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**4 SEM TDC ECO M 1**

**2 0 1 8**

( May )

**ECONOMICS**

( Major )

Course : 401

**( Mathematics for Economics )**

*Full Marks : 80*

*Pass Marks : 32/24*

*Time : 3 hours*

*The figures in the margin indicate full marks  
for the questions*

1. Choose the correct option/Answer the following : 1×8=8

(a)  $A \cap A' = ?$

(i)  $\Omega$

(ii)  $\phi$

(iii)  $A$

(iv)  $A'$

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(b) If  $A = \begin{bmatrix} 3 & 2 \\ 1 & 5 \end{bmatrix}$ , then the value of  $|A'|$  will be

(i) -13

(ii) 13

(iii) -16

(iv) 16

(c) The maximum number of linearly independent rows or columns of a matrix is called

(i) norm of a matrix

(ii) rank of a matrix

(iii) idempotent matrix

(iv) partitioned matrix

(d) Let  $A$  matrix is of dimension  $m \times n$  and  $B$  matrix is of dimension  $o \times p$ .  $A$  and  $B$  are conformable for multiplication in the form  $AB$  if

(i)  $m = p$

(ii)  $n = o$

(iii)  $n = p$

(iv)  $m = o$

(e) Define producer's surplus.

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(f) The elasticity of substitution of CES production function is

(i) 0

(ii) 1

(iii)  $\frac{1}{1+p}$

(iv)  $\frac{1}{1-p}$

(g) Given,  $MC = 2aQ + b$ . TC will be

(i)  $bQ + c$

(ii)  $aQ^2 + c$

(iii)  $aQ^2 + bQ$

(iv)  $aQ^2 + bQ + c$

(h) The function

$$f(x) = \frac{x^2 + 3x + 4}{x - 1}$$

is not continuous at

(i) 1

(ii) 2

(iii) 3

(iv) None of the above



2. Answer any four of the following :  $4 \times 4 = 16$

(a) Mathematically derive the relationship between average revenue, marginal revenue and price elasticity of demand.

(b) Evaluate :

$$\lim_{x \rightarrow 1} \frac{x^3 - 3x^2 + 2}{x^2 + 5x - 6}$$

(c) Write the assumptions of input-output analysis.

(d) Solve  $Y_t = -7Y_{t-1} + 16$ ,  $Y_0 = 5$ .

(e) Draw the graph of  $xy = 1$ .

(f) Prepare a note on polynomial and rational functions.

3. (a) (i) Distinguish between equal set and equivalent set. 3

(ii) If  $A = \{1, 4, 5, 7\}$  and  $B = \{4, 9, 8, 10\}$ , find  $(A \cup B) \setminus (A \cap B)$ . 3

(iii) Show the operations of sets with the help of Venn diagram. 5

Or

(b) (i) Write in short on the following with example :  $3 + 3 = 6$

(1) Ordered pairs

(2) Continuity of function

(ii) In a test, 60 percent of the students passed in Economics and 50 percent in Statistics. How many students passed in both the subjects? 5

4. (a) (i) Solve the input-output model  $X(I - A) = F$  by using Cramer's rule. Given

$$A = \begin{bmatrix} 0.3 & 0.2 & 0.4 \\ 0 & 0.2 & 0.1 \\ 0.1 & 0.2 & 0.2 \end{bmatrix} \text{ and } F = \begin{bmatrix} 400 \\ 600 \\ 500 \end{bmatrix}$$

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(ii) Distinguish between the following :  $2 + 2 = 4$

(1) Static and Dynamic input-output models

(2) Open and Closed input-output models

Or

(b) (i) Verify that the following matrix A is idempotent : 3

$$A = \begin{bmatrix} \frac{1}{6} & -\frac{1}{3} & \frac{1}{6} \\ -\frac{1}{3} & \frac{2}{3} & -\frac{1}{3} \\ \frac{1}{6} & -\frac{1}{3} & \frac{1}{6} \end{bmatrix}$$



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- (ii) Find the inverse of the following matrix  $B$  :

$$B = \begin{bmatrix} 2 & 0 & -5 \\ 4 & 1 & 2 \\ -3 & 0 & 1 \end{bmatrix}$$

- (iii) Given

$$A = \begin{bmatrix} 2.1 & 3.2 & 0.1 \\ 5.3 & 1.7 & 2.6 \end{bmatrix} \text{ and } B = \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 1 & 5 \end{bmatrix}$$

Find  $AB$ .

5. (a) (i) In a perfectly competitive market, the price of a product ( $q$ ) is  $\Sigma 4$  and the total cost ( $c$ ) of a firm is  $c = q^3 - 15q^2 + 31q + 500$ . Find the profit maximizing output and maximum profit.

- (ii) If the total productivity is given by

$$Q = \frac{L^2 - K}{L + K^2}$$

find the marginal productivity of  $L$  and  $K$ . 3+3=

( 7 )

Or

- (b) (i) Given the consumption function

$$C = 2000 - \frac{6000}{(5 + Y)}$$

find the marginal propensity to consume when  $Y = 95$ . 6

- (ii) Prove that the elasticity of substitution is equal to one in case of CD production function. 6

6. (a) (i) Briefly discuss the uses of integral calculus in Economics. 5

- (ii) Obtain the consumer's surplus of the following demand function when the market price is  $\text{£ } 16$  per unit : 6

$$Q = \sqrt{16 - \frac{3}{2}P}$$

Or

- (b) (i) Find the integral of  $\int x e^x dx$ . 3

- (ii) The marginal revenue and marginal cost functions of a firm are  $MR = 20 - 2Q$  and  $MC = 6Q^2 - 4Q + 5$  respectively. The total fixed cost is  $\text{£ } 20$  when it sells 4 units of produce. Find the total profit of the firm. 8

( Turn Over )

7. (a) (i) Solve :

$$\frac{dy}{dx} + 2y = 4$$

(ii) Analyze the following market model for stability :

$$Q_d = 10 - 5p$$

$$Q_s = -10 + 5p$$

$$\frac{dp}{dt} = 3(Q_d - Q_s)$$

Or

(b) (i) Write a note on the Cobweb model.

(ii) In a market model

$$Q_{dt} = 12 - 2P_t$$

$$Q_{st} = -4 + 2P_{t-1}$$

$$\text{and } P_{t+1} - P_t = -0.25(Q_{st} - Q_{dt})$$

find the time path  $P_t$  and test whether the time path is convergent.

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