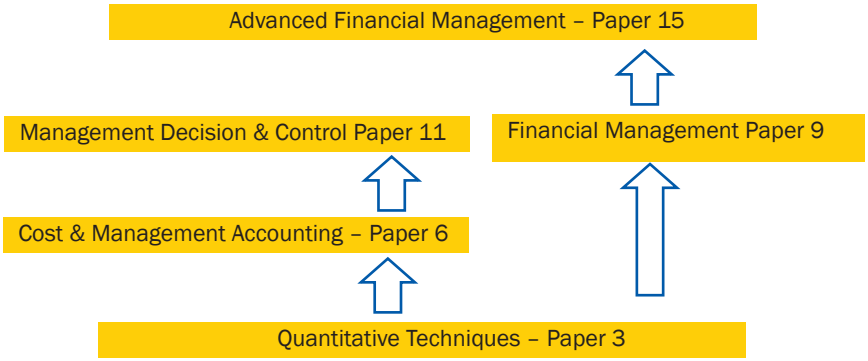
QUANTITATIVE TECHNIQUES

SYLLABUS CHART



OVERALL AIM

To equip the learner with skills to apply mathematical and statistical principles and concepts in problem solving and decision making

LEARNING OUTCOMES

On completion of this course, the learner should be able to:

	Learning outcomes	K	C	A	An	S	E
1.	Describe data collection methods and sampling techniques		✓				
2.	Present data in tables, charts and graphs			✓			
3.	Apply descriptive statistics in decision making			✓			
4.	Apply the principle of optimisation to strategy and deployment of resources			✓			
5.	Apply mathematical, linear, quadratic and simultaneous equations in production, cost and revenue functions			✓			
6.	Apply time series in estimating and forecasting			✓			
7.	Demonstrate an understanding of probability, confidence intervals and hypothesis testing		✓				
8.	Demonstrate an understanding of linear programming		✓				
9.	Apply selected mathematical models to business situations			✓			

LEVEL OF ASSESSMENT

The examination will test the learner's ability to comprehend and apply mathematical and statistical principles in problem solving and decision making

EXAMINATION STRUCTURE

There will be a three-hour examination made of six questions of 20 marks each, of which the candidate will be required to attempt any five

DETAILED SYLLABUS

A. INTRODUCTION

1. Importance of quantitative techniques
2. Role of statistics and mathematical models
3. Functions and limitations of statistics
4. Descriptive and inference statistics

B. DATA COLLECTION AND PRESENTATION

1. Introduction:
   - (a) Primary and secondary data; sample and population; discrete and continuous data; variable and attribute; qualitative and quantitative data
   - (b) Data collection methods, including interviews, questionnaires, direct observation, census and sample surveys; merits and demerits of each method of data collection
   - (c) Sampling techniques, including simple random and stratified, systematic and multistage as well as cluster and quota sampling; advantages and disadvantages of each technique
   - (d) Data presentation using the following methods, including their interpretation and limitations:
     - (i) Row and column tables, two-way tables, frequency tables and percentage distribution tables
     - (ii) Simple and compound bar charts, pie charts, Lorenz and Z-charts
     - (iii) Line graphs, histograms, frequency polygons and curves including the Ogive

C. DESCRIPTIVE STATISTICS

1. Measures of central tendency, including interpretation of calculated values:
   (a) Arithmetic mean, weighted mean and quadratic mean for discrete and continuous variables in grouped (frequency) and ungrouped distributions
   (b) Median and mode, including calculation and graphical presentation thereof
   (c) Combined mean and combined standard deviation from two distributions
2. Measures of dispersion, including their characteristics, merits, demerits and interpretation of calculated values:
   (a) Dispersion and variation
   (b) Measures of dispersion:
      (i) Range
      (ii) Quartile deviation (interquartile range), decile and percentile range, including their graphical determination
      (iii) Semi-quartile deviation (semi-interquartile range)
      (iv) Decile and percentile range, including their graphical determination
      (v) Mean deviation
      (vi) Quartile coefficient of dispersion, standard deviation and variance, including their determination using direct and working mean methods; properties of standard deviation and coefficient of variation
   (c) Dispersion versus skewness; determination of skewness by Karl Pearson and Bowley's methods
3. Index numbers, including interpretation of calculated values of indices:
   (a) Importance and limitations of indices
   (b) Simple and weighted (price and quantity) indices
   (c) Price and quantity relatives
   (d) Factors to consider in construction of indices
   (e) Laspeyre's and Paasche's price and quantity indices
   (f) Time series relatives, including fixed base and chain relatives

(g) Published indices, including cost of living index, consumer index, stock index and retail index

