

WEST BENGAL COUNCIL OF HIGHER SECONDARY EDUCATION
SYLLABUS FOR CLASS XI AND XII
SUBJECT: BUSINESS MATHEMATICS AND BASIC
STATISTICS (BMBS)

Course Objectives

The Mathematics curriculum for commerce students has been designed in response to the field's expansion and the changing demands of society. In order to address the evolving demands of specific discipline, the current syllabus has been created. More focus has been placed on the application of certain principles, drawing inspiration for the issues from real-world scenarios and other academic disciplines.

The following are the main goals of teaching mathematics to senior school students opting for commerce:

- To develop general interest in Mathematics as a discipline
- To gain a good measure of insight and knowledge to application oriented problems (daily life problems)
- To experience the fashion of demonstrating an outcome or resolving an issue
- To use the gained information to solve practical life oriented mathematical and statistical problems
- To be able to solve practical problems by forming and solving mathematical and statistical structures associated therewith
- To develop the power of solving problems logically step by step
- To develop a sense of appreciation and respect for notable mathematicians and their contributions to mathematics
- To cultivate an optimistic outlook in order to evaluate and perform coherently

Course Outcomes

At the end of the course, the students are expected to develop the power of critical thinking to solve various problems.

The following are the major course outcomes. A student is expected:

- To be able to develop problem solving skills and apply mathematical concepts to real life situations
- To be able to develop a mindset to collaborate with peers to solve mathematical problems
- To be able to understand the graphical representation of curves and to be able to make predictions and draw conclusions based on statistical data
- To be able to communicate mathematical ideas and solutions both verbally and in written form
- To be able to present mathematical arguments and justifications
- To be able to perform up to (at least) satisfactory level in formal evaluation
- To be able to understand the relevance of mathematics in real-world applications
- To be able to compete in the several Entrance Examinations successfully

CLASS - XI**SEMESTER – I****SUBJECT: BUSINESS MATHEMATICS AND BASIC STATISTICS (BMBS)****FULL MARKS: 40****CONTACT HOURS: 100 Hours****COURSE CODE : THEORY**

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-I	ALGEBRA	45	18
	1. Theory of Quadratic Equations: General form of quadratic equation $p(x) = 0$ [where $p(x) = ax^2 + bx + c$, ($a \neq 0$) is a polynomial in x of degree 2; $a, b, c \in \mathbb{R}$.]; Zeros of a polynomial $p(x)$, also known as the roots of the polynomial equation $p(x) = 0$; To find the solutions/roots of quadratic equations with rational coefficients by factorization, the method of perfect squares and by Sridharacharya's method(statement only), For a given real number, to check whether that is a root of a given quadratic equation? Cardinality of the set of real solutions for a of quadratic equation	20	8
	2. Compound Interest: Compound interest compounding yearly, half yearly, quarterly, monthly (for a span of 3 years, at the most)	12	5
	3. Taxes Sales tax, Value Added Tax (VAT), Goods and Services Tax (GST, including SGST and CGST), Comparison among them	13	5

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-II	Statistics	25	10
	1. Evaluation of Arithmetic mean (discrete data) 2. Evaluation of Arithmetic mean (grouped data) 3. Evaluation of mode for discrete data 4. Evaluation of median for discrete data 5. Evaluation of mean of y from that of x , where $y = ax + b$, where a, b are real constants	5 5 5 5 5	2 2 2 2 2
UNIT-III	Theory of Sets	15	6
	Definition of set, Representation of sets: Roster form; Set-builder form, Some types of sets: empty set, singleton sets, universal set, finite sets. Cartesian product of two finite sets (idea of ordered pair). Cardinality of finite sets and cardinality of Cartesian product of two finite sets Set relation: Subset, Superset (Example: $\mathbb{N} \subseteq \mathbb{W}$), Proper subset (Example: $\mathbb{N} \subset \mathbb{W}$), Special Thinking: $A \subset B \Rightarrow A \subseteq B$ but converse is not necessarily true (example only),	15	6
UNIT-IV	Trigonometry	15	6
	1. Trigonometric ratios; Trigonometric ratios of $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$; Trigonometric identities ($\sin^2 x + \cos^2 x = 1$) and other identities from trigonometric ratios; Complementary angles and supplementary angles and the values of $\sin x, \cos x, \tan x$ for $x = 120^\circ, 135^\circ, 150^\circ, 180^\circ$	15	6

