DegreeLive

B.COM HONOURS	SEMESTER 2	CALICUT UNIVERSITY	COURSE CODE: COM2MN104

FUNDAMENTALS OF BUSINESS MATHEMATICS AND STATISTICS

EXAM REVISION NOTES

JOIN WHATSAPP CHANNEL →

MODULE I

INTRODUCTION TO BUSINESS MATHEMATICS

Numerical Expressions and Business Equations

Dependent vs. Independent Variables

- **Independent Variable (x):** , units produced).
- **Dependent Variable (y):** , total production cost TC).

Numerical Problem 1: Breakeven Market Equilibrium Analysis: 1. Functional Formulations: nbsp; nbsp;TC(q) = 1,80,000 + 350q

- Formulate the Total Cost, Total Revenue, and Total Profit functions.
- Calculate the Breakeven production volume (QBE) and breakeven sales revenue.
- Determine the production volume required to generate a target monthly net profit of Rs.

Classical Methods of Solving Systems in Two Variables

Numerical Problem 2: Three-Product Resource Allocation Case: Step 1: Formulate the System of Three Equations: nbsp; nbsp;(1) Machining Capacity: 2x + 1y + 3z = 85

- Each unit of Product A requires 2 hours of Machining, 3 hours of Assembly, and 1 hour of Inspection.
- Each unit of Product B requires 1 hour of Machining, 2 hours of Assembly, and 2 hours of Inspection.
- Each unit of Product C requires 3 hours of Machining, 1 hour of Assembly, and 2 hours of Inspection.
- The total weekly labor capacities available are: 85 hours in Machining, 90 hours in Assembly, and 55 hours in Quality Inspection.

The Discriminant and the Nature of Roots: The quantity Delta=b2−4ac is designated as the Discriminant of the quadratic equation. The value of Delta completely dictates the economic and mathematical nature of the roots:

- **Change in gt; 0 and a Perfect Square:** ; The business possesses two distinct, rational breakeven or target production volumes.
- **Change in gt; 0 and NOT a Perfect Square:** ; Two real operational solutions exist, but involve fractional decimal output quantities.
- **Delta=0:** ; Tangency point: the business has exactly one unique breakeven point (TR is tangent to TC).
- **Change in lt; 0:** Complex / imaginary roots (p±iq).

The Quadratic Formula (Shreedhara Acharya's Rule)

- Universally applicable to all quadratic equations, including non-factorable equations.

Numerical Problem 3: Non-Linear Profit Maximization Breakeven: 1. Revenue and Profit Formulations: nbsp; nbsp;TR(q) = P * q = (1,000 - 2q) * q = 1,000q - 2q2

- Formulate the Total Revenue and Total Profit equations.
- Calculate the lower and upper breakeven production quantities by solving the quadratic profit equation using both factorization and the quadratic formula.
- Determine the output level that maximizes total profit and calculate the maximum monthly profit.

Comparative Regulatory and Practical Implementation Standards: A rigorous examination of corporate commercial practice highlights the indispensable role of standardized accounting principles.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.
- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 3): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

Executive Synthesis, Governance Policy, and Continuing Professional Mastery: To conclude, mastery of the concepts examined throughout this module empowers students and commerce executives to evaluate complex fiscal data with precision, independence, and analytical clarity.

Executive Synthesis, Governance Policy, and Continuing Professional Mastery: To conclude, mastery of the concepts examined throughout this module empowers students and commerce executives to evaluate complex fiscal data with precision, independence, and analytical clarity.

Comparative Regulatory and Practical Implementation Standards: A rigorous examination of corporate commercial practice highlights the indispensable role of standardized accounting principles.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.
- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 7): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

MODULE II

PROGRESSION THEORY

Sequence, Series and Progression: Concepts Differences

Series

Arithmetic Progression (AP): Theory, Formulations Applications

The Sum of First n Terms (Sn) of an AP: The classic Sum of mation formula, famously derived by Carl Friedrich Gauss, pairs terms symmetrically from beginning and end:

Concept of Single and Multiple Arithmetic Means: When three quantities a,A,b are in Arithmetic Progression, the middle term A is designated as the Arithmetic Mean between a and b:

DegreeLive

Numerical Problem 2: Inserting Arithmetic Means: Given a = 15, b = 57, and number of means n = 6. Total terms in AP = n + 2 = 6 + 2 = 8 terms.

