Session- 2022-23

Secondary School Education prepares students to explore future career options after graduating from schools. Mathematics is an important subject that helps students to choose various fields of their choices. Mathematics is widely used in higher studies as an allied subject in the field of Economics, Commerce, Social Sciences and many others. It has been observed that the syllabus of Mathematics in senior secondary grades meant for Science subjects may not be appropriate for the students who wish to pursue Commerce or Social Science-based subjects in university education. By keeping this in mind, one more elective course in the Mathematics syllabus is developed for Senior Secondary classes with an aim to provide students relevant experience in Mathematics that can be used in fields other than Physical Sciences.

This course is designed to develop substantial mathematical skills and methods needed in other subject areas. Topics covered in two years aim to enable students to use mathematical knowledge in the field of business, economic and social sciences. It aims to promote appreciation of mathematical power and simplicity for its countless applications in diverse fields. The course continues to develop mathematical language and symbolism to communicate and relate everyday experiences mathematically. In addition, it reinforces the logical reasoning skills of formulating and validating mathematical arguments, framing examples, finding counterexamples. It encourages students to engage in mathematical investigations and to build connections within mathematical topics and with other disciplines. The course prepares students to use algebraic methods as a means of representation and as a problem-solving tool. It also enables students to interpret two-dimensional geometrical figures using algebra and to further deduce properties of geometrical figures in a coordinate system. The course content will help students to develop a sound understanding of descriptive and inferential statistics which they can use to describe and analyze a given set of data and to further make meaningful inferences out of it. Data based case studies from the field of business, economics, psychology, education, biology and census data will be used to appreciate the power of data in contemporary society.

It is expected that the subject is taught connecting concepts to the applications in various fields. The objectives of the course areas are as follows:

Objectives:
a) To develop an understanding of basic mathematical and statistical tools and their applications in the field of commerce (business/ finance/economics) and social sciences.
b) To model real-world experiences/problems into mathematical expressions using numerical/algebraic/graphical representation.
c) To make sense of the data by organizing, representing, interpreting, analysing, and making meaningful inferences from real-world situations.
d) To develop logical reasoning skills and apply the same in simple problem-solving.
e) To reinforce mathematical communication by formulating conjectures, validating logical arguments and testing hypothesis.
f) To make connections between Mathematics and other disciplines.

Grade XI (2022-23)

Number of Paper: 1

Total number of Periods: 240 (35 Minutes Each)

Time: 3 Hours

Max Marks: 80

No.	Units	No. of Periods	Marks
I	Numbers, Quantification and Numerical Applications	25	09
II	Algebra	45	15
III	Mathematical Reasoning	15	06
IV	Calculus	35	10
V	Probability	25	08
VI	Descriptive Statistics	35	12
VII	Basics of Financial Mathematics	45	15
VIII	Coordinate Geometry	15	05
Total		240	80
Internal Assessment			20

CLASS- XI

MONTHS	Contents	Learning Outcomes: Students will be able to	NO. OF PERIODS
<td colspan="4">**UNIT – 1 NUMBERS, QUANTIFICATION AND NUMERICAL APPLICATIONS**</td>
<td colspan="4">**Numbers & Quantification**</td>

AUGUST	Binary Numbers, Indices, Logarithm and Antilogarithm, Laws and properties of logarithms, Simple applications of logarithm and Antilogarithm, Averages Clock, Calendar, Time, Work and Distance, Mensuration, Seating arrangement	● Express decimal numbers in binary system
		● Express binary numbers in decimal system
		● Relate indices and logarithm /antilogarithm
		● Find logarithm and antilogarithms of given number
		● Enlist the laws and properties of logarithms
		  *Apply laws of logarithm
		  Use logarithm in different applications
		  *Determine average for a given data
		● Evaluate the angular value of a minute
		● Calculate the angle formed between two hands of clock at given time
		● Calculate the time for which hands of clock Meet
		● Determine Odd days in a month/ year/ century
		  Decode the day for the given date
		● Establish the relationship between work and time
		● Compare the work done by the individual / group w.r.t. time
		● Calculate the time taken/ distance covered/ Work done from the given data
		● Solve problems based on surface area and volume of 2D and 3D shapes
		  Calculate the volume/ surface area for solid formed using two or more shapes
		● Create suitable seating plan/ draft as per given conditions (Linear/circular)
		● Locate the position of a person in a seating arrangement
			25

