

**KRANTIGURU SHYAMJI KRISHNA VERMA
KACHCHH UNIVERSITY**

Faculty of Science



**B. Sc. Semester I & II
(Exit option)**

MATHEMATICS

SYLLABUS (CBCS)

**Curriculum as per UGC Guideline Framed according to
National Education Policy (NEP) - 2020
With effect from June - 2023**

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NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME IN MATHEMATICS (HONOURS)

A bachelor's degree in Mathematics with Research or without Research is a 4 year degree course which is divided into 8 semesters.

Sr. No.	Type of Award	Stage of Exit	Mandatory Credits to be secured for the Award
1	Certificate in the Discipline	After successful completion of 1st Year	Certificate With Exit 4 Credit course (44+4)
2	Diploma in the Discipline	After successful completion of 1st and 2nd Years	Diploma With Exit 4 Credit course (88+4)
3	B.Sc. in Mathematics	After successful completion of 1st, 2nd and 3rd Years	Bachelor degree (132)
4	B.Sc. (Honours with Research/without Research) in Mathematics	After successful completion of 1st, 2nd, 3rd and 4th Years	Bachelor + Honors degree (176) Bachelor + Research degree (176)

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures required Credits. Similarly, for certificate, diploma and degree, a student needs to fulfil the associated credits. An illustration of credits requirements in relation to the type of award is illustrated as above.

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field of study/profession. Thus, B.Sc. (Honours) Course in Mathematics aims to prepare students to qualify for joining a profession or to provide development opportunities in particular employment settings.

AIMS:

- To enable the students not only in learning of mathematical concepts but also in contemporary interdisciplinary ideas related to mathematics.
- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- To shape students as a responsible and sensible citizen of India.

- To prepare students for national as well as international competitive examinations, especially UGC-CSIR NET/SET/JAM/GATE etc.

COURSE INTRODUCTION:

The newly designed curriculum of B.Sc. in Mathematics aims to achieve basic knowledge and computational skills to study mathematical science. Students would be exposed to different areas of mathematical science using a unique combination of theoretical and practical learning.

Students would be taught using modern methods and technologies to understand Theoretical mathematics, mathematical software's like SCILAB, MATLAB etc. The programme also aims to equip students with computing techniques using Python and similar software.

The programme will also have study tours, students exchange programmes and various levels seminar, conference etc.

PROGRAMME OUTCOMES:

- Students will generate more interest in study of mathematics.
- Students will acquire basic Theoretical concepts and practical skills along with domain knowledge of different branches in mathematics.
- Students will become employable; they will be eligible for career opportunities in Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies and research as well as contemporary professional courses.
- Student will be equipped with mathematical modelling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- Students will learn how to apply mathematical concepts to practical and real-life problems.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total
					CA	UA	
First Year	I	MAJ MAT-101 (Theory)	Calculus & Theory of Matrices - I	3	35	40	75
		MAJ MAT-102-P (Practical)	Calculus & Theory of Matrices - I - Practical	1	15	10	25
		MAJ MAT-103 (Theory)	Calculus & Theory of Matrices - II	3	35	40	75
		MAJ MAT-104-P (Practical)	Calculus & Theory of Matrices - II - Practical	1	15	10	25
			Total Credits	8	Total Marks		200
		MIN MAT-105 (Theory)	Calculus & Theory of Matrices - I	3	35	40	75
		MIN MAT-106-P (Practical)	Calculus & Theory of Matrices - I - Practical	1	15	10	25
			Total Credits	4	Total Marks		100
		MDC MAT-107 (Theory)	Calculus & Theory of Matrices - I	3	35	40	75
		MDC MAT-108-P (Practical)	Calculus & Theory of Matrices - I - Practical	1	15	10	25
		Total Credits	4	Total Marks		100	
Second Year	II	MAJ MAT-201 (Theory)	Calculus & Differential Equations	3	35	40	75
		MAJ MAT-202-P (Practical)	Calculus & Differential Equations - Practical	1	15	10	25
		MAJ MAT-203 (Theory)	Calculus & Theory of Equations	3	35	40	75
		MAJ MAT-204-P (Practical)	Calculus & Theory of Equations - Practical	1	15	10	25
			Total Credits	8	Total Marks		200
		MIN MAT-205 (Theory)	Calculus & Differential Equations	3	35	40	75
		MIN MAT-206-P (Practical)	Calculus & Differential Equations - Practical	1	15	10	25
			Total Credits	4	Total Marks		100
		MDC MAT-207 (Theory)	Calculus & Differential Equations	3	35	40	75
		MDC MAT-208-P (Practical)	Calculus & Differential Equations - Practical	1	15	10	25
		Total Credits	4	Total Marks		100	

