

## FACULTY OF SCIENCES

### SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028

**Programme Code:BA**

**Programme Name:B.A.**

**(Subject: Mathematics)  
(Semester I-II)**

**Examinations: 2024-2028**



**P.G.Department of Mathematics  
Khalsa College, Amritsar**

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(c) Please visit the College website time to time.

# SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028

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## Syllabus of Mathematics

SEMESTER - I										
Course Code	Course Name	Credits			Total Credits	Max Marks				Page No.
		L	T	P		Th	P	IA	Total	
<b>Major Courses</b>										
MAT-111A	Algebra-I	2	-	-	2	37	-	38	50	3-4
MAT-111B	Calculus-I	2	-	-	2	37	-		50	5-6
MAT-111P	Algebra Laboratory	-	-	2	2	-	38		50	7
<b>Total</b>		<b>4</b>	<b>-</b>	<b>2</b>	<b>6</b>	<b>74</b>	<b>38</b>	<b>38</b>	<b>150</b>	

SEMESTER - II										
Course Code	Course Name	Credits			Total Credits	Max Marks				Page No.
		L	T	P		Th	P	IA	Total	
<b>Major Courses</b>										
MAT-121A	Algebra-II	2	-	-	2	37	-	38	50	8-9
MAT-121B	Calculus-II	2	-	-	2	37	-		50	10-11
MAT-121P	Calculus Laboratory	-	-	2	2	-	38		50	12
<b>Total</b>		<b>4</b>	<b>-</b>	<b>2</b>	<b>6</b>	<b>74</b>	<b>38</b>	<b>38</b>	<b>150</b>	

**Khalsa College, Amritsar**

(An Autonomous College)

Syllabus for

**PROGRAMME: B.A.**

**SEMESTER-I**

**MATHEMATICS**

**COURSE CODE: MAT-111A**

**COURSE TITLE: Algebra-I**

L	T	P	Credits
2	0	0	2

**Time: 3 Hours**

**MAXIMUM MARKS: 50**

**THEORY:37**

**INTERNAL ASSESSMENT:13**

**Medium: English**

**INSTRUCTIONS FOR THE PAPER SETTERS:**

1. The question paper will consist of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section-B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section-A will consist of eight short answer type questions, each of 1.5 marks. Students are to attempt any six.
3. Sections-B, C, D & E will consist of two questions each. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 7 marks.

**COURSE OBJECTIVES:**

- Students will be able to solve problems based on matrix algebra.
- Students can have an idea to solve the problems on eigen values and eigen vectors of matrices.
- Students can solve the problems based on Cayley Hamilton theorem.

**COURSE CONTENT:**

**Unit-I**

Partitioning of Matrices, Matrices Partitioned conformably for Multiplication, Rank of a Matrix, Normal form, Row rank, Column rank of a matrix, Equivalence of column and row ranks, rank of product of matrices.

**Unit-II**

Linear independence of row and column vectors Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations.

**Unit-III**

Eigenvalues, Eigenvectors, Hermitian Matrix, Skew Hermitian matrix and unitary matrix and properties of Eigen value.

**Unit-IV**

Minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.

## **SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028**

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### **BOOKS RECOMMENDED:-**

1. Shanti Narayan and P.K. Mittal: Text Book of Matrices.
2. K.B. Datta : Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

### **REFERENCE BOOK RECOMMENDED:-**

1. Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023

### **COURSE OUTCOMES:**

**On completing the course, the students will be able to:**

- solve problems based on matrices, vector spaces, eigen values and eigen vectors,
- recognize consistency and inconsistency of linear equations.

# SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028

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**Khalsa College, Amritsar**  
(An Autonomous College)  
Syllabus for  
**PROGRAMME: B.A.**  
**SEMESTER-I**  
**MATHEMATICS**  
**COURSE CODE: MAT-111B**  
**COURSE TITLE: Calculus-I**

L	T	P	Credits
2	0	0	2

**Medium: English**

**MAXIMUM MARKS: 50**  
**THEORY:37**  
**INTERNAL ASSESSMENT:13**

**Time: 3 Hours**

### INSTRUCTIONS FOR THE PAPER SETTERS:

1. The question paper will consist of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section-B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section-A will consist of eight short answer type questions, each of 1.5 marks. Students are to attempt any six.
3. Sections-B, C, D & E will consist of two questions each. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 7 marks.

