HIGHER SECONDARY MATHEMATICS – XII STANDARD SCIENCE STREAM

1. SYSTEMS OF EQUATIONS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
1.1	Systems of linear equations	Presentation in Matrix form; computing the rank of matrix and determining cases of i. a unique solution ii. a set of solution iii. no solution	Sets of simultaneous equations of at most three variable only to be prescribed Graphical interpretation wherever possible . Discriminating between inconsistent and dependent equations.	15
1.2	Methods of solution	Computing the unique solution of a system of equations when it exist by i)Cramer' s Rule and ii) Inverse matrix method	- Do -	

2. APPLICATIONS OF MATRICES

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
2.1	Matrices for transformations: Matrices for Translation, Reflection, Rotation, Glide reflection, Shear and Stretch	Recognising matrices as tool to study specific geometrical notions. Applying transformation matrices to derive geometric results	Correlation with Pure and Analytical geometry and results in Trigonometry	15
2.2	Isometry and similarity matrices for the same.	Identifying points, lines etc remaining invariant under a transformation	Correlation with geometrical notions studied in earlier classes.	

3. VECTOR ALGEBRA

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods

3.1	Vectors and Scalars Representations of vectors and operations of addition and subtractions	Definition vector addition, multiplication by scalars, linear relation among vectors, orthogonal decomposition; 3 dimensional Cartesian coordinates: direction cosines.	Concept to be supported by Geometrical interpretation. Relation to velocity, acceleration, resultants etc to be introduced	30
3.2	Scalar and vector products Triple products and products 4 vectors	Ability to do simple manipulative problems. Ability to use appropriate product in a given situation	Geometrical meaning to be explained. Use of suitable 3-D diagrams.	
3.3	Applications to mechanics	Applying formulae for Work don by force and Moment of a force using vectors	Relating the results to actual problems in mechanics in the relevant areas.	
3.4	Applications to Geometry Parallel & Perpendicular vectors. Angle between lines, Equations of lines and planes	Derivations of the equations and applying them in simple problems. Ability to apply the ideas to derive standard trigonometric results too.	Translation into analytical results of two dimensions wherever possible. Collincarity & coplanarity to be discussed appropriately	

4. COMPLEX NUMBERS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
4.1	Complex Algebra Fundamental operations on complex numbers	Ability to separate real and imaginary parts; compute absolute value; multiplicative inverse of a complex number, conjugation: Triangle inequality	Emphasis to be given on Complex numbers as a vector. Interpretation through Argand diagram	15
4.2	Applications	De Moivre' s theorem: Roots of a complex number; Euler, formula, Statement and meaning of Fundamental Thm. Of Agebra.	Complex solutions to be illustrated by simple examples and diagrams	

5. ANALYTICAL GEOMETRY

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
5.1	Definition of a conic	Focus-directrix definition Given the equation to find	Tracing Parabola, Ellipse and Hyperbola using the	30

	Derivation of the standard equation of Parabola, Ellipse, Hyperbola and Rectangle Hyperbola.	the foci, directrices. Eccentiricity, latus recta etc of the conic.	standard equations and explaining the special features	
5.2	Chords, Tangents & Normals	Chord joining two point on the conic. Tangent and normal at a point on the conic. Condition for a line to be tangent to a conic: chord of contact of tangent. Chord with a given mid point (Not by ' r' method)	Use of equations to illustrate simple geometrical results	
5.3	Parametric representation	Representing point on the conic in terms of parametric co-ordinates.	Results on chords and tangents to be explained in terms of parametric coordinates.	
5.4	Asymptotes	Derive the equations of asymptotes of hyperbola and identify their properties	Explaining the role of asymptotes in tracing the conic.	

