KRANTIGURU SHYAMJI KRISHNA VERMA
KACHCHH UNIVERSITY

Faculty of Science
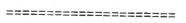

B. Sc. Semester III & IV
(Exit option)

MATHEMATICS

SYLLABUS (CBCS)

Curriculum as per UGC Guideline Framed according to

National Education Policy (NEP) - 2020

With effect from June – 2024

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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 + Honours 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	
Second Year	III	MAJ MAT-301 (Theory)	Advanced Calculus - I	3	35	40	75
		MAJ MAT-302-P (Practical)	Advanced Calculus - I - Practical	1	15	10	25
		MAJ MAT-303 (Theory)	Advanced Calculus - II	3	35	40	75
		MAJ MAT-304-P (Practical)	Advanced Calculus - II - Practical	1	15	10	25
		MAJ MAT-305 (Theory)	Linear Algebra - I	3	35	40	75
		MAJ MAT-306-P (Practical)	Linear Algebra - I - Practical	1	15	10	25
			Total Credits	**12**	**Total Marks**		**300**
		MDC MAT-307 (Theory)	Advanced Calculus - I	3	35	40	75
		MDC MAT-308-P (Practical)	Advanced Calculus - I - Practical	1	15	10	25
			Total Credits	**4**	**Total Marks**		**100**
Second Year	IV	MAJ MAT-401 (Theory)	Linear Algebra - II	3	35	40	75
		MAJ MAT-402-P (Practical)	Linear Algebra - II - Practical	1	15	10	25
		MAJ MAT-403 (Theory)	Linear Algebra - III	3	35	40	75
		MAJ MAT-404-P (Practical)	Linear Algebra - III - Practical	1	15	10	25
		MAJ MAT-405 (Theory)	Advanced Calculus - III	3	35	40	75
		MAJ MAT-406-P (Practical)	Advanced Calculus - III - Practical	1	15	10	25
			Total Credits	**12**	**Total Marks**		**300**
		MIN MAT-407 (Theory)	Linear Algebra - II	3	35	40	75
		MIN MAT-408-P (Practical)	Linear Algebra – II - Practical - Practical	1	15	10	25
			Total Credits	**4**	**Total Marks**		**100**

KSKV Kachchh University, BHUJ

B.Sc.: Semester: III (THREE) SUBJECT: MATHEMATICS
PAPER: Advanced Calculus – I
PAPER Code: MAJ MAT-301/MDC MAT - 307
(3 Credits)

Unit 1

Limits of real functions of two variables (only examples using definition), Iterated limits, Continuity of functions of two variables (only examples)

Unit 2

Partial Derivatives of first order (only examples – usual and by using definition), Directional Derivatives Partial Derivatives of second order (only examples)

Unit 3

Partial Derivatives of second order (only examples– usual and by using definition)

❖ **Reference Books :**

1. Advanced Calculus: David Widder (Prentice-Hall, inc)
2. Differential Calculus: Shanti Narayan (S. Chand & Co)
3. Integral Calculus: Shanti Narayan (S. Chand & Co)
4. Advanced Calculus Vol. 2 : Tom Apostol (published by John Wiley & Sons)

KSKV Kachchh University, BHUJ
B.Sc.: Semester: III (THREE) SUBJECT: MATHEMATICS
PAPER: Advanced Calculus – I - Practical
PAPER Code: MAJ MAT-302 -P/ MDC MAT-308-P
(1 Credit)

Practical No.	Description
1	Basic of C programming.
2	Write a programme of Arithmetic Operations on int Data type and on float Data type in C programming and run it.
3	Write code of Mathematical Formulae in C programming.
4	Write a programme of Hierarchy of Operators and ASCII values using Character data type in C programming.
5	Write Coding of 'If -Else' statement in C programming and run it.
6	Write coding of Multiple conditions 'IF - ELSE' statement in C programming.
7	Write code of 'NESTED IF - ELSE' statement in C programming.
8	Write code of ' ELSE - IF' statement in C programming.