### COURSE OBJECTIVES:

- The content of this course is designed to make the students understand the concepts of limits and continuity of functions, the methods of differentiation of various types of functions.
- To understand the concept of hyperbolic functions
- To make students familiar with the concept of concavity and convexity.
- To have an idea about the applications of Leibnitz theorem, Taylor's theorem and Maclaurin's theorem.

### COURSE CONTENT:

#### Unit-I

Real number system and its order properties: lub, glb of sets of real numbers, Completeness property, Archimedean property, Dense property of Rational numbers, Limit of a function of real variable, Properties of Limits, Squeeze Theorem.

#### Unit-II

Continuous function and classification of discontinuities, Differentiability of a function of real variable, Concavity and Convexity of function, Point of inflexion.

#### Unit-III

Derivatives of Hyperbolic and Inverse Hyperbolic functions, nth order derivatives, Leibnitz theorem on nth derivative and its applications.

#### Unit-IV

Taylor's and Maclaurin theorem with Lagrange form of remainder, Application of Taylor's theorem in error estimation; Taylor's series expansions of  $\sin x, \cos x, e^{\cos x}, \log x$  etc. Indeterminate forms and L'Hopital rule.

## SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028

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### **BOOKS RECOMMENDED: -**

1. S. Narayan and P. K. Mittal: Integral Calculus. Sultan Chand & Sons.
2. Gorakh Prasad, Differential Calculus (19th ed.). Pothishala Pvt. Ltd. Allahabad, 2016.

### **REFERENCE BOOKS RECOMMENDED: -**

1. Tom M. Apostol, Calculus: An Indian Adaptation, Wiley India, 2023.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum's outline series, Schaum Publishing Co. New York.

### **COURSE OUTCOMES: On completing the course, the students will be able to:**

- acquaint with the concept of limits, functions and derivatives.
- know about concavity and convexity of the functions

**Khalsa College, Amritsar**  
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**Syllabus for**  
**PROGRAMME: B.A.**  
**SEMESTER-I**  
**MATHEMATICS**  
**COURSE CODE:MAT-111P**  
**COURSE TITLE: ALGEBRA LABORATORY**

L	T	P	Credits
-	-	2	2

**MAXIMUM MARKS: 50**  
**PRACTICAL:38**  
**INTERNAL ASSESSMENT:12**

**Medium: English**

**Time: 3 Hours**

**List of Practicals (using any package)**

1. Introduction to the computer package in the practicals.
2. Matrix operations: addition, multiplication, inverse. transpose, determinant of matrix.
3. Find Rank of matrix: Row Rank, Column Rank.
4. Find row reduced echelon form
5. Create the coefficient matrix A and vector b. Solve for x using the inverse, using the builtin function.
6. Solving a linear system, using Gauss elimination numerically.
7. Finding eigenvalues and eigenvectors, numerically.

**BOOKS RECOMMENDED:-**

1. S.S. Sastry, Engineering Mathematics - Volume I (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics - Volume II (4th Edition), PHI,2008.

**Khalsa College, Amritsar**

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Syllabus for

**PROGRAMME: B.A.**

**SEMESTER-II**

**MATHEMATICS**

**COURSE CODE: MAT-121A**

**COURSE TITLE: Algebra-II**

L	T	P	Credits
2	0	0	2

**Time: 3 Hours**

**MAXIMUM MARKS: 50**

**THEORY:37**

**INTERNAL ASSESSMENT:13**

**Medium: English**

**INSTRUCTIONS FOR THE PAPER SETTERS:**

- 1.The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section-B, C, D and E from Unit-I, II, III and IV, respectively.
- 2.Section-A will consists of eight short answer type questions, each of 1.5 marks. Students are to attempt any six.
3. Sections-B, C, D & E will consist of two questions each. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 7 marks.

**COURSE OBJECTIVES:** Students will be able

- to solve problems based on matrix algebra.
- to have an idea about quadratic forms.
- to apply Cardan’s and Descarte’s methods for solving cubic and biquadratic equations.

**COURSE CONTENT:**

**Unit-I**

Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field. Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Reduction in the real field.

**Unit-II**

Classification of real quadratic forms in n variables. Definite, semi-definite and indefinite real quadratic forms. Characteristic properties of definite, semi-definite and indefinite forms. Relations between the roots and coefficients of general polynomial equation of degree n in one variable. Vieta ‘s Formula,

**Unit-III**

Fundamental Theorem of Algebra (Statement only) Transformation of equations, Equations of Squared differences, Solution of cubic equations by Cardan method.

