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63 (FY)SEM-3/MIN/COMMIN2014

2024

COMMERCE

Paper : COMMIN2014

(Business Mathematics)

Full Marks : 70

Pass Marks : 28

Time : Three hours

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

1. Choose the most appropriate options of the following questions : $1 \times 10 = 10$

(a) Scalar matrix is :

(i) a square matrix

(ii) a diagonal matrix

(iii) a unit matrix

(iv) both square matrix and diagonal matrix

55/FY (Sem-3)

Contd.

(b) The annuity which is to continue forever is known as :

- (i) annuity certain
- (ii) annuity contingent
- (iii) perpetual annuity
- (iv) immediate annuity

(c) Objective function of a linear programming problem is :

- (i) a relation between the variables
- (ii) a constant
- (iii) a function to be optimized
- (iv) a constraints

(d) If u and v are two differentiable functions of x then :

(i) $\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$

(ii) $\frac{d}{dx}(uv) = u \frac{dv}{dx} - v \frac{du}{dx}$

(iii) $\frac{d}{dx}(uv) = u \frac{du}{dx} + v \frac{dv}{dx}$

(iv) $\frac{d}{dx}(uv) = u \frac{du}{dx} - v \frac{dv}{dx}$

(e) $\log x$ is the integral of :

- (i) x^{-1}
- (ii) $\sqrt{x}$
- (iii) e^x
- (iv) a^x

(f) The Minor and Cofactor of the element 8 in the determinant :

3	4	5
2	-1	8
5	-2	7

are :

- (i) 26 and 26
- (ii) - 26 and 26
- (iii) 26 and -26
- (iv) -26 and -26

(g) $\frac{d}{dx}(a^x)$ is equal to :

- (i) a^x
- (ii) $a^x \log_e a$
- (iii) xa^x
- (iv) $a^x \log_a e$

(h) $\int (M.C.) dx$ is equal to :

(i) M.C.

(ii) T.C.

(iii) A.C.

(iv) All of the above

(i) A set of values of decision variables that satisfies all the linear constraints and non-negativity conditions of an LPP are called :

(i) optimum solution

(ii) unbounded solution

(iii) feasible solution

(iv) all of the above

(i) In linear programming problem, optimum value of objective function, if exist, is attained at —

(i) any point of the feasible region.

(ii) any point on the boundary of the feasible region.

(iii) any point inside the boundary of the feasible region.

(iv) the corner points on the boundary of the feasible region.

2. Answer the following questions : **(any five)**
 $2 \times 5 = 10$

(a) If $A = \begin{bmatrix} 1-x & 2 \\ -3 & 1+x \end{bmatrix}$

and $B = \begin{bmatrix} 1+x & -2 \\ 3 & 1-x \end{bmatrix}$, find $A + B$.

(b) What is sinking fund?

(c) Evaluate,

$$\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$$

(d) A function $f(x)$ is defined as follows :

$$f(x) = \begin{cases} x+2, & \text{when } 0 \leq x \leq 1 \\ 4-x, & \text{when } 1 < x \leq 3 \end{cases}$$

2, when $x > 3$

Find $f\left(\frac{1}{2}\right)$, $f(1)$, $f(2)$ and $f(5)$.

(e) Find the integral—

$$\int \left(\frac{2+x}{x} \right) dx$$

(f) Define homogeneous function and its degree.

(g) Find the interest on Rs. 6,000 @ 7% per annum simple interest for the period from 12th August, 2022 to 24th October, 2022.

3. Answer **any six** of the following questions :
5×6=30

(a) Find the inverse of the matrix A given by

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$$

(b) If $y = 2x + \frac{4}{x}$, prove that

$$x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = 0$$

(c) Discuss the graphical method of solving linear programming problem.

(d) (i) A manufacturer produces 3 products A, B and C which are sold in Delhi and Calcutta. The annual sales of these products are given below:

	A	B	C
Delhi	5000	7500	15000
Calcutta	9000	12000	8700

If the sales prices of products A, B and C per unit be Rs. 2, Rs. 3 and Rs. 4 respectively, calculate the total revenue in each centre by using matrices.

(ii) Find the value of

$$\Delta = \begin{vmatrix} 1 & 1^2 & 2^2 \\ 2 & 2^2 & 4^2 \\ 3 & 3^2 & 6^2 \end{vmatrix}$$

(e) Verify Euler's theorem for the function

$$(x, y) = x^3 + 2x^2y + y^3.$$

(f) Solve the following system of equations using Cramer's rule:

$$3x + 4y + 5z = 18; \quad 2x - y + 8z = 13;$$

$$5x - 2y + 7z = 20$$

(g) What are the basic assumption of linear programming problem?

(h) Find the principal for which the difference of simple interest and compound interest is Rs. 20 @ 4% for two years.

(i) Find (i) the average cost function and (ii) the marginal cost function for the following total cost function—

$$TC = 35 + 5Q - 2Q^2 + 2Q^3$$

Also evaluate them at $Q = 3$ and $Q = 5$.
 $2+3=5$

4. Answer **any two** of the following questions: $10 \times 2 = 20$

(a) (i) If $f(x) = x^2 - 5x + 6$,
find $f(A)$

$$\text{where } A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix} \quad 5$$

(ii) The Marginal Revenue function (MR) of a product is—
 $MR = 8 + 5x - x^2$.

Find the Total Revenue function (TR) and Average Revenue function (AR), given $TR = 82$ when $x = 5$.

(b) (i) Explain the concept of linear programming problem and decision variables? 5

(ii) Solve the following LPP by graphical methods.

$$\text{Minimize } z = 3x + 2y$$

$$\text{Subject to : } 5x + y \geq 10$$

$$x + y \geq 6$$

$$x + 4y \geq 12$$

$$x \geq 0, y \geq 0$$

(c) A steel plant produces x tones of steel per week at a total cost of

$$\text{Rs. } \left(\frac{1}{3}x^3 - 5x^2 + 99x + 35 \right). \text{ Find the}$$

output level at which the marginal cost attains its minimum value. Also find the minimum marginal cost.

(d) (i) Find the present value of the annuity of Rs. 2,000 for 10 years at 5% compound interest per annum, the payment being made at the beginning of each year.

$$[\text{ Given, } \log(1.05) = 0.0212;]$$

$$\text{Antilog } (1.788) = 0.6138] \quad 5$$

(ii) A company buys a machine for Rs. 1,00,000. Its estimated life is 12 years and scrap value is Rs. 5,000. What amount is to be retained every year from profits and allowed to accumulate at 5% compound interest per annum for buying a new machine at the same price after 12 years ?

$$[\text{Given, } \log(1.05) = 0.0212;]$$

$$\text{Antilog } (0.2544) = 1.797] \quad 5$$