KSKV Kachchh University: BHUJ
B.Sc.: Semester: I (ONE) SUBJECT: MATHEMATICS
PAPER: Calculus & Theory of Matrices – I
PAPER Code: MAJ MAT-101 / MIN MAT-105 / MDC MAT-107
(3 Credits)

Unit 1

Successive Differentiation: Successive derivatives, standard results (without proof) for n^{th} derivatives.

Method of finding n^{th} derivative of an Algebraic Rational Function.

Leibnitz's rule (statement) and its examples.

Unit 2

Theory of Matrices: Symmetric and skew-symmetric matrices, Orthogonal, Periodic, Idempotent, nilpotent and involuntary matrices.

Elementary row Operations on Matrices, Row-reduced echelon form of a matrix.

Inverse of a matrix by Adjoint method and row-reduced echelon form method.

Rank of a matrix.

Unit 3

Convergence and Divergence of Series of real numbers: Definitions of Convergence and divergence of real infinite series, Five Tests (Integral test, Comparison Test, Practical Comparison test, Ratio Test and Root Test – only examples for these tests).

Convergence of power series and radius of convergence, Absolute Convergence, Leibniz test for convergence of alternating series.

❖ **Reference Books:**

1. Differential Calculus – Shantinakaran
2. Matrix and Linear Algebra – K. B. Dutta
3. Calculus – T. M. Apostol
4. Theory of Matrices – Vatssa
5. Calculus – James Stewart- sixth edition

KSKV Kachchh University: BHUJ
B.Sc.: Semester: I (ONE) SUBJECT: MATHEMATICS
PAPER: Calculus & Theory of Matrices – I -Practical
PAPER Code: MAJ MAT-102 -P/ MIN MAT-106-P / MDC MAT-108-P
(1 Credit)

Practical No.	Description
1	Perform Mathematical operations like Addition, Subtraction, Multiplication, Division and Power of natural numbers in MATLAB / SCILAB.
2	Perform Log_e , Log_{10} , Exponential, Trigonometric, Factorial in MATLAB / SCILAB.
3	Evaluate the value of given expression using MATLAB / SCILAB.
4	Evaluate the derivative of given function using MATLAB / SCILAB.
5	Evaluate $A+B$, $2A-3B$, $A^T + B^T$, A^{-1} for given Matrices using MATLAB / SCILAB.
6	Check given matrix is idempotent, nilpotent using MATLAB / SCILAB.
7	Draw the graph of given polynomial function in MATLAB / SCILAB.
8	Draw graph of $y = \log(ax+b)$ and $y = e^{(ax+b)}$ in MATLAB / SCILAB.

Note: The preferable and recommended software for above practical is MATLAB because it offers wide applications.

❖ **Reference books:**

1. An Introduction to Scilab-Satish Annigeri, December 2009
2. Scilab for very beginners-Scilab enterprises.
3. MATLAB for Beginners A Gentle Approach- Peter I. Kattan, PETRA Books.

Note: This list is demonstrative and institute can apply necessary changes in content and design of practical as per the availability of infrastructure and need of the students and requirement of skills in the region.

Preferable Infrastructure Requirement: A well-equipped computer lab with MATLAB or equivalent.

