             x, y $\geq$ 0