

**FACULTY OF SCIENCES**  
**SYLLABUS FOR THE SESSION 2023 -24**

| <b>Programme Name</b>   | <b>Programme Code</b> |
|-------------------------|-----------------------|
| B.Sc.(Economics)        | B.Sc.(ECO)            |
| B.Sc.(Computer Science) | BCS                   |
| B.Sc.( Non-Medical)     | BSNM                  |

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

**Examinations: 2023-2024**



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

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(b) Subject to change in the syllabi at any time.  
(c) Please visit the College website time to time.

**SYLLABUS FOR THE BATCH 2023-2026**

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## Syllabus of Mathematics

| COURSE SCHEME |                           |            |         |   |   |               |           |   |    |       |          |
|---------------|---------------------------|------------|---------|---|---|---------------|-----------|---|----|-------|----------|
| SEMESTER - I  |                           |            |         |   |   |               |           |   |    |       |          |
| Course Code   | Course Name               | Hours/Week | Credits |   |   | Total Credits | Max Marks |   |    |       | Page No. |
|               |                           |            | L       | T | P |               | Th        | P | IA | Total |          |
| Major Courses |                           |            |         |   |   |               |           |   |    |       |          |
| MAT-111A      | Algebra                   | 4          | 3       | 1 | - | 4             | 75        | - |    | 100   | 3-4      |
| MAT-111B      | Calculus and Trigonometry | 4          | 3       | 1 | - | 4             | 75        | - | 50 | 100   | 5-6      |
| Total         |                           | 8          | 6       | 2 | - | 8             | 150       |   | 50 | 200   |          |

| SEMESTER - II |                                     |            |         |   |   |               |           |   |    |       |          |
|---------------|-------------------------------------|------------|---------|---|---|---------------|-----------|---|----|-------|----------|
| Course Code   | Course Name                         | Hours/Week | Credits |   |   | Total Credits | Max Marks |   |    |       | Page No. |
|               |                                     |            | L       | T | P |               | Th        | P | IA | Total |          |
| Major Courses |                                     |            |         |   |   |               |           |   |    |       |          |
| MAT-121A      | Calculus and Differential equations | 4          | 3       | 1 | - | 4             | 75        | - |    | 100   | 7-8      |
| MAT-121B      | Calculus                            | 4          | 3       | 1 | - | 4             | 75        | - | 50 | 100   | 9-10     |
| Total         |                                     | 8          | 6       | 2 | - | 8             | 150       |   | 50 | 200   |          |

**Khalsa College, Amritsar**  
(An Autonomous College)  
Syllabus for  
**PROGRAMME: B.Sc.(Eco.)/B.Sc.(C.S.)/B.Sc.(N.M.)**  
**SEMESTER-I**  
**MATHEMATICS**  
**COURSE CODE: MAT-111A**  
**COURSE TITLE: Algebra**

| L | T | P | Credits |
|---|---|---|---------|
| 3 | 1 | 0 | 4       |

**CREDIT HOURS(PER WEEK): 4**

**TOTAL HOURS: 60 hrs.**

**MAXIMUM MARKS: 75**

**Time: 3 Hours**

**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 2.5 marks. Students are to attempt any six.
3. Sections-B, C, D & E will consist of two questions each (**each question should be subdivided into atmost two parts**). Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15 marks.
4. Teaching time for this paper would be six periods per week.

**COURSE OBJECTIVES:**

- Students will be able to solve problems based on matrix algebra, vector spaces, eigen values and eigen vectors, Cardon's and Descarte's methods of solving a system of equations and inequalities.

**COURSE CONTENT:**

**Unit-I**

Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks, Nullity of a matrix, Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations.

**Unit-II**

Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field.

**Unit-III**

Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Matrix Congruence of skew-symmetric matrices. Reduction in the real field. Classification of real quadratic forms in variables. Definite, semi-definite and indefinite real quadratic forms. Characteristic properties of definite, semi-definite and indefinite forms.

