

- (b) A consumer's utility function is $U = x_1 x_2^2$. Given that income is ₹140 and prices of x_1 and x_2 are ₹4 and ₹6 respectively, find the optimal consumption bundle.
6. (a) Define a homogeneous function and state Euler's theorem for a function of two variables. The production function is given by $q = AL^a K^b$, where A, a, and b are constants, (i) Find the conditions under which this is a linearly homogeneous function, (ii) Apply Euler's theorem when these conditions hold, and interpret the result economically.
- (b) Check whether the following functions are homogeneous or not. If homogeneous, state the degree :
- (i) $f(x, y) = 4x^3y + 5x^2y^2 - 2xy^3$
(ii) $f(x, y) = x^4y + 5x^2y^3 - 3x^3y^3 + 2xy^4$
(iii) $f(x, y) = x^3y + 3x^2y^2 - 2x^3y^2$
7. (a) A production function is given by $Q = 20L - L^2$. Explain the Law of Variable Proportions with reference to this function. Derive the TP_L , MP_L and AP_L and identify the three stages of production.
- (b) Briefly explain :
- (i) Engels curves and its interpretation.
(ii) Consumer equilibrium using indifference curve analysis.

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6622

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Unique Paper Code : 2374001202

Name of the Paper : GE: Applications in Statistics (NEP)

Name of the Course : **B.Sc. (Hons) Statistics**

Semester : II

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

- Write your Roll No. on the top immediately on receipt of this question paper.
 - Attempt **six** questions in all. **Q1.** is compulsory.
 - All** questions carry equal marks.
 - Use of a non-programmable scientific calculator is allowed.
- (a) Describe Pareto's Law of income distribution and state its applications in economic analysis. How does it help in understanding income inequality?
(b) Write short notes on :
 - The Central Statistical Organisation (CSO) and its major functions.
 - The National Statistical Commission (NSC) in India, mentioning its two important functions.

2. (a) Define partial and cross elasticity of demand. Explain their uses in economic analysis. The following are the demand functions for two commodities X_1 and X_2 :

$$x_1 = p_1^{-1.2} p_2^{0.6}, \quad x_2 = p_1^{0.4} p_2^{-0.9}$$

Determine whether x_1 and x_2 are complementary, substitute or independent commodities.

- (b) (i) The demand function for a commodity X is given by

$$x = 400 - 0.4p^2 + 0.03p_0 + 0.06y$$

where x is the quantity demanded of X, p is the price of X, p_0 is the price of a related commodity, and y is the consumer's income. Compute (i) the price elasticity of demand for X, and (ii) the income elasticity of demand for X.

- (ii) The demand x as a function of income y is given by $50x = 15 + 4y$. Obtain the expression for income elasticity of demand and evaluate it when $y = 500$.

3. (a) Discuss the method of estimation of income elasticities of demand on the basis of family budget data. What is the Engel's law and how is it related to income elasticity?

- (b) The demand and supply curves for computers are:

$$D = 200 - 8P, \quad S = 40 + 5P$$

Find the equilibrium price and quantity. If the demand curve shifts to $D = 250 - 8P$, what is the new equilibrium? Compute the price elasticity of demand at the original equilibrium.

4. (a) Define the indifference curve and state its properties. Define the marginal rate of substitution (MRS) and show that for the utility function $U = x_1^\alpha x_2^\beta$, the MRS is given by $MRS = \alpha x_2 / \beta x_1$.

- (b) Find the optimum level of commodities for a consumer whose utility function is $U = x_1 x_2$ given that the prices of x_1 and x_2 are 10 and 50 respectively and income is 100. Comment on the optimum level of commodities.

5. (a) Define the budget line (constraint). What are the necessary and sufficient conditions for maximising the utility function w.r.t. a given budget constraint? If $U = x_1^\alpha x_2^\beta$ is an individual's utility function for two goods, show that the demand functions are:

$$x = \alpha M / [(\alpha + \beta)p_x] \quad \text{and} \quad y = \beta M / [(\alpha + \beta)p_y]$$

where p_x and p_y are fixed prices and M is the individual's fixed income. Deduce the price elasticity of demand and income elasticity of demand for either good.