SEMESTER – II

SUBJECT: BUSINESS MATHEMATICS AND BASIC STATISTICS (BMBS)

FULL MARKS: 40

CONTACT HOURS: 80 HOURS

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-I	ALGEBRA	24	12
	1. Arithmetic Progression and Geometric Progression: Idea through examples, idea of first term and common difference (for arithmetic progression) and common ratio (for geometric progression), formula for general term for above mentioned types of progressions and related problems such as – to find the value of a term or finding the position of a term for a particular value assigned to that particular term, Some Important Series, Formulae for sum of the first n terms of Arithmetic Progression and Geometric Progression and related problems, Verification of the following formulae for a given positive integer: $\sum_{i=1}^n i = \frac{n(n+1)}{2}, \sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}, \sum_{i=1}^n i^3 = \left(\frac{n(n+1)}{2}\right)^2$ 2. Permutations and Combinations Factorial of any natural number, $0! = 1$ (axiom), $n_{P_r} = \frac{n!}{(n-r)!}$ ($0 \leq r \leq n$) ($r, n \in \mathbb{W}$); $n_{C_r} = \frac{n!}{r!(n-r)!}$ ($0 \leq r \leq n$) ($r, n \in \mathbb{W}$), Meaning of n_{P_r} and n_{C_r}, Evaluation of n_{P_r} and n_{C_r}, simple problems related on these for $n \leq 8$	12	6
		12	6

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-II	Theory of Sets	20	10
	Important Theorem (statement only): Null set is considered as a subset of any set. Power set of a finite set and its cardinality (verification with sets with cardinality ≤ 4), Set operations: Union, Intersection, Difference, Symmetric Difference, and Complement of a set in the universal set. Knowledge of disjoint sets. Venn Diagram, Some Important Properties/Axioms (excluding proofs): Commutative property for Union and Intersection of sets, Distributive property of Union over Intersection and Intersection over Union for sets. Verification of the above with Venn diagram and for finite sets (with cardinality ≤ 6), De Morgan's Laws (excluding proof) and verification with sets (with cardinality ≤ 6), Inclusion and Exclusion theorem of set theory (Cardinality theorem) for two sets and three sets; Simple problems including word problems using this theorem; Cartesian product of two sets, Ordered pair; Cardinality of Cartesian product of two finite sets Functions: Pictorial representation of a function, understanding the function as a set of ordered pair, understand the domain, co-domain and range of a function guided by the diagram, Concept of one-to-one function and many-to-one function, surjectivity and bijectivity of functions through pictorial presentations	20	10
UNIT-III	Limits and Derivatives	24	12
	1. Limits: Concept of limits (questions should not be set on this), Formal representation of a limit of a function like $\lim_{x \rightarrow a} f(x)$, limit over addition, subtraction, product and division of two functions. Basic difference between Right hand limit and Left hand limit,	24	12

UNIT No.	TOPICS	CONTACT HOURS	MARKS
	Limit formulae: $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$ and $\lim_{x \rightarrow 0} \frac{(1+x)^n - 1}{x} = n$, $n \in \mathbb{Q}$ (the set of rational numbers) (different representation of the same formula), $\lim_{x \rightarrow 0} \frac{e^x - 1}{x} = 1$, $\lim_{x \rightarrow 0} \frac{\log_e(1+x)}{x} = 1$; Simple problems using these formulae, Derivative as a rate of measure (First principle to calculate derivative is excluded); Differentiation formulae: $\frac{dc}{dx} = 0$, c is a constant $\frac{dx^n}{dx} = nx^{n-1}$, $n \in \mathbb{Q}$, $\frac{de^x}{dx} = e^x$, $\frac{d \log_e x}{dx} = \frac{1}{x}$, $\frac{da^x}{dx} = a^x \log_e a$ ($a > 0$); Chain rule; Simple problems using these formulae Application of derivatives: Maxima and Minima: Cost functions, demand functions, marginal cost etc.		
UNIT-IV	Theory of Probability	12	6
	Important terminology: random experiment, sample space, events, simple event, compound event, mutually exclusive events, collectively exhaustive events, equally likely events (regarding the number of sample points), classical definition of probability and related problems	12	6

[Note: 20 Hours reserved for Remedial classes, Tutorials and Home Assignments.]

