UPSC INDIAN ECONOMIC SERVICE (IES)

Previous Years questions
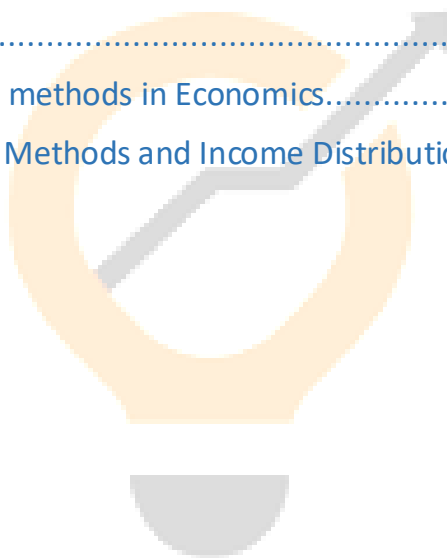
(Topic wise segregation)

(Till 2025)

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Price income and substitution effects,
Slutsky theorem and derivation of demand curve,
Revealed preference theory
Duality and indirect utility function and expenditure function,
Choice under risk and uncertainty
Simple games of complete information,
Concept of Nash equilibrium

Q1 Define MRS (Marginal Rate of Substitution). Calculate MRS for a utility function U = $q_1^\alpha q_2^\beta$. (2025, 5 mark- 100 words)

Q2

 a. How can an ordinary demand function be derived in a two-commodity framework? Show that the ordinary demand function is homogeneous of degree zero with respect to all prices and income. (2025, 10 mark- 150 words)

 b. A consumer is observed to purchase x = 10, y = 5 at prices Px = 1 and Py = 3. The consumer is also observed to purchase x = 9, y = 3 at Px = 2 and Py = 2. Is the behavior of the consumer consistent with axioms of revealed preference? (2025, 8 mark- 150 words)

Q3

 a. Under what condition is an economic agent called a risk averter? State and prove the Neumann–Morgenstern expected utility theorem. (2025, 3+6=9 marks- 150 words)

 b. Suppose that an economic agent has 4 choice options A_1, A_2, A_3 and A_4 with corresponding probabilities and utilities. Given a utility index, calculate the expected utilities and determine preference ranking. (2025, 6 mark- 100 words)

Q4 Construct the compensated demand function from a utility function using duality. Derive the expenditure function. (2025, 9 mark- 150 words)

Q5 If the demand function is P = $(4 - 0.5q)^2$, for what value of a will the price elasticity of demand be unity? (2024, 5 Marks)

Q6 (a) In a two-commodity framework, what will be the shape of the indifference curve when-

    (i)   one commodity is 'bad';

    (ii)   one commodity is 'neutral'?

    Explain your answer. (2024, 8 Marks)

(b) State and prove the Slutsky's theorem. Derive the demand curve for a Giffen good by using this theorem. (2024, 10 Marks)

Q7 Consider the following utility function:

$$^{Q8} \quad u = q1 * q2^2$$

Derive the compensated demand function for q1. Show that this demand curve is always negatively sloped. (2024, 5 + 3 = 8 Marks)

Q9 (a) Both the marginal utility approach and the indifference curve approach yield the same equilibrium position for a rational consumer. Discuss the relative advantages of the indifference curve approach over the marginal utility approach. (2024, 8 Marks)

(b) Show that demand has unitary price elastic if the price consumption curve is horizontal. (2024, 7 Marks)

(c) Suppose that a consumer in a two-commodity (X, Y) world has linear indifference curve with a slope equal to -1/2. Find out the equilibrium consumption when prices for both commodities equal to 2 (Px - Py -2) and income level of the consumer is Rs.2,000. How does equilibrium bundle change when Px = 1 and Py = 4 with the same level of income? [Assume that the consumer spends all income on these two combinations only. (2024, 10 Marks)

Q10 In a two-good world, show that both good cannot be inferior. (2023, 5 marks-100 words)

Q11 Differentiate between adverse selection and moral hazards in determining pricing under incomplete information. (2023, 5 marks-100 words)

Q12 Explain the concept of a weakly separable and a weakly additive utility function. (2023, 10 marks)

Q13 Suppose two firms are selling a homogenous product. They can charge a high price (H) or a low price (L). The pay-offs from their actions are given in the following game matrix:

		Firm-2	
		H	L
Firm-1	H	8,8	3,10
	L	10,3	5,5

Q14 Find Nash Equilibrium for the given game.

Is there any dominant strategy in this game? Explain. (2023, 10 marks)

Q15 (2023, 10+15 marks)

Show that the substitution effect is always negative by using the weak axiom of revealed preference theory.

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 price of X_1 and X_2 are ₹2 and ₹3 respectively. Suppose the 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 the substitution effect, income effect and endowment effect.

Q16 Show that the ordinary demand curve will have a greater demand elasticity than the compensated demand curve. (2022, 5 marks-100 words)

Q17 Solve the following 2 x 2 game: (2022, 5 marks-100 words)

a.

		Player A	
		B_1	B_2
Player B	A_1	2	3
	A_2	4	− 1

Q18 (2022, 6+6+6 marks-200 words)

    i.   Define Indirect Utility Function. Derive the Indirect Utility Function from the Direct Utility Function.

B) Consider the Indirect Utility Function:

$V = \dfrac{M^2}{4\,P_1P_2}$ where notations have their usual meanings.

Derive the demand functions for x_1 and x_2.

C) Consider the utility function and budget equation of a consumer respectively:

$U = x_1\, x_2$

$M = p_1x_1 + p_2x_2$

where notations have their usual meanings.

Derive the expenditure function of the consumer.

Q19 The demand and supply functions are $P_d = (6-x)^2$ and $P_s = 14+ x$ respectively. Find the consumer surplus under pure competitive market. (2021, 5 marks-100 words)

Q20 Distinguish between pure strategies and mixed strategies (2021, 5 marks-100 words)

Q21 (2021, 5+8+5 marks, 200 words)

    i.   Derive Slutsky equation and interpret it.

    ii.   Given the utility function as 12y=36-x2

  b. And the budget line as M=12x+24y

  c. Determine the utility maximizing basket of the two goods.

d. C) Find the value of game:

Firm A		Firm B	
		B_1	B_2
	A_1	25	10
	A_2	5	15

Q22 Explain the difference between Bandwagon effect and snob effect. (2020, 5 marks-100 words)

(2020, 8+10 marks-200 words)

Q23 (a) Explain the meaning of Nash equilibrium. How does it differ from an equilibrium in dominant strategies?

(b) Let market demand faced by the duopolists be

    i. P=100-0.5Q; Q=Q1+Q2

    ii. And their respective cost functions as

    iii. C1= 5Q1 and C2= 5Q2

    iv. Find out Cournot Nash equilibrium.

Q24 (2020, 12+6 marks-200 words)

(a) Suppose the utility function for the consumer takes one of the following forms:

U= 50x+20y

U= 20x+50y

U= 80x+40y

    i. The budget of the consumer is ₹10000. The price of good X and good Y are ₹50 and ₹20 per unit respectively. Determine the possibility of determination of the equilibrium basket in each case using diagram and comment on the nature of the solutions.

(b) Outline how the production possibility frontier can be used to explain the concept of opportunity cost. Why is the production possibility frontier concave to the origin?

Q25 (2019, 5+5 marks-150 words)

In a two-commodity framework, the marginal rate of substitution is everywhere equal to 2. The prices of the two goods are equal. Draw a diagram to identify the utility maximizing equilibrium.

Q26 The cost minimising demand for labour is

$$L = \frac{Q}{50}\sqrt{\frac{r}{w}}$$

    i. And that for capital is

$$K = \frac{Q}{50}\sqrt{\frac{w}{r}}$$

    ii. where, w and r denote wage and price of capital respectively. Find the production function.

Q27 (2019, 6+6+6 marks-200 words)

    a. An individual has the utility function U = XY and the budget equation is 10X + 10Y = 1000. Find the maximum utility that she can attain

    b. If the price of good X decreases to 5, find the compensating variation in income in order to maintain her level of satisfaction in part (a).

    c. An individual buys two goods X and Y at prices PX and PY. Check whether her behaviour satisfies the weak axiom of revealed preference, given the following information:

        i. When (PX, PY) = (1,2), (X, Y) = (1,2)

        ii. When (PX, PY) = (2,1), (X, Y) = (2,1)

Q28 A firm with market power faces the demand curve given by P = 100 – 3Q + 4√A, where P, Q and A denote price, quantity and expenditure on advertising respectively. The total cost is given as C = $4Q^2$ + 10Q + A. Find the firm's profit maximising price. (2019, 8 marks-120 words)

Q29 Write down the Slutsky equation in elasticity form and prove that the ordinary demand curve will have greater demand elasticity than the compensated demand curve for a normal commodity. How does your result change if the commodity becomes inferior? (2019, 10 marks-150 words)

Q30 (2019, 7+8 marks-200 words)

The demand function Q1 = 50 – p1 intersects another linear demand function Q2 at p = 10. The elasticity of demand for Q2 is six times larger than that of Q1 at that point. Find the demand function for Q2.

Q31 For monopolist, the demand law is p = $(6 – X)^2$ and the marginal cost is 14 + X. Find consumer's surplus.

Q32 Explain with a diagram why the compensated demand curve is vertical if the consumer's utility function is of the form: (2018, 5 marks-100 words)

    i. v (x,y) = min[x,y]

Q33 (2018, 18 marks-200 words)

    a. A price taking consumer consumes two goods X and Y. Let X and Y denote the quantities of goods X and Y respectively, and let Px and Py with the respective prices of the two goods. Assume that: the consumer's budget is given by M, ∞ > M > 0 Px and Py are finite and positive

Q34 Let the consumer's utility function be given by

    a. U(x, y) = min[x, y]

   b. Define indirect utility function and derive the consumer's Indirect Utility Function.

Q35 Suppose instead that is Utility function is given by
   a. U(x, y) = xy
   b. Define expenditure function and derive the consumers compensated demand for good x using his expenditure function.

Q36 (2018, 3+5+10 marks, 200 words)

Consider a one shot simultaneous move game with two players, player 1 and player 2. Let si, i = 1, 2 designate a pure strategy of player i. Let si ≠ 0 be the pure strategy set for player i, and πi (s1, s2) be the pay-off function for player i, i = 1,2.

Q37 Define Nash equilibrium in pure Strategies for this game.
Q38 Consider the following game:

		Player 2	
		s_2^1	s_2^2
Player	s_1^1	10, 10	0, 12
1	s_1^2	12, 0	3, 3

   a. Show that the unique pure strategy Nash equilibrium is not Pareto optimal.

Q39 Consider two firms – Firm 1 and Firm 2 – producing a homogenous good Q. The output of the two firms is given by q1 and q2 respectively. The market inverse demand curve is given by P = A – bq, where A > 0, P is the price of the good and q = q1 + q2. Suppose that there is no fixed cost and the average cost for each firm is c, ∞ > c > 0, Find the unique pure strategy Nash equilibrium of this game.

Q40 Consider the utility function U = $x^\alpha y^\beta$, α > 0, β > 0

   a. which is to be maximised subject to the budget constraint m = pxx + pyy, where m = income (nominal) and px and py are the prices respectively per unit of the goods X and Y.
   b. Derive the demand function for X and Y. Show that these demand functions are homogenous of degree zero in prices and income. (2018, 6 marks, 75 words)

Q41 Why do we need the constancy assumption of marginal utility of money in Cardinal utility analysis? Justify your answer. (2017, 5 marks-100 words)
Q42 Define the method of compensating variation of income and the method of cost difference. Why is the latter method superior to the former one? (2017, 5 marks-100 words)

Q43 How can you measure the price elasticity of demand at any point on a straight line demand curve? (2017, 9 marks-100 words)

Q44 Compare between price elasticity at a given price and also at a given quantity for a set of parallel demand functions. (2017, 9 marks-100 words)

Q45 (2017, 8+10+7 marks, 300 words)

Let the demand function for a good be

   i. $Q = Ap^{\alpha}y^{\beta}$ where q = the quantity demanded, p = the price per unit and y = the income. What do the parameters, α and β imply and what is the sum of α and β? Interpret your result.