UNIT – 2 ALGEBRA			
Sets			
AUGUST	Introduction to sets – definition, Representation of sets, Types of sets and their notations, Subsets, Intervals, Venn diagrams, Operations on sets,	• Define set as well-defined collection of objects • Represent a set in Roster form and Set builder form • Identify different types of sets on the basis of number of elements in the set • Differentiate between equal set and equivalence set • Enlist all subsets of a set • Find number of subsets of a given set • Find number of elements of a power set • Express subset of real numbers as intervals • Apply the concept of Venn diagram to understand the relationship between sets • Solve problems using Venn diagram • Perform operations on sets to solve practical problems	10
Relations			
SEPTEMBER	Ordered pairs, Cartesian product of two sets, Relations	• Explain the significance of specific arrangement of elements in a pair • Write Cartesian product of two sets • Find the number of elements in a Cartesian product of two sets • Express relation as a subset of Cartesian product • Find domain and range of a relation	10

		Sequences and Series	
SEPTE MBER	Sequence and Series, Arithmetic Progression, Geometric Progression, Applications of AP and GP	● Differentiate between sequence and series ● Identify Arithmetic Progression (AP) ● Establish the formulae of finding n^{th}term and sum of n terms ● Solve application problems based on AP ● Find arithmetic mean (AM) of two positive numbers ● Identify Geometric Progression (GP) ● Derive the n^{th}term and sum of n terms of a given GP ● Solve problems based on applications of GP ● Find geometric mean (GM) of two positive numbers ● Solve problems based on relation between AM and GM ● Apply appropriate formulas of AP and GP to solve application problems	15
		Permutations and Combinations	

SEPT EMB ER	Factorial, Fundamental Principle of Counting, Permutations, Combinations	● Define factorial of a number
		● Calculate factorial of a number
		● Appreciate how to count without counting
		● Define permutation
		  *Apply the concept of permutation to solve simple problems
		● Define combination
		
		● Differentiate between permutation and combination
		  Apply the formula of combination to solve the related problems
			10

UNIT -3		MATHEMATICAL REASONING	
OCTO BER	Logical reasoning	● Solve logical problems involving odd man out, syllogism, blood relation and coding decoding	15
UNIT – 4 CALCULUS			
OCT OBE R	Functions, Domain and Range of a function, Types of functions, Graphical representation of functions Concepts of limits and continuity of a function Instantaneous rate of change Differentiation as a process of finding derivative Derivatives of algebraic functions using Chain Rule	● Identify dependent and independent variables ● Define a function using dependent and independent variable ● Define domain, range and co-domain of a given function ● Define various types of functions ● Identify domain, co- domain and range of the function ● Representation of function graphically ● Define limit of a function ● Solve problems based on the algebra of limits ● Define continuity of a function ● Define instantaneous rate of change ● Find the derivative of the functions ● Find the derivative of function of a function	25

UNIT – 5 PROBABILITY			
NOVE MBER	Introduction, Random experiment and sample space, Event, Conditional Probability, Total Probability, Bayes' Theorem	● Appreciate the use of probability in daily life situations ● Define random experiment and sample space with suitable Examples ● Define an event ● Recognize and differentiate different types of events and find their probabilities ● Define the concept of conditional probability Apply reasoning skills to solve problems based on conditional probability ● Interpret mathematical information and identify situations when to apply total probability ● Solve problems based on application of total probability ● State Bayes' theorem Solve practical problems based on Bayes' Theorem	20

