Name of the Programme: Bachelor of Commerce (Honors)
Course Code: COM-142
Title of the Course: Business Mathematics I
Number of Credits: 03 (1T+2P)
Effective from AY: 2023-24

Pre-requisites for the Course:	Elementary Mathematics	
Course Objectives:	Objectives of the Course are: 1. To provide mathematical literacy and foundations in concepts of Mathematics necessary in the areas of Economics, Finance, Commerce and Management 2. To demonstrate modelling of descriptive problems into mathematical formulae for solving business problems. 3. To enable learners to integrate acquired knowledge and skills with practical problems in Economics.	
Content:	**Unit 1: Mathematics of Finance** • Ratio, Proportions, Percentage • Simple Interest, Compound Interest • Annuity **Unit 2: Set Theory and Solutions of Algebraic Equations** • Sets: Definition, Representation, Types of sets, Operations on Sets, Power set, De Morgan's laws. • Relations and Functions, Domain, Co-domain, Range • Quadratic Equations **Unit 3: Calculus** • Derivatives and its applications: Definition, Computational formulae, Algebra of derivatives, derivatives of composite functions. Increasing/decreasing functions, Maxima and Minima. (Definition and Interpretation) • Integration and its applications: Definition, standard forms, Algebra of integration, Integration by parts, definite integrals. **Practicals** List of Practicals (Each practical of two hours each) UNIT I • Ratio • Proportions • Work and Time • Unit conversion (SI to metric, metric to SI) • Discounts • Profit and Loss • Compound Interest (compounded annually, half-yearly, quarterly, monthly) • EMI using interest on reducing balance and flat interest rate • Future value • Present value	**5 hours** **5 hours** **5 hours** **60 hours**

	UNIT II
	• Venn diagram
	• Principle of inclusion and exclusion
	• Graph of a function
	• Roots of quadratic equation
	• Numerical Solution of Algebraic Equations:
	  • Bisection method
	  • Regula-Falsi method
	  • Newton-Raphson method
	UNIT III
	• Cost/ Demand/ Revenue, Marginal Cost/ Demand/ Revenue
	• Elasticity of demand, supply
	• Increasing/decreasing functions
	  ○ Maxima and minima
	  ○ Area under a curve
	  ○ Consumer Surplus
	  ○ Producer's Surplus
	• Numerical Differentiation using:
	  ○ Newton's Forward difference
	  ○ Backward difference method
	  ○ Divided difference method
	• Numerical Integration using:
	  ○ Trapezoidal rule
	  ○ Simpson's one-third formula
	  ○ Weddle's formula
	Practicals using softwares like GeoGebra for interactive sessions is encouraged. Additional workshops on these softwares are recommended.	

Pedagogy:	Lectures, Practicals	
Reference/ Readings:	1. Clendenen, G., & Salzman, S. (2015). Business Mathematics (Global Edition), Pearson Education. 2. Sharma, J. K. (2014). Business Mathematics: Theory and Applications (Ane's Student Edition), Lakshi Publishers. 3. Dikshit, A., & Jain, J. K. (2009). Business Mathematics, Himalaya Publishing House. 4. Sastry, S. S. (2012). Introduction to Numerical Analysis (Fifth Edition), Prentice Hall India Learning Pvt. Ltd. 5. Cain, J., & Emeritus, R. C. (2000). Mathematics for Business Careers (Fifth Edition), Pearson Education. 6. Eugene, D., & Lerner, J. (2009). Schaum's Outline of Basic Business Mathematics (Second Edition), McGraw-Hill Education. 7. Hilderbrand, F. B. (2003). Introduction to Numerical Analysis (Second Edition), Dover Publications Inc. 8. Robert, B., & Zima, P. (2011). Schaum's Outline of Mathematics of Finance (Second Edition), McGraw Hill Education.	

Course Outcomes:	After completion of this course, the learners will be able to: 1. Solve problems in the areas of business calculus, simple and compound interest account, loan and consumer credit. 2. Undertake necessary computations for problems of interest, annuities and perpetuities, capitalized cost, depletion allowances, stocks and bonds. 3. Evaluate and select financial arrangements which are best for a consumer. 4. Demonstrate and use calculus in the areas of Commerce, Economics and Finance.

