Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions:

There are THIRTEEN questions divided under THREE sections.

The ONLY question in Section A is compulsory.

In Section B, FIVE out of SEVEN questions are to be attempted.

In Section C, THREE out of FIVE questions are to be attempted.

Candidates should attempt questions/parts as per the instructions given in the sections.

The number of marks carried by a question/part is indicated against it.

Candidates are required to write clear, legible and concise answers.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly.

Any page or portion of the page left blank in the Question-cum-Answer (QCA) Booklet must be clearly struck off.

Answers must be written in ENGLISH only.
SECTION A  
(Compulsory Section)

Q1. Answer all the following questions. $5 \times 7 = 35$

(a) In a two-good world, show that both the goods cannot be inferior. 5

(b) Calculate the elasticity of substitution for the following production function:

$$Q = \left( L^p + K^p \right)^{\frac{\gamma}{p}}$$

(c) Differentiate between adverse selection and moral hazards in determining pricing under incomplete information. 5

(d) In a two-input framework, state and prove the adding up theorem with necessary assumptions. 5

(e) How do you derive the aggregate demand for a private good and a public good? 5

(f) Give the economic interpretations of the Lagrange Multiplier for the following constrained optimisation problems:

(i) Utility maximisation

(ii) Expenditure minimisation

(iii) Output maximisation

(iv) Cost minimisation

(g) Explain the role of the degrees of freedom in statistical inference. 5
SECTION B

Answer any five out of the following seven questions: 18x5=90

Q2. (a) (i) Explain the relevance of including an intercept term in a classical linear regression model.

(ii) How do you calculate elasticity from a linear regression model? 5+3=8

(b) The following estimated equation was obtained by OLS with sample size 80:

$$\hat{Y}_i = 2.2 + 0.11x_{1i} + 3.48x_{2i} + 0.34x_{3i}$$

(3.4) (0.005) (2.2) (0.15)

Figures in parentheses indicate standard errors. The explained sum of square was 112.5 and the residual sum of square was 19.5.

(i) Calculate the values of $R^2$ and $\bar{R}^2$.

(ii) Test the significance of the slope coefficients by using t statistic at 5% level of significance.

[Given that $t_{0.05, 76} = 1.98$]

(iii) Test for overall significance of the model at 5% level of significance.

[Given that $F_{0.05, 76} = 1.35$]

Q3. (a) Specify Leontief closed input-output system. Interpret the conditions for non-trivial solution of this model. 10

(b) Why do you prefer coefficient of variation to standard deviation as a measure of dispersion? 4

(c) In a regression equation of $Y$ on $X$, the value of $X$ is fixed at 5. What will the regression equation look like? 4

Q4. (a) Derive the Pareto optimality conditions in consumption in a two-commodity framework with two consumers. 10

(b) Show that the Pareto optimality may not ensure equitable distribution. 8
Q5. (a) (i) Distinguish between monopolistic and monopsonistic exploitations in determining wage rate under imperfect competition.

(ii) “Trade unions have a role in reducing the monopsonistic exploitation but not the monopolistic exploitation.” Discuss. 7+3=10

(b) Compare the views of Marx and Kaldor with reference to the theory of distribution. 8

Q6. (a) “In a duopolistic market, the first mover’s advantage disappears as one moves away from the quantity adjustment model to the price adjustment model.” Elaborate. 10

(b) Suppose that a monopolistic competitive market consists of 11 firms with the following identical demand and cost functions:

\[ p_k = 150 - 2q_k - 0.2 \sum_{i=1, i \neq k}^{11} q_i \]

\[ c_k = 0.5q_k^3 - 20q_k^2 + 270q_k \]

Determine the maximum profit and the corresponding price and quantity for a representative firm. Assume that number of firms in the industry does not change. 8

Q7. (a) A production function following constant returns to scale can follow diminishing returns to a factor. Justify with logic. 8

(b) Define the concept of technical efficiency as proposed by Farrell. How is it different from allocative efficiency? Illustrate your answer graphically by considering a two-input and one-output framework. 10

Q8. (a) Explain the concepts of a weakly separable and a weakly additive utility function. 10

(b) (i) “In Edgeworth model, an increase in demand will lead to a rise in price.” Justify your answer.

(ii) Show that a monopolist can charge higher price in a market with less elastic demand. 4+4=8
SECTION C

Answer any three out of the following five questions: \(25 \times 3 = 75\)

Q9. (a) "Heteroscedasticity is a problem in cross-section data, but not in time series data." Discuss. \(8\)

(b) A researcher estimated an employment (N) equation with GDP (G), education (E) and price (P) as explanatory variables. The estimated equation is given below:

\[
N = 506 + 0.06G - 0.01E - 19.8P
\]

\[
(1.399) \quad (3.227) \quad (-0.033) \quad (-0.142)
\]

\[R^2 = 0.97, \text{ number of observations} = 16\]

[Figures in parentheses are t-statistics]

(i) Interpret the estimated coefficients. \(3+3+3=9\)

(ii) Identify the problems in the estimation.

(iii) How can you improve the estimation?

(c) Distinguish between the deterministic trend and the stochastic trend in time series analysis. \(8\)

Q10. (a) Show that principal components are obtained from the eigenvectors corresponding to the covariance matrix of the variables in a given sample. \(10\)

(b) (i) Distinguish between the time and factor reversal tests of a price index.

(ii) For the data given below, calculate the price index by using Fisher's formula, and interpret your result. \(5+5=10\)

<table>
<thead>
<tr>
<th>Commodities</th>
<th>2019 P</th>
<th>2019 Q</th>
<th>2022 P</th>
<th>2022 Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>10</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>8</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>9</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
(c) Interpret the coefficients from the following estimated equations:

\[ \ln \hat{Y} = \hat{\alpha} + \hat{\beta}_1 \ln X_1 + \hat{\beta}_2 \ln X_2 \]

\[ \ln \hat{Y} = \hat{\alpha} + \hat{b}_1 X_1 + \hat{b}_2 X_2 \]

Q11. (a) What are the basic properties of idempotent matrix? Mention its application in econometrics.

(b) The general solution of a second order non-homogeneous difference equation, \( Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} \), has two components: particular solution and homogeneous solution. Explain the implications of these two solutions.

(c) (i) Differentiate between concavity and quasi-concavity.

(ii) What is the implication of the point of inflection in a short-run production function?

Q12. (a) Given a two-input Cobb-Douglas production function, derive the short-run supply function of a competitive firm.

(b) Suppose that two firms are selling a homogeneous product. They can charge high price (H) or low price (L). The pay-offs from their actions are given in the following game matrix:

\[
\begin{array}{c|cc}
& H & L \\
\hline
Firm-1 & 8, 8 & 3, 10 \\
Firm-2 & 10, 3 & 5, 5 \\
\end{array}
\]

(i) Find Nash equilibrium for the given game.

(ii) Is there any dominant strategy in this game? Explain.
Q13. (a) Show that the substitution effect is always negative by using the weak axiom of revealed preference theory. 10

(b) A farmer grows 70 kg of $X_1$ and 20 kg of $X_2$. He keeps some parts of $X_1$ and $X_2$ for self-consumption and sells the rest in the market. His utility function is

$$U(X_1, X_2) = \min (2X_1, X_2)$$

and prices of $X_1$ and $X_2$ are ₹ 2 and ₹ 3 respectively.

Suppose that price of $X_1$ increases to ₹ 4 and at the same time his consumption of $X_1$ also increases.

Explain the behaviour of the farmer using substitution effect, income effect and endowment effect. 15