Exam. Code : 103203
Subject Code : 1131

B.A./B.Sc. 3rd Semester

QUANTITATIVE TECHNIQUES—III

Time Allowed—3 Hours] [Maximum Marks—100

Note :— Use of simple (Non-scientific) calculators is allowed.

Note :— (i) The **FIRST** question consisting of **TEN** short answer type parts is compulsory. Attempt **all** parts of this question with answer to each part in upto **5** lines. Each part carries **2** marks.

(ii) The candidates will attempt **ONE** out of **TWO** questions from each of the **four** units (of **20** marks each).

1. (a) If z = f(t), how would you determine extreme values of z with respect to t ?

(b) Find the derivative of $y = (4x - 3)^2 (2x + 1)^{1/2}$

(c) If u and v are two functions of x, how would you obtain $\int uv\,dx$?

(d) Evaluate $\int \frac{1-x^3}{1-x}\,dx$.

(e) Some areas of application of integration in the subject matter of economics.

(f) If $A = \begin{pmatrix} 1 & 2 \\ 3 & -5 \end{pmatrix}$, then show that A (Adj. A) = (Adj. A)A

(g) Conceptual meaning of producer surplus.

(h) Assumptions of linear programming problem.

(i) If $A = \begin{pmatrix} 2 & 4 \\ 3 & 5 \end{pmatrix}$, $B = \begin{pmatrix} 3 & -2 \\ 5 & 4 \end{pmatrix}$ and $C = \begin{pmatrix} 5 & 3 \\ 1 & -1 \end{pmatrix}$, then find 2A – B + 3C.

(j) Basic purpose of input-output analysis.

UNIT—I

2. (a) Show that the maximum value of the function $y = x^3 - 27x + 108$ is 108 more than the minimum value.

(b) Evaluate $\int x^2 e^x \, dx$.

3. (a) Differentiate $\frac{e^x \log x}{x^2}$ w.r.t. x

(b) Find total differential dz from the function $z = \frac{x^2 - y^2}{x^2 + y^2}$.

UNIT—II

4. (a) Evaluate $\int x^2 e^x \, dx$.

(b) Evaluate area under the curve $y = 5 + 3x - x^2$ between x = 2 and x = 5.

5. If demand and supply functions are given respectively by $p = 10 - x - x^2$ and $p = x + 2$, then work out consumers surplus and producers surplus at equilibrium price.

UNIT—III

6. (a) Find rank of the matrix $A = \begin{pmatrix} 3 & 2 & 1 & -4 \\ 4 & 3 & -1 & 0 \\ 1 & 2 & 3 & 4 \end{pmatrix}$.

(b) If $A = \begin{pmatrix} 3 & -5 \\ -2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & 2 \\ 1 & -6 \end{pmatrix}$, find $(AB)^{-1}$ and $(BA)^{-1}$.

7. (a) Given $Y = C + I_0$, where $C = C_0 + bY$, use matrix inversion approach to find the equilibrium level of Y and C.

(b) Solve the following system of simultaneous equations by Cramer's rule :

$2x_1 + 5x_2 + x_3 = 10;\ 2x_1 + x_2 - x_3 = 0;\ 4x_2 + 3x_3 = 9$

UNIT—IV

8. (a) Write down the dual of the following primal problem :

Minimise $Z = X_1 + 4X_2 + 3X_3$, subject to the constraints

$$2X_1 + 5X_2 - 5X_3 \le 2$$
$$3X_1 - X_2 + 6X_3 \ge 1$$
$$X_1 + X_2 + X_3 = 4$$
$$X_1, X_2 \ge 0;\ X_3 \text{ is unrestricted in sign.}$$

(b) A toy company manufactures two types of dolls; a popular-type doll A, and a deluxe-type doll B. Each doll of type B takes twice as much time to produce as one doll of type A, and the company has a maximum of 2000 units of time per day. The supply of plastic is sufficient to produce 15,000 dolls (of both the types, taken together) per day. The deluxe type doll requires a fancy dress, of which only 600 per day are available. The company makes a net profit of Rs. 30 on each doll of type A and Rs. 50 on each doll of type B. Formulate it as a linear programming problem to determine the most profitable combination of the two types of dolls.

9. (a) Explain the Input-Output technique relating to a closed economy.

(b) The input-output coefficient matrix for a 2-sector economy is :

$$A = \begin{pmatrix} 0.40 & 0.25 \\ 0.20 & 0.50 \end{pmatrix}$$

The final demand for the two industries are 18 and 44 units, respectively. Find the gross output.