

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1199

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Your Roll No.....

Unique Paper Code : 237202

Name of the Course : B.Sc. (H) Statistics

Name of the Paper : Applied Statistics – I [STHT–204]

Semester : II

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
 2. Attempt any six questions in all.
 3. Question No. 1 is compulsory.
 4. Select two questions from Section A and three from Section B.
 5. Use of simple calculators and finance tables is allowed.
 6. Attempt all parts of a question in continuation.
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1. (i) Which is better from the standpoint of the investor, 3% per year compounded monthly or 3.1% per year simple interest ?
(ii) If MR is Rs. 26 and elasticity of demand with respect to price is 3, find AR.
(iii) η_1 and η_2 are the price elasticities of demand for the demand laws :
 $x = 1 - p$ and $x = p - p^2$. Show that $\eta_2 = \eta_1 - 1$.
(iv) Obtain the demand function for a commodity whose elasticity of demand is given by $\eta_d = a - bp$ where a, b are constants and p denotes the price.
(v) Explain the concept of a learning curve.
(vi) What are the advantages of chain base index over fixed base index ?
(vii) Find the elasticity of substitution for the production function : $Q = K^{0.5} L^{0.2}$.
(2,2,2,2,2,2,3)

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SECTION A

2. (a) If $L(p)$ and $P(q)$ represent Laspeyre's index number for prices and Paasche's index number for quantities respectively, show that $L(p) \times P(q) = V_{01}$, where V_{01} is the value index number. Hence or otherwise, show that :

$$\frac{L(p)}{L(q)} = \frac{P(p)}{Q(q)}$$

- (b) What do you understand by cost of living index number? Describe briefly the main steps to be followed in its construction. (6,6)
3. (a) The demand functions for two commodities x_1 and x_2 in terms of their respective prices p_1 and p_2 are given by :

$$x_1 = p_1^{-a_1} \cdot e^{b_1 p_2 + c_1} \quad \text{and} \quad x_2 = p_2^{-a_2} \cdot e^{b_2 p_1 + c_2}$$

where a_1, a_2, b_1, b_2, c_1 and c_2 are constants.

Find the four partial (marginal) demand functions and show that :

- (i) The 'direct' price elasticities are independent of the prices, and
- (ii) The cross price elasticities are determined in sign by the constants b_1 and b_2
- (b) What is an Engel's curve? Explain the two methods of drawing Engel's curve. (6,6)

4. (a) Define the price elasticity of demand. The elasticity of demand of a commodity with respect to price is calculated to be :

$$\frac{5p}{(p+3)(p-2)} \quad (\text{where } p \text{ is price})$$

Find the demand function if it is known that the quantity demanded is 5 units at $p = 3$.

(b) Explain :

(i) Time Reversal test

(ii) Factor Reversal test

in index number theory. Show that Fisher's ideal index number formula satisfies both these tests. (6,6)

SECTION B

5. (a) What is constrained utility maximization ? Derive the necessary and sufficient condition for $u = f(x_1, x_2)$ to be maximum using Lagrange multiplier where $u = f(x_1, x_2)$ is the utility function and $Y_0 = p_1x_1 + p_2x_2$ is the budget constraint.

(b) Find the ratio of the marginal utilities for two goods x_1 and x_2 , when the utility function is :

$$U = (x_1 + a)^p \cdot (x_2 + b)^q.$$

Show that the same result is obtained when the utility function is taken as :

$$U = p \log(x_1 + a) + q \log(x_2 + b). \quad (6,6)$$

6. (a) The monopolist's demand curve is $x = 200 - 2p$, ($x = x_1 + x_2$) and the cost of the two plants are $C_1 = 10x_1$ and $C_2 = 0.25x_2^2$. Determine the output that maximizes the profit of monopolist and also find the maximum profit.

(b) What is Marginal Rate of Technical Substitution (MRTS) ? For the Cobb-Douglas production function given by $P = AL^\alpha K^{1-\alpha}$, find the Marginal Rate of Technical Substitution between the factors. (6,6)

7. (a) Explain the concept of consumer's and producer's surplus assuming pure competition in the market. The demand and supply function are $p = 16 - x^2$ and $p = 2x^2 + 4$ respectively. Find the consumer's surplus.

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- (b) A production function is given by $Q = AL^{1/3}K^{1/3}$, where L is labour and K is capital.
- (i) Find the behaviour marginal product of each factor.
 - (ii) What is the nature of returns to scale ?
 - (iii) Show that the total product is not exhausted if each factor is paid a price equal to its marginal product. (6,6)
8. (a) What is an equation of value ? The sums of Rs. 2000, Rs. 3000 and Rs. 4000 are due at the end of 2, 4 and 8 years respectively. It is proposed to replace this series of payments by a single sum of Rs. 9000 payable at the end of n years. If the rate of interest is 10% per annum effective, find the value of n.
- (b) 'A' purchased a television paying Rs. 5000 down and promising to pay Rs. 200 every three months for next 4 years. The seller charges interest at 8% per annum compounded quarterly.
- (i) What is the cash price of television ?
 - (ii) If A missed the first three payments, what must he pay at the time the fourth is due to bring him upto date ? (6,6)