		UNIT- 6 DESCRIPTIVE STATISTICS	
NOV EMB ER	Data Interpretation		
	Measure of Dispersion, Skewness and Kurtosis Percentile rank and Quartile rank Correlation	● Understand meaning of dispersion in a data set ● Differentiate between range, quartile deviation, mean deviation and standard deviation ● Calculate range, quartile deviation, mean deviation and standard deviation for ungrouped and grouped data set ● Choose appropriate measure of dispersion to calculate spread of data ● Define Skewness and Kurtosis using graphical representation of a data set ● Interpret Skewness and Kurtosis of a frequency distribution by plotting the graph ● Calculate coefficient of Skewness and interpret the Results ● Define Percentile rank and Quartile rank ● Calculate and interpret Percentile and Quartile rank of scores in a given data set ● Define correlation in values of two data sets ● Calculate Product moment correlation for ungrouped and grouped data ● Calculate Karl Pearson's coefficient of correlation ● Calculate Spearman's rank correlation ● Interpret the coefficient of correlation	20
		UNIT – 7 FINANCIAL MATHEMATICS	
DECE MBE R JANU ARY	Interest and Interest Rates Accumulation with simple and compound interest Simple and compound interest rates with equivalency Effective rate of interest Present value, net present value and future value Annuities, Calculating value of Regular Annuity Simple applications of regular annuities (upto 3 period Tax, calculation of	● Define the concept of Interest Rates ● Compare the difference between Nominal Interest Rate, Effective Rate and Real Interest Rate ● Solve Practical applications of interest rate ● Interpret the concept of simple and compound interest ● Calculate Simple Interest and Compound Interest ● Explain the meaning, nature and concept of equivalency ● Analyze various examples for ● understanding annual equivalency rate ● Define with examples the concept of effective rate of interest ●Interpret the concept of compounding and discounting along with practical applications ●Compute net present value ● Apply net present value in capital budgeting decisions ●Explain the concept of Immediate Annuity, Annuity due and Deferred Annuity ● Calculate General Annuity ●Calculate the future value of regular annuity, annuity due Apply the concept of Annuity in real life situations ●Explain fundamentals of taxation ●Differentiate between Direct and indirect tax ●Define and explain GST ●Calculate GST ●Explain rules under State Goods and Services Tax (SGST) Central Goods and Services Tax (CGST) and Union Territory	30 15

tax, simple applications of tax calculation in Goods and service tax, Income Tax Bills, tariff rates, fixed charge, surcharge, service charge Calculation and interpretation of electricity bill, water supply bill and other supply bills	● Goods and Services Tax (UTGST) ● Describe the meaning of bills and its various types ● Analyze the meaning and rules determining tariff rates ● Explain the concept of fixed charge ● To interpret and analyze electricity bills, water bills and other supply bills ● Evaluate how to calculate units consumed under electricity bills/water bill	

UNIT – 8 COORDINATE GEOMETRY			
JANUARY	Straight line, Circle, Parabola	● Find the slope and equation of line in various form ● Find angle between the two lines ● Find the perpendicular from a given point on a line ● Find the distance between two parallel lines ● Define a circle ● Find different form of equations of a circle ● Solve problems based on applications of circle ● Define parabola and related terms ● Define eccentricity of a parabola ● Derive the equation of parabola	15

Practical: Use of spreadsheet
Calculating average, interest (simple and compound), creating pictographs, drawing pie chart, bar graphs, calculating central tendency visualizing graphs (straight line, circles and parabola using real-time data)

Suggested practical using spreadsheet
1. Plot the graph of functions on excel study the nature of function at various points, drawing lines of tangents
2. Create a budget of income and spending
3. Create and compare sheet of price & features to buy a product
4. Prepare the best option plan to buy a product by comparing cost, shipping charges, tax and other hidden costs
5. Smart purchasing during sale season
6. Prepare a report card using scores of the last four exams and compare the performance
7. Collect the data on weather, price, inflation, and pollution. Sketch different types of graphs and analyze the results

Grade XII (2022-23)

