2018/SEM/ODD/ECOH-103
(Arts/Sc)/213

TDC Odd Semester Exam., 2018

ECONOMICS

(Honours)

(1st Semester)

Course No. : ECOH-103

Full Marks : 50

Pass Marks : 17

Time : 2 hours

The figures in the margin indicate full marks for the questions

Arts students will answer ECOH-103 (Arts) and Science students will answer ECOH-103 (Sc)

OPTION—A

(For Arts Students)

Course No. : ECOH-103 (Arts)

(MATHEMATICS FOR ECONOMICS—I)

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Given $A = \{2, 5, 7, 9\}$, $B = \{5, 6, 7\}$ and $C = \{2, 7, 9\}$. Answer the following :

(i) Find power set of B.

(ii) Find all subsets of A.

$(x-3)\sqrt{x+1}$ 3+3+4=10

(iii) Is $A \cap (B \cup C) = (A \cap B) \cup C$?

(iv) Find $B \times C$.

(v) Find $(A - B) \cup (B - A)$.

(b) Define the following concepts with suitable examples :

(i) Equivalent set

(ii) Complement of a set $(1 \times 5) + (2\frac{1}{2} \times 2$

2. (a) Let $A = \{1, 2, 3\}$, $B = \{3, 4\}$ and $C = \{4, 5, 6\}$. Find the following :

(i) $A \times (B \cap C)$

(ii) $(A \times B) \cap (A \times C)$

(iii) $A \times (B \cup C)$

(b) Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R from A to A by $R = \{(x, y) : y = x + 1\}$. Also write the domain and range of R.

(c) State and illustrate the meaning of mathematical function. 3+4+3=

UNIT—II

3. (a) If $\frac{{}^{n}P_{r-1}}{a} = \frac{{}^{n}P_{r}}{b} = \frac{{}^{n}P_{r+1}}{c}$, then prove that $b^2 = a(b + c)$. 3+3+4=10

(b) $(x - 3)\sqrt{x + 1}$

(b) In how many ways a consonant and a vowel can be chosen out of the letters of the word PROBLEM?

(c) If $5 \cdot {}^{4}P_{r} = 6 \cdot {}^{5}P_{r-1}$, then find r. 4+3+3=10

4. (a) If $x = \log_a^{bc}$, $y = \log_b^{ca}$ and $z = \log_c^{ab}$, then prove that

$$\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1} = 1$$

(b) Find the derivative $\left(\frac{dy}{dx}\right)$ of the following :

(i) $y = (2x^2 + 3)e^{-3x^2}$

(ii) $y = 4a^4 + 3ax^2 + x^3$ 4+(3+3)=10

UNIT—III

5. (a) Define definite integral. Mention the properties of definite integral.

(b) Evaluate :

$$\int \frac{x^2 dx}{x^4 + 3x^2 + 2}$$

(c) Evaluate :

$$\int_8^{15} \frac{dx}{(x-3)\sqrt{x+1}}$$

3+3+4=10

6. (a) Evaluate :

(i) $\int \frac{dx}{x(x^2+1)}$

(ii) $\int x^3 e^x dx$

(b) Evaluate :

$$\int_0^1 x^3 \sqrt{1+3x^4}\, dx$$

(3+3)

UNIT—IV

7. (a) Find the value of

$$\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix}$$

(b) Find the rank of the following matrix :

$$A = \begin{pmatrix} 6 & 3 & 5 \\ -10 & 2 & 8 \\ 5 & 2 & 3 \end{pmatrix}$$

(c) Find the inversion of the following matrix :

$$A = \begin{pmatrix} 1 & 4 & 3 \\ 4 & 2 & 1 \\ 3 & 2 & 2 \end{pmatrix}$$

3+3+4=1

8. (a) Prove that transpose of transpose of a matrix is the original one.

(b) If A and B both are square matrices and of the same order as follows

$$A = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 2 & 2 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix}$$

then show that $AB \neq BA$.

