

GOA BOARD OF SECONDARY AND HIGHER SECONDARY
EDUCATION

MATHEMATICS (2023 – 2024)

CLASS XII -SCIENCE

UNIT I: RELATIONS AND FUNCTIONS

1. Relations and Functions:

Periods-10

Types of relations: Reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

2. Inverse Trigonometric Functions :

Periods-12

Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

UNIT II: ALGEBRA

1. Matrices:

Periods-18

Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

2. Determinants:

Periods-20

Determinant of a square matrix (up to 3×3 matrices), properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

UNIT III: CALCULUS

1. Continuity and Differentiability:

Periods-18

Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concepts of exponential, logarithmic functions.

Derivatives of $\log_e x$ and e^x . Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations

2. Applications of Derivatives:

Periods- 10

Applications of derivatives: Rate of change, increasing/decreasing functions, tangents and normals, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

3. Integrals:

Periods- 20

Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type –

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$$

$$\int \frac{(px+q)}{ax^2 + bx + c} dx, \int \frac{(px+q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} dx, \int \sqrt{x^2 - a^2} dx$$

$$\int \sqrt{ax^2 + bx + c} dx, \int (px+q)\sqrt{ax^2 + bx + c} dx$$

to be evaluated.

Definite integrals as a limit of a sum. Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of the Integrals:

Periods- 10

Applications in finding the area under simple curves, especially lines, arcs of circles/parabolas/ellipses (in standard form only), area between the two above said curves (the region should be clearly identifiable).

5. Differential Equations:

Periods-10

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type –

$$\frac{dy}{dx} + Py = Q$$

where P and Q are functions of x or constant

$$\frac{dx}{dy} + Px = Q$$

where P and Q are functions of y or constant

UNIT IV: VECTORS AND THREE-DIMENSIONAL GEOMETRY

Vectors:

Periods- 10

1. Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and coplanar vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors, scalar triple product.

2. Three-dimensional Geometry:

Periods-12

Direction cosines/ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

UNIT V: LINEAR PROGRAMMING:

Periods-12

Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

UNIT VI: PROBABILITY:

Periods-18

Multiplication theorem on probability. Conditional probability, independent events, total probability, Baye's theorem. Random variable and its probability distribution, mean and variance of haphazard variable. Repeated independent (Bernoulli) trials and Binomial distribution.

DESIGN OF THE MODEL QUESTION PAPER

Final -HSSC EXAMINATION. (2023-24)

CLASS : XII

SUBJECT : Mathematics

Time : $2\frac{1}{2}$ hours

Max Marks : 80

The weightage or the distribution of marks over different dimensions of the question paper shall be as follows.

1. Weightage to learning outcomes :

S. No	Learning outcomes	Marks	Percentage of marks
1.	Knowledge	20	25%
2.	Understanding	40	50%
3.	Application	16	20%
4.	Skill	04	05%
	Total	80	100%

2. Weightage to content / subject units:

Serial No	Units	Marks
1.	Relations and Functions	04
2.	Inverse Trigonometric Functions	04
3.	Continuity and Derivatives (4 + 8)	12
4.	Applications of Derivatives	06
5.	Integrals and applications (14 + 4)	18
6.	Differential Equations	06
7.	Vectors and 3D (4+ 6)	10
8.	Probability	06
9.	Matrices	06
10.	Determinants	04
11.	Linear Programming	04
	Total	80

3. Weightage to forms of questions:

S. No	Form of questions	Marks for each question	Number of questions	Total marks
1.	Very short answer type(VSA1) MCQ	1	8	08
2.	Very short answer type(VSA2)	1	8	08
3.	Short answer type (SA1)	2	6	12
4.	Short answer type (SA2)	3	6	18
5.	Long answer type (LA1)	4	6	24
6.	Long answer type (LA2)	5	2	10
	Total		36	80

The expected time for different type of questions would be as follows

S. No	Form of questions	Approx. time for each question in mins (t)	Number of questions (n)	Approx .time for each form of questions in mins (t xn)
1.	Very short answer type(VSA1) mcq	2	8	16
2.	Very short answer type(VSA2)	2	8	16
3.	Short answer type (SA1)	3	6	18
4.	Short answer type (SA2)	5	6	30
5.	Long answer type (LA1)	7	6	42
6.	Long answer type (LA2)	9	2	18
	Total		36	140 mins

As the actual time is calculated on the basis of the number of questions required to be answered and the length of their expected answer it would therefore be advisable for candidates to budget the time properly by cutting out the superfluous words and be within the expected time limits.