Number of Paper: 1

Total number of Periods: 240 (35 Minutes Each)

Time: 3 Hours

Max Marks: 80

No.	Units	No. of Periods	Marks
I	Numbers, Quantification and Numerical Applications	30	11
II	Algebra	20	10
III	Calculus	50	15
IV	Probability Distributions	35	10
V	Inferential Statistics	10	05
VI	Index Numbers and Time-based data	30	06
VII	Financial Mathematics	50	15
VIII	Linear Programming	15	08
Total		240	80
Internal Assessment			20

CLASS XII

MONTHS	Contents	Learning Outcomes: Students will be able to	PERIODS
UNIT-1 NUMBERS, QUANTIFICATION AND NUMERICAL APPLICATIONS			
APRIL	Modulo Arithmetic, Congruence Modulo, Alligation and Mixture, Numerical Problems, Boats and Streams (upstream and downstream) , Pipes and Cisterns , Races and Games, Numerical Inequalities	• Define modulus of an integer • Apply arithmetic operations using modular arithmetic rules • Define congruence modulo • Apply the definition in various problems • Understand the rule of alligation to produce a mixture at a given price • Determine the mean price of a mixture • Apply rule of allegation • Solve real life problems mathematically • Distinguish between upstream and downstream • Express the problem in the form of an equation • Determine the time taken by two or more pipes to fill or empty the tank • Compare the performance of two players w.r.t. time, distance • Describe the basic concepts of numerical inequalities • Understand and write numerical inequalities	30
	UNIT- 2 ALGEBRA		

MAY/JUNE	Matrices and types of matrices, Equality of matrices, Transpose of a matrix, Symmetric and Skew symmetric matrix, Algebra of Matrices	● Define matrix
		● Identify different kinds of matrices
		  Find the size / order of matrices
		● Determine equality of two matrices
		● Write transpose of given matrix
		  Define symmetric and skew symmetric matrix
		● Perform operations like addition & subtraction on matrices of same order
		● Perform multiplication of two matrices of appropriate order
		  Perform multiplication of a scalar with matrix
			10

MAY/JUNE	Determinants, Inverse of a matrix, Solving system of simultaneous equations using matrix method, Cramer's rule	● Find determinant of a square matrix
		● Use elementary properties of determinants
		● Define the inverse of a square matrix
		● Apply properties of inverse of matrices
		● Solve the system of simultaneous equations using
		  i) Cramer's Rule
		  ii) Inverse of coefficient matrix
		● Formulate real life problems into a system of simultaneous linear equations and solve it using these methods
			10

	UNIT- 3 CALCULUS		
	Differentiation and its Applications		
JULY	Higher Order Derivatives, Application of Derivatives, Marginal Cost and Marginal Revenue using derivatives, Increasing /Decreasing Functions, Maxima and Minima	● Determine second and higher order derivatives ● Understand differentiation of parametric functions and implicit functions ● Determine the rate of change of various quantities ● Understand the gradient of tangent and normal to a curve at a given point ● Write the equation of tangents and normal to a curve at a given point ● Define marginal cost and marginal revenue ● Find marginal cost and marginal revenue ● Determine whether a function is increasing or decreasing ● Determine the conditions for a function to be increasing or Decreasing ● Determine critical points of the function ● Find the point(s) of local maxima and local minima and corresponding local maximum and local minimum values ● Find the absolute maximum and absolute minimum value of a function Solve applied problems	15

Integration and its Applications			

JULY	Integration, Indefinite Integrals as family of curves, Definite Integrals as area under the curve,	• Understand and determine indefinite integrals of simple functions as anti-derivative
		• Evaluate indefinite integrals of simple algebraic functions by method of:
		  •substitution
		  • partial fraction
		• by parts
		• Define definite integral as area under the curve
		• Understand fundamental theorem of Integral calculus and apply it to evaluate the definite integral
		• Apply properties of definite integrals to solve the problems
			15