**Unit-IV**

Discriminant of polynomial equation, Discriminant of Cubic equation, nature of roots of cubic, Solution of Biquadratic by Ferrari’s Method with illustrations, Descartes’s Rules of Signs with illustrations.



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### **BOOKS RECOMMENDED:-**

1. Shanti Narayan and P.K. Mittal: Text Book of Matrices.
2. K.B. Datta : Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

### **REFERENCE BOOK RECOMMENDED:-**

1. Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023

### **COURSE OUTCOMES:**

**On completing the course, the students will be able to:**

- understand the relation between roots and coefficients.
- solve cubic and biquadratics equations.
- have an idea about the nature of roots without solving the equation.

# SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2028

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**Khalsa College, Amritsar**  
(An Autonomous College)  
Syllabus for  
**PROGRAMME: B.A.**  
**SEMESTER-II**  
**MATHEMATICS**  
**COURSE CODE: MAT-121B**  
**COURSE TITLE: Calculus-II**

L	T	P	Credits
2	0	0	2

**Medium: English**

**MAXIMUM MARKS: 50**  
**THEORY:37**  
**INTERNAL ASSESSMENT:13**

**Time: 3 Hours**

### INSTRUCTIONS FOR THE PAPER SETTERS:

- 1.The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 1.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 7marks.

### COURSE OBJECTIVES:

- The content of this course is designed to make the students understand the concept of Asymptotes.
- To study the concept of De Moivre’s.
- To make students familiar with the concept of Integration of hyperbolic functions and Definite integral.
- To have an idea about the applications of Reduction formulae.

### Unit-I

Asymptotes, Horizontal Asymptotes, Vertical Asymptotes, Oblique Asymptotes, Asymptotes of general Rational Algebraic Curve with illustrations, Intersection of curve and its Asymptotes

### Unit-II

De Moivre’s theorem (for integer and Rational index) and its applications, primitive nth roots of unity

### Unit-III

Integration of hyperbolic functions, Properties of definite integral.

### Unit-IV

Reduction formulae of type

$\int \tan^n x dx, \int \cot^n x dx, \int \sec^n x dx, \int \operatorname{cosec}^n x dx, \int x \cos^n x dx, \int \cos^m x \sin^n x dx,$   
Reduction formulae using Rule of Smaller index +1 of the type  $\int_0^{\pi/2} \sin^n x \cos^n x dx,$   
 $\int_0^{\pi/2} \sin^n x dx, \int_0^{\pi/2} \cos^n x dx.$

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### **BOOKS RECOMMENDED: -**

1. S. Narayan and P. K. Mittal: Integral Calculus. Sultan Chand & Sons.
2. Gorakh Prasad, Differential Calculus (19th ed.). Pothishala Pvt. Ltd. Allahabad, 2016.

### **REFERENCE BOOKS RECOMMENDED: -**

1. Tom M. Apostol, Calculus: An Indian Adaptation, Wiley India, 2023.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum's outline series, Schaum Publishing Co. New York.

### **COURSE OUTCOMES: On completing the course, the students will be able to:**

- acquaint with the concept of Asymptotes and De Moivre's
- solve problems on hyperbolic functions and Reduction formula.

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Syllabus for  
**PROGRAMME: B.A.**  
**SEMESTER-II**  
**MATHEMATICS**  
**COURSE CODE: MAT-121P**  
**COURSE TITLE: CALCULUS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

**MAXIMUM MARKS: 50**  
**PRACTICAL:38**  
**INTERNAL ASSESSMENT:12**

**TIME: 3Hrs**  
**MEDIUM: English**

List of Practicals (using any package)

1. Plotting graphs of elementary functions  $e^{ax+b}$ ,  $\sin(bx+c)$ ,  $\log(ax+b)$ ,  $1/(ax+b)$ ,  $\sin(ax+b)$ ,  $\cos(ax+b)$ ,  $|ax+b|$  and to illustrate the effect of a and b on the graphs.
2. Plotting the graphs of the polynomial of degree 4 and 5, the derivative graph, the second derivative graph
3. Tracing of conics in Cartesian coordinates and using the general equation of second degree in x and y.
4. Tracing of conicoids: Ellipsoid, Hyperbolic paraboloid, Elliptic paraboloid, Hyperboloid of one and two sheets etc.
5. Graphs of hyperbolic functions.
6. Approximation of limit.
7. Approximations of derivatives.

**BOOKS RECOMMENDED:-**

1. S.S. Sastry, Engineering Mathematics - Volume I (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics - Volume II (4th Edition), PHI, 2008.