Sum of First n Terms (Sn) of a GP

- **When |r| gt; 1:** Sn=r−1a(rn−1); Exponential compound interest accumulations, compounding sales growth.
- **When |r| lt; 1:** Sn=1−ra(1−rn); Reducing balance depreciation, present value of finite annuities.
- **When r=1:** Constant periodic equal cash flows.
- **Sum to Infinity (n→∞, |r| lt; 1):** Sinfty=1−ra; Perpetual Annuities amp; Capitalized Value: Valuing perpetual preferred dividends or perpetual commercial leases.

Numerical Problem 3: Practical Business Modeling with GP and HP: Part A: Reducing Balance Depreciation as a GP: nbsp; nbsp;Initial Cost C = Rs. 20

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.
- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 2): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 3): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

Executive Synthesis, Governance Policy, and Continuing Professional Mastery: To conclude, mastery of the concepts examined throughout this module empowers students and commerce executives to evaluate complex fiscal data with precision, independence, and analytical clarity.

Comparative Regulatory and Practical Implementation Standards: A rigorous examination of corporate commercial practice highlights the indispensable role of standardized accounting principles.

Comparative Regulatory and Practical Implementation Standards: A rigorous examination of corporate commercial practice highlights the indispensable role of standardized accounting principles.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.
- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 7): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

MODULE III

DIAGRAMMATIC AND GRAPHIC PRESENTATION

Fundamentals of Visual Representation in Business Statistics

Significance and Managerial Utility of Visual Presentation: The widespread adoption of visual presentations in corporate reporting, macroeconomic analysis, and market research is driven by distinct operational advantages:

Trend Cycle Recognition

General Rules and Academic Conventions for Diagram Construction: To ensure statistical integrity, aesthetic professionalism, and academic rigor, every statistical diagram must adhere strictly to established construction canons:

Scientific Scale Selection

Neatness Simplicity

Theoretical Principles of Bar Diagram Construction: In a one-dimensional diagram, magnitude is reflected solely by the length (for horizontal bars) or height (for vertical bars) of geometric rectangles called bars.

Sub-divided (Component) Bar Diagrams: When an aggregate total can be partitioned into distinct constituent components, a Sub-divided Bar Diagram is constructed.

Broken-Scale Bar Diagrams and Sliding Bar Diagrams: In corporate datasets containing extreme outliers, scaling the vertical axis to accommodate an anomalously high figure compresses all other bars into tiny, indistinguishable stubs.

- **Broken-Scale Bar Diagram:** The axis and the anomalous bar are interrupted by a distinct zig-zag break line (kink).
- **Sliding Bar Diagram:** Used to represent bivariate percentage splits (such as percentage of satisfied vs.

Rectangular Diagrams and Sub-divided Rectangles: In a rectangular diagram, the width of the rectangle represents one variable, and the height represents another related variable.

- **Discom North:** 00 per kWh.
- **Discom South:** 50 per kWh.

Rigorous Construction Protocol for Pie Charts:: A multinational enterprise allocates its annual capital expenditure budget of ttRs. 500 Crores across five strategic divisions.

- Calculate the total aggregate value of all constituent items.
- Compute the individual percentage share of each item: (% = (tItem / tTotal) × 100).
- **Compute the exact sector angle in degrees:** (theta = (tItem / tTotal) × 360circ).
- Draw a circle of appropriate radius using a compass.
- Using a protractor, measure and mark the sector angle for the largest component starting from the 12 o'clock line in a clockwise direction.

Pictograms (Picture Diagrams): A pictogram represents statistical quantities through repeated realistic visual icons or symbols. For instance, a vehicle icon may be designated to represent 50,000 units produced, or a human silhouette may denote 1,000,000 citizens.

- **Standard Rule:** Magnitude must be shown by repeating identical unit icons of the same size, NOT by enlarging a single icon (which creates visual distortion due to quadratic area expansion).
- **Merits:** Immediate public engagement, highly appealing for general exhibitions and corporate annual brochures.
- **Demerits:** Imprecise; fractions of an icon are difficult to draw or interpret accurately.

The Mathematical Coordinate Plane and Graphing Mechanics: Graphs represent mathematical functions and continuous empirical frequency distributions plotted upon a Cartesian coordinate grid.

Graphic Determination of the Mode using a Histogram: The Mode is the value of the variable that occurs with the greatest frequency. Geometrically, the mode resides within the tallest rectangle of the histogram, termed the Modal Class.

Frequency Polygon: A Frequency Polygon is a closed rectilinear geometric figure formed by connecting the midpoints of the tops of the histogram rectangles with straight line segments.