AUGUST	Application of Integration	• Identify the region representing C.S. and P.S. graphically Apply the definite integral to find consumer surplus-producer surplus	10
Differential Equations and Modeling			
AUGUST	Differential Equations, Formulating and Solving Differential Equations, Application of Differential Equations	● Recognize a differential equation ● Find the order and degree of a differential equation ● Formulate differential equation ● Verify the solution of differential equation ● Solve simple differential equation ● Define Growth and Decay Model ● Apply the differential equations ● to solve Growth and Decay Models	10

UNIT- 4 PROBABILITY DISTRIBUTIONS			
AUGUST, SEPTEMBER	Probability Distribution, Mathematical Expectation, Variance, Binomial Distribution, Poison Distribution, Normal Distribution	● Understand the concept of Random Variables and its Probability Distributions ● Find probability distribution of discrete random variable ● Apply arithmetic mean of frequency distribution to find the expected value of a random variable ● Calculate the Variance and S.D. of a random variable ● Identify the Bernoulli Trials and apply Binomial Distribution ● Evaluate Mean, Variance and S.D of a binomial distribution ● Understand the Conditions of Poisson Distribution Evaluate the Mean and Variance of Poisson distribution ● Understand normal distribution is a Continuous distribution ● Evaluate value of Standard normal variate Area relationship between Mean and Standard Deviation	15 20

UNIT - 5 INFERENTIAL STATISTICS			
SEPTE MBER	Population and Sample, Parameter and Statistics and Statistical Interferences, t-Test (one sample t-test and two independent groups t-test)	• Define Population and Sample • Differentiate between population and sample • Define a representative sample from a population • Differentiate between a representative and non- representative sample • Draw a representative sample using simple random sampling • Draw a representative sample using and systematic random sampling • Define Parameter with reference to Population • Define Statistics with reference to Sample • Explain the relation between Parameter and Statistic • Explain the limitation of Statistic to generalize the estimation for population • Interpret the concept of Statistical Significance and Statistical Inferences • State Central Limit Theorem • Explain the relation between Population-Sampling Distribution-Sample • Define a hypothesis • Differentiate between Null and Alternate hypothesis • Define and calculate degree of freedom • Test Null hypothesis and make inferences using t-test statistic for one group / two independent groups	10
UNIT – 6 INDEX NUMBERS AND TIME BASED DATA			
SEPTEM BR OCTOBE R	Time Series, Components of Time Series, Time Series analysis for univariate data, Secular Trend, Methods of Measuring trend	• Identify time series as chronological data • Distinguish between different components of time series • Solve practical problems based • on statistical data and Interpret the result • Understand the long term tendency • Demonstrate the techniques of • finding trend by different methods	10 20

		UNIT - 7 FINANCIAL MATHEMATICS	
OCTOBER NOVEMBER	Perpetuity, Sinking Funds, Calculation of EMI, Calculation of Returns, Nominal Rate of Return, Linear method of Depreciation	- Explain the concept of perpetuity and sinking fund - Calculate perpetuity Differentiate between sinking fund and saving account - Explain the concept of EMI Calculate EMI using various methods - Explain the concept of rate of return and nominal rate of return Calculate rate of return and nominal rate of return - Define the concept of linear method of Depreciation - Interpret cost, residual value and useful life of an asset from the given information Calculate depreciation	20 30
		UNIT - 8 LINEAR PROGRAMMING	
NOVEMBER	Introduction and related terminology, Mathematical formulation of Linear Programming Problem, Different types of Linear Programming Problems, Graphical method of solution for problems in two variables, Feasible and Infeasible Regions, Feasible and infeasible solutions, optimal feasible solution	- Familiarize with terms related to Linear Programming Problem - Formulate Linear Programming Problem - Identify and formulate different types of LPP - Draw the Graph for a system of linear inequalities involving two variables and to find its solution graphically, - Identify feasible, infeasible, bounded and unbounded regions - Understand feasible and infeasible solutions Find optimal feasible solution	15
DECEMBER		REVISION	20