Q46 Consider the utility function $u = \log x_1 + x_2$ which is to be maximized subject to the budget constraint $m = p_1 x_1 + p_2 x_2$, where p1 and p2 are the prices per unit of the goods x1 and x2 respectively, and m is the income of the consumer. Derive the demand for x1 and x2 and interpret your results.

Q47 Given the demand function and total cost function of a perfectly competitive firm as $p = 32 - X$, $c = X^2 + 8X + 4$, p being price, c being cost and X = output. Find out the output, price, profit and total revenue corresponding to maximization of total profit.

Q48 Define the substitution effect. Separate income effect from substitution effect for a fall in the price of a Giffen type good using a suitable diagram. (2016, 5 marks-100 words)

Q49 Show that if the consumer is free from money illusion, the demand function is homogenous of degree zero. (2016, 5 marks-100 words)

Q50 Derive the demand functions from the utility function $U = f(q_1, q_2, \ldots q_n)$ subject to budget constraint $y = p_1 q_1 + p_2 q_2 + \ldots + p_n q_n$ and if the demand function for a commodity i (i = 1,2, …,n) is homogenous of degree zero in prices and income, then show that the sum of own and cross price elasticities of demand for the commodity equals its income elasticity of demand with negative sign. (2016, 15 marks-200 words)

Q51 (2016, 5+5+5+5 marks-300 words)

Distinguish between a cooperative and a non cooperative game.

Q52 In a non Cooperative game, find:
   a. Saddle point in a pure strategy game
   b. Maximum expected payoff in a mixed strategy game
   c. Solution of a sequential game in an 'extensive form'

Q53 Explain the situation of market-equilibrium when; (2016, 10+10 marks-300 words)
   a. supply and demand are not equal at a non negative price-quantity combination.
   b. supply and demand are equal at more than one non-negative price-quantity combination.

Q54 The demand function Q1 = 50 − P1 intersects another demand function Q2 at price P = 10. The elasticity of demand for Q2 is six times larger than that of Q1 at that point. Find out the demand function for Q2. (2015, 5 marks-75 words)

Q55 Suppose the government as a monopolist firm produces electricity and sells it to people at price per unit 'p'. The demand function for the electricity, of the people is $q = \alpha p^{-\beta}$. If the elasticity of demand for electricity in absolute sense is found to be 0.894, should the Government increase the price per unit to increase the revenue? Justify your answer. (2015, 5 marks-75 words)

Q56 Define consumer's and producer's surplus. Given the demand function $p = 113 − q^2$ and the supply function $p = (q + 2)^2$ under perfect competition, find out the consumers' surplus and producers' surplus. (2015, 5 marks-75 words)

Q57 Elucidate the statement that no economic rent is earned when the supply of a factor is perfectly elastic. (2015, 5 marks-75 words)

Q58 Consider the utility function as $U = \sqrt{q_1 q_2}$, where q1 and q2 are two commodities on which the consumer spends his entire income of the month. Let the price per unit of q1 and q2 be Rs. 40 and Rs. 16 respectively and the monthly income of the consumer be Rs. 4000. Find out the optimal quantities of q1 and q2. (2015, 15 marks-200 words)

Q59 Derive the consumption possibility locus. (2015, 9 marks-100 words)

Q60 Is the following statement true or false? Explain. (2014, 5 marks, 100 words)

   i. "If a consumer's utility function is of the form = $x_1^{1/3} x_2^{1/3}$, she faces prices p1 and p2 and her income is I, then her indirect utility function is V = I^3/ (3p1p2)."

Q61 Define complement and substitutes. In the two commodity case, can the commodities be complements? Explain. Is your answer valid in the case of gross substitutes and complements? Explain. (2014, 5 marks-100 words)

Q62 Other things equal, what happens to consumer surplus if the price of a good falls? Why? Illustrate using a demand curve. (2014, 5 marks-100 words)

Q63 What is Nash equilibrium? Do all games have Nash equilibrium? Can a game have more than one equilibrium? (2014, 5 marks-100 words)

Q64 Hrishita likes sandwiches (S) and coffee (C). Her indifference curves are bowed in toward the origin and do not intersect the axes. The price of a sandwich is Rs. 5 and the price of a cup of coffee is Rs. 3. She is spending all her income at the basket she is currently consuming, and her marginal rate of substitution of sandwiches for coffee is 2. Is she at an optimum?

   a. If so, show why. If not, should she buy fewer sandwiches and more coffee, or the reverse? Argue in favour of your opinion. (2014, 15 marks-200 words)

Q65 The demand for good X is estimated to be Q = 250,000 − 500P − 1.5M − 240 PR is the price of a related good Y. The values of P, M and PR are expected to be Rs. 200, Rs. 60,000 and Rs. 100 respectively. (2014, 15 marks-200 words)

    a. Calculate the price elasticity of demand, income elasticity of demand and cross price elasticity.

    b. Is the demand for X elastic, inelastic or unit-elastic? How would a small increase in P affect total revenue?

    c. Is the good X normal or inferior? Are the goods X and Y substitutes or complements?

Q66 Consider a two-person, two-commodity, pure-exchange, competitive economy. The consumers' utility functions are U1 = q11q12 + 12q11 + 3q12 and U2 = q21q22 + 8q21 + 9q22 respectively (where qij denotes the consumption of commodity Qj by consumer i, with i = 1, 2 and j = 1, 2). Consumer 1 has initial endowments of 8 and 30 units of Q1 and Q2 respectively; consumer 2 has 10 units of each commodity. Determine the excess demand function for the two consumers. Determine an equilibrium price ratio for this economy. (2014, 25 marks-300 words)

Q67 If the law of demand is x = ae^{-bp}, where p is price and x is quantity demanded. Express price elasticity of demand, total revenue and marginal revenue as functions of x. (2013, 5 marks-50 words)

Q68 What is adverse selection in insurance markets? How the problem can be solved? (2013, 5 marks-50 words)

Q69 Given utility function U = q1q2 and budget constraint Y = p1q1 + p2q2, derive the indirect utility function. (2013, 5 marks-50 words)

Q70 Cardinal utility approach and Ordinal utility approach to demand suggest same decision rule for the optimising consumer (which one?). Yet, latter approach is preferred over former. Why? (2013, 15 marks-150 words)

Q71 Describe Von Neuman and Morgenstern utility index. Is this index unique? Explain. (2013, 15 marks-150 words)

Q72 Define elasticity of goods substitution and distinguish it from cross-price elasticity of demand. Which one is a better measure of substitution and why? (2013, 15 marks-150 words)

Q73 For statistically estimated demand function for the commodity X,

    a. where x, y, z are goods, A stands for advertisement outlay, B for budget of

$$D_x = \frac{1547 \, P_x^{0.2} \, P_y^{0.3} \, A^{0.4}}{P_z^{0.5} \, B^{0.3}}$$

the consumer and Px, Py, Pz are prices of goods x, y, z respectively).

    b. Answer the following: (2013, 10+10+10 marks-300 words)

How are x, y and z related?

Whether x is an inferior, normal or Giffen type good?

What would be the percentage change in demand for x (i.e. Dx) and in which direction if advertisement outlay increases by 50 percent?

Q74 Discuss Nash equilibrium for non-collusive firms. (2012, 5 marks-50 words)

Q75 Suppose you have a demand function for milk of the form $x1 = 100 + \frac{m}{100p1}$ and your weekly income (m) is Rs. 12000 and the price of milk (p1) is Rs. 20 per litre. Now suppose the price of milk falls from Rs. 20 to Rs. 15 per litre, then what will be the substitution effect? (2012, 5 marks-50 words)

Q76 Show graphically on your answer-book that if a consumer buys only two goods, both cannot be inferior at the same time. (2012, 5 marks-50 words)

Q77 Separate income effect from substitution effect for a price change using (i) Hicks' method (ii) Slutsky's method. Hence explain the difference between the two compensated demand curves. (2012, 12 marks-150 words)

Q78 Compare different methods of measuring risk aversion. (2012, 12 marks-150 words)

Q79 Distinguish between compensating variation and equivalent variation of the budget line. How can you measure consumer's surplus using these two concepts? (2012, 12 marks-150 words)

Q80 Why is the convexity assumption so important in indifference curve analysis? In particular, would a consumer equilibirum exist, if indifference curves were concave? Explain. (2012, 12 marks-150 words)

Q81 Explain the relationship between slope and elasticity of a straight line demand curve. (2012, 12 marks-150 words)

Q82 What is 'Prisoner's Dilemma'? Discuss its importance and implications in Game theory. (2012, 12 marks-150 words)

Q83 Define the compensated demand curve. How does it differ from the uncompensated demand curve? (2011, 5 marks-50 words)

Q84 What do you mean by corner solution? In the case of perfect complementary goods, where do you get the corner solution? (2011, 5 marks-50 words)

Q85 Define cross elasticity of demand. Based on such definition, how can you distinguish between substitute goods and complementary goods? (2011, 5 marks-50 words)

Q86 Consider a linear demand function q = a – bp, where q = quantity demanded, p = price per unit and a, b > 0. Find out average and the marginal revenue and draw the diagram. (2011, 5 marks-50 words)

Q87 In game theory, comment on the terms 'maxi-min' and 'mini-max'. (2011, 5 marks-50 words)

Q88 Define income effect, substitution effect and price effect of any change in price. Show that the price effect can be decomposed into the income effect and the substitution effect. (2011, 2+2+2+9 marks-150 words)

Q89 The demand function Q1 = 50 – P1 intersects another linear demand function Q2 at P = 10. The elasticity of demand for Q2 is six times larger than that of Q1 at that point. Find the demand function for Q2. (2011, 15 marks-150 words)

Q90 Consider the utility function as u = √q₁q₂, where q1 and q2 are two commodities on which the consumer spends his monthly income Rs. 5000. If the price per unit of

q1 and q2 be Rs. 50 and Rs. 20 respectively, find out the optimal quantities of q1 and q2. (2011, 15 marks-150 words)

Q91 If D = 250 – 50p and S = 25p + 25 are the demand and supply functions respectively, calculate the equilibrium price and the quantity. Hence calculate both consumer's and producer's surpluses under equilibrium. (2011, 5+5+5 marks-150 words)

Q92 Define consumer's surplus. Derive an expression for it using integral calculus. (2010, 7 marks-50 words)

Q93 Derive consumer's expenditure function by minimising total expenditure; y =p1q1 + p2q2 subject to utility constraint u = q1q2. (2010, 15 marks-150 words)

Q94 Draw consumer's indifference curve from Revealed Preference Theory. (2010, 15 marks-150 words)

Q95 Separate income effect from substitution effect of a price change for a Giffin type good. Use suitable diagram. (2010, 15 marks-150 words)

Theory of Production

Factors of production and production function.
Forms of Production Functions: Cobb Douglas, CES and Fixed coefficient type, Translog production function
Laws of return,
Returns to scale and Return to factors of production.
Duality and cost function,
Measures of productive efficiency of firms,
Technical and allocative efficiency
Partial Equilibrium versus General Equilibrium approach Equilibrium of the firm and industry

Q1

a. Specify the Cobb-Douglas production function taking two inputs in producing one output. Interpret the parameters used in this function. (2025, 5 mark-100 words)

b. Write down the economic meaning of a first-order derivative of a short-run production function. Interpret the situation where one second-order derivative of that function is zero. (2025, 5 mark- 100 words)

Q2

a. How do you construct the long-run average cost curve from short-run average cost curves? Explain why an average cost curve is U-shaped under variable returns to scale. (2025, 8 mark- 150 words)

b. Derive the necessary and sufficient conditions for a firm's equilibrium in producing a good by using two inputs at a given cost. Illustrate your answer graphically. (2025, 10 mark- 150 words)

Q3 If a production function is homogeneous of degree 1, following CRS, show that the marginal productivity and average productivity functions are independent of the absolute amounts of the inputs, but depend upon the input ratios. (2024, 5 Marks)

Q4 Show that the production function $Q = \log(L^{\beta_1} K^{\beta_2})$ is concave for all $B_1, B_2 > 0$. (2024, 5 Marks)

Q5 (a) Write down the major characteristics of a translog production function. In what ways is this production function different from Cobb-Douglas production function? (2024, 10 Marks)

(b) Suppose that the production function of a firm is given as $QAL^{1/3} K^{2/3}$

    (i)   Find out the returns to scale of this production function.