Human resource requirement: A lab in-charge with good computer knowledge preferably PGDCA, BCA required for computer lab.

INTERNAL EVALUATION SCHEME :**❖ Theory (MAJ MAT-101 / MIN MAT-105 / MDC MAT-107) : 35 Marks**

1.	Internal Continuous and Comprehensive Evaluation (CCE) will be conducted by the department. The total internal theory marks will be 35 Marks.
2.	<p>CCE Marking Scheme for Theory: For each paper, CCE may be further distributed as under. This list is not exhaustive and new parameters can be added :</p> <ul style="list-style-type: none"> a) Unit Test / Internal Examination (MCQ or Descriptive) b) Seminar c) Assignments d) Attendance <p>The Department Head will be final authority for finalizing the distribution of internal evaluation marks in every semester.</p>

❖ Practical (MAJ MAT-102-P/ MIN MAT-106-P / MDC MAT-108-P): 15 Marks

CCE Marking Scheme for Practical : Any one or more of the parameters from Lab Performance/ Lab attendance / Internal practical Test / Journal / Viva etc. can be used. The total internal practical marks will be 15 Marks.

➤ **EXTERNAL (UNIVERSITY) EVALUATION SCHEME:**❖ **Theory (MAJ MAT-101 / MIN MAT-105 / MDC MAT-107): 40 Marks**

There will be a written test of total 40 marks, having total 4 questions.

The Demonstrative Structure of the External Examination Question Paper

Question No.	Question type	Marks
1 (Unit 1)	Descriptive Questions (2 out of 3)	10
2 (Unit 2)	Descriptive Questions (2 out of 3)	10
3 (Unit 3)	Descriptive Questions (2 out of 3)	10
4 (Unit 1,2,3)	Descriptive question / Short questions	10

- The above paper scheme is demonstrative but not exhaustive. An examiner may apply necessary changes if felt necessary.
- Types of questions may be varied: like: one descriptive question/one line answers / two line answers / definitions / reasoning / derivations of equations / derivations of sums / drawing small figures etc.

❖ **Practical (MAJ MAT-102-P/ MIN MAT-106-P / MDC MAT-108-P): 10 Marks**

There will be a practical test of total 10 marks, having total 4 exercises.

The Demonstrative Structure of the External Examination Practical Paper

Exercises No.	Exercises	Marks
1	Based on Mathematical Exercise in SCILAB / MATLAB	3
2	Based on Graphical Exercise in SCILAB / MATLAB	3
3	Viva Voice/MCQ Exercise	2
4	Journal	2

The above practical paper scheme is demonstrative but not exhaustive. An examiner may apply necessary changes if felt necessary.

KSKV Kachchh University: BHUJ
B.Sc.: Semester: I (ONE) SUBJECT: MATHEMATICS
PAPER: Calculus & Theory of Matrices - II
PAPER Code: MAJ MAT-103
(3 Credits)

Unit 1

Expansion of function using Taylor and Maclaurin Series, Expansion of e^x , $\sin x$, $\cos x$, $\log(1+x)$, $\log(1-x)$ and $(1+x)^n$.

Maxima and minima of a function of one variable using 1st derivative and 2nd derivative test.

Unit 2

Continuity and discontinuity of a function of one variable and Examples.

Indeterminate Forms: Examples using L' Hospital's rules for various indeterminate forms like $\frac{0}{0}$ form, $\frac{\infty}{\infty}$ form, $0 \cdot \infty$ form, $\infty - \infty$ form etc.

Unit 3

Complex matrix, Hermitian, Skew - Hermitian and Unitary matrices.

Solution of Linear equations and consistency: Gauss Elimination and Gauss Jordan Elimination. Solution of n linear equations in n unknown.

Solution of m linear equations in n unknowns with $m < n$ and $m > n$.

Homogeneous linear equations.