JANUARY		REVISION	20

Practical: Use of spreadsheet
Graphs of an exponential function, demand and supply functions on Excel and study the nature of function at various points, maxima/minima, Matrix operations using Excel

Suggested practical using the spreadsheet
i) Plot the graphs of functions on excel and study the graph to find out the point of maxima/minima
ii) Probability and dice roll simulation
iii) Matrix multiplication and the inverse of a matrix
iv) Stock Market data sheet on excel
v) Collect the data on weather, price, inflation, and pollution analyze the data and make meaningful inferences
vi) Collect data from newspapers on traffic, sports activities and market trends and use excel to study future trends

List of Suggested projects (Class XI /XII)
i) Use of prime numbers in coding and decoding of messages
ii) Prime numbers and divisibility rules
iii) Logarithms for financial calculations such as interest, present value, future value, profit/loss etc. with large values)
iv) The cardinality of a set and orders of infinity
v) Comparing sets of Natural numbers, rational numbers, real numbers and others
vi) Use of Venn diagram in solving practical problems

vii)   Fibonacci sequence: Its' history and presence in nature
viii) Testing the validity of mathematical statements and framing truth tables
ix)   Investigating Graphs of functions for their properties
x)   Visit the census site of India http://www.censusindia.gov.in/Census_Data_2001/Census_Data_Online/Language/State ment3.htm Depict the information given there in a pictorial form
xi)   Prepare a questionnaire to collect information about money spent by your friends in a month on activities like travelling, movies, recharging of the mobiles, etc. and draw interesting conclusions
xii)   Check out the local newspaper and cut out examples of information depicted by graphs. Draw your own conclusions from the graph and compare it with the analysis given in the report
xiii) Analysis of population migration data – positive and negative influence on urbanization
xiv)   Each day newspaper tells us about the maximum temperature, minimum temperature, and humidity. Collect the data for a period of 30 days and represent it graphically. Compare it with the data available for the same time period for the previous year
xv)   Analysis of career graph of a cricketer (batting average for a batsman and bowling average for a bowler). Conclude the best year of his career. It may be extended for other players also – tennis, badminton, athlete
xvi)   Vehicle registration data – correlating with pollution and the number of accidents
xvii) Visit a village near Delhi and collect data of various crops over the past few years from the farmers. Also, collect data about temperature variation and rain over the period for a particular crop. Try to find the effect of temperature and rain variations on various crops
xviii) Choose any week of your ongoing semester. Collect data for the past 10 – 15 years for the amount of rainfall received in Delhi during that week. Predict the amount of rainfall for the current year
xix)   Weather prediction (prediction of monsoon from past data)
xx)   Visit Kirana shops near your home and collect the data regarding the sales of certain commodities over a month. Try to figure out the stock of a particular commodity which should be in the store in order to maximize the profit
xxi)   Stock price movement
xxii) Risk assessments by insurance firms from data
xxiii) Predicting stock market crash
xxiv) Predicting the outcome of an election – exit polls
xxv)   Predicting mortality of infants

Assessment Plan

1. Overall Assessment of the course is out of 100 marks.
2. The assessment plan consists of an External Exam and Internal Assessment.
3. External Exam will be of 03 hours duration Pen/ Paper Test consisting of 80 marks.
4. The weightage of the Internal Assessment is 20 marks. Internal Assessment can be a combination of activities spread throughout the semester/ academic year. Internal Assessment activities include projects and excel based practical. Teachers can choose activities from the suggested list of practical or they can plan activities of a similar nature. For data-based practical, teachers are encouraged to use data from local sources to make it more relevant for students.
5. Weightage for each area of internal assessment may be as under:

Sl. No.	Area and Weightage	Assessment Area	Marks allocated
1	Project work (10 marks)	Project work and record	5
		Year-end Presentation/ Viva of the Project	5
2	Practical work (10 marks)	Performance of practical and record	5
		Year-end test of any one practical	5
		Total	20