6. APPLICATIONS OF DIFFERNTIATION

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
6.1	Derivative as a rate measurer	Rate of change of quantities; interpretation of velocity and acceleration using distance-time formulae and solving problems involving them.	Majority of examples to be chosen from science and Engineering areas.	
6.2	Derivative as a measure of slope	Solving problems connected with slope of a curve at a point: Equations of tangent and normal, angle between curves.	Comparing results of Analytical geometry with the ones derived.	
6.3	Maxima and minima	Solving problems related to: Increasing and decreasing functions: Stationary values: local and global maxima and minima; point of inflexion	Graphical approach wherever possible with stress on applications to Science and Engineering.	
6.4	Mean Value Theorems	Statements of Rolle' s Theorem, Lagrange' s Mean Value Theorem. Taylor' s and Maclaurin' s Theorems, Taylor' s and Maclaurin' s series Statement and	No formal proofs to be given. Geometrical interpretation of Rolle' s and Mean Value Theorems.	

		application of L Hospital rule to ideterminate forms.		
6.5	Errors and Approximations	Comprehending Absolute, Relative and Percentage errors. Computing ‘ small’ changes	Illustrations from Geometry, Trigonometry and Science to be provided	
6.6	Curve tracing	Obtaining an idea of the approximate shape of a curve without actually plotting points.	Use of symmetry, meets on axes, pass-ing through origin, real and imaginary values, extension to infinity turning points etc.	
6.7	Partial derivatives	Handling functions of 2 or 3 variables; Chain rule: Using Euler’ s Theorem on homogeneous functions (without proof)	Illustrative problems from Science and Engineering.	

7. APPLICATIONS OF INTEGRATION

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
7.1	Definite Integral	Identifying Definite Integral as the limit of a sum; Deriving and using properties of definite integral	Geometrical interpretation $\int_0^{?/2}$ $\int_0^{?/2}$ Evaluation of $\sin^m x\,dx$ $\cos^m x\,dx$ $\int_0$	15
7.2	Application of definite integral	Applying to solve problems on I) Area under a curve. ii) Length of are of a curve, and iii) Surface and volume of revolution	Use of ideas of curve tracing in identifying parts of the curve to be used in the problem	

8. DIIFFERENTIAL EQUATIONS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
8.1	Formation of Differential Equations	Formation of Differential Equations; identifying order & degree; discriminating between general and particular solutions.	Using Graphs of families of curves	25
8.2	I order : Variables separable.	Applying Method of separation of variables; Reducing to variables separable type.	Geometrical interpretation of results	

8.3	I Order: Homogeneous Equation	Reducing to the type of Variables separable by proper substitution	Emphasis on how this type can be identified	
8.4	I Order: Exact Equations	Ability to identify and solve exact equation by inspection.	Introducing the idea of an Integrating factor to make an equation exact.	
8.5	I Order: Linear Equations	Solving equations of the form y^2 + Py=Q where P, Q are functions of x	Explanation for use of Integrating factor.	
8.6.	II Order: Linear equations with constant coefficient	Solving equations of type ay" + by' + cy = 0 (with a, b, c,?? R, a ? o) and ay" + by' + cy = f(x)	f(x) to be restricted to the form x, x^2? e^{mx} or sin mx or cos mx (m ??R)	
8.7	Applications	Geometrical applications involving slope, tangent normal etc.: Simple applications involving movement of a particle, Radioactive decay, Heat conduction, Electric circuits.	Interpretation of simple solutions such as that of simple harmonic equation to the form x = - n^2x	

9. PROBABILITY DISTRIBUTIONS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
9.1	Random variable	Definition and illustrations. Discriminating between and working with discrete and continuous random variables	Projecting Random variable as a real valued function through examples.	20
9.2	Probability functions	Definitions and illustrations for (i) probability mass function (ii) probability density function (iii) distribution functions	Verification of properties through a variety of examples.	
9.3	Mathematical Expectations	Definition and justification on properties for discrete and continuous cases.	Straightforward application of E (X), E (X^2) and Var (X)	
9.4	Discrete distributions	Definitions and application of Binomial and poisson distribution	Special attention to the parameters Mean, Variance and S.D. of the distribution	
9.5	Continuous distribution	Definition and application of Normal distribution.	Properties to be corrected with the form of Normal curve and its characteristics.	

