Applied Mathematics

Grade XII

One Paper — Total Period–240 (35 Minutes Each)

Three Hours — Max Marks: 80

No.	Units	No. of Periods	Marks
I.	Numbers, Quantification and Numerical Applications	20	06
II.	Algebra	20	10
III.	Inferential Statistics	10	06
IV.	Index Numbers and Time-based data	30	10
V.	Calculus	60	15
VI.	Financial Mathematics	40	15
VII	Linear Programming	25	08
VIII	Probability	35	10
	Total	240	80
	Internal Assessment		20

Unit I Numbers, Quantification and Numerical Applications

- Modulo Arithmetic
- Congruence modulo
- Simple arithmetic functions
- Allegation or Mixture
- Numerical problems on boats and streams; partnership; pipes and cistern; races and games, scheduling
- Numerical inequalities

Unit II Algebra

- Solution of simultaneous linear equations using elimination method (up to 3 variables)
- Matrices and types of matrices
- Algebra of matrices
- Determinants
- Inverse of a matrix
- Cramer's rule and its application
- Simple applications of matrices and determinants including Leontiff input output model for two variables

Unit III Calculus

- Application of derivatives
- Increasing/Decreasing functions
- Maxima and Minima
- Marginal cost and marginal revenue using derivatives
- Integration
- Indefinite integral as family of curves
- Definite integral as area under the curve
- Integration of simple algebraic functions (primitive, by substitution, by parts)
- Application of Integration (consumer surplus-producer surplus)
- Differential equation (definition, order, degree)
- Formulating and solving linear differential equation
- Application of differential equation (Growth and Decay Model)

Unit IV Probability

- Probability Distribution
- Mathematical Expectation
- Variance
- Binomial Distribution
- Poisson distribution
- Normal distribution
- Basic applications and inferences

Unit V Inferential Statistics

- Population and sample
- Parameter, statistic and statistical inferences
- t-Test (one sample t-test and two independent groups t-test)

Unit VI Index numbers and Time-based data

- Index numbers, uses of index numbers
- Construction of index numbers (simple and weighted)
- Tests of adequacy of index numbers (unit test and time reversal test)
- Time series, Time series analysis for univariant data sets
- Trend analysis by moving average method
- Trend analysis by fitting of linear trend line using least squares

Unit VII Financial Mathematics

- Perpetuity, Sinking funds
- Valuation of Bonds (Present value approach and Relative price approach)
- Calculation of EMI
- Calculation of returns, nominal rate of return, effective rate of interest
- Compound annual growth rate
- Stock, shares and debentures
- Linear method of depreciation

Unit VIII Linear Programming

- Introduction and related terminologies (constraints, objective function, optimization)
- Mathematical formulation of linear programming problems
- Different types of linear programming problems (Transportation and assignment problem)
- Graphical method of solution for problems in two variables
- Feasible and infeasible regions (bounded and unbounded)
- Feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints)

Practical: Use of spread sheet

Graphs of 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

1. Plot the graphs of functions on excel and study the graph to find out point of maxima/minima;
2. Probability and dice roll simulation;
3. Matrix multiplication and inverse of a matrix;
4. Stock Market data sheet on excel;
5. Collect the data on weather, price, inflation, and pollution; analyze the data and make meaningful inferences;
6. Collect data from newspapers on traffic, sports activities and on market trends and use excel to study future trends.

List of Suggested projects (class XI /XII)

Use of prime numbers in coding and decoding of messages;

Prime numbers and divisbility rules;

Logrithms for financial calculations such as interest, present value, future vale, profit/loss etc with large values);

Cardinality of a set and orders of infinity;

Comparing sets of Natural numbers, rational numbers, real numbers and others;

Use of Venn Diagram in solving practical problems;

Fibonacci Sequence: Its' history and presence in nature;

Testing the validity of mathematical statements and framing truth tables;

Investigating graphs of functions for their properties;
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;

Prepare a questionnaire to collect information about money spent by your friends in a month on activities like traveling, movies, recharging of the mobiles, etc. and draw interesting conclusions;

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;

Analysis of population migration data – positive and negative influence on urbanization;

Each day newspaper tells us about the maximum temperature, minimum temperature, 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;

Analysis 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;

Vehicle registration data – correlating with pollution and number of accidents;

Visit a village near Delhi and collect data of various crops over 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;

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 amount of rainfall for the current year;

Weather prediction (prediction of monsoon from past data);

Visit Kirana shops near your home and collect the data of sale 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;

Stock price movement ;

Risk assessments by insurance firms from data;

Predicting stock market crash;

Predicting outcome of election – exit polls;

Predicting mortality of infants.

Assessment Plan

1. Overall Assessment of the course is out of 100 marks.
2. Assessment plan consists of External Exam and Internal Assessment.
3. External Exam will be of 03 hours duration Paper/Pencil Test consisting of 80 marks.
4. Weightage of Internal Assessment is of 20 marks. Internal Assessment can be a combination of activities spread throughout 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 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:

Sr.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
		Yearend test of any one practical	5
Total			20