    (ii)   Is the production process labour-intensive?

    (iii)   If the prices of L and K are Rs.20 and Rs.100 respectively and the firm incurs total cost Rs.1,050, what will be the optimal combination of L and K? (2024, 8 Marks)

Q6 (i) Write down the behavioural assumptions on Walrasian and Marshallian stability analysis.

(ii) Derive the conditions for Walrasian and Marshallian stability.

(iii) Show that these two conditions cannot be fulfilled together when the demand and supply curve both have negative slope. (2024, 3+4+3 = 10 Marks)

Q7 Show that the long-run average cost curve is an envelope of the short-run average cost curves. What will be the shape of the long-run average cost curve under increasing returns to scale? Explain your answer. (2024, 15 Marks)

Q8 Calculate the elasticity of substitution for the following production function:

    (iv) $Q = \left(L^{\rho} + K^{\rho}\right)^{\frac{\gamma}{\rho}}$ (2023, 5 marks)

Q9 (2023, 5+5 marks)

Distinguish between concavity and quasi-concavity.

What is the implication of the point of inflexion in a short-run production function?

Q10 Given a two-input Cobb-Douglas Production function, derive the short-run supply function of a competitive firm. (2023, 15 marks)

Q11 (2023, 8+10 marks)

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

(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.

Q12 (2022, 6+8+5+6 marks-300 words)

    A) Show that MC cuts ATC at its lowest point

    B) The short-run cost function of a competitive firm is given by:

$c = 0{\cdot}1x^3 - 2x^2 + 15x + 10$

where notations have their usual meanings.

Derive the short-run supply function of the firm

    C) Show that the elasticity of demand is the same at all points on the demand curve:

$x = ap^{-\alpha}$

a, α: parameters

x: quantity demand

p: price

D.) Consider the demand function of two goods, x_1 and x_2 respectively:

    $x_1 = p_1^{-0.7}\, p_2^{0.2}$

    and $x_2 = p_1^{0.6}\, p_2^{-0.4}$

    where p_1 and p_2 are prices of x_1 and x_2 respectively.

    Determine whether the commodities are complementary or competitive.

Q13 Distinguish between Partial Equilibrium and General Equilibrium Approaches. (2022, 5 marks-100 words)

Q14 (2022, 8+10 marks-200 words)

    D) Consider the production function:

    $X = A\, L^{\alpha} K^{\beta}$, A, α, β > 0,

    where notations have their usual meanings.

    A, α, β are parameters.

    How would you restrict the values of α and β so that there occurs constant returns to scale and decreasing returns to scale?

    B) Consider the production function and cost function of a competitive firm respectively:

    $X = A\, L^{\alpha} K^{\beta}$, A, α, β > 0 and C = wL + rK,

    where notations have their usual meanings.

    Derive the supply function of the competitive firm.

Q15 Distinguish between Economies and Diseconomies of scope. How can the degree of Economies of scope be determined? (2021, 5 marks-100 words)

Q16 A) Define cost-output elasticity. Show how can it be used to explain existence or absence of economies of scale in production. (2021, 10+8 marks-200 words)

Verify your answer on the following:

AC=20 and MC=10

AC=MC=15

AC=20 and MC=30

B) Given Total Cost (TC) = a+ bQ+ cQ^2

Show that $MC = AC = b + 2\sqrt{(ac)}$ at $Q = \sqrt{(a/c)}$ where AC is minimum.

Q17 A) Given the production function as: (2021, 5+10+10 marks-300 words)

$$Q = A L^{\alpha} K^{\beta} ; \alpha > 0, \beta > 0, A > 0$$

Find the shape of isoquant from the above function.

B) Define Elasticity of Substitution of factors. What will be the shape of the isoquant when the elasticity of substitution is zero and infinity?

C) Write down the Constant Elasticity of the Substitution (CES) production the function and show that Cobb-Douglas (CD) production function is a special case of CES function.

Q18 Given the production function and cost function as: (2021, 15+10 marks-300 words)

$$Q = 500 L^{1/4} K^{3/4}$$
$$C = wL + rK$$

(I) Derive the demand curve for labour and capital with a view to maximizing the output when the cost is limited to 10,000. Would your answer change if the objective shifts to cost minimization with a desired level of output? Give reasons in support of your answer

(II) Determine the equilibrium levels of employment of the factors in each case given:

W = 10 and r = 75

Q19 (2020, 5 marks-100 words)

Show the conditions for a Cobb Douglas production function under

(v) increasing returns to scale

(vi) constant returns to scale

(vii) diminishing returns to scale

Are the laws of return compatible?

Q20 What is monopoly power? What factors determine the amount of monopoly power? (2020, 5 marks-100 words)

Q21 (2020, 8+3+3+3+4 marks, 200 words)

(viii) Suppose that firms production function is given by cobb Douglas function: $Q = K^{\alpha}L^{\beta}$ where $\alpha, \beta > 0$. The firm can purchase all the K and L it wants in competitive input markets at rental rates of r and w respectively.

(ix) Show that cost minimisation requires $\frac{rK}{\alpha} = \frac{wL}{\beta}$. What is the slope of the expansion path for this firm?

(x) Assuming cost minimisation show that total cost can be expressed as a function of Q, r and w of the form TC = $BQ^{\frac{1}{\alpha+\beta}} \cdot w^{\frac{\beta}{\alpha+\beta}} \cdot r^{\frac{\alpha}{\alpha+\beta}}$

   Where B is constant depending on α and β

(xi) Show that if $\alpha + \beta = 1$, total cost TC is proportional to Q.

(xii) Calculate the firms marginal cost curve.

Q22 (2019, 12+6 marks-200 words))

Show that q = $\gamma[\delta L^{-\alpha} + (1 - \delta)K^{-\alpha}]^{-1/\alpha}$ is a production function that represents the average of two inputs L and K for different values of α given that $\gamma > 0$ and $0 < \delta < 1$

Q23 Find the marginal rate of technical substitution for the production function given in part (a).

Q24 Show that the elasticity of substitution is constant in a Cobb-Douglas production function. Find its value and interpret. (2018, 5 marks-100 words)

Q25 (2018, 6+6+6 marks-200 words))

(xiii) Show that even if the production function is not linear homogenous, the expansion path can be a straight line passing through the origin.

(xiv) Do you think that the Cobb-Douglas production function can analyse both the returns to a factor and returns to scale? Explain logically.

(xv) Show that the concept of marginal product is implicit in the definition of the marginal rate of technical substitution.

Q26 Given the production function of a commodity q = $40L + 3L^2 - \frac{L^3}{3}$, where q = output, L = labour input. Verify that when the average is maximum, it is equal to marginal product. Plot AP and MP on the graph paper. (2018, 4 marks-50 words)

Q27 Distinguish between law of variable proportions and law of returns to scale. Find out the elasticity of substitution in the case of fixed Coefficient type production function. (2017, 5 marks-100 words)

Q28 Find out the cost elasticity of output at the minimum point of the average cost curve in the short run. (2017, 5 marks-100 words)

Q29 (2017, 12+6, 200 words)

Write down the form of CES production function and interpret its parameters. Show that the Cobb-Doughlas production function is a special case of CES function.

Q30 Find out the elasticity of substitution of the CES production function.

Q31 For the Cobb-Doughlas Production Function $Q = A L^{\alpha} K^{\beta}$ (where symbols have usual meaning), calculate the input elasticities of output and also derive an expression for the expansion path of the firm. (2016, 5 marks-100 words)

Q32 Show that, "If the second order condition is satisfied, every point of tangency between an isoquant and an isocost line is the solution of both a constrained maximum and a constrained minimum." (2016, 15 marks-200 words)

Q33 Consider an industry represented by two competitive firms with the total costfunctions as follows: (2016, 8 marks-100 words)

(xvi) $C_1 = a_1 q_1^2 + b q_1 q$

(xvii) $C_2 = a_2 q_2^2 + b q_2 q$

(xviii) where $q1 + q2 = q$ and $a1 > 0$, $a2 > 0$

(xix) Derive the aggregate supply function of the industry when there are (i) external economies ($b < 0$), and (ii) external diseconomies ($b > 0$).

Q34 Show that in a translog production function, elasticity of substitution is not constant. (2015, 5 marks-75 words)

Q35 Define Linear homogenous production function and give an example. Show that in the case of the linear homogenous production function the expansion path must be a straight line passing through the origin. (2015, 6+9 marks-200 words)

Q36 How can you graphically derive the long run marginal cost curve from the short run marginal cost curves? (2015, 15 marks-200 words)

Q37 What is productivity principle? How can this be achieved through market mechanism? (2014, 5 marks-100 words)

Q38 Consider the production function $Q = (K^{0.5} + L^{0.5})^2$

(xx) (2014, 25 marks-300 words)

(a) What is the name of this type of production function?

(b) What is the elasticity of substitution for this production function? (c) Does the production function exhibit increasing, decreasing or constant returns to scale?

(c) Suppose that the production function took the form $Q = (100 + K^{0.5} + L^{0.5})^2$. Does this production function exhibit increasing, decreasing or constant returns to scale?

Q39 Graphically explain the expansion path of a firm taking labour and capital as inputs. (2013, 5 marks-50 words)

Q40 Show that the Cobb-Douglas production function $Q = AL^{\alpha}K^{1-\alpha}$, where symbols have usual meaning, exhibits constant returns to scale but diminishing returns to a factor of production. (2013, 5 marks-50 words)

Q41 "In the long run competitive equilibrium rewarding each input according to its marginal physical product precisely exhausts the total physical product." Critically examine the above statement. (2013, 15 marks-150 words)

Q42 What are ridge lines? What are their implications in the theory of the firm? (2012, 12 marks-150 words)

Q43 Drive an expression for elasticity of factor substitution for CES production function and use it to establish that Cobb-Douglas production function is a special case of CES production function. (2012, 12 marks-150 words)

Q44 Given that the average revenue curve is a rectangular hyperbola, what will be the shape of the marginal revenue curve? Comment briefly. (2011, 5 marks-50 words)

Q45 Consider a Cobb-Douglas production function $Y = AK^{\alpha}L^{\beta}$ where K and L are respectively the capital and labour to produce output Y. Show that if all the factors are paid according to their marginal products, the total product will be exhausted if $\alpha + \beta = 1$. (2011, 5 marks-150 words)

Q46 Consider a linear demand function $q = a - bp$, where q = quantity demanded, p = price per unit and a, b > 0. Find out the average and marginal revenue and draw the diagram. (2011, 5 marks-150 words)

Q47 Establish mathematically the relationship between average cost (AC) and marginal cost (MC). (2011, 5 marks-150 words)

Q48 Define the linear homogenous production function with the help of CES production function. Also establish that CES production function is strictly quasi-concave for positive L and K, where L and K are labour and capital respectively. (2011, 10 + 5 marks-150 words)

Q49 Why is short run average cost curve U-shaped? Show that marginal cost curve intersects the average cost curve at the latter's minimum point. (2010, 7 marks-50 words)

Q50 What is elasticity of factor substitution? Give various forms of production function based on this concept. (2010, 15 marks-150 words)

Q51 Define production function. The production function for a product is given by Q = 100 KL. If the price of capital (K) is $120 per day and that of labour (L) is $30 per day, what is the minimum cost of producing 400 units of output? (2010, 30 marks-500 words)

Theory of Value

Pricing under different market structures,
Public sector pricing,
Marginal cost pricing,
Peak load pricing,
Cross-subsidy free pricing and average cost pricing
Marshallian and Walrasian stability analysis
Pricing with incomplete information and moral hazard problems

Q1. Comment on the role of conjectural variations in the determination of oligopoly equilibrium. (2025, 5 mark- 100 words)

Q2.
   a. Explain the concepts of horizontal, vertical, and conglomerate merger of firms with suitable examples. Discuss one objective briefly in each case. (2025, 6 mark- 100 words)
   b. "Asymmetric information does not cause an efficiency problem, but it does have equity implications." Discuss critically. (2025, 6 mark- 100 words)

Q3. Explain the meaning of Nash equilibrium in the context of firms competing with respect to price. Why is the equilibrium stable? Why can the firms not raise prices to the level that maximizes joint profits? (2025, 3+3+4=10 mark- 150 words)

Q4.
   a. "A monopolist cannot increase price level indefinitely." Explain. What would be the price if the government wants to set a price ceiling that maximizes the monopolist's output? (2025, 8 mark- 150 words)
   b. Explain the kinked demand curve model. How is the problem of prisoner's dilemma associated with the duopoly model? (2025, 8 mark- 150 words)

Q5.
   a. Explain graphically why there is no supply curve in a monopoly market. (2025, 7 mark- 120 words)
   b. What is market signaling? Distinguish between separating equilibrium and pooling equilibrium in this context. (2025, 8 mark- 150 words)
   c. Explain the pricing policy of public sector enterprises by using long-run marginal cost-based price. How is it different from public utility and rate of return approaches? (2025, 10 mark- 150 words)

Q6. Explain the 'peak load pricing' with reference to power sector. In what way will it increase economic efficiency? (2024, 5 Marks)

Q7. Show that a monopolist can charge a higher price in a market with less elastic demand. (2023, 4 marks)

Q8. (2023, 7+3 marks)

    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.