10. ALGEBRAIC STRUCTURES

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
10.1	Group structure	Illustrations from Number systems, matrices, functions, transformations. Etc. Justifying main properties of a group and applying them in simple problems. Identifying order of a group and order of a group element. Definition and examples of a cyclic group	Varied examples to be chosen Subgroup not to be treated Non-examples also to be given	15
10.2	Rings. Integral Domains and Fields	Illustrating structure through examples from Number system only. (No theorems are to be proved)	Use of different number systems to bring out the differences among various structures	

COMMERCE STREAM

1.SYSTEMS OF EQUATIONS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
1.1	Systems of linear equations	Presentation in Matrix form, Computing the rank of matrix and determining cases of (i) a unique solution (ii) a set of solutions (iii) no solution Discriminating between Inconsistent and dependent equations	Sets of simultaneous equations of at most three variables only to be presented. Graphical interpretation wherever possible.	**15**
1.2	Methods of solution	Computing the unique solution of a system of equations, when it exists, by (i) Cramer' s Rule and (ii) Inverse matrix method	-Do-	

2. APPLICATIONS OF MATRICES

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
2.1	Storing Information	Using matrices to store information. Applying matrix algebra to	Variety in examples to be adopted Relation matrices, Route	**15**

		manipulate such matrices.	matrices, and Probability matrices are also to be used for illustration	
2.2	Input-Output Analysis	Comprehension of the meaning and basic assumptions; framing and studying ‘ Transaction table; verification of viability of an input-output system.	‘ Hawkins-Simons viability conditions to be stated (without proof) and used.	
2.3	Transition matrices for market share	Interpreting Probability Transition matrices and using them.	Multiplication of Probability Transition Matrices used for forecasting.	

3. ANALYTICAL GEOMETRY

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
3.1	Definition of a conic Derivation of the standard equations	Focus-directrix definition Using it to derive the equation of a conic in general; Equation of Parabola, Ellipse, Hyperbola and Rectangle hyperbola	Using the illustration of a ‘ double cone’ to explain the idea of conic	20
3. 2	Standard Equations	Derivation of the standard equation of Parabola, Ellipse, Hyperbola and Rectangle Hyperbola	Training in the skill of finding the foic, directrices, eccentricity, latus-recta etc. when the standard equation is given	
3.3	Tracing the conics	Introduction to tracing of curves Tracing of Parabola, Ellipse and Hyperbola in their standard form.	Appropirate graphical illustrations to be given	

4. SEQENCES AND SERIES

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
4.1	Progressions and Number sums	Recall of AP, GP and HP and formulae for ? n,?? n^2,?? n^3	Geometrical illustrations to be given wherever possible	20

4.2	Application in – Commerce	Working with concepts of (i) Discounting (ii) Annuities & Sinking funds, (iii) Interest paid continuously (iv) Present Value and Investment Analysis	Use of information from standard financial institutions to be used for illustration.	

5. APPLICATIONS OF DIFFERENTIATION

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
5.1	Function in Economics and Commerce	Identifying and manipulating supply, Demand, Cost, Revenue, Production and Elasticity functions. Interpreting Market Equilibrium	Detailed exposition of dependent and independent variables in the case of each function	30
5.2	Derivative as a rate measurer	Rate of change of quantities, interpretation solving problems programmes involving them.	Majority of examples to be chosen from Commerce and Economics.	
5.3	Derivative as a measure of slope	Solving problems connected with: Slope of a curve at a point. Equations of tangent and normal	Comparing results of Analytical geometry with the once derived	
5.4	Maxima and Minima	Solving problems related to: Intereasing and decreasing functions. Stationary values; Local and global maxima and minima; points of inflexion	Graphical approach wherever possible with stress on applications to Commerce and Evonomics	
5.5	Application of Maxima and Minima	Solving problems on Profit Maximisationd. Inventory Control and Economics Order Quantity	Attention to be drawn to the constraints in each such problems	
5.6	Partial derivatives	Handling functions of 2 or 3 variables. Using Euler' s Theorem (without proof)	Illustrative problems from Commerce and Economics	
5.7	Application of partial Derivatives	Production function of two variables , Marginal productivities of Labour and Capital, Partial Elasticities of Demand.	- Do -	

5.8	Errors and Applications	Comprehending Absolute, Relative and Percentage errors. Computing ' small changes,	Use of concept: $\frac{?\ ?y}{?\ ?x} = \frac{dy}{dx}$	

6. APPLICATIONS OF INTEGRATION

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
6.1	Definite Integral	Identifying Definite Integral as the limit of a sum; Deriving and using properties of definite integrals	Geometrical interpretation; statement of Fundamental theorem of Integral Calculus	15
6.2	Area Under a Curve	Applying Definite integral to solve problems on Area under a curve.	Use of ideas of curve tracing in identifying parts of the curve to be used in the problem	
6.3	Applications of Definite Integral Computing Consumer' s Surplus and Producer' s surplus	scanning	Total Inventory carrying Cost = $H_e \int_0^T I(x)dx$ Where I (x) is inventory on hand and He is unit holding cost.	