4. Scheme of options.

There will be no overall choice . However there will be internal choice in 02 questions of 04 marks category and 02 questions of 05 marks category .

S, No	Estimated difficult level of questions	Marks	Percentage
1.	Easy	20	25%
2.	Average	44	55%
3.	Difficult	16	20%
	Total	80	100%

5. Weightage to difficult level of questions.

A question may vary in difficulty level from individual to individual. As such the assessment in respect of each question will be made by the paper setter on the basis of general anticipation from the group as a whole taking the examination. This provision is only to make the paper balanced in its weightage rather than to determine the pattern of marking at any stage.

6. 10 % theory (10 marks) is to be included.

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Alto , Betim- Goa

STD : XII SCIENCE

(2023 - 24)

SUB: MATHEMATICS

TOPICS FOR FIRST FORMATIVE / INTERNAL TEST & MARKS		
Sr. No	Topics/Units	Marks
1.	Relations and Functions	05
2.	Continuity and Differentiability	10
3.	Inverse Trigonometric Functions	05
	Total	20
TOPICS FOR SECOND FORMATIVE/ INTERNAL TEST & MARKS		
1.	Matrices	06
2.	Determinants	06
3.	Integration (Indefinite)	08
	Total	20
TOPICS FOR THIRD FORMATIVE (Innovative method/Assignment) & MARKS		
1.	Vectors and 3 D	10
2.	Linear Programming	04
3.	Probability	06
	Total	20

GOA BOARD OF SECONDARY AND HIGHER SECONDARY EDUCATION, PORVORIM - GOA

BLUE PRINT OF HSSC EXAMINATION -(2023-24)

SUB: MATHEMATICS

DURATION: 2 ½ HOURS

STD: XII SCIENCE

MARKS: 80

SR. NO	Content area	OBJECTIVES																				TOTAL		
		Knowledge						Understanding						Application					Skill					
Type →	VSA1-MCQ	VSA2	SA1	SA2	LA1	LA2	VSA1-MCQ	VSA2	SA1	SA2	LA1	LA2	VS A2	SA1	SA2	LA1	LA2	VSA 2	SA 1	SA 2	LA1	LA2		
Marks→	1	1	2	3	4	5	1	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
1	Relations and Functions	2(Av)								23(E)													04	
2	Inverse Trig. Functions	4(E)		19(Av)				14(Av)															04	
3	Continuity and Derivatives		11(E)	17(Av)						24(Av) 25(Av)					28(D)								12	
4	Applications of Derivatives							12(Av)									35*(D)						06	
5	Integrals & Applications		16(E)			31(Av)		5(E)	13(D)	18(E)		34(D)	36*(Av)										18	
6	Differential Equations			20(E)				6(E)			27(D)												06	
7	Vectors & 3-Dim. Geometry	3(Av)	15(Av)					7(Av)	10(Av)	21(D)		33*(Av)											10	
8	Probability			22(Av)												32*(Av)							06	
9	Matrices	1(E)							9(Av)							30(Av)							06	
10	Determinants	8(E)									26(Av)												04	
11	Linear Programming																					29(E)	04	
		5(1)	3(1)	4(2)		1(4)		3(1)	5(1)	2(2)	5(3)	2(4)	1(5)			1(3)	2(4)	1(5)				1(4)		
		20						40						16					04					80

KNOWLEDGE - 20 marks (25%)

UNDERSTANDING - 40 MARKS (50%)

APPLICATION - 16 MARKS (20%)

SKILL - 4 MARKS (5%)

EASY- 20 MARKS (25%)

AVERAGE- 44 MARKS (55%)

DIFFICULT- 16 MARKS (20%)