Q9. (2023, 10+8 marks)

    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.

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

$$p_k = 150 - 2q_k - 0.2 \sum_{i=1}^{11} q_i$$

        i. $i \neq k$

      2. $c_k = 0.5 q - 20q + 270q_k$

    $k = 1,2...11$

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

Q10. Discuss the Lerner Index of monopoly power (2022, 5 marks-100 words)

Q11. Illustrate graphically the effects of advertising on price and output in monopolistic competition (2022, 5 marks-100 words)

Q12. (2022, 8+4+6 marks-200 words)

A) Show that a monopolist produces output in the elastic range of demand.

B) The demand and the total cost function of a firm respectively are given by: $p = 132 - 8x$,

$c = x^3 - 14x^2 + 69x + 128$, where notations have usual meanings.

        I. Show that a monopolist produces output in the elastic range of demand.

        II. Calculate the efficiency loss of monopoly.

Q13. (2022, 6+12 marks-200 words)

A) Explain the concept of stability and its different types.

B) Explain the stability conditions in a single market both in the Walrasianprocess and Marshallian process.

Q14. For a monopsonist, what is the relationship between the supply of an input and the marginal expenditure on it? (2021, 5 marks-100 words)

Q15. Explain divergence between private and social costs and mislocation of resources in a perfectly competitive system. (2021, 5 marks-100 words)

Q16. (2021, 10+8 marks-200 words)

A) What do the Cournot and Bertrand models have in common? What are the differences
between these two models?

B) Why is it possible for a monopolist to earn supernormal profit in the long-run?

Q17. (2021, 15+10 marks-300 words)

A) Discuss the notion that the bargaining solution' to environmental problems results in the
same outcome whether the polluter compensates the sufferers or the sufferers pay the
polluter to reduce their levels of emissions.

B) Why is there a social cost to monopsony power ? If the gains to buyer from monopsony
power could be redistributed to sellers, would the social cost of monopsony power be
eliminated? Explain

Q13. What is meant by deadweight loss? Why does a price ceiling usually result in
deadweight loss? (2020, 5 marks-100 words)

Q14. (2020, 9+9 marks-200 words)

a. Distinguish between economic rent and transfer earnings. Can economic rent exist
in long run? Justify your answer.
b. Explain graphically the role of Elasticity of supply of a factor determining
the economic rent.

Q15. (2020, 15+10 marks-300 words)

a. the kinked demand curve describes price rigidity. Explain how the model works. Why
does price rigidity occur in oligopolistic market?
b. state and prove product exhaustion theorem. How does is differ from Clark Wick
steed – Walras theorem?

Q16. Explain the principle of average cost pricing in the context of a natural
monopoly. (2019, 5 marks-100 words)

Q17. Find the monopolist's demand function for labour when the labour market is perfectly
competitive. (2019, 5 marks-100 words)

Q18. Suppose that the demand and supply functions in a market are given as QD= 100 – P
and QS = 200 – 5p

Analyse whether the equilibrium is Walrasian stable or Marshallian stable. (2019, 10 marks-150 words)

Q19 A price discriminating monopolist produces its output with a total cost function given by TC = 5Q + 20 and sells its output in two markets which are completely separated from each other. The demand curves of the two markets are Q1 = 55 - P1 and Q2 = 70 - 2P2

Given this information, answer the following: (2019, 15 marks, 200 words)

(i)   What quantity should the monopolist sell in each market?

(ii)   What price should be charged in each market?

(iii)   Explain the result in terms of price elasticity of demand in the two markets

Q20. Pharmacies often give senior citizens discount on medicines. Explain why this may be profit maximizing behaviour as opposed to pure generosity on the part of the pharmacy owners. (2018, 5 marks-100 words)

Q21. Suppose that the government as a Monopoly form produces electricity and sells it to the people at a price p per unit. The demand (q) function for electricity is q = ap. If the price elasticity of demand for electricity in an absolute sense is found to be 0.894, should the government reduce the price per unit to increase the revenue? Justify your answer. (2018, 5 marks-100 words)

Q22. (2018, 12+6 marks-200 words)

a) How is the Monopoly power measured? State Lerner's measure of degree of monopoly power. Show that the degree of monopoly power is the inverse of the price elasticity of demand.

b) A Monopoly firm's demand curve is given by q = A/P, where q is the quantity demanded, P is the price of the good, and A is a positive constant. There are no fixed costs. The average cost curve is given by C(q) =cq, where ∞ > c > 0. Using a diagram to show that this form does not have a profit maximizing output.

Q23. Define peak load pricing. How does it differ from third degree price discrimination? Analyse graphically. (2017, 5 marks-100 words)

Q24. Consider the equilibrium of a firm under perfect competition. Find out the condition for normal profit, or supernormal profit or loss (whichever is applicable for the firm) without using the average cost curve. Explain only diagrammatically. (2017, 5 marks-100 words)

Q25. What do you mean by price discrimination? Under what circumstances is price discrimination profitable? Trace out the equilibrium situation under price discrimination. (2017, 18 marks-200 words)

Q26. If a single buyer focuses on a single seller, what are the outcomes likely to appear? Do you think that the exploitation of labour will emerge? Justify in favour of your arguments. Find out the equilibrium condition of a firm in the presence of perfect competition in both the product and input market. (2017, 18 marks-200 words)

Q27. Derive the long run supply function under perfect competition when there are external economies or external diseconomies. (2016, 7 marks-100 words)

Q28. Consider a duopoly with product differentiation in which the demand and cost functions are : (2016, 15 marks-200 words)
q1 = 88 – 4p1 + 2p2
C1 = 10q1
and q2 = 56 + 2p1 – 4p2
C2 = 8q2 for firms I and II respectively.
Derive the price reaction functions for each firm on the assumption that each maximizes its profits with respect to its own price. Determine the equilibrium values of price, quantity and profit for each firm.

Q29. What is meant by excess capacity? Why is it bad? Are there any benefits of the excess capacity associated with monopolistic competition? (2015, 6+9 marks-200 words)

Q30. How is the Monopoly power measured? State Lerner's measure of degree of monopoly power. Show that the degree of monopoly power is the inverse of the price elasticity of demand. (2015, 4+5+6 marks-200 words)

Q31. Derive the long-run supply curve in the constant cost industry under perfect competition. Under what conditions can the long run supply curve of a competitive industry slope downward? (2015, 6+9 marks-200 words)

Q32. Consider the competitive market with excise tax such that the supplier receives the price netted of tax. Answer the following questions. (2015, 4+3+4+8+6 marks, 300 words)
   i.   What is the equilibrium price in the presence of tax?
   ii. Under which condition will the price be undefined?
   iii. Show that the market price is totally unaffected in the case of price inelastic supply curve.
   iv. If the tax yield (T) is a fraction (t > 0, which is the rate of tax) of quantity (q), find out the tax yield and the conditions under which tax yield varies directly with the rate of tax (t).
   v.   Find out the value of the rate of tax such that the tax yield is maximum.

Q33. What do you mean by collusive oligopoly? Distinguish between cartel and price leadership with respect to the determination of price and quantity. Write a note on barometric price leadership model. (2015, 5+15+5 marks-300 words)

Q34. What is meant by "internalising" and externality? How can a negative externality be internalized? (2014, 5 marks-100 words)

Q35. List out the sources of monopoly power. (2014, 5 marks-100 words)

Q36. Assume that a monopolist sells a product with the cost function $C = F + 20Q$, where C is total cost, F is a fixed cost, and Q is the level of output. The inverse demand function is $P = 60 – Q$, where P is the price in the market. (i) How much profit does the firm earn when it charges the price that maximises profit? (ii) At what price will the firm earn zero economic profits? (2014, 15marks-200 words)

Q37. There are only two firms in an industry, firm 1 and firm 2. The market demand curve is given by the equation $P = 12 – (q_1 + q_2)$ are the (total) cost functions facing the firms are $C_i = 4q_i$, where i = 1, 2. If firm 1 acts as a leader and firm 2 as a follower, what are the quantities that the two firms will produce in the equilibrium? What profits will they earn? (2014, 15 marks-200 words)

Q38. Consider a manufactured good whose production process generates pollution. The annual demand for the good is given by $Qd = 100 – 3P$. The annual market supply is given by $Qs = P$. In both equations, P is the price in rupees per unit. For every unit of output produced, the industry emits one unit of production. The marginal damage from each unit of pollution is given by 2Q. (2014, 15 marks-150 words)
   c. Find the equilibrium price and quantity in a market with no government intervention.
   d. Find the socially optimal quantity of the good. What is the socially optimal market price?

Q39. What is monopoly power? Give an expression for measuring it. (2013, 5 marks-50 words)

Q40. Why does a perfectly competitive firm keep on producing in the short-run even when it is incurring losses? Explain also when the firm will shut down. Use suitable diagram. (2013, 5 marks-50 words)

Q41. State the causes of market failure. (2013, 5 marks-50 words)

Q42. Consider the following duopoly. Demand is given by P = 10 – Q, where Q = Q1 + Q2. The firm's cost functions are: (2013, 15 + 15 marks, 300 words)

C1(Q1) = 4 + 2Q1 and C2(Q2) = 3 + 3Q2

e. Suppose both firms have entered the industry. What is joint profit maximising level of output? How much will each firm produce? How would your answer change if the firms have not yet entered the industry?

f. What is each firm's equilibrium output and profit if they behave non-co operatively?

Q43. Can the threat of a price war deter entry by potential competitors? What actions might a firm take to make this threat credible? Give example. (2013, 30 marks-300 words)

Q44. Distinguish between Marshallian and Walrasian stability analysis. (2012, 5 marks-50 words)

Q45. Explain dead-weight loss in a monopoly situation. (2012, 5 marks-50 words)

Q46. Highlight the role of market signalling when there is asymmetric information. (2012, 5 marks-50 words)

Q47. Assume that the market demand is P = 100 – 0.5 (X1 + X2) and the two collusive firms have costs given by C1 = 5X1 and C2 = $0.5X_2^2$. Calculate the joint profit of the firms. (2012, 12 marks-150 words)

Q48. "In the long run, a perfectly competitive firm will be earning just normal profit." Discuss. (2012, 12 marks-150 words)

Q49. What is "moral hazard" problem? How does it lead to inefficient allocation of resources? Suggest remedial measures. (2012, 20 marks-250 words)

Q50. (2012, 20 marks-250 words)

In a discriminating monopoly, the total demand function is P = 100 – 2X and demand function of segmented markets are

P1 = 80 – 2.5X1 and

P2 = 180 – 10X2

The cost function is

C = 50 +40 (X1 + X2); where X1 + X2 = X.

