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Roll No. | | | | | | | | | | |

S. No. of Question Paper : **5440**

Unique Paper Code : **2374001202**

Name of the Paper : **Applications in Statistics**

Name of the Course : **GE**

Semester : **II (NEP)**

Duration : **3 Hours** Maximum Marks : **90**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *six* questions in all.

Question No. **1** is compulsory.

All questions carry equal marks.

Use of non-programmable scientific calculator is allowed.

1. (*a*) Discuss briefly the structure of the present Official Statistics System in India. What purpose is served by the collection, compilation and publication of data ? 8

(*b*) Write short notes on the following :

(*i*) NSSO and

(*ii*) MoSPI. 3½,3½

P.T.O.

2. (*a*) Define price and income elasticity of demand. Point out their uses in economic analysis. For the demand curve : $p = (10 - 2x)(20 - x^2)$, where $x > 0$, $p > 0$, x is quantity demanded and p is the price. Find the price elasticity of demand at $x = 4$ and comment on your result. 8

(*b*) (*i*) The demand function for a particular commodity is $y = 15e^{-x/3}$ for $0 \leq x \leq 8$, where y is the price per unit and x is the number of units demanded. Determine the price and quantity for which the revenue is maximum.

(*ii*) The demand curve is $x = 3y + 2y^2 - 6p^2 - 5p^{-4}$ where $y > 0$, $p > 0$, x is quantity demanded, y is income and p is the price. Find slope for demand curve and also check, whether commodity under consideration is normal or inferior. 3½,3½

3. (*a*) Explain *two* important methods commonly used to graduate income distributions, pointing out their assumptions, merits and demerits. 8

(*b*) The price elasticity of demand of a commodity is

$$\varepsilon_p = \left[\frac{5p}{\{(p-2)(p+3)\}}\right],$$

where p is the price. Find the corresponding demand function if it is known that the quantity demanded is 5 units when the price is Rs. 3. 7

4. (*a*) What do you understand by utility function, marginal utility and rate of change of marginal utility. For the utility function

$U = x_1^2 x_2 + 3x_1 x_2^2$, where x_1 and x_2 are quantities of commodities X_1 and X_2 respectively, show that the rate of change of marginal utility of commodities X_1 w.r.t. X_2 is equal to the rate of change of marginal utility of X_2 w.r.t. X_1. 7½

(*b*) Derive conditions for the constrained utility maximisation of utility function $U = f(x, y)$ subject to budget constraint : $p_1x_1 + p_2x_2 = y$, where x_1, x_2 are the quantities consumed and p_1, p_2 are the prices of the *two* commodities X_1 and X_2 respectively and y is the fixed income. 7½

5. (*a*) The utility function of the consumer is given by $U = x_1x_2$, where x_1 and x_2 are consumed quantities of commodities X_1 and X_2 respectively. Find the optimum value of x_1 and x_2 if his income is 91 and product prices are 2 and 5, respectively. 7½

(*b*) Discuss the importance of indifference curve and state its properties. A utility function is given as $U = \log\sqrt{xy}$. Find the demand function for the commodity X, if fixed income of the consumer is Rs. 500. Hence, determine the price elasticity of demand. 7½

6. (*a*) What do you mean by production function, average product, marginal product and elasticity of substitution ? 7½

(*b*) Consider a production function as follows :

$$Q = 2L^2K^3 - 3L^3K^2,$$

where Q is the total output produced, and K is capital and L is labour.

(*i*) Find average product and marginal product of labour.

(*ii*) If capital is fixed, find L for which AP will be maximum ?

(*iii*) Does the maximum of marginal product reach at lower level of labour than that of average product curve ? 2½,2½,2½

7. (*a*) State the Euler's theorem for a homogeneous function of degree n for two factors of production. Given the production function : $q = AL^{\alpha}K^{\beta}$, A, α and β are constants.

(*i*) Find the conditions under which this is a linear homogeneous function.

(*ii*) Apply Euler's theorem, if these conditions hold true. 4,3½

(*b*) A production function is given by $q = AL^{3/4}K^{3/4}$, where L is labour and K is capital.

(*i*) What is the nature of returns to scale ?

(*ii*) What is the total reward of labour and capital if each factor is paid a price equal to its marginal product ? 4,3½