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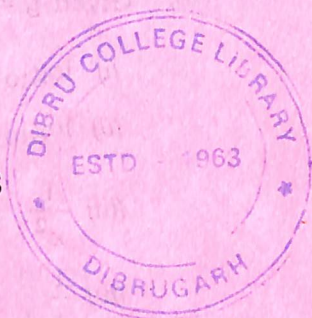
# 4 SEM TDC ECO M 1

2014

( May )

ECONOMICS

( Major )



Course : 401

( 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 answer :

1×8=8

(a)  $A \cup A'$  is

(i)  $A$

(ii)  $A'$

(iii)  $\Omega$

(iv)  $\phi$

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(b) Given  $y = \log_{10} x$ ,  $\frac{dy}{dx}$  is

(i)  $\log_{10} x$

(ii)  $\log_{10} e \times \frac{1}{x}$

(iii)  $\frac{1}{x^2}$

(iv)  $\frac{1}{x}$

(c)  $\int_a^b f(x) dx = ?$ 

(i)  $-\int_b^a f(x) dx$

(ii)  $\int_b^a f(x) dx$

(iii)  $\int_0^b f(x) dx$

(iv)  $\int_a^0 f(x) dx$

(d) In the determinant  $\begin{vmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{vmatrix}$ , the minor of the element 8 is

(i) 0

(ii) 8

(iii) -3

(iv) -6

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(e) Given the AR function  $AR = 10 - 0.5q$ , the MR function is

(i)  $MR = -0.5q^2$

(ii)  $MR = 10 - 0.5q^2$

(iii)  $MR = 10 - q$

(iv)  $MR = 10q - q$

(f) Rank of the matrix  $\begin{bmatrix} 3 & 0 & 2 \\ -1 & 1 & 0 \\ 5 & 2 & 3 \end{bmatrix}$  is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(g) 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

(h)  $\int a^x dx = ?$ 

(i)  $a^x + c$

(ii)  $\log a^x + c$

(iii)  $ax + c$

(iv)  $\frac{a^x}{\log_e a} + c$

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

- (a) Find the numbers  $a$  and  $b$  that make  $A$  the inverse of  $B$ , when

$$A = \begin{bmatrix} 2 & -1 & -1 \\ a & \frac{1}{4} & b \\ \frac{1}{8} & \frac{1}{8} & -\frac{1}{8} \end{bmatrix} \quad B = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 1 & 6 \\ 1 & 3 & 2 \end{bmatrix}$$

- (b) Illustrate Hawkins-Simon conditions  
 (c) Draw the graph of  $xy = 1$   
 (d) Derive the elasticity of substitution for Cobb-Douglas production function.  
 (e) Evaluate :

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

- (f) Given the input coefficient matrix

$$A = \begin{bmatrix} 0.05 & 0.25 & 0.34 \\ 0.33 & 0.10 & 0.12 \\ 0.19 & 0.38 & 0 \end{bmatrix}$$

Explain the economic meaning of the third column sum and the third row sum.

3. (a) (i) Define the following with examples :  $1 \times 4 = 4$

Null set ; Disjoint set ; Convex set ; Union of sets

- (ii) Define limit of a function.

- (iii) A function is given by

$$y = \frac{x^2 - 4x + 3}{x^2 + 2x - 3}$$

find whether the function is continuous at  $x = 1$  or not.

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Or

- (b) (i) If  $A = \{2, 3, 4\}$ ,  $B = \{2, 5, 6\}$ ; find

$$(A \cup B) \setminus (A \cap B)$$

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- (ii) Solve the following pair of equations graphically :

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$$x + 4y = 2$$

$$6x + 8y = 24$$

- (iii) Define continuity of a function.

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4. (a) (i) Consider the following macro-economic model of two countries,  $i = 1, 2$ , that trade with each other :

$$Y_1 = C_1 + A_1 + X_1 - M_1, \quad C_1 = c_1 Y_1, \quad M_1 = m_1 Y_1$$

$$Y_2 = C_2 + A_2 + X_2 - M_2, \quad C_2 = c_2 Y_2, \quad M_2 = m_2 Y_2$$

Here  $\forall i = 1, 2$ ;  $Y_i$  is income,  $C_i$  is consumption,  $A_i$  is (exogenous) autonomous expenditure,  $X_i$  denotes exports and  $M_i$  denotes imports of country  $i$ . Find the equilibrium values of  $Y_1$  and  $Y_2$  by matrix algebra.

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- (ii) Distinguish between the following :

2+2=

Static and Dynamic input-output models

Open and Closed input-output models

Or

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

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

- (ii) Given the technical coefficient matrix (A) and the final demand vector (F), find the consistent level of sectoral output in a static input-output framework :

$$A = \begin{bmatrix} 0.2 & 0.3 & 0.2 \\ 0.4 & 0.1 & 0.3 \\ 0.3 & 0.5 & 0.2 \end{bmatrix} \quad F = \begin{bmatrix} 150 \\ 200 \\ 210 \end{bmatrix}$$

5. (a) Distinguish between Cobb-Douglas production function and CES production function. State and prove the properties of CES production function.

2+10=1

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( 7 )

Or

- (b) (i) A consumer has a utility function
- $u = u(x) = \alpha x^\beta$
- ,
- $\alpha > 0$
- ;
- $0 < \beta < 1$
- . Does the utility function display diminishing marginal utility?

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- (ii) Find out
- $\frac{dy}{dx}$
- , when

$$y = \sqrt{\frac{1-x}{1+x}}$$

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- (iii) The AR function is given by
- $AR = 100 - 3q$
- . Find the elasticity of demand at
- $q = 5$
- .

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6. (a) (i) Find
- $\int x \ln x dx$
- .

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- (ii) Given the MC function

$$MC = Q^2 - 4Q + 3$$

find the level of output (Q) at which the AVC will be minimum.

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Or

- (b) (i) Given the marginal propensity to import
- $M'(Y) = 0.1$
- and the information that
- $M = 20$
- when
- $Y = 0$
- , find the import function
- $M(Y)$
- .

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( Continued

( Turn Over )

- (ii) Define consumer's surplus. Given the demand function  $p = 36 - q^2$  and the supply function  $p = 6 + \frac{q^2}{4}$ , find the consumer's surplus at equilibrium.

7. (a) (i) Let the demand and supply functions be

$$Q_d = \alpha - \beta P + \sigma \frac{dP}{dt}, \quad Q_s = -\gamma + \delta P$$

( $\alpha, \beta, \gamma, \delta > 0$ )

Assuming that the rate of change of price over time is directly proportional to the excess demand, find the time path  $P(t)$ .

- (ii) Briefly explain the use of differential equations in economics.

Or

- (b) (i) 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.

- (ii) Write a note on the cobweb model.

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