- **Independent Construction:** Plot mid-values (m) on the X-axis against frequencies on the Y-axis, then join consecutive coordinate pairs (mi, fi) using a ruler.
- **Closure Rule:** To ensure the area under the polygon equals the area under the histogram, the polygon must be anchored to the X-axis at both ends by extending lines to the midpoints of two hypothetical adjacent classes with frequency zero.

Graphic Determination of Partition Values (Median, Quartiles, Deciles, Percentiles):: An audit of 200 corporate accounts measures processing turnaround t × (in hours). Construct the "Less than" and "More than" cumulative distributions and determine the Median, First Quartile (Q1), and Third Quartile (Q3):

- Locate the target cumulative frequency rank on the vertical Y-axis: (N/2) for Median, (N/4) for First Quartile (Q1), (3N/4) for Third Quartile (Q3), and (k · N/100) for the (k)-th Percentile (Pk).
- Draw a horizontal line from this Y-coordinate until it intersects the "Less than" Ogive at point (K).
- From point (K), drop a vertical perpendicular straight down to the horizontal X-axis.
- The point of intersection on the X-axis provides the exact statistical partition value!

MODULE IV

DESCRIPTIVE STATISTICS

Measures of Central Tendency (Statistical Averages)

Based on All Observations

Sampling Stability

Geometric Mean (GM): The Geometric Mean of (n) positive values is the (n)-th root of their product: GM = sqrt[n]X1 · X2 ... Xn = tAntilogleft((∑ log X) / (n))

- **Grouped Series:** (GM = Antilogleft(∑ f log m) / (N)right).
- **Business Utility:** The only mathematically correct average for calculating compound annual growth rates (CAGR), inflation indices, index numbers, and compound returns on financial assets.
- **Constraint:** Fails if any value is zero or negative.

The Mode and Empirical Relationship: The Mode (Z) is the value that occurs with the highest frequency in a distribution. In discrete series with multiple peaks or irregular clustering, the mode is determined using Grouping and Analysis Tables (forming pairs and triplets of column frequencies).

Range: The simplest measure of dispersion, defined as the difference between the maximum and minimum observations: Range=L−S Coefficient of Range=L+SL−S

- **Business Utility:** Daily stock market high/low price spreads; quality control control charts (X^{-} and (R) charts); meteorological weather forecasts.
- **Limitation:** Completely ignores all intermediate data and is hyper-sensitive to extreme outliers.

Coefficient of Variation (CV) Commercial Risk Comparison: The Coefficient of Variation (CV), developed by Karl Pearson, expresses the standard deviation as a percentage of the arithmetic mean:

- A series with a lower CV is deemed more consistent, stable, uniform, and reliable.
- A series with a higher CV exhibits greater variability, dispersion, risk, and volatility.
- **Stock Alpha:** Mean price $X^{-}A$=Rs.
- **Stock Beta:** Mean price $X^{-}B$=Rs.

Mathematical Measures of Skewness: Statisticians compute relative coefficients of skewness to quantify asymmetry independently of data units:

- **Karl Pearson's Coefficient (Skp):** If the mode is ill-defined, deploy (Skp = (3Mean−Median) / (sigma)).
- **Bowley's Quartile Coefficient (Skb):** Simplifies to: Skb=Q3−Q1Q3+Q1 −2M Bound strictly between (-1) and (+1).
- **Kelly's Measure (Skk):** Based on the 10th and 90th percentiles: Skk =P90−P10P90+P10−2M.

Platykurtic (Broad / Flat): A distribution with a broad, flat-topped peak and thinner tails than the normal curve.

- **Moment Ratio:** β2 lt;3 (or Excess Kurtosis (gamma2 < 0)).
- **Business Meaning:** Wide, even dispersion with minimal heavy-tail outlier events.

Comparative Regulatory and Practical Implementation Standards: A rigorous examination of corporate commercial practice highlights the indispensable role of standardized accounting principles.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.
- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.

- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

- **Ledger amp; Voucher Integrity:** ; Companies Act (Sec.
- **Revenue amp; Cost Allocation:** ; Ind AS 115 (Revenue from Contracts with Customers) amp; CAS 1 to 24 Cost Accounting Standards.
- **Fiscal Risk amp; Tax Compliance:** ; GST Law Section 16/36 Rules amp; Income Tax Act Transfer Pricing Provisions.
- **Working Capital Governance:** ; Tandon amp; Chore Committee Norms for Bank Working Capital Credit Appraisal.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 5): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 6): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

Advanced Analytical Dimensions and Applied Commerce Casework (Analytical Division 7): The concepts, statutory provisions, operational accounting rules, and quantitative models detailed in this module carry critical implications for enterprise governance, audited disclosure standards, and executive fiscal decision-making.

DegreeLive