**Unit-IV**

Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equations and symmetric function of roots, Descarte's rule of signs, Newton's Method of divisors, Solution of cubic equations by Cardan method, Solution of biquadratic equations by

## SYLLABUS FOR THE BATCH 2023-2026

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Descarte's and Ferrari's Methods.

### **BOOKS PRESCRIBED:**

1. K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
2. H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
3. Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.

### **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.
- understand the relation between roots and coefficients.

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**Syllabus for****PROGRAMME: B.Sc.(Eco.)/B.Sc.(C.S.)/B.Sc.(N.M.)****SEMESTER-I****MATHEMATICS****COURSE CODE:MAT-111B****COURSE TITLE: Calculus and trigonometry**

| L | T | P | Credits |
|---|---|---|---------|
| 3 | 1 | 0 | 4       |

**CREDIT HOURS(PER WEEK): 4****TOTAL HOURS: 60 HRS.****MAXIMUM MARKS: 75****Medium: English****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 2.5 marks. Students are to attempt any six.
3. Sections-B, C, D& E will consist of two questions each (**each question should be subdivided into atmost two parts**). Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Teaching time for this paper would be six periods per week.

**COURSE OBJECTIVES:**

- Calculus has widespread applications in science, economics, and engineering and can solve many problems for which algebra alone is insufficient.
- Trigonometry is a branch of mathematics that studies relationships between side lengths and angles of triangles.
- Students will apply calculus and Trigonometry in areas such as geodesy, surveying, celestial mechanics, and navigation.
- Students will learn relationships to other branches of mathematics, in particular complex numbers, infinite series, logarithms and calculus.

**COURSE CONTENT:****Unit-I**

Real number system and its properties, lub, glb of sets of real numbers, limit of a function, Basic properties of limits, Continuous functions and classification of discontinuities, Uniform continuity.

**Unit-II**

Differentiation of hyperbolic functions, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's theorem with various forms of remainders, Indeterminate forms.

**Unit-III**

De-Moivre's Theorem and its applications, circular and hyperbolic functions and their inverses.

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### Unit-IV

Exponential and Logarithmic function of complex numbers, Expansion of trigonometric functions, Gregory's series, Summation of series.

#### **BOOKS PRESCRIBED:**

1. N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow.
2. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
3. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999.
4. Shanti Narayan and P.K. Mittal: Differential Calculus, S Chand & Company.
5. Shanti Narayan and P.K. Mittal: Real Analysis, S Chand & Company.
6. Rajinder Pal Kaur: Calculus, First world Publication, Ludhiana.

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

- understand the relationships between side lengths and angles of triangles.
- understand Calculus as a major part of contemporary mathematics education.
- Have knowledge in applications in science, economics, and engineering and students can solve many problems for which algebra alone is insufficient.
- Calculate the limit and examine the continuity of a function at a point.
- Develop intricate relationships to other branches of mathematics, in particular complex numbers, infinite series, logarithms and calculus.

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## Khalsa College, Amritsar

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Syllabus for

PROGRAMME: B.Sc.(Eco.)/B.Sc.(C.S.)/B.Sc.(N.M.)

SEMESTER-II

MATHEMATICS

COURSE CODE: MAT-121A

COURSE TITLE: Calculus and differential equations

| L | T | P | Credits |
|---|---|---|---------|
| 3 | 1 | 0 | 4       |

CREDIT HOURS(PER WEEK) : 4

TOTAL HOURS: 60 HRS

MAXIMUM MARKS: 75

Medium: English

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 2.5 marks. Students are to attempt any six.
3. Sections-B, C, D & E will consist of two questions each (**each question should be subdivided into at most two parts**). Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15 marks.
4. Teaching time for this paper would be six periods per week.

### COURSE OBJECTIVES:

- Calculus is a branch of mathematics focused on limits, functions, derivatives, integrals, and infinite series.
- This subject constitutes a major part of contemporary mathematics education. Calculus has widespread applications in science, economics, and engineering and can solve many problems for which algebra alone is insufficient.
- A differential equation is a mathematical equation that relates some function with its derivatives.
- In applications, the functions generally represent physical quantities, the derivatives represent their rates of change, and the differential equation defines a relationship between the two. Differential equations have applications in fields of engineering, physics, economics, and biology.

