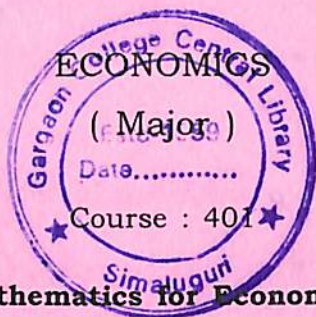


Total No. of Printed Pages—7

**4 SEM TDC ECO M 1**

**2015**

( May )



**( Mathematics for Economics )**

Full Marks : 80

Pass Marks : 32

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)  $A'$

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

(i)  $m = p$

(ii)  $n = o$

(iii)  $n = p$

(iv)  $m = o$

(c) Define diagonal matrix.

(d) Mention one property of CES production function.

(e) If  $C = 120 - 10q$  is an average cost function, which of the following is its marginal cost for  $q = 5$ ?

(i) 20

(ii) 30

(iii) 25

(iv) None of the above

( 3 )

(f) Given,  $C = 1000 - 0.7Y$ , where  $C$  is consumption expenditure and  $Y$  is National Income. Which of the following is marginal propensity to save (MPS)?

(i) 1

(ii) 0.7

(iii) 0.3

(iv) None of the above

(g) Given  $MC = 2aQ + b$ . TC is

(i)  $bQ + c$

(ii)  $aQ^2 + c$

(iii)  $aQ^2 + bQ$

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

(h) Write the necessary and sufficient conditions for the maximization of a function  $y = f(x)$ .

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

(a) Write the assumptions of input-output analysis. 4

(b) Write four properties of determinants. 4

(c) Write the meanings of the following :

$$1+2+1=4$$

(i) Idempotent matrix

(ii) Rank of matrix

(iii) Norms of matrix

(d) The total cost  $C$  of a firm is given by

$$C = 1000 + 100q + 80q^2 + \frac{1}{3}q^3$$

Find the value of  $q$  at which marginal cost equals average cost. 4

(e) The marginal revenue function is given by  $MR = 50 - 4Q$ . Find the point elasticity of demand  $Q = 10$ . 4

3. (a) (i) Define the following with examples :  
 $2 \times 4 = 8$

Unit set; Power set; Proper subset; Intersection of sets.

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

Or

(b) (i) Distinguish between relation and function with example. 5

(ii) Draw the graph of  $y = x^2 + 2$ . 6

( 5 )

4. (a) In a three-sector economy, the input coefficient matrix and final demand vector are given below :

$$A = \begin{bmatrix} 0.3 & 0.0 & 0.3 \\ 0.1 & 0 & 0.4 \\ 0.2 & 0.3 & 0 \end{bmatrix} \quad F = \begin{bmatrix} 500 \\ 700 \\ 600 \end{bmatrix}$$

Find the sectoral output  $X_1$ ,  $X_2$  and  $X_3$ . 11

Or

- (b) Solve the following National Income model using Cramer's rule :

$$Y = C + I_0 + G_0$$

$$C = \alpha + \beta(Y - T) \quad (\alpha > 0; 0 < \beta < 1)$$

$$T = \gamma + \delta Y \quad (\gamma > 0; 0 < \delta < 1)$$

5. (a) (i) In a perfectly competitive market, the price of a product ( $q$ ) is ₹ 4 and the total cost ( $C$ ) of a firm is given by

$$C = q^3 - 15q^2 + 31q + 100$$

Find profit maximizing output and maximum profit. 6

- (ii) Show the relationship among Marginal Revenue, Average Revenue and Price Elasticity of Demand. 6

Or

- (b) The production function of a firm is given by

$$Q = 5K^{1/2} L^{1/2}$$

where  $L$  and  $K$  are labour and capital inputs respectively. The cost function is given by  $C = 16K + 4L$ . Find the least cost capital labour ratio, when  $Q = 40$ . 12

6. (a) (i) Briefly discuss the uses of integral calculus in economics. 5
- (ii) Define producer's surplus. Given the producer's supply function  $Q = \sqrt{-4 + 4P}$  and market price is 10. Find the producer's surplus. 2+4=6

Or

- (b) (i) Define marginal propensity to save (MPS). Given MPS function

$$MPS = S'(Y) = 0.3 - 0.1y^{-\frac{1}{2}}$$

and saving is zero when income is 81. Find the aggregate saving function. 2+4=6

( 7 )

(ii) Given the marginal cost function

$$C'(Q) = 4Q^2 - 16Q + 25$$

What is the decrease in total cost  $C(Q)$  as output produced is reduced from 10 to 5 units? 5

7. (a) (i) Solve the differential equation

$$\frac{dy}{dx} = 5 \quad 3$$

(ii) Analyze the following market model for stability : 8

$$Q_d = 14 - 3P$$

$$Q_s = -10 + 2P$$

$$\frac{dP}{dt} = 4(Q_d - Q_s)$$

Or

(b) (i) Solve the first-order difference equation  $y_{t+1} + 3y_t = 2$  and  $y_0 = 5$ . 4

(ii) Given the demand and supply functions for cobweb model

$$Q_{dt} = 10 - 2P_t$$

$$Q_{st} = -5 + 3P_{t-1}$$

Find the intertemporal equilibrium price and also examine whether you will get stable equilibrium. 7

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