Course: Project for Class XI

Full Marks: 20

Projects should be conducted regularly throughout the year. A project notebook is to be prepared by each and every student where all the below mentioned activities should be recorded. There should be a project assessment once a year (once in Class XI and once in Class XII) where the student will be asked to do one of the activities and write it in his/her script provided for the purpose. The student should carry his/her project notebook during the assessment. A viva should also be conducted during the assessment to test the knowledge of the student regarding the project activity.

List of Projects for Class XI

Sl. No.	Topics	Activities
1	Sequence and Series	To illustrate that the arithmetic mean of two different positive numbers is always greater than the geometric mean (by proper diagram and by proper calculation)
2	Theory of Sets	To show that the total number of subsets of a given set with 'n' number of elements is 2^n (by inductive method of learning and by using the notion of combination)
3	Theorem of Inclusion and Exclusion	Verification through Venn Diagram
4	Limits and Derivatives-I	Evaluating $\lim_{x \rightarrow c} \frac{x^2 - c^2}{x - c}$, $\lim_{x \rightarrow c} \frac{x^3 - c^3}{x - c}$, $\lim_{x \rightarrow c} \frac{x^4 - c^4}{x - c}$, and inductive learning of the generalized formula $\lim_{x \rightarrow c} \frac{x^n - c^n}{x - c}$ for positive integer n
5	Limits and Derivatives-II	Evaluating $\lim_{x \rightarrow c} \frac{x^2 - c^2}{x - c}$, $\lim_{x \rightarrow c} \frac{x^3 - c^3}{x - c}$, $\lim_{x \rightarrow c} \frac{x^4 - c^4}{x - c}$, and inductive learning of the generalized formula $\lim_{x \rightarrow c} \frac{x^n - c^n}{x - c}$ and inductive learning the general formula for negative integer n
6	Permutations and Combinations	To find out the number of permutations and combinations from a set of 3 different objects taking 2 at a time. 1. Using formulae and 2. Verify the results thus obtained by real activities
7	Theory of probability	To write the sample space, when a coin is tossed three times. Finding out the probability of the events "zero head"; "one head"; "two heads" and "three heads" and two find the sum of probabilities of these events and verify that the sum is 1

Marks Division for the Project Assessment

<u>Sl. No.</u>	<u>Item</u>	<u>Marks</u>
1	Project Notebook	10
2	Doing and writing a project during the project assessment	5
3	Viva	5
	Total	20

CLASS - XII

SEMESTER – III

SUBJECT: BUSINESS MATHEMATICS AND BASIC STATISTICS (BMBS)

FULL MARKS: 40

CONTACT HOURS: 100 Hours

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-I	Algebra	35	14
	1. Banking (special emphasis on Fixed deposit and Recurring deposit calculation)	10	4
	2. Shares and Dividends	7	3
	3. Laws of Indices	8	3
	4. Logarithm	10	4
UNIT-II	Geometry	15	6
	Geometry of two dimensions: Cartesian co-ordinate system. Formula for distance between two points, Section formula, Formula for finding co-ordinates of centroid of a triangle with given vertices	15	6
UNIT-III	Statistics	40	16
	1. Graphical representation of statistical data: Line graph, Bar diagram (including multiple bars), Pie diagram, Histogram, Frequency Polygon, Ogives, Comparison of statistical data from graphical presentation	15	6
	2. Measurement of dispersion (for discrete set of data and continuous set of data): Mean deviation about arithmetic mean and median, Variance, Standard Deviation, Coefficient	15	6

UNIT No.	TOPICS	CONTACT HOURS	MARKS
	of Variance 3. Index Numbers Price Index Numbers: Simple Aggregate Method ($\frac{\sum p_n}{\sum p_0} \times 100$), Weighted Aggregate Method ($\frac{\sum p_n w}{\sum p_0 w} \times 100$), Cost of Living Index ($\frac{\sum IW}{\sum W}$)	10	4
UNIT-IV	Logical Reasoning	10	4
	1. Number series coding and decoding and odd man out 2. Direction Tests 3. Seating Arrangements 4. Blood relations	3 2 2 3	1 1 1 1

SEMESTER – IV

SUBJECT: BUSINESS MATHEMATICS AND BASIC STATISTICS (BMBS)