Name of the Programme : **B.Sc. Mathematics**
Course Code : **MAT-131**
Title of the Course : **Mathematical Techniques in Competitive Exams**
Number of Credits : **3 (3L)**
Effective from AY : **2023-24**

Prerequisites for the Course	NIL	
Course Objectives	To make students competent enough to answer competitive examinations like Banks, Post Office, SSC, LIC, CDS, CSAT, CAT, CMAT, GMAT, MAT, UPSC, CBI, CPO, Civil Services, Hotel Management, Railway, Police, Defence, etc.	
Content		**No. of Hours**
Unit I	**Ratio and Proportion:** Ratio; Comparison of ratios; Proportion. **Mixture or Alligation:** Mixture; Rule of mixture or allegation. **Partnership:** Types of partnerships; Types of partners. **Problems Based on Ages:** Rules for problems based on ages.	**15**
Unit II	**Work and Time:** Basic rules related to work and time. **Work and Wages:** Important points. **Pipes and Cisterns:** Facts related to pipes and cisterns. **Clock and Calendar:** Clock; Calendar; Day Gain/Loss.	**15**
Unit III	**True Discount and Banker's Discount:** True discount; Banker's discount. **Speed, Time and Distance:** Basic formulae related to speed, time and distance. **Problems Based on Trains:** Basic rule related to problems based on trains. **Boats and Streams:** Concepts and formulae on boats and streams.	**15**
Pedagogy	Lectures/Problem Solving/Self study.	
References/Readings	1) R. Verma: *Fast Track Objective Artithmtic*, Arihant Publications Limited, 2017. (**Principal Text**) 2) A. Sharma: *How to Prepare for Quantitative Aptitude for CAT*, 9th Edition, McGraw Hill, 2021. 3) P. K. Mishra, and R. Mishra: *Elementary & Advanced Mathematics For Competitive Exams*, Source Books, 2018. 4) R. S. Aggarwal: *Quantitative Aptitude for Competitive Examinations*, S. Chand Publications, 2017. 5) R. Mathuriya: *Mathematics for all Competitive Exams SSC (Pre./Mains),* Sunita Publications, 2017.	
Course Outcomes	The student will be able to, 1. Apply mathematical techniques in solving problems.	

	2. Identify tricks in solving problems quickly. 3. Employ various strategies to solve problems arising in various competitive exams. 4. Manage time in answering several questions appearing in the exam.

Name of the Programme: Bachelor of Commerce (Honors)
Course Code: COM-147
Title of the Course: Business Mathematics II
Number of Credits: 03 (1T+2P)
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	Objectives of the Course are: 1. To provide mathematical literacy and foundations in concepts of Mathematics required in the areas of Economics, Finance, Commerce and Management 2. To develop an ability in mathematical reasoning and general intelligence. 3. To enable learners to integrate acquired knowledge and skills with practical problems in Business and Economics.	
Content:	**Unit 1: General Intelligence** A. Mathematical Logic • Logical Statement, Negation, Conjunction, Disjunction, Conditional and Bi-Conditional statements, truth tables, Tautology and Contradiction B. General Aptitude and Logical Reasoning • Meaning and Prerequisites • Introduction to measures of aptitude, Logical reasoning, Verbal reasoning, Numerical ability, Abstract reasoning	**5 hours**
	Unit 2: Matrices and Determinants • Matrices: Definition, Types of Matrices, Matrix Operations-Addition, Scalar and Matrix multiplication, Inverse of a matrix. • Determinants: Definition, Computation, Properties.	**5 hours**
	Unit 3: Straight Lines, Linear Programming Problems, and Progressions A. Straight Lines and Linear Programming Problems • Coordinate system, Distance formula • Equation of line: slope and intercepts, interpretations, equation of line, two-point form, slope-point form, slope-intercept form, two-intercept form, general form. B. Progressions • Arithmetic Progression: Definition, formula for nth term, sum of first n terms • • Geometric Progression: Definition, formula for nth term, sum of first n terms	**5 hours**