Calculate the profit of the monopolist; (i) with discrimination and (ii) without discrimination.

Q51. Suppose that a monopolist faces a demand curve with price elasticity less than one. Should the monopolist adopt the policy of price-increase in order to increase revenue? Justify your answer. (2011, 5 marks-50 words)

Q52. Define and distinguish between the normal profit and the super normal profit under perfect competition. In the short run, find out graphically the amount of profit corresponding to the equilibrium without using the average cost curve. (2011, 5 marks-50 words)

Q53. What do you mean by price discrimination? Under which condition is the price discrimination profitable? Trace out the equilibrium situation under price discrimination. (2011, 4+4+7- 150 words)

Q54. What is meant by excess capacity? Why is it bad? Are there any benefits of excess capacity associated with monopolistic competition? (2011, 3+3+9-150 words)

Q55. Compare long-run equilibrium of the firm under perfect competition with that under monopolistic competition using suitable example. (2010, 7 marks-50 words)

Q56. "Asymmetric or incomplete information leads to market failure". Examine lemons' problem in the above context with the help of pricing of used cars. (2010, 15 marks-150 words)

Q57. What is Peak-load pricing? How is it different from third degree price discrimination? Give diagrams to illustrate your answer. (2010, 30 marks-500 words)

Theory of distribution

Neo classical distribution theories;
Marginal productivity theory of determination of factor prices,
Factor shares and adding up problems
Euler's theorem,
Pricing of factors under imperfect competition,
Monopoly and bilateral monopoly
Macro- distribution theories of Ricardo, Marx, Kaldor, Kalecki

Q1. "Rent is not the income of a particular factor of production but merely an aspect of income of any factor of production." Discuss. (2025, 5 mark- 100 words)

Q2.
a. Why is an input demand called a derived demand? Explain graphically how factor prices are determined when the product market is a monopoly and the factor market is perfectly competitive. (2025, 8 mark- 150 words)
b. Critically examine the Marxian theory of distribution and explain how it differs from Kaldor's theory of distribution. (2025, 10 mark- 150 words)

Q3. Distinguish between Ricardo and Kalecki theories of distribution. (2024, 5 Marks)

Q4. (a) State Euler's theorem. Use this theorem to explain product exhaustion problem. (2024, 8 Marks)

(b) Explain how factor prices are determined under bilateral monopoly. (2024, 10 Marks)

Q5. (a) Show the conditions that ensure efficient distribution of a given combination of products between two consumers. Would the same conditions ensure maximum equity? (2024, 15 Marks)

(b) Compare the social choice theories of Ronald Coase and Amartya Sen. (2024, 10 Marks)

Q1 Compare the views of Marx and Kaldor with reference to the theory of distribution (2023, 8 marks)

Q6. How is inter-temporal pricing a form of price discrimination? Give example. (2021, 5 marks-100 words)

Q7. (2021, 10+8 marks-200 words)

A) State and explain the modern theory of rent. Show how it can be applied to other factors of Production

B) Explain in terms of the marginal productivity theory how a 'monopolist-monopsonist' firm exploits the society

Q8. (2020, 10+10+5 marks-300 words)

a. compare the distribution theory of Marx with that of Ricardo.
b. explain when kaldor's theory of distribution becomes more appropriate.
c. narrate the areas where kaldor's distribution model fails.

Q9. (2019, 9+9 marks, 200 words)

a. Consider a profit-maximizing monopolist who is also a monopsonist and uses a single variable input. Determine the equilibrium price of the input.
b. In the context of part (a), explain the concept of monopsonist exploitation of labour using a suitable diagram.

Q10. Economic rent is not earned when the supply of a factor is perfectly elastic. Elucidate. Use a diagram. (2018, 5 marks-100 words)

Q11. (2018, 6+12 marks, 200 words)

a) How is quasi-rent different from rent?
b) How can you get the wage offer curve and the supply curve of labour? In a flourishing economy there is every possibility that the labour supply curve will be backward bending. Do you agree? Justify your answer.

Q12. (2018, 5+10+10 marks, 300 words)

a. State briefly the assumptions of Kaldor's model of income distribution.
b. What do you mean by 'widow's cruse'? Distinguish between the two phrases 'savings according to the classes of income' and 'savings according to the income of the classes'.
c. Show that in Kaldor's model of income distribution the 'rate of profit' and the 'share of profit' are uniquely determined at equilibrium.

Q13. State, prove and give an economic interpretation of Euler's theorem. Show that at the minimum point of long-run average cost, the total product is exhausted. (2017, 18 marks, 200 words)

Q14. How can I get the wage offer curve and the supply curve of labour? How can you justify the backward bending supply curve of labour? (2011, 8+7, 150 words)

Q15. Define and distinguish between rent and Quasi rent. What do you mean by transfer earnings? Elucidate the statement that no economic rent is earned when the supply of a factor is perfectly elastic. (2011, 4+4+7-150 words)

Welfare Economics

Inter-personal comparison and aggression problem,
Public goods and externalities,
Divergence between social and private welfare,
Compensation principle
Pareto optimality
Social choice and other recent schools, including Coase and Sen

Q1 State and explain the Coase theorem. (2025, 5 marks)

Q2. What do you mean by the free rider problem? Explain how the free rider problem makes the private provision of public goods inefficient. (2025, 6 mark- 100 words)

Q3.
   a. Define externalities in the context of public goods. Explain how externalities affect the efficiency of market outcomes. (2025, 10 mark- 150 words)
   b. Explain the main features of Sen's theory of social choice. How is it relevant in the present situation? (2025, 8 mark- 150 words)

Q4. Define Hicks-Kaldor compensation principle. What are the main criticisms against this compensation principle? (2024, 5 Marks)

Q5. What do you mean by market failure? Explain it with a real world example. (2024, 8 Marks)

Q6.   Explain the following pricing rules of public sector enterprises:
   a. Pricing of public utility services
   b. Marginal cost pricing rule
   c. No-profit no-loss policy
   d. Profit price policy. (2024, 10 Marks)

Q7. In the Edgeworth model, an increase in demand will lead to a rise in price." Justify your answer. (2023, 4 marks)

Q8. How do you derive the aggregate demand for a private good and a public good? (2023, 5 marks)

Q9. (2023, 10+8 marks)
  a) Derive the Pareto Optimality conditions in consumption in a two-commodity framework with two consumers.
  b) Show that Pareto optimality may not ensure equitable distribution.

Q10. (2022, 12+6+7 marks-300 words)
  A) "It is not possible to construct social preferences from individual preferences without violating one or more of the five axioms." Examine the statement given by Arrow.
  B) Consider the economy with two goods and fixed factor supplies. Assume that the social
  welfare function defined in commodity space:
  $w = (x_1 + 2) x_2$
  and that society's implicit production function
  $x_1 + 2x_2 - 1 = 0$
  Find the values of x_1 and x_2 that maximize social welfare.

  C) Explain 'Compensation Principle' and 'Test Criteria' formulated by Hicks-Scitovsky.

Q11. "The social optimal output occurs where Marginal Social Benefits (MSBs) equal Marginal Social Costs (MSCs)." Examine the statement. (2022, 5 marks-100 words)

Q12. Consider an economy consisting of two consumers, one producer, one ordinary good, one public good and one primary factor. Show that Pareto optimality conditions are not valid for the public good. (2022, 18 marks-200 words)

Q13. (2021, 8+10 marks-200 words)
  A) Distinguish between Egalitarian society, Utilitarian society, Market-oriented society and Rawlsian society.
  B) Using Bergson's welfare contours and grand utility possibility frontier, determine the optimal point of social welfare.

Q14. State the fundamental theorems of welfare economics. (2020, 5 marks-100 words)

Q15. Public goods are both non rival and non-exclusive. Explain each of these terms and show clearly how they differ from each other. (2020, 5 marks-100 words)

Q16. (2020, 10+8 marks-200 words)
  a. Why do externalities prevent markets from being efficient? How does Coasetheorem correct an externality?
  b. Using a particular industry, explain what is meant by economies of scale and economies of scope. How do these effect the industry you have identified?

Q17. Discuss social choice theory in economics. Distinguish between the views of Amartya Sen and Kenneth arrow in making choices for social welfare. (2020, 18 marks-200 words)

Q18. Explain the concept of external economies in the context of marginal social benefits and marginal social costs. (2019, 5 marks-100 words)

Q19. Explain the conditions for Pareto optimality in exchange and production in a model where there are two consumers and two goods, each good being produced with labour and capital. (2019, 10 marks-150 words)

Q20. (2019, 5+10+10 marks-300 words)

  a. What are the characteristics of a public good?

  b. The demand for a public good is given as Q = 100 - P1 and Q = 200 - P2 for two individuals 1 and 2. Find the optimal provision of the public good if the marginal cost of producing it is

    i. 240 and
    ii. 50.

    In each case, draw diagrams to explain your answer.

  c. What is the Coase theorem? A factory pollutes a river where fishermen operate. A pollution treatment plant costs Rs. 2 lakhs to install while the damage to fishermen is Rs. 1 lakh if the pollution treatment plant is not installed. Demonstrate the results of the Coase theorem when-

    i. the factory has the right to pollute;
    ii. the fishermen have the right to clean river water.

Q21. In a competitive market, the demand function is given as QD = 24 - P, while the marginal cost of production is MC = 2 + Q. There is a negative externality giving rise to the total externalities cost $C = -2Q + \frac{Q^2}{2}$

Compare the private and social optimum quantity and price. (2019, 8 marks-100 words)

Q22. An economy has 10 slave owners and 500 slaves. Slave owners like having slaves more than not having slaves, and slaves would rather be free than remain as slaves. Explain why the Institution of slavery is Pareto optimal in this case. (2018, 5 marks-100 words)

Q23. Explain the concept of social welfare function. Does perfect competition ensure maximum social welfare? Analyse critically. (2018, 18 marks, 200 words)

Q24. Explain the concept of divergence in the context of social and private welfare. (2017, 5 marks-100 words)

Q25. State and explain the Kaldor-Hicks compensation principle. How does Scitovsky provide an improvement of Kaldor-Hicks compensation principle. (2017, 18 marks-200 words)

Q26. Give the different views of equity and use utility possibility frontier to show that efficiency does not necessarily imply equity. (2016, 5 marks-100 words)

Q27. "Pareto optimal allocation is contingent upon the assumption that there are no external effects on consumption and production." Examine what happens if there are external effects. (2016, 15 marks-200 words)

Q28. State and explain Hicks-Kaldor compensation principle. (2015, 5 marks-75 words)

Q29. Explain the concept of social welfare. Does perfect competition ensure maximum social welfare? (2015, 5 marks-75 words)

Q30. Critically examine Hicks-Kaldor criterion of compensation. Give Scitovsky's improvement over this criterion. (2013, 15 marks-150 words)

Q31. Compare and contrast the the theories of social choice as propounded by Professor A.K Sen and Professor K.J. Arrow. (2012, 20 marks-250 words)

Q32. What is a social welfare function? State the underlying assumption in its formulation. (2010, 7 marks-50 words)

Q33. What is Hicks-Kaldor criteria of compensation? What are its weaknesses? Give Scitovsky's suggestion for improvement. (2010, 15 marks-150 words)

Q34. Distinguish between positive and negative externalities and explain with examples. Why does government provide some goods which are not public goods? (2010, 15 marks-150 words)

Mathematical/Quantitative methods in Economics

Differentiation and Integration and their application in economics
Optimisation techniques,
Sets,
Matrices and their application in economics
Linear algebra and Linear programming in economics,
Input-output model of Leontief

Q1.

    a. Define feasible solution, basic feasible solution, and optimal solution of a linear programming problem. Explain these concepts using a hypothetical constrained minimization problem. (2025, 9 mark- 150 words)

    b. Solve the following constrained profit maximization problem using graphical method: (2025, 9 mark- 150 words)