Note: The preferable and recommended software for above practical is **Microsoft Visual Studio** because it offers wide applications.

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.

❖ Reference books:

1. Let Us C: Authentic Guide to C programming Language: Yashavant Kanetkar

2. Computing Fundamentals and C programming: E. Balgurusamy

3. C Programming for Beginners: Dr, Madhav Bokare and Ms. Nishigandha Kurale

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.

KSKV Kachchh University, BHUJ

B.Sc.: Semester: III (THREE) SUBJECT: MATHEMATICS
PAPER: Advanced Calculus – II
PAPER Code: MAJ MAT-303
(3 Credits)

Unit 1

Homogeneous functions, Euler's theorem for Homogeneous functions, Examples of Euler's theorem

Unit 2
Extreme values of real functions of two variables.

Unit 3
Lagrange's Method for Extreme values of real functions of two variables.

❖ Reference Books :

1. Advanced Calculus: David Widder (Prentice-Hall, inc)
2. Differential Calculus: Shanti Narayan (S. Chand & Co)
3. Integral Calculus: Shanti Narayan (S. Chand & Co)
4. Advanced Calculus Vol. 2 : Tom Apostol (published by John Wiley & Sons)

KSKV Kachchh University, BHUJ
B.Sc.: Semester: III (THREE) SUBJECT: MATHEMATICS
PAPER: Advanced Calculus – II - Practical
PAPER Code: MAJ MAT-304 - P
(1 Credit)

Practical No.	Description
1	Prepare a PPT on a renowned Mathematician
2	Prepare a PPT on a Mathematical topic
3	Prepare a PPT on student's Institute
4	Prepare a PPT on a selected Book
5	Prepare a PPT on Kachchh
6	Prepare a PPT on favourite role model
7	Prepare a PPT on a topic of student's choice
8	Prepare a PPT on a topic of student's choice

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 licensed Microsoft office.

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

KSKV Kachchh University, BHUJ
B.Sc.: Semester: III (THREE) SUBJECT: MATHEMATICS
PAPER: Linear Algebra – I
PAPER Code: MAJ MAT-305
(3 Credits)

Unit 1

Prerequisite (Sets, Binary operation, Group, Field)Vector spaces, properties of vector space, subspace of a vector space, Linear combination of vectors, linear span of a set, Linear dependence and linear independence of vectors.

Unit 2

Basis of a vector space, Finite – dimensional vector space, Dimension of a vector space, coordinates of a vector, Dimension Theorem of subspace, linear and direct sum of subspace.

Unit 3

Linear Transformation, vector space isomorphism, Range, rank, kernel and nullity of a linear Transformation, Rank – Nullity theorem, singular and non-singular linear Transformation, The space L(U, V), composition of linear Transformations.

❖ Reference Books :

1. An introduction to Linear Algebra: V. Krishnamurthy

2. SurekhBijganit (in gujarati): Dr. I. H. Sheth

3. Linear Algebra: G Paria.

4. Linear Algebra: A.R.Vasistha

KSKV Kachchh University, BHUJ
B.Sc.: Semester: III (THREE) SUBJECT: MATHEMATICS
PAPER: Linear Algebra – I - Practical
PAPER Code: MAJ MAT-306 - P
(1 Credit)

Practical No.	Description
1	Basics of 'FOR LOOP' in C programming.
2	Write a code for LOOP without using Mathematical formulae in C programming.
3	Write a code for 'BREAK statement' in C programming.
4	Write a code for 'CONTINUE statement' in C programming.
5	Write a code for 'WHILE LOOP' in C programming.
6	Write a code for 'INFINITE LOOP' in C programming.
7	Write a code for Post / Pre - Increment / Decrement operators in C programming.
8	Write a code for 'DO WHILE LOOP' in C programming.