	Practicals List of Practicals (Each practical of two hours each) UNIT I • Equivalence of logical statements • Syllogism (with two premises) • Syllogism (with more than two premises) • Alphanumeric series • Analogies: Numerical analogy, word analogy • Coding-Decoding • Directions • Clocks • Blood relations • Reasoning using Venn diagram • Speed, Distance and Time • Work and Time UNIT II • Matrix multiplication • Computing determinants of matrices • Minor, Adjoint of a matrix • Computing inverse of a matrix • Solution of system of equations using elimination method • Solution of system of equations by Matrix Inversion method • Solution of system of equations using Cramer's rule UNIT III • Finding equation of line (two-point form, slope-point form) • Finding equation of line (slope-intercept form, two-intercept form) • General equation of a line • Distance in coordinate system • Graphs of linear equations and inequalities • Graphical method for LPP • Practical problems on nth term of a A.P. • Practical problems on nth term of a G.P. • Computing sum of first n terms of A.P. • Computing sum of n terms of G.P. • Deflation, Inflation, Depreciation Practicals using softwares like GeoGebra for interactive sessions is encouraged. Additional workshops on these softwares are recommended.	**60 hours**
Pedagogy:	Lectures, Practicals, Assignments	
Reference/ Readings:	1. Loney, S. L. (2019). The Elements of Coordinate Geometry, Math Valley Publishers. 2. Sharma, J. K. (2014). Business Mathematics: Theory and Applications	

	(Ane's Student Edition), Lakshi Publishers. 3. Dikshit, A., & Jain J. K. (2009). Business Mathematics, Himalaya Publishing House. 4. Joshi N., & Chitale, S. G. (2015). A New Approach to Mathematical Techniques, Sheth Publishers. 5. Agarwal, R. S. (2018). A Modern Approach to Logical Reasoning (Second Edition), S. Chand Publications. 6. Vaidya, M.V., & Kumtha, A. P. (2022). Elementary Business Mathematics (Fifth Edition), Vipul Prakashan. 7. Seymour, L. (1998). Schaum's Outline of Set Theory and Related Topics (Second Edition), McGraw-Hill Education. 8. Sinha, N. (2020). Logical Reasoning and Data Interpretation for CAT (Seventh Edition), Pearson Education. 9. Robert, B., & Zima, P. (2011). Schaum's Outline of Mathematics of Finance (Second Edition), McGraw Hill Education.
Course Outcomes:	After completion of this course, the learners will be able to: 1. Analyse and relate acquired mathematical concepts to problems in Business and Economics 2. Solve problems on general aptitude and logical reasoning in view of various competitive examinations. 3. Demonstrate ability to solve system of equations and its applications in Operations Research. 4. Apply mathematical logic in reasoning and constructing mathematical arguments to provide proofs.

Name of the Programme : **B.Sc. Mathematics**
Course Code : **MAT-132**
Title of the Course : **Descriptive Statistics**
Number of Credits : **3 (3L)**
Effective from AY : **2023-24**

Prerequisites for the Course	NIL	
Course Objectives:	To make students aware of various statistical tools and techniques that can be employed in data analysis and simple research.	
Content		**No. of Hours**
Unit I	**Data Visualization** Introduction to Statistics: Definition and scope of Statistics; Concepts of statistical population and sample; Variates and attributes. Types of Data: Quantitative and Qualitative data, Cross-sectional and Time-series data, Discrete and continuous data. Different types of scales: Nominal, Ordinal, Interval and Ratio. Collection and Scrutiny of Data: Primary data, Secondary data – its major sources, Complete enumeration; Construction of tables with one or more factors of classification; Frequency distributions and cumulative frequency distributions and their graphical representations (Histograms, frequency polygon, Ogives).	**15**
Unit II	**Data Summarization** Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Coefficient of variation, Skewness and Kurtosis.	**15**
Unit III	**Correlation and Regression** Bivariate data: Scatter diagram; Karl Pearson's coefficient of correlation; Spearman's rank correlation coefficient. Bivariate Regression Analysis: Regression lines; Properties of regression coefficients; Residual variance. Principle of least squares and fitting of polynomials and exponential curves.	**15**
Pedagogy	Lectures/Problem Solving/Self study.	
References/Readings	1) S. C. Gupta: *Fundamentals of Statistics,* 7th Edition, Himalaya Publishing House, 2018. (**Principal Text**) 2) A. M. Goon, M. K. Gupta, and B. Dasgupta: *Fundamentals of Statistics, Vol. I*, 8th Edition, The World Press, Kolkata, 2016.	

	3) S. C. Gupta, and V. K. Kapoor: *Fundamentals of Mathematical Statistics*, 12th Edition, S. Chand and Sons, Delhi, 2020. 4) S. P. Gupta: *Statistical Methods,* S. Chand & Sons, 2017. 5) S. Bernstein, and R. Bernstein: *Schaum's Outlines: Elements of Statistics I – Descriptive Statistics and Probability*, McGraw Hill, 2020.
Course Outcomes	The student will be able to, 1. Understand concepts of sample v/s. population and Identify different types of scales. 2. Distinguish between primary and secondary data and Organize the Statistical data. 3. Calculate measures of central tendencies and variations. 4. Interpret correlation and regression.

