

Model Question Paper  
Economics (Honours)

Paper: ECO-HC-1026

Mathematical Methods in Economics)

Full Marks: 80

Time: 3 hours

1. Answer the following as directed  $1 \times 10 = 10$

a) If  $A = \{a, e, i\}$  and  $B = \{e, i\}$  find  $A \cup B$ .

b) Total cost  $C$  of a firm per day is the function of its daily output ' $Q$ '.  $C = 150 + 7Q$ . The firm has a capacity limit of 100 units of output per day. What is the domain of the cost function?

c) Given the function  $f(x) = ax + b$ , find the derivative of  $f(x)$ .

d)  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$  find limit of the function.

e) If  $y = \frac{1}{x^3}$  find  $dy/dx$ .

f) Give an example of universal set.

g) Find  $\frac{2^{3/4}}{2^{1/4}}$

h) Find  $\int \frac{1}{x^2} dx$

i) If  $A = \begin{Bmatrix} a & b & c \\ \dots & \dots & \dots \end{Bmatrix}$ , find sub matrices.

j) What is symmetric matrix?

2. Answer the following questions  $2 \times 5 = 10$

a) Distinguish between function and relation.

b) Evaluate the limit of the function.

$\lim_{x \rightarrow 2} (-5x^2 - 2x + 3)$

c) If  $AR = ₹ 30$  and price demand is 4, find MR.

d) Examine whether the following function is convex or concave:  
 $f(x) = x^2 - 4x - 5$

e) Given the demand function:  
 $D = 10P^{1.5}$

where  $D$  is the demand and  $P$  is the price, obtain the elasticity of demand.

Answer any four of the following questions -  $5 \times 4 = 20$

a) Say  $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}_{2 \times 2}$ ,  $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}_{2 \times 2}$  and  $C = \begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}_{2 \times 2}$

Show that  $A(B+C) = AB+AC$

$$\text{or } (A+B)C = AC+BC$$

b) Find  $\frac{\partial y}{\partial x_1}$  and  $\frac{\partial y}{\partial x_2}$  for the following function:

$$y = \frac{5x_1 + 3}{x_2 - 2}$$

c) Find the relative extreme value (maximum and minimum) of the following function:

$$y = 5x^2 - 30x + 15$$

d) Compute marginal productivity of Capital ( $MP_K$ ) and marginal productivity of Labour ( $MP_L$ ) at  $K=1$  and  $L=2$

P.T.O.

(3)

for the following production function  
where  $Q$  is output,  $K$  is capital and  $L$  is  
labour:

$$Q = 3KL^3 + 4K^2L + 2L + 2K$$

e) Given the production function  $Q = 96L^{0.3}K^{0.7}$   
find out  $MPP_K$  and  $MPP_L$

4. Answer any four of the following  
questions -  $4 \times 10 = 40$

a) A monopolist demand curve is given  
by  $p = 100 - 5Q$ , where  $p$  is price and  
 $Q$  is quantity demanded.

i) find the MR function

ii) Establish the relationship between  
slopes of AR and MR curve.

iii) find the price at which MR is zero

b) A firm has the following total cost and  
demand function:

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

$$\text{and } Q = 100 - P$$

find profit maximising level of output,  
also find profit at this level of  
output.

(4)

c) Find out the saving function, given  
 $MPS = 1 - 0.2y^{1/3}$  with zero saving  
when income  $y = 125$ .

d) Evaluate

i)  $\int_2^4 2x^2 dx$

ii)  $\int (10x^3 - \frac{1}{x} - 2e^x + \frac{5}{x}) dx$ .

e) Find  $\frac{dy}{dx}$  of the function  $y = \frac{1}{x}$  using  
the definition of derivative.

f) Show that the following function is  
discontinuous at the point  $x = 0$ :

$$\begin{aligned} f(x) &= 1, & x > 0 \\ &= 0, & x = 0 \\ &= -1, & x < 0 \end{aligned}$$

—  $x$  —