4. Correlation and regression:
   (a) Meaning and importance
   (b) Types of correlation
   (c) Scatter diagrams
   (d) Calculation of coefficient of correlation using product moment (Karl Pearson's), rank correlation (Spearman's formula) and Kendall's methods; interpretation of correlation co-efficient; merits and demerits of each method
   (e) y on x and x on y regression equations, including interpretation of calculated values

D. PROBABILITY AND INFERENCE STATISTICS

1. Probability theory:
   (a) Basic concepts of probability such as event, outcome, sample, sample space and equiprobable
   (b) Probability limits, total probability and complimentary probability
   (c) Independent, dependent, and mutually exclusive events
   (d) Rules of probability
   (e) Conditional probability
   (f) Probability frequency distributions and expected values

   Note: Application of the knowledge of set theory in probability is assumed

2. Permutations and combinations:
   (a) The factorial notation
   (b) Forms of arrangements, selections and combinations
   (c) Application of permutations and combinations in probability
3. Probability distribution:
   (a) Properties of discrete probability distributions
   (b) Normal distribution, including computation of probabilities using normal distribution tables

(c) Binomial distribution, including the use of the binomial formula; computation of the mean, variance and standard deviation of a binomial distribution; use of binomial distribution tables; normal approximation to the binomial

(d) Poisson distribution

4. Estimation and hypothesis testing:

(a) Confidence limits and intervals

(b) Determination of sample size

(c) Interval estimation of the population proportion using normal distribution

(d) Estimation of the mean from a small sample using Student's t distribution

(e) Use of contingency tables for chi-square distributions

(f) Estimation of the population proportion from a large sample

5. Hypothesis and significance tests:

(a) Null (Ho) and the alternative (Ha) hypotheses, type I and type II errors, acceptance and rejection regions and level of significance

(b) Methods of testing, including the normal or Z score, Student's t-distribution and Chi-square

(c) Statistic and level of significance at a particular percentage

(d) Hypothesis testing of the:

(i) Mean and difference of means using small samples and proportions

(ii) Population mean, difference of means and population proportion

(e) Test of goodness-of-fit and independence; computation of expected values for Chi-square test

E. MATHEMATICAL MODELING

1. Linear algebra:

(a) Linear, quadratic and simultaneous equations

(b) Formulating and solving equations using elimination, substitution and matrix methods

(c) Cost and marginal cost, revenue and marginal revenue and profit

(d) Analysis of production, cost, expenditure, sales and profits as functions of time and price

(e) Algebraic and graphical approaches to cost and breakeven analysis

2. Control charts:
   (a) Advantages and disadvantages of control charts
   (b) Control charts for sample mean, range and proportion
   (c) Distinction between common cause and assignable cause
   (d) Interpretation of control charts
3. Linear programming:
   (a) Problem model, objective function, constraints, feasible region and optimal solution
   (b) Assumptions
   (c) Advantages and limitations
   (d) Application to product mix, cost and profit
   (e) Graphical and simplex methods, including their assumptions, advantages and limitations
   (f) Primal and dual linear programming problems
4. Decision theory:
   (a) State of nature, event, decision alternatives and payoff
   (b) Types of decision making
   (c) Decision making under uncertainty
   (d) Payoff tables and decision trees
   (e) Bayes decision rule
   (f) Expected payoff of decision alternatives
   (g) Expected loss and opportunity loss
   (h) Maximin, maximax and minimax regret strategies
5. Queuing theory:
   (a) Meaning and statement of the theory
   (b) Queuing system, discipline and behaviour
   (c) Classification and queuing model
6. Game theory and decision making:
   (a) Game theory, strategy and payoff, optimum and strictly determined game

(b) Two-person and zero-sum games

(c) Pure mixed, optimal, saddle point and dominance strategies

(d) Maximin and minimax principles

(e) Environments of decision making (

(f) The decision making environments, including certainty, uncertainty, risk and conflict

(g) Decision rules/ principles

7. Network analysis:

(a) Network terminology, including network, dummy activity, critical path, float, cost slope, activity and event

(b) Network diagrams and Gantt charts

(c) Critical path and program evaluation and review technique (PERT) models

(d) Earliest and latest start times of programme activities

(e) Project crashing, resource analysis and scheduling

F. TIME SERIES AND FORECASTING

1. Time series:

(a) Forecasting and time series; examples of time series and their importance

(b) Components of time series

(c) Seasonal adjustments and deflating time series

(d) Determination of trend:

(i) Methods, including moving average, exponential smoothing and least squares; merits and limitations of moving averages and least squares methods

(ii) Graphical representation of data and estimation of output using a trend line

2. Forecasting:

(a) Steps involved

(b) Methods used, including quantitative and qualitative methods, regression analysis, deseasonalisation and exponential smoothing

(c) The Z chart

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