7. DIFFERNTIAL EQUATIONS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
7.1	Formula of Differential Equations	Formation identifying order & degree discriminating general and particular solution.	Using Graphs of families of curves	25
7.2	I Order: Variables separable.	Appling Method of separation of variables; Reducing to Variables separable type.	Geometrical interpretation of results	
7.3	I Order: Homogeneous Equations.	Reducing to the types of Variables separable by proper substitution	Emphasis on how this type can be identified.	
7.4	I Order: Exact Equations	Ability to identify and solve exact equations by inspection	Introducing the idea of an Integrating factor to make an equation exact.	
7.5	I Order: Linear Equations	Solving equations of the form y' + Py = Q where P,Q are functions of x	Explanation for use of Integral factor to make an equation exact	
7.6	II Order: Linear equations with constant	Solving equations of type ay" + by' +cy = 0 (with a, b, c ? R, a? ? o) ay" + by' +cy =f(x)	f(x) to be restricted to the form x or x^2 or exponential form.	

	coefficients			
7.7	Applications'	Solving Models involving Investment, Price adjustment, Spread of disease etc.,	Usual relationships involving cost, Production etc. to be solved as illustrations	

8. PROBABILITY DISTRIBUTIONS

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
8.1	Random variable	Definition and illustrations. Discriminating between and working with discrete and continuous random variables	Projecting Random variable as a real valued function through examples. (Most illustrations in this topic to be from Commerce and Economics)	20
8.2	Probabilty functions	Definitions and illustrations for (i) probability mass function (ii) probability density function (iii) distribution function	Verification of properties through a variety of examples.	
8.3	Mathematical Expectation	Definition and justification of properties for discrete nd continuous cases	Straight forward application of E (X), E (X^2) and Vary (X)	
8.4	Discrete distribution s	Definitions and application of Binomial and Poisson distributions.	Special attention to the parameters mean, Variance and S.D of the distributions.	
8.5	Continuous distributions	Definition and application of Normal distribution	Properties to be correlated with the form of Normal curve and its characteristics.	

9. SAMPLING TECHNIQUES

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
9.1	Concept of Sampling Definition and types	Classifying as Random Stratified, systematic. Multi-stage Also as Non-random: purposive, Quota, Cluster & Sequential	Simulation applying Monte-Carlo method and Random Numbers.	25

9.2	Errors	Discriminating sampling and non-sampling errors		
9.3	Sampling distributions	Illustrating with Distributions of sample Mean and Sample Proportions. Computing Standard Error in simple cases	Central limit theorem to be stand and explained without proof.	
9.4	Estimation	Meaning of Statistical estimation Computing confidence intervals	Both point and interval estimation to be illustrated	
9.5	Hypothesis testing	Identifying levels significance Determining critical region	Statistical inference to be illustrated in very simple cases.	
9.6	Quality control charts	Classifying causes for variation in the quality of product into those (i) of chance and (ii) assignable Defining Process control & Product control	Presentation of technique for drawing a control chart explaining its underline principles.	

10. FORCASING TECHNIES & DECISION THEORY

S.No.	Content	Expected Outcome	Transactional Strategy	No. of Periods
10.1	Linear Programming	Dealing with objective function with not more than 3 constraints and 2 variables	To be illustrated through graphical approach only	25
10.2	Correlation & Regression	Applying method of least squared to perform curve fitting	Explaining estimates through the concept of approach curve of best fit	
103.	Time Series and determination of trend	Identifying different components of Time series Applying (i) Free and (ii) Semi-average (iii) Moving average & (iv) Least squares methods.	Graphical illustration to be provided for explanation.	
10.4	Index Numbers	Use of formulae of (i) Laspeyre, (ii) Paasche, and (iii) Fisher. Testing Reversal tests to be satisfied by an index number	(i) Aggregate expenditure method & (ii) Family budget method to compute Cost of living index	
10.5	Decision Theory	Identifying basic criteria for making decision: EMV, Pay-offs, EOL, Using Maximin, and Minimax and Baye' s Principles	Role of Decision trees to be highlighted and decision diagram to be illustrated	