Name of the Programme: Bachelor of Commerce (Financial Accounting)
Course Code: COM-213
Title of the Course: Business Statistics I
Number of Credits: 04
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	Objectives of the Course are: 1. Provide common statistical literacy and demonstrate the relevance of statistical findings for business problem solving and decision making. 2. Develop statistical thinking and practical computational skills for a systematic problem-solving capability to analyse and interpret data for various business problems and managerial decisions. 3. Apply technology to statistical analysis and problem solving 4. Provide business analysts a toolkit of descriptive and inferential analysis.	
		No. of Hours
Content:	**Unit 1: Introduction and Data Organization** Introduction: Definition and meaning, Basic statistical concepts: Population, sample, variate, attribute, parameter and statistic. Types of data-Primary and Secondary data, Sources and methods of collecting data. Data Measurement Scales: Nominal, Ordinal, Interval/Ratio. Data Organization: Frequency distribution table, Cumulative frequency, Percentage frequency. Representation: Graphs and diagrams-Histogram, frequency curve, Frequency polygon and Ogives, Simple, multiple, subdivided bar diagram, pie chart.	**15**
	Unit 2: Sampling Theory and Questionnaire Design Sampling Theory: Methods of sampling- Census and Sample enumeration, Methods of Sampling: Simple Random, Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Purposive Sampling, Quota and multi stage sampling. Questionnaire Design: Basic principles of questionnaire design, Role of questionnaire, Types of questions, Framing the questions, layout.	**10**
	Unit 3: Descriptive Data Analysis Measures of Central Tendency: Arithmetic Mean, Median, Mode (ungrouped and grouped), Harmonic Mean and Geometric Mean (ungrouped data), Quartiles, Deciles and percentiles. Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Variance. Absolute and Relative measures, Coefficient of range, Coefficient of quartile deviation, Coefficient of mean deviation, Coefficient of variation, Skewness- Karl Pearson's	**15**

	and Bowley's coefficient of Skewness. Kurtosis (definition, meaning and interpretation).	
	Unit 4: Correlation and Regression Analysis Coefficient of Correlation, Spearman's Rank Coefficient of Correlation, Properties of Coefficient of correlation. Regression: Lines of regression and regression coefficients. Relation between Correlation and regression coefficient, Multiple Regression. Analysis of Time Series: Time series, Models of time series, Measurement of trend- Moving averages, Least Square Method (linear and non-linear).	**20**
Pedagogy:	Lectures, Group discussions, Seminars, Case studies, Field work	
Reference/ Readings:	1. Anderson David R., Sweeney Dennis J., Williams Thomas A., Camm Jeffrey D., Cochran James J., Fry Michael J. and Ohlmann Jeffrrey W. (2021), *Statistics for Business and Economics*, Cengage Learning. 2. Cooper Donald R. and Schindler Pamela S. (2013), *Business Research Methods* (12th Edition), McGraw Hill. 3. George Argyrous (2011), *Statistics for Research: With a Guide to SPSS*, SAGE Publications. 4. Gupta S. C. (2018), *Fundamentals of Statistics*, Himalaya Publishing House. 5. Harris Jenine K. (2020), Statistics *with R: Solving Problems Using Real-World Data,* SAGE Publications Inc. 6. Holmes Lex, Illowsky Barbara and Dean Susan (2018), Introductory Business Statistics, OpenStax. 7. Levine David, Stephan David and Szabat Kathryn (2016), *Statistics for Managers using Microsoft Excel (8th Edition)*, Pearson Education. 8. Thulin, M. (2021), Modern Statistics with R. Eos Chasma Press.	
Course Outcomes:	After completion of this course, the learners will be able to: 1. Carry out a basic data analysis using descriptive statistics and appropriate statistical graphics. 2. Understand the concept of sampling distributions and identify appropriate way of collecting samples based on population 3. Construct a reliable questionnaire based on objectives of a research study 4. Measure and establish association between business variables using correlation analysis and regression analysis for business decision making and forecasting.	