❖ **Reference Books:**

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2. Matrix and Linear Algebra – K. B. Dutta
3. Calculus – T. M. Apostol
4. Theory of Matrices – Vatssa
5. Calculus – James Stewart- sixth edition

KSKV Kachchh University: BHUJ
B.Sc.: Semester: I (ONE) SUBJECT: MATHEMATICS
PAPER: Calculus & Theory of Matrices - II - Practical
PAPER Code: MAJ MAT-104 -P
(1 Credit)

Practical No.	Description
1	Draw graph of $y = \sin(ax+b)$ and $\cos(ax+b)$ in MATLAB / SCILAB.
2	Draw graph of $y = \tan(ax+b)$ and $\cot(ax+b)$ in MATLAB / SCILAB.
3	Draw graph of $y = \operatorname{cosec}(ax+b)$ and $y = \sec(ax+b)$ in MATLAB / SCILAB.
4	Solve the system of equations in three and four variables in MATLAB / SCILAB.
5	Solve the system of equations in five variables in MATLAB / SCILAB.
6	If-elseif -else condition: To determine whether a number is +ve or -ve or zero
7	For loop and While loop: To find factorial of given number
8	Multiple plots of functions

Note: The preferable and recommended software for above practical is MATLAB because it offers wide applications.

❖ **Reference books:**

1. An Introduction to Scilab-Satish Annigeri, December 2009
2. Scilab for very beginners-Scilab enterprises.
3. MATLAB for Beginners A Gentle Approach- Peter I. Kattan, PETRA Books.

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Preferable Infrastructure Requirement: A well-equipped computer lab with MATLAB or equivalent.

Human resource requirement: A lab in-charge with good computer knowledge preferably PGDCA, BCA required for computer lab.

INTERNAL EVALUATION SCHEME:**❖ Theory (MAJ MAT-103): 35 Marks**

1.	Internal Continuous and Comprehensive Evaluation (CCE) will be conducted by the department. The total internal theory marks will be 35 Marks.
2.	<p>CCE Marking Scheme for Theory: For each paper, CCE may be further distributed as under. This list is not exhaustive and new parameters can be added :</p> <ul style="list-style-type: none"> e) Unit Test / Internal Examination (MCQ or Descriptive) f) Seminar g) Assignments h) Attendance <p>The Department Head will be final authority for finalizing the distribution of internal evaluation marks in every semester.</p>

❖ Practical (MAJ MAT-104-P): 15 Marks

CCE Marking Scheme for Practical : Any one or more of the parameters from Lab Performance/ Lab attendance / Internal practical Test / Journal / Viva etc. can be used. The total internal practical marks will be 15 Marks.

➤ **EXTERNAL (UNIVERSITY) EVALUATION SCHEME:**❖ **Theory (MAJ MAT-103): 40 Marks**

There will be a written test of total 40 marks, having total 4 questions.

The Demonstrative Structure of the External Examination Question Paper

Question No.	Question type	Marks
1 (Unit 1)	Descriptive Questions (2 out of 3)	10
2 (Unit 2)	Descriptive Questions (2 out of 3)	10
3 (Unit 3)	Descriptive Questions (2 out of 3)	10
4 (Unit 1,2,3)	Descriptive question / Short questions	10

- The above paper scheme is demonstrative but not exhaustive. An examiner may apply necessary changes if felt necessary.
- Types of questions may be varied: like: one descriptive question/one line answers / two line answers / definitions / reasoning / derivations of equations / derivations of sums / drawing small figures etc.

❖ **Practical (MAJ MAT-104-P): 10 Marks**

There will be a practical test of total 10 marks, having total 4 exercises.

The Demonstrative Structure of the External Examination Practical Paper

Exercises No.	Exercises	Marks
1	Based on Mathematical Exercise in SCILAB / MATLAB	3
2	Based on Graphical Exercise in SCILAB / MATLAB	3
3	Viva Voice/MCQ Exercise	2
4	Journal	2

The above practical paper scheme is demonstrative but not exhaustive. An examiner may apply necessary changes if felt necessary.