(c) Prove that

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

3+3+4=10

UNIT—V

9. (a) Solve the following system of simultaneous equations by matrix inversion :

$$3X + Y + Z = 1$$
$$2X + 2Z = 0$$
$$5X + Y + 2Z = 2$$

(b) Use Cramer's rule to solve the following equations :

$$P_1 + P_2 + P_3 = 6$$
$$P_1 + 2P_2 + P_3 = 8$$
$$2P_1 + P_2 + 3P_3 = 13$$

5+5=10

10. (a) Use determinants to determine when a unique solution exists for the following system of equations :

$$2x_1 + 3x_2 = 27$$
$$6x_1 + 9x_2 = 81$$

(b) Use Cramer's rule to solve the following system of equations :

$$5x_1 - 2x_2 + 3x_3 = 16$$
$$2x_1 + 3x_2 - 5x_3 = 2$$
$$4x_1 - 5x_2 + 6x_3 = 7$$

OPTION—B

(For Science Students)

Course No. : ECOH-103 (Sc)

(ELEMENTS OF MATHEMATICAL ECONOMICS—I)

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* State the properties of determinants. 5

(b) In a two-economy model denoted by the subscripts 1 and 2

$$C_1 = 0 \cdot 8Y_1 \qquad C_2 = 0 \cdot 7Y_2$$

$$M_1 = 0 \cdot 2Y_1 \qquad M_2 = 0 \cdot 15Y_2$$

$$Y_1 = C_1 + 200 + (X_1 - M_1)$$

$$Y_2 = C_2 + 100 + (X_2 - M_2)$$

$$X_1 = M_2 \qquad X_2 = M_2$$

where C, Y, X and M stand for consumption, national income, exports and imports respectively. Find equilibrium national income by using Cramer's rule. 5

(a) State the economic interpretation of derivative. 2

(b) Distinguish between partial derivative and total derivative. 2

(c) Given the marginal cost function

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

Find the level of output Q at which the average variable cost (AVC) will be minimum.

UNIT—II

3. Given the demand and supply functions :

$$Q_d = a - bP + \delta \frac{dP}{dt} \quad (a, b > 0)$$

$$Q_s = -c + dP \quad (c, d > 0)$$

Obtain the time path of price P_t assuming that the rate of change of price over time is directly proportional to excess demand. Also indicate the restriction on the value of δ to ensure dynamic stability. 8+2=1

4. Mathematically derive Slutsky's equation. How is Slutsky's idea of compensation different from that of Hicks? 8+2=1

UNIT—III

5. (a) A firm has the total cost function

$$C = 7Q^2 + 5Q + 120$$

and its demand function is

$$P = 180 - 0.5Q$$

Further a subsidy of ₹ 5 per unit of output is paid by the government. Find—

(i) profit maximising output and price;

(ii) maximum profit;

(iii) impact of subsidy on equilibrium output and prices. 2+2+2=6

(b) State and illustrate the relationship between total product (TP), average product (AP) and marginal product (MP) with the help of a suitable diagram. 4

6. (a) Show that Cobb-Douglas production function exhibits constant returns to scale. 6

(b) A production function is given as follows :

$$Q = 200K^{\frac{1}{2}}L^{\frac{4}{5}}$$

Where K = capital and L = labour.

Show that the isoquant of the above production function is convex to the origin. 4

(10)

UNIT—IV

7. (a) The total revenue R and total cost functions of a perfectly competitive firm are given as

$$R = 26Q - 3Q^2$$

$$C = 2Q^2 - 4Q + 10$$

where Q stands for output produced.

Find—

(i) profit maximising output and corresponding profit, profit maximising price and total revenue at that level of output;

(ii) revenue maximising output and corresponding profit, revenue maximising price and total revenue at that level of output;

(iii) whether or not the minimum profit constraint of $\pi \geq 30$ will prevent the attainment of the revenue maximising output. 4+4+2=10

8. A monopolist has the following total revenue function R and total cost function C :

$$R = 46Q - 3Q^2$$

$$C = 2Q^2 - 4Q + 10$$

Where Q is the amount of output produced.

Suppose an excise tax at the rate t is imposed on the output. Find—

(a) the tax rate which will maximise total excise revenue of government;

(b) monopolist's maximum profit after the payment of tax and profit maximising output and the price at which the product is sold. 5+5=10

UNIT—V

9. Derive the mathematical formula of Gini coefficient. State the relative merits and demerits of Gini coefficient as a measure of inequality. 4+(3+3)=10

10. Write short notes on the following : 5+5=10

(a) Lorenz curve

(b) Pareto's law of income distribution

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