FULL MARKS: 40

CONTACT HOURS: 80 HOURS

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-I	Algebra	24	12
	1. Theory of Matrices (order up to 2×2) Idea of rows and columns of a matrix, idea of equal matrices, null matrix, square matrix, diagonal matrix, scalar matrix, identity matrix, Algebra of matrices: addition, subtraction, multiplication by a scalar and multiplication of two matrices	6	3
	2. Determinants: Determinant of a square matrix of order 2×2, solving linear equations in two variables using Cramer's rule (number of independent equations=number of variables)	8	4
	3. Different types of financial loans: EMI calculation for different situations arises in real life	6	3
	4. Calculation of billing discount and average billing date	4	2
UNIT-II	CALCULUS	28	14
	1. Integration Integration as an operation just opposite to the operation differentiation Simple problems using formulae: $\int x^n dx = \frac{x^{n+1}}{n+1} + C \quad (n \neq -1), \int \frac{1}{x} dx = \ln x + C,$	16	8

UNIT No.	TOPICS	CONTACT HOURS	MARKS
	$\int e^x dx = e^x + C, \int \frac{1}{x^2 - a^2} dx (x > a) = \frac{1}{2a} \ln \left \frac{x-a}{x+a} \right + C,$ $\int \frac{1}{a^2 - x^2} dx = \frac{1}{2a} \ln \left \frac{x+a}{x-a} \right + C (a > x), \text{ integration by parts}$ (both the functions must be polynomial or algebraic in nature), statement of fundamental theorem of integral calculus, definite integration – simple problems only, 2. Differential Equations Definition of differential equations, order and degree of differential equations, formation of a differential equation for simple cases, solving differential equations on simple problems based on algebraic functions using variable separation technique	12	6
UNIT-III	Statistics	14	7
	Statistics Idea of bivariate data: calculation of covariance and correlation coefficient; Geometric point of view of Pearson correlation coefficient and Rank correlation coefficient. Regression coefficient b_{xy} and b_{yx}, finding regression lines x on y, and y on x; the point $(\bar{x}, \bar{y})$ as the point of intersection of these two regression lines	14	7
UNIT-IV	LINEAR PROGRAMMING	14	7
	1. Linear Inequalities Basic idea and locate the region represented by the linear in-equation with respect to the graph of the corresponding equation (hand drawn graph on plain paper) 2. Simple examples of Linear Programming Problems, Idea of	4	2
		10	5

UNIT No.	TOPICS	CONTACT HOURS	MARKS
	Objective function, constraints, feasible solution, convex set of solutions, corner points of solution set(region) Solving linear programming problem by graphical method (two variable cases, feasible solution cases with non-negativity restriction)		

[Note:20 Hours reserved for Remedial classes, Tutorials and Home Assignments.]

Course: Project for Class XII

Full Marks: 20

Projects should be conducted regularly throughout the year. A project notebook is to be prepared by each and every student where all the below mentioned activities should be recorded. There should be a project assessment once a year (once in Class XI and once in Class XII) where the student will be asked to do one of the activities and write it in his/her script provided for the purpose. The student should carry his/her project notebook during the assessment. A viva should also be conducted during the assessment to test the knowledge of the student regarding the project activity.

List of Projects for Class XII

<u>Sl. No.</u>	<u>Topics</u>	<u>Activities</u>
1.	Theory of matrices	Emergence of the fact that 'scalar algebra' is different from 'matrix algebra' with the help of posing two matrices A and B such that $AB \neq BA$ and posing two non-null matrices X and Y such that XY is a null matrix.
2.	Determinants	Verification of Cramer's rule by posing two independent linear equations containing two variables and by solving them by elimination method beside by Cramer's rule method.
3.	Integration	Evaluation of $\int \frac{dx}{x^2-5x+6}$ by factorising the denominator of the integrand and by using the standard integral-result and comparison between the two answers thus obtained.
4.	Linear programming problem	To form an L.P.P. from a given situation and to find the solution graphically (by corner point method)
5.	Statistics	For a given set of statistical data, draw different types of graphs to represent the data.

Marks division for the Project Assessment

<u>Sl. No.</u>	<u>Item</u>	<u>Marks</u>
1.	Project Notebook	10
2.	Doing and Writing a project during the project assessment	05
3.	Viva	05
	Total	20