

2024

STATISTICS — GENERAL

Paper : DSE-A-1 and DSE-A-2

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Paper : DSE-A-1

(Operations Research)

Full Marks : 50

1. Answer *any five* questions : 2×5
- (a) Define a slack variable in the context of a Linear Programming Problem (LPP).
 - (b) State the criteria to check for optimality of a transportation problem through the modified difference (MODI) method.
 - (c) What is artificial variable in the context of LPP?
 - (d) Define a convex set.
 - (e) What do you mean by a basic feasible solution in terms of LPP?
 - (f) What is meant by optimization in Operations Research (O.R.)?
 - (g) When do you use Charne's Big M Method?
 - (h) What do you mean by replacement ratio in terms of a simplex tableau?
2. Answer *any two* questions :
- (a) Show that the set of all convex combinations of a finite number of points is a convex set. 5
 - (b) How do you check for degeneracy in a transportation problem? If it exists, how do you resolve it? 2+3
 - (c) Prove that the dual of a dual problem is the primal problem. 5
3. Answer *any three* questions :
- (a) Define Operations Research (O.R.) and describe its significance in decision-making. Explain the key phases of O.R. (2+2)+6
 - (b) (i) Describe how a primal linear programming problem can be converted into a dual linear programming problem.
 - (ii) Discuss about the different types of solution of an LPP. 5+5

Please Turn Over

(0640+0641)

Paper : DSE-A-2**(Econometrics)****Full Marks : 50**

1. Answer *any five* questions : 2×5
- (a) What is the primary objective of econometric modelling?
 - (b) How are dummy variables used to incorporate qualitative information into a regression model?
 - (c) What is multicollinearity?
 - (d) What is autocorrelation?
 - (e) What do you mean by heteroscedasticity?
 - (f) What is the difference between exogenous and endogenous variables in econometrics?
 - (g) What are the key assumptions of the classical linear regression model?
 - (h) What do you mean by coefficient of determination?
2. Answer *any two* questions :
- (a) Discuss the role of economic theory, statistical methods, and mathematical methods in econometric modelling. 5
 - (b) How does multicollinearity affect the estimation and inference of regression coefficients? 5
 - (c) Write down the linear model used in presence of autocorrelation. How does autocorrelation violate the classical linear regression model assumptions? 2+3
3. Answer *any three* questions :
- (a) Discuss the methods for detecting multicollinearity in a regression model with their limitations. 10
 - (b) Explain the Durbin-Watson test. What does a value of the test statistic close to 2 indicate? Discuss a procedure for estimating parameters in the presence of autocorrelation. 4+1+5
 - (c) How does heteroscedasticity violate the classical linear regression model assumptions? How can heteroscedasticity be detected using a scatter plot? What is the log transformation and how can it be used in the context of heteroscedasticity? 2+3+5
 - (d) Explain the concept of an instrumental variable. What are the conditions for a valid instrumental variable? What are the limitations of the instrumental variable method? How can the quality of instrumental variables be measured? 2+3+2+3
 - (e) Write short notes on : 5+5
 - (i) Qualitative data in Econometrics
 - (ii) Weighted least squares method.

- (c) (i) Discuss the assumptions of an LPP.
- (ii) Illustrate the graphical method for solving a two-variable LPP. 4+6
- (d) (i) What is meant by balanced and unbalanced transportation problems? How are unbalanced problems addressed?
- (ii) Describe the North West Corner method to find initial basic feasible solution of a transportation problem. (2+3)+5
- (e) (i) Discuss the Hungarian method for solving assignment problems.
- (ii) Prove that if in an assignment problem, we add or subtract a constant to every element of any row or column of the cost matrix, then an assignment that minimizes the total cost on one matrix will also minimize the total cost on the other transformed matrix. 6+4