Programme: Bachelor of Commerce (Financial Accounting).
Course Code: COM-226 **Title of the Course: Business Statistics-II (VET)**
Number of Credits: 4 (3L+1P)
Effective from AY: 2026-27

Prerequisites for the Course :	Elementary Mathematics, Business Statistics-I.	
Course Objectives:	1. Provide statistical literacy and develop statistical thinking. 2. Develop practical computational skills and systematic problem-solving capabilities to analyse and interpret data for various business problems and managerial decisions. 3. *Provide business analysts a toolkit of descriptive and inferential analysis.*	
Content		**No. of Hours**
Unit I	**Elementary Probability Theory** • Permutations: Definition, Formula, Permutation with repetition • Combinations: Definition, formula, Properties. • Probability: Elements of Probability-Random Experiments, events, definition of probability, conditional probability, Baye's theorem. • Random Variables- Definition, Probability distribution, Mathematical expectation.	**10**
Unit II	**Probability Distribution functions and Estimation** • Theoretical Distribution - Binomial, Poisson and Normal Distribution. • **Estimation:** Sampling distribution, Standard error, Sample mean and Sample proportion, confidence limits, population mean and population proportion, determining sample size. • Normality of a population. Tests for normality (practical only), Parametric and non-parametric tests.	**15**
Unit III	**Testing of Hypothesis** • Test of Hypothesis: Procedure for testing of hypothesis, Null and Alternate hypothesis, Type I and Type II error, critical region, level of significance, One-tailed and two-tailed test, significance of p-value. • **Parametric tests-** Test of significance for large samples (Population mean and proportion, difference of means and proportion), t-test for small samples, One-way Analysis of Variance (ANOVA) • **Non-parametric tests**: Chi-square test, Mann-Whitney U-test, Kruskal-Wallis test. • **Introduction to Data Analytics:** Types of data (structured/ unstructured), Role of statistics in business analytics, Case-based interpretation	**20**

Practicals	**List of Practicals** **(Practicals to be conducted using softwares like Microsoft Excel/SPSS/PSPP/R etc.)** 1. Permutations and Combinations (Aptitude questions) 2. Probability and Mathematical Expectation 3. Binomial and Poisson distribution 4. Normal distribution curve, Normal distribution table (significance of areas and probability using graph) 5. Tests for normality (Kolmogorov-Smirnov test/ Shapiro-Wilk test/using Regression analysis) 6. Determining sample size 7. Test of significance for large samples (z-test for population mean and difference of means) 8. Test of significance for small samples (t-test for population mean and difference of means) 9. Analysis of Variance: One way ANOVA 10. Two-way ANOVA 11. Chi-square test 12. Mann-Whitney U-test 13. Kruskal Wallis test 14. Working with a real dataset (data analytics) 15. Basic data preprocessing of real datasets.	**30**
Pedagogy	Lectures/Self-study/ Practicals	
Reference Reading	1. Gupta S. C. (2018), *Fundamentals of Statistics*, Himalaya Publishing House. 2. Levine David, Stephan David and Szabat Kathryn (2016), *Statistics for Managers using Microsoft Excel (8th Edition)*, Pearson Education. 3. Anderson David R., Sweeney Dennis J., Williams Thomas A., Camm Jeffrey D., Cochran James J., Fry Michael J. and Ohlmann Jeffrrey W. (2021), *Statistics for Business and Economics*, Cengage Learning. 4. Holmes Lex, Illowsky Barbara and Dean Susan (2018), *Introductory Business Statistics,* OpenStax. 5. Cooper Donald R. and Schindler Pamela S. (2013), *Business Research Methods* (12th Edition), McGraw Hill. 6. George Argyrous (2011), *Statistics for Research: With a Guide to SPSS*, SAGE Publications. 7. Thulin, M. (2021), *Modern Statistics with R*. Eos Chasma Press. 8. Harris Jenine K. (2020), Statistics *with R: Solving Problems Using Real-World Data,* SAGE Publications Inc.	
Course Outcome	At the end of the course, student will be able to 1. Demonstrate use of probability and its applications in a business context. 2. Understand discrete and continuous random variables and be able to use their distributions to compute probabilities. 3. Understand the concept of a normal population and test the normality using appropriate statistical tool. 4. Estimate population parameters using point and interval estimates	

	5. Estimate appropriate sample size for a research study based on the population. 6. Use hypothesis testing as a tool for statistical decision making in a business context. 7. Understand the difference between parametric and non-parametric tests and identify appropriate tool based on a statistical hypothesis. 8. Communicate concepts in probability and statistics using both technical and non-technical language