    Maximize $\pi = 4x_1 + 3x_2$

    subject to

    $x_1 + 2x_2 \leq 8$

    $x_1 \leq 6$

    $x_2 \leq 3$

    $x_1, x_2 \geq 0$

Q2. Define rank of a matrix. Write down the implications of the full rank assumption of a multiple linear regression model. Why is full rank assumption not required for a simple linear regression model? (2025, 2+3+3 mark = 8 marks, 150 words)

Q3. Explain the Leontief input-output matrix. Given a 2×2 matrix with specific coefficients and output, calculate the gross output vector. (2025, 5+5+5=15 marks- 150 words)

Q4. Specify an orthogonal factor model by mentioning the underlying assumptions of the model. (2024, 5 Marks)

Q5. Price index can be defined as a weighted average of price relatives. Find out the formulae for the Laspeyres and Paasche price index by taking appropriate weights. Write down the merits and demerits of these indices. (2024, 8 Marks)

Q6. Show that in finding the AM of 100 readings on temperature, it does not matter whether it is measured in Centigrade or Fahrenheit scale, but it matters in finding the GM. (2024, 10 Marks)

Q7. Consider the following two-sector economy:

Sectors	I	II	Final Consumption
I	100	100	50
II	120	80	80

Calculate the Leontief inverse of this hypothetical two sector economy after formulating the open Leontief model. Interpret the coefficients of this matrix properly. If the final consumption demand changes to 100 units for sector 1. and 50 units for sector II, what would be the new production levels in sector I and sector II? (2024, 8 Marks)

Q8. Formulate the dual form of the following problem relating to production by a rational firm:

Maximize $\pi = p'x$

subject to $Ax \leq b$

and $x \geq 0$

where

π is the total profit

p' is the row vector of order 1x2 of output prices

x is the column vector of order 2x1 of output produced

A is the coefficient matrix of order 2x2

Give economic interpretations of the dual problem. Give a Lagrange's multiplier interpretation to the optimal values of the dual choice variables. (2024, 4+3+3= 10)

Q9. 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

Q10. Specify Leontif closed input-output system. Interpret the conditions for the non-trivial solution of this model. (2023, 10 marks)

Q11. (2023, 8+7 marks)

   i. What are the basic properties of an idempotent matrix? Mention its application in econometrics.

   ii. 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: a particular solution and homogenous solution. Explain the implication of these two solutions.

Q12. (2022, 7+10+8 marks, 300 words)
   A) What is the Leontief inverse matrix? What are the mathematical properties of it?
   B) State and prove graphically the Hawkins-Simon condition in case of 2 x 2 industries in the
   static open input-output model. Give an economic interpretation of it.

   C) Consider the Leontief input coefficient matrix:

$$A = \begin{bmatrix} 0.1 & 0.2 & 0.2 \\ 0.2 & 0.4 & 0.1 \\ 0.3 & 0.1 & 0.6 \end{bmatrix}$$

   I. Test the viability of the system.
   II. Test the properties of Leontief inverse.

Q13. (2021, 8+10 marks-200 words)
   A) Given the technology matrix

$$A = \begin{bmatrix} 0.1 & 0.3 & 0.1 \\ 0 & 0.2 & 0.2 \\ 0 & 0 & 0.3 \end{bmatrix}$$

   And final demands are F_1, F_2 and F_3.
   Find the output levels if $F_1 = 20$, $F_2 = 0$ and $F_3 = 100$

   B) Fit a second degree polynomial to the following data:

Year :	1882	1883	1884	1885	1886	1887	1888	1889	1890
Price Index :	84	82	76	72	69	68	70	72	73

Q14.   A local business firm is planning to advertise a special sale on radio and television. Its weekly advertising budget is 16,000. A radio commercial costs 800 per 30-second slot while a television commercial costs 4,000 per 30-second slot. Radio slots cannot be bought less than 6 in number while TV slots available are at the most 4 per week. Given that a TV slot is 6 times as effective as a radio slot in reaching consumers, how should the firm allocate its advertising budget to attract the largest number of them? How will the optimal solution be affected if the availability of the television slots is no longer constrained? (2021, 10+15 marks-300 words)

      I.   Formulate LPP model

      II.   Solve the above using graphical method

Q15.   (2020, 15+10 marks-300 words)

    a.   An economy produces only coal and steel. The two commodities serve as intermediate inputs in each other's production. 0.4 tonne of steel and 0.7 tonne of coal are needed to produce a tonne of steel. Similarly, 0.1 tonne of steel and 0.6 tonne of coal are required to produce a tonne of coal. No capital inputs are needed. 2 and 5 labour days are required to produce a tonne of coal and steel respectively. If the economy needs 100 tonnes of coal and 50 tonnes of steel,

      i.   Calculate the gross output of the two commodities and the total labor required.

      ii.   Write down technology matrix.

      iii.   Do you think that the system is viable?

      iv.   Determine the equilibrium prices if the wage rate is rs.10 per man day.

    b.   Mohan is paid rs.8 if two coins turn both heads and rs.1 if two coins turn both tails. Ram is paid rs.3 when two coins don't match.

      i.   write down the pay-off matrix of the above problem.

      ii.   whom do you consider in a better situation?

Q16. Suppose that the Leontief input-output coefficient matrix is

$$A = \begin{pmatrix} 0.1 & 0.4 \\ 0.2 & 0.5 \end{pmatrix}$$

and the final demand vector is $\begin{bmatrix} 1 & 1 \end{bmatrix}$ Find the total direct and indirect requirement of the second input to satisfy the final demand. (2019, 5 marks-100 words)

Q17. A firm is producing two goods A and B. It has two factories that jointly produce the two goods in the following quantities (per hour):

	Factory 1	Factory 2

Good A	10	20
Good B	25	25

The firm receives an order for 300 units of A and 500 units of B. The costs of operating the two factories are 10,000 and 8,000 per hour. Formulate the linear programming problem of minimizing the total cost of meeting this order. Also, find the minimum cost. (2019, 10 marks-150 words)

Q18. Consider the optimisation problem: (2018, 5 marks-100 words)

Maximize u(x1,x2)

Subject to M = p1x1 + p2x2

Where, M, p1 and p2 are positive constants.

Write down the Lagrangian for this problem and explain why you need to assume that an interior solution exists before using Lagrangian method to solve the problem.

Q19. Assume that there are three sectors. The input coefficient matrix A and the final demand vector d is given as follows:

$$A = \begin{bmatrix} 0.3 & 0.4 & 0.2 \\ 0.2 & 0 & 0.5 \\ 0.1 & 0.3 & 0.1 \end{bmatrix} \text{ and } d = \begin{bmatrix} 100 \\ 30 \\ 30 \end{bmatrix}$$

Would the amount of the primary input required be consistent with what is available in the economy? (2018, 15 marks-200 words)

Q20. Describe the Leontief static open input-output model along with its assumptions. (2017, 5 marks-75 words)

Q21. Find out the total demand schedule for industries 1,2 and 3 if coefficient matrix A and the final demand vector B are as follows: (2017, 15 marks-200 words)

$$A = \begin{bmatrix} 0.3 & 0.4 & 0.1 \\ 0.5 & 0.2 & 0.6 \\ 0.1 & 0.3 & 0.1 \end{bmatrix} \text{ and } d = \begin{bmatrix} 20 \\ 10 \\ 30 \end{bmatrix}$$

Q22. Distinguish between basic feasible solution, feasible solution and optimal solution of a Linear Programming Problem (LPP). Solve the following LPP graphically: (2016, 20 marks-300 words)

Maximize Y = q1 + 2q2

subject to q1 + 3q2 ≤ 18

q1 + q2 ≤ 8

2q1 + q2 ≤ 14

q1, q2 ≥ 0

Q23. Find out the total demand for industries 1,2 and 3, if the coefficient matrix A and final vector B are given as: (2015, 5 marks-75 words)

$$A = \begin{bmatrix} 0.3 & 0.4 & 0.1 \\ 0.5 & 0.2 & 0.6 \\ 0.1 & 0.3 & 0.1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 20 \\ 10 \\ 30 \end{bmatrix}$$

Q24. Consider the Leontief static input-output model along with its assumptions. How can you confirm that the model is either open or closed? State the fundamental objective of Leontief static open input-output model. (2015, 8 marks, 100 words)

Q25. Distinguish between Differentiation and Integration. Explain their application in economics with suitable examples. (2014, 15 marks-200 words)

Q26. What is optimization problem in economics? How does linear programming technique help in assigning optimal solution in given resource use? Explain. (2014, 25 marks-300 words)

Q27. Explain 'Leontief Inverse' in the input-output model suggested by W.W. Leontief. (2013, 5 marks-50 words)

Q28. Write dual for the following linear programme and solve the obtained dual graphically: (2013, 15 marks-150 words)

Minimise: Z = 3x1 +3x2

   subject to:

$$x1 + 2x2 \geq 1$$
$$2x1 + x2 \geq 1$$
$$x1 \geq 0, x2 \geq 0$$

Q29. What are the basic features and limitations of Leontief's input-output model? (2012, 5 marks-50 words)

Q30. What is the dual problem in Linear programming? Explain its use with suitable examples. (2012, 12 marks-150 words)

Q31. Using graphical approach, solve the following linear programming problem: (2011, 5 marks-150 words)

Minimise: C = 80X + 60Y

   Subject to: 2X + 2Y ≥3

   2X + 0Y ≥ 1

   X, Y ≥ 0

Q32. Four products A, B, C D are to be bought to satisfy minimum requirements of calories and Vitamin (which are 18 and 10 units respectively) at minimum cost.

Formulate linear programming problem using additional information given below: (2010, 15 marks-150 words)

Product type	A	B	C	D
Calorie content	2	0	1	3
Vitamin content	0	3	1	4
Price per unit	5	10	12	15

Q33. Describe Leontief's static input-output model. Calculate outputs of two industries from following input-output table if final use for outputs of the two industries increases to 15 and 20 units, respectively. Given figures are in physical units (2010, 30 marks-500 words)

	Industry I	Industry II	Final use	Total output
Industry I	20	9	11	40
Industry II	12	6	12	30

Statistical and Econometric Methods and Income Distribution

Measures of central tendency and Dispersions,
Correlation and Regression
Time series
Index numbers
Sampling of curves based on various linear and non-linear function Least square methods and other multivariate analysis (only concepts and interpretation of results)
Analysis of Variance,
Factor analysis,
Principle component analysis,
Discriminant analysis
Pareto law of Distribution,
Log normal distribution,
Measurement of income inequality
Lorenz curve and Gini coefficient
Univariate and multivariate regression analysis
Problems and remedies of Heteroscedasticity,
Autocorrelation and Multicollinearity

Q1. Explain why adjusted R-squared is important for testing the goodness of fit of a regression model. (2025, 5 mark- 100 words)

Q2. Explain the concept of eigenvalues and eigenvectors associated with a square symmetric matrix. How are these concepts used in principal component analysis? (2025, 5+5=10 marks- 150 words)

Q3.

    a. Explain the role of random error in an econometric model. Differentiate between error and residual in this context. (2025, 5 mark- 100 words)

b. State the Lorenz dominance principle. How is the Gini Coefficient related to the Lorenz curve? (2025, 5 mark- 100 words)

Q4.

    a. Differentiate between seasonal and cyclical fluctuations. Explain the method of de-seasonalisation. (2025, 3+3+3=9 marks- 150 words)

    b. Describe the basic principles of Ordinary Least Squares (OLS) and Maximum Likelihood Estimation (MLE) in estimating a regression model. (2025, 4+4=8 marks- 150 words)

    c. Explain the concept of heteroscedasticity. What are the remedies? Discuss its relevance for cross-section data. (2025, 3+3+2=8 mark- 150 words)

Q5. Suppose that you have got the following estimated results in estimating a relationship between Y and X in a dynamic framework:

$Y_t = 2.7 + 0.6 x + 0.05 y_{t-1}$

(0.392) (0.004)

$R^2 = 0.989$, DW = 0.06

[The figures in parentheses show standard errors]

In your estimation even R^2 is very high, the results are useless. Explain why this estimation is useless. (2024, 5 Marks)

Q6. "Univariate regression analysis is more meaningful with time series data than with cross-section data." Discuss. (2024, 5 Marks)

Q7.

(a) "Multiple linear regression model can consider the ceteris paribus effect, while simple linear regression model fails to do it." Explain the validity of this statement. (2024, 4 Marks)

    (b) In a two-regressor multiple linear regression model $Y1 = β0 + β1*X1i + β2*X2i + εi$ the estimated coefficients are:

$$\beta_1 = \frac{S_{1y}S_{22} - S_{2y}S_{12}}{S_{11}S_{22} - S_{12}^2}$$

$$\beta_1 = \frac{S_{2y}S_{11} - S_{1y}S_{21}}{S_{11}S_{22} - S_{12}^2}$$

Where,

$$S_{jy} = \sum_i (X_{ij} - \overline{X}_j)(Y_i - \overline{Y})$$

$$S_{jj} = \sum_i (X_{ij} - \overline{X}_j)^2$$

$$S_{jk} = \sum_i (X_{ij} - \overline{X}_j)(X_{ik} - \overline{X}_k)$$

How do you interpret β1 and β2? (2024, 6 Marks)

   (c) Write down the desirable properties of a good index of inequality. Discuss whether Gini index satisfies all the desirable properties. (2024, 8 Marks)

Q8. (a) Suppose that the sample observations on price (X) and supply (Y) of a commodity reveal that Y is increasing faster than X implying the non-linear relationship between X and Y. How do you specify a linear regression model to estimate this supply function? Give reasons. Write down the economic interpretation of the regression coefficient. What are the major components involved in the random error of this regression model? (2024, 15 Marks)

(b) In a linear regression model Y= β0 + β1*X + u the variance of the regression coefficient β1 varies inversely with of X. What are the implications of this result? If the sample mean $\overline{X}$ is zero, show that the cov (β0, β1) = 0, where β0 and β1 are the OLS estimates of βo and β1. (2024, 10 Marks)

Q9. Show that correlation coefficient between two variables X and Y can be interpreted as the proportion of the total variability of Y which is accounted for by its linear regression on X. (2024, 7 Marks.

  Q10. Explain the role of the degrees of freedom in statistical inference(2023, 5 marks-100 words)

  Q11. (2023, 4+4 marks)
    a) In a regression equation of Y on X, the value of X is fixed at 5. What will the regression equation look like?
    b) Why do you prefer coefficient of variation to standard deviation as a measure of dispersion?

  Q12. (a) (2023, 5+3 marks)
    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?

(b) The following estimated equation was obtained by OLS with a sample size of 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 the parentheses indicate standard errors. The explained sum of squares was 112.5 and the residual sum of squares was 19.5.

    i. Calculate the value of R^2 and $\overline{R}^2$

    ii. Test the significance of slope coefficient by using t statistic at 5% level of significance. [Given that $t_{0.95,76}=1.98$]

    iii. Test the overall significance of the model at 5% level of significance [Given that $F_{0.95,76}=1.35$]   (2023, 10 marks)

Q13. (2023, 8+9+8 marks)

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

    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) (3.227)   (-0.033) (-0.142)

R^2 = 0.97, number of observations =16 [Figures in parentheses are t-statistics.

    i. Interpret the estimated coefficients.

    ii. Identify the problem in the estimation.

    iii. How can you improve the estimation?

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

Q14.

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

(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.

Commodities	2019 P	2019 Q	2022 P	2022 Q
A	4	10	5	9
B	5	8	3	6
C	2	6	2	4
D	3	9	1	7
E	5	5	4	5

(c) Interpret the coefficients from the following estimated equations:

$$\hat{\ln Y} = \hat{\alpha} + \hat{\beta}_1 \ln X_1 + \hat{\beta}_2 \ln X_2$$
$$\hat{\ln Y} = \hat{a} + \hat{b}_1 X_1 + \hat{b}_2 X_2$$

Q15. Show that TSS = ESS + RSS (2022, 5 marks-100 words)

Q16. (2022, 10+8 marks-200 words)

Consider the 2-variable linear regression model:

$Y_i = \alpha + \beta X_i + U_i$, i = 1, 2,...,n

where notations have their usual meanings.

I. Estimate the α and β by the OLS method. Also estimate the standard errors of these estimates.

II. Describe the testing procedure of β and estimate the 95% confidence interval of β.

Q17. (2022, 6+4+4+4 marks, 200 words)

A) Consider the 3-variable linear regression model in deviation form:

$y_i = \beta_2 x_{2i} + \beta_3 x_{3i} + u_i$, i = 1, 2, ..., n

u_i: spherical disturbance term

Would you estimate the parameters β_2 and β_3?

B) Consider the following data:

$\Sigma X = 20$, $\Sigma Y = 40$, $\Sigma (X - \bar{X})^2 = 40$, $\Sigma (Y - \bar{Y})^2 = 124$

$\Sigma (X - \bar{X})(Y - \bar{Y}) = 70$, n = 5

I. Estimate the parameters α and β of the model:
$Y_i = \alpha + \beta X_i + U_i$

II. Estimate the standard errors of these estimates.

III. How would test ß?

($t_{0.025,3}$ = 3.182)

Q18. Describe the methods used in isolating secular trend in a time series. (2021, 5 marks-100 words)

(2021, 10+8 marks-200 words)

Q19. A) Consider two variable linear regression model:

Y=α+β

The following results are given below:

$$\sum X_i = 228, \sum Y_i = 3121, \sum X_i Y_i = 38297, \sum X_i^2 = 3204 \text{ and}$$

$$\sum x_i y_i = 3347 \cdot 60, \sum x_i^2 = 604 \cdot 80 \text{ and } \sum y_i^2 = 19837 \text{ and } n = 20$$

Using this data, estimate α and β and the variance of your estimates.

B) The results of the estimated multiple regression models are given below:

TFR=4.180-0.031FLIT+ 0.013 POV-0.009 URBAN

(0·619) (0·0009)   (0·0008)   (0·011)

R^2= 0.637, F=9.36, n=sample size=20

Figures in the brackets show standard error.

Where TFR= Total Fertility rate

FLIT=Female Literacy Rate

URBAN=Rate of Urbanization

I. Interpret the above results.

II. Do you suspect presence of multicollinearity in the above regression? How do you know?

III. Would you like to drop any of the explanatory variables from the above regression? If yes, which variable and why?

Q20. (2021, 5+10+5+5 marks-300 words)

a) i) Explain the concept of direct regression and reverse regression in presence of two variables

X and Y.

ii) Suppose a two variable linear regression model without intercept term. Estimate the slope

parameter of such a model and show that it is an unbiased estimator.

iii) Find the value of r^2 when the intercept term is absent in the two variable linear regression

model.

(b)   Consider Cobb-Douglas production function :

$$Q = b_0\, L^{b_1}\, K^{b_2}$$

Test the hypothesis at 5% level of significance

$$H_0 : b_1 + b_2 = 1$$

against $H_1 : b_1 + b_2 \neq 1$.

Q21. (2022, 9+7+9 marks-300 words)

A) Consider the first-order autoregressive scheme in the general regression model. How would you estimate the variance, covariance and autocorrelation coefficient of the disturbance term of the model?

B) Describe the Durbin-Watson (DW) test of autocorrelation.

C) Given a sample of 50 observations and 4 explanatory variables, what can you say about autocorrelation if the computed Durbin-Watson (DW) values are:

    I.   1.05

    II.   2.5

    III.   3.97

$DW_L = 1.378$, $DW_U = 1.721$ at 5% level of significance, n = 50 and k = 4

Q22. (2022, 5+10+10 marks-300 words)

A) Graphically explain the Lorenz curve as a measure of income inequality.

B) How would you derive the Gini coefficient from the Lorenz curve?

C) How would you derive the Gini coefficient from the Pareto law of income distribution?

Q23. Define homothetic preferences. Explain the common characteristics of such preferences with the help of necessary diagrams. (2020, 5 marks-100 words)

Q24. (2020, 9+9 marks-200 words)

a. In a contest two judges ranked 8 candidates A B C D E F G and H in order of their preference as shown in the following table. Find the rank correlation coefficient.

	A	B	C	D	E	F	G	H
First judge	5	2	8	1	4	6	3	7
Second judge	4	5	7	3	2	8	1	6

b. The regression equation of variables x and y are 8x-10y+66=0 and 40x-18y=214. The variance of x is 9. Identify the two regression lines. Find the simple correlation coefficient between the two variables and variance of y.

Q25. (2020, 5+5+15 marks-300 words)

a. Consider a two variable linear regression model

$$Yt = α + βXt + Ut$$

and $Ut = ρUt-1 + εt$; $|ρ| < 1$

find mean, variance and covariance of random disturbance term (Ut).

b. Consider the model of wage determination:

$$Yt = β1 + β2Xt + β3Yt-1 + Ut$$

where

Y=wages, X=productivity

$Ut = ρUt-1 + εt$; $-1 < ρ < 1$

Discuss the method of testing with the help of appropriate test statistic.

c. Consider a model:

$$Yt = β1 + β2Xt + Ut$$

And $Ut = ρUt-1 + ε_t$

Discuss the process of the removal of autocorrelation when:

i. $ρ$ Is known

ii. $ρ$ Is unknown (using Cochrane Orcutt iterative method)

Q26. (2020, 10+15 marks, 300 words)

a. Consider a two variable linear regression model:

$Yi = α + βXi + Ui$ and

Var (Ui) = E (Ui^2) = $σi^2$

Show that $β$ is unbiased and inefficient estimator of β.

b. Consider a three variable linear regression model

$Yi = β_1 + β_2X_{2i} + β_3X_{3i} + ε_i$ and suppose that

i. $σi^2 = σ^2Zi^2$

ii. $σi^2 = σ^2X_{1i}$

iii. $σi^2 = σ^2X^2_{1i}$

Discuss generalised least squares (GLS) method to overcome the heteroscedasticity problem under three cases (i, ii and iii).

Q27. Show that in the regression model Yi = α + βXi + Ui; i = 1, 2, ..., n, the covariance between the regressor and the error term is zero under ordinary least squares method of estimation. (2019, 5 marks-100 words)

Q28. Consider the following data on two variables: (2019, 9+9 marks-200 words)

X	-5	-4	-3	-2	-1	0	1	2	3	4	5
Y	25	16	9	4	1	0	1	4	9		25

    a. Find the product-moment correlation coefficient between X and Y.

    b. Can you develop a suitable linear regression model to explain Y with the help of X? (2019, 10+4+4, 200 words)

Q29. a. Define Gini Coefficient with the help of Lorenz Curve and show that Gini is defined as Gini = 1 – 2×Area below Lorenz Curve

b. How is Gini affected is θ amount of income is added to all the persons in an income distribution?

c. Show that Gini is distribution insensitive.

Q30. (2019, 8+5+7+5 marks-300 words)

    a.   Consider the multiple regression model $Y_i = \alpha + \beta_2 X_{2i} + \beta_3 X_{3i} + U_i$; i = 1, 2, ….,n. where U_i's are independent and normally distributed with mean zero and variance σ^2. Also consider the auxiliary regressions

$$X_{2i} = \hat{a} + \hat{b}X_{3i} + \hat{V}_{2i}$$
$$X_{3i} = \hat{c} + \hat{d}X_{2i} + \hat{V}_{3i}$$

where $\hat{V}_2$ and $\hat{V}_3$ are error terms. Show that $\hat{\beta}_2$, the ordinary least squares estimate of β_2 can be interpreted as a simple regression of Y on $\hat{V}_2$.

b. Consider the regression $Y_i = \gamma + \delta_2 \hat{V}_{2i} + \delta_3 \hat{V}_{3i} + W_i$, where $\hat{V}_2$ and $\hat{V}_3$ are as defined in part (a). Find the relation between the ordinary least squares estimate $\hat{\delta}_2$ and the estimate $\hat{\beta}_2$ as defined in part (a)

c. (i) In the regression model of part (a), what will be the variance of the ordinary least squares estimate $\hat{\beta}_2$?

(ii) Develop the F-test statistic for the goodness of fit of the regression model of part (a)

Q31. (2019, 10+10+5 marks-300 words)

    a. Suppose that the relation to be estimated is $Y_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + U_i$ and X1 and X2 are related with the exact relation X2 = kX1, where k is an arbitrary constant. Show that the estimates of the coefficients are indeterminate and standard errors of these estimates become infinitely large.

b. Assume three explanatory variables like X1, X2 and X3, which are found to be highly collinear. The following three principal components (PC) and their corresponding eigenvalues (λ) are reported as:

$$PC1 = a_{11}x_1 + a_{12}x_2 + a_{13}x_3$$
$$PC2 = a_{21}x_1 + a_{22}x_2 + a_{23}x_3$$
$$PC3 = a_{31}x_1 + a_{32}x_2 + a_{33}x_3$$

where a_{ij} be the factor loading of the ith principal component of the jth factor, and λ1, λ2 and λ3 are the eigenvalues of first, second and third principal components respectively. How are factor loadings (a_{ij}) related to eigen value in each PC? What is the statistical meaning of the square of a_{ij} in each PC? Do you think that λ1 > λ2 > λ3? What is the sum of λ's?

c. How do you use principal component analysis to tackle the problem of multicollinearity in regression analysis?

Q32. Heights of fathers(X) and sons(Y) in inches are given in the following table: (2018, 6+6+6 marks-200 words)

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

a. Calculate the correlation coefficient between the heights of fathers and those of sons.
b. Obtain the equation of the lines of regression and the estimate of X for Y = 70
c. Given that, X = 4Y + 5 and Y = kX + 4 are the lines of regression of X on Y and Y on X respectively. Show that 0 < 4k < 1.
   if k = 1/16, what is the point of interaction of the two regression lines?

Q33. Define Pareto's law of income distribution and state its applications. How is the Pareto distribution related to the Log-normal distribution? For the Pareto distribution, calculate the Lorenz curve and the Gini coefficient. Explain their meanings. (2018, 25 marks-300 words)

Q34. (2018, 18+7 marks-300 words)

a. The ordinary least square estimate of β in the classical linear regression model

$$Y_i = \alpha + \beta X_i = U_i; \; i = 1, 2, \ldots, n$$

is $\hat{\beta} = \sum_{i=1}^{n} W_i Y_i$, where $W_i = \frac{x_i}{\sum_{i=1}^{n} x_i^2}$

and $x_i = X_i - \bar{X}$, $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

Show that if $\text{Var}(\hat{\beta}) = \frac{\hat{\sigma}_u^2}{\sum_{i=1}^{n} x_i^2}$, no other linear unbiased estimator of β can be constructed with a smaller variance. (All symbols have their usual meaning). (

b. Consider the regression model: (2018)

$$Y_i = \alpha + \beta X_i + U_i$$

where Y is the quantity demanded of bread and X is the price of the butter, and U_i is a random term that is distributed normally with mean zero and unknown variance σ_u^2. A sample of 20 observations yields the following information:

$$\sum_{i=1}^{20} Yi = 21.9 \quad \sum_{i=1}^{20} (Yi - Y)^2 = 86.9$$

$$\sum_{i=1}^{20} Xi = 186.2 \quad \sum_{i=1}^{20} (Xi - X)^2 = 215.4$$

$$\sum_{i=1}^{20} (Xi - X)(Yi - Y) = 106.4$$

i. Set up the null and alternative hypotheses to test if the price of butter as a determinant of the quantity demanded of bread is significant.
ii. How would you test your hypothesis? [Given that $t_{0.05; \, 18} = 1.734$, $t_{0.01; \, 18} = 2.552$, $t_{0.025; \, 18} = 2.101$ and $t_{0.005; \, 18} = 2.878$, where $0.025 = \int_{t0.025}^{\infty} f(t)dt$

Q35. (2018, 5+5+15 marks-300 words)

a. Define autocorrelation and state what are the possible sources of autocorrelation.
b. Suppose that the time series data follows the auto-regressive scheme of order one, that is, AR(1). Show that an AR(1) process is simply an MA(∞) process (that is, moving average scheme of order infinity).
c. Find the mean and variance if the time series data are modelled by the process

$$Y_t = a + Y_{t-1} + \varepsilon_t$$

where ε_t is a pure white noise. Find out also, the auto-correlation coefficient of sth order. Interpret your results. How do you test stationarity in this case?

Q36. (2017, 12+6 marks-200 words)

a) Consider two regression equations of Y on X and X on Y. Show that the Arithmetic mean of two regression coefficients is greater than the correlation coefficient, provided the correlation Coefficient is positive. Under which condition do the two regression lines coincide?

b) In bivariate distribution, a researcher gets two lines of regression as:
$2x - y + 1 = 0$
$3x - 2y + 7 = 0$
Identify the true regression lines and find the mean of x and y.

Q37. (2017, 5+5+15 marks-300 words)

a. What do you mean by multicollinearity?
b. How does it affect the Precision of estimates?
c. Consider a simple model
$Yi = \beta_2 x_{2i} + \beta_3 x_{3i} + u_i;\ i = 1,2, \dots , n$
and the variables are in derivation form. The disturbance term u_i satisfies all the classical assumptions. Suppose x_{2i} and x_{3i} are multicollinear. Should you drop either x_{2i} or x_{3i} to have precise estimates of the remaining parameters? If so, under what condition are you permitted to do so?

Q38. (2017, 3+4+18 marks-300 words)

a. Explain the meaning of spurious regression.
b. How are the values of Durbin-Watson d statistic and R^2 indicative of spurious regression?
c. Show that in the case of spurious regression between Yt and Xt, where both Yt and Xt are generated by random walks, (i) the errors have a permanent effect; (ii) the variance of the errors is infinitely large. What should you interpret from your result?

Q39. (2017, 5+12+8 marks-300 words)

a. Explain what do you mean by heteroscedasticity?
b. Given the model $Y_i = \beta_1 + \beta_2 X_{2i} + u_i$, where $E(u_i^2) = \sigma^2 X_1^2$ and $I = 1,2,3,\dots,n$, find out the OLS and GLS variance of the regression slope
c. State that if Xi takes the values 1, 2, 3, 4, 5, $Var(\hat\beta_2) > Var(b2)$, where $\hat\beta_2$ is the OLS estimator of β_2 and b2 is the GLS estimator of β_2.

Q40. State the assumptions of classical linear regression model. Why are the regressors (X) assumed to be non-stochastic in repeated samples? (2016, 5 marks-100 words)

Q41. Define level of significance. How is this level decided for a given problem? Can we take it as 2% or 6%? Explain. (2016, 5 marks-100 words)

Q42. Distinguish between point estimation and interval estimation of a population parameter. State the small sample properties of a good estimator. (2016, 15 marks-200 words)

Q43. What is stationarity in time series analysis? Show that a random work model is non stationary. Discuss the Dickey-Fuller test of stationarity. (2016, 15 marks-200 words)

Q44. (2016, 5+5+5+5 marks-300 words)
   a. Define heteroscedasticity
   b. Explain:
      i. Consequences of heteroscedasticity on OLS estimates
      ii. Detection of heteroscedasticity in a model
      iii. Estimation procedure in the presence of heteroscedasticity

Q45. Given the classical linear regression model with usual assumptions (2016, 10+10 marks-300 words)
   $Y_i = \beta_0 + \beta_1 X_i + U_i$ $i = 1, 2, ..., n$
   a. Examine the goodness of fit of the model using ANOVA.
   b. If the value of $\overline{R}^2$ is low, how can it be improved?

Q46. How is distributional inequality of various kinds measured with the help of income as a resource? Name some common inequality measures and state their properties.(2016, 20 marks-300 words)

Q47. Define and distinguish between level of significance and confidence interval. What do you mean by 'power of the test'? (2015, 5 marks-75 words)

Q48. Explain the distinction between parametric and non-parametric tests. (2015, 5 marks-75 words)

Q49. Consider a simple model of classical regression as $Y_i = \beta X_i + u_i$, where u_i stands for random disturbance term with the standard assumptions and $u_i \sim N(0, \sigma^2)$, and X_i is non-stochastic and $i = 1, 2, ..., n$. (2015, 5+10+10 marks-300 words)
   a. Find out the OLS estimator for β, say $\hat{\beta}_{OLS}$.
   b. Show that the OLS estimator for β is BLUE. Prove ab-initio.
   c. Prove that $\overline{\beta} = \frac{\overline{Y}}{\overline{X}}$, where $\overline{Y}$ and $\overline{X}$ are means respectively, is unbiased but less efficient estimator of β than $\hat{\beta}_{OLS}$.

Q50. Hawkins-Simon condition and explain its economic meaning and significance. (2015, 8 marks-100 words)

Q51. Explain the concept of co-integration in a time series analysis. (2014, 5 marks-100 words)

Q52. What is autocorrelation? How can we detect it? How can it be removed from a single equation model? (2014, 15 marks-200 marks)

Q53. What is the problem of multicollinearity in a regression model? What is its plausibility? Explain Farrar-Glauber method to detect it. How can it be removed?(2014, 25 marks-300 words)

Q54. What are Type 1 and type 2 errors in testing of a hypothesis? (2013, 5 marks-50 words)

Q55. State and explain the assumptions for applying ordinary least square (OLS) method to two variable linear regression model: (2013, 15 marks-150 words)

$$Y_t = b_0 + b_1 X_t + u_t \quad t = 1. 2, \ldots, n$$

Q56. How can you measure income inequality by using Lorenz curve method? (2012, 5 marks-50 words)

Q57. Define the terms white noise and random walk in time series analysis. (2012, 5 marks-50 words)

Q58. How does Lorenz curve explain income inequality? Explain with one suitable example. Define Gini coefficient with the help of Lorenz curve and show that Gini = [1 - 2 x (area below Lorenz curve)] (2011, 5+5+15 marks-300 words)

Q59. In computing the correlation Coefficient between two variables X and Y from 25 pairs of observations, the immediate results are

$n = 25$, $\sum_i X_i = 125$, $\sum X_i^2 = 650$, $\sum_i Y_i = 100$, $\sum_i Y_i^2 = 460$, $\sum_i X_i Y_i = 508$

Later on at the time of checking it was found that two pairs of observations which should be had been incorrectly recorded as

X	8	12
Y	6	8

X	6	14
Y	8	6

Calculate the correct value of the correlation coefficient. (2011, 25 marks-300 words)

Q60. Find out the variance of the numbers 1, 2, 3, …,50 and the coefficient of variation. What is the advantage of computing the coefficient of variation over the variance? (2011, 5+3+2 marks-150 words)

Q61. Explain the terms as follows and their importance in the context of inference analysis: Degrees of freedom, Level of significance and Power of the test. (2011, 4+4+4 marks, 150 words)

Q62. Briefly discuss the principal component analysis and the rationale for its use. (2011, 10+3 marks, 150 words)

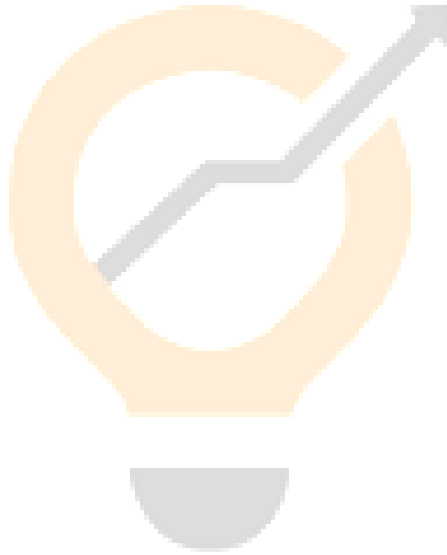Q63. State and explain the assumptions of two variable Linear Regression Model. (2010, 7 marks-50 words)

Q64. What is Log normal distribution? Where is it used in economic analysis? (2010, 7 marks-50 words)

Q65. What are Type 1 and type 2 errors? Why is the probability of Type 1 error fixed in a hypothesis testing problem? (2010, 15 marks-150 words)