### COURSE CONTENT:

#### Unit-I

Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple Points, Curvature, Tracing of Curves (Cartesian and Parametric coordinates only).

#### Unit-II

Integration of hyperbolic functions. Reduction formulae. Definite integrals. Fundamental theorem of integral calculus. Quadrature, rectification.

#### Unit-III

Exact differential equations. First order and higher degree equations solvable for  $x, y, p$ . Clairaut's Form and singular solutions. Geometrical meaning of a differential equation. Orthogonal Trajectories.

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### Unit-IV

Linear differential equations with constant and variable coefficients. Variation of Parameters method, reduction method, series solutions of differential equations. Power series Method, Bessel and Legendre equations (only series solution).

#### BOOKS PRESCRIBED:

1. D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
2. G.F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
3. E.A. Codington: An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
4. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
5. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999.
6. Shanti Narayan and P.K. Mittal: Integral Calculus, S Chand & Company

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

- acquaint with the limits, functions, derivatives, integrals, and infinite series.
- associate Differential equations with the Mathematical modeling.
- solve multifarious differential equation that relates functions with its derivatives.
- know about concavity and convexity of the functions, Asymptotes and multiple points of a curve.
- Have knowledge about applications in fields of engineering, physics, economics, and biology.



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## Khalsa College, Amritsar

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Syllabus for

PROGRAMME: B.Sc.(Eco.)/B.Sc.(C.S.)/B.Sc.(N.M.)

SEMESTER-II

MATHEMATICS

COURSE CODE: MAT-121B

COURSE TITLE: Calculus

| L | T | P | Credits |
|---|---|---|---------|
| 3 | 1 | 0 | 4       |

CREDIT HOURS (PER WEEK) : 4

TOTAL HOURS: 60 hrs.

MAXIMUM MARKS: 75

TIME: 3Hrs

MEDIUM: English

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 2.5 marks. Students are to attempt any six.
3. Sections-B, C, D & E will consist of two questions each (**each question should be subdivided into at most two parts**). Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15 marks.
4. Teaching time for this paper would be six periods per week.

### COURSE OBJECTIVES:

- This course introduces the concept of partial derivatives which are used in fields such as computer graphics, physical sciences, vector calculus and engineering.
- Evaluate double and triple integrals of functions of several variables. Apply them in evaluating area and volume of solids.
- This course covers the concepts of jacobians, maxima and minima of functions of two variables, envelopes and evolutes.

### COURSE CONTENT:

#### Unit-I

Limit and Continuity of functions of two variables, Partial differentiation, Change of variables, Partial derivatives and differentiability of real-valued functions of two variables, Schwartz's and Young's Theorem, Statements of Inverse and implicit function theorems and applications.

#### Unit-II

Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Envelopes. Evolutes, Maxima, Minima and saddle points of functions of two Variables.

#### Unit-III

Lagrange's undetermined multiplier method. Double and Triple Integrals, Change of variables, Change of order of integration in double integrals.

**Unit-IV**

Applications to evaluation of Areas, Volumes, Surfaces of solid of revolution.

**BOOKS PRESCRIBED:**

1. Narayan, S. & Mittal, P.K. : Integral Calculus, S. Chand & Co.
2. Kreyszig, E.: Advanced Engineering Mathematics.
3. Narayan S. & Mittal, P.K. : Differential Calculus, S. Chand & Co.

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

- apply Calculus in various fields such as computer graphics, physical sciences, economics and engineering.
- use Calculus in oceanography to calculate the height of tides in oceans.
- understand concept of partial derivatives which are used in fields such as computer graphics, physical sciences, vector calculus and engineering.
- learn about evaluating double and triple integrals of functions of several variables and apply them in evaluating area and volume of solids.
- Understand the concepts of jacobians, maxima and minima of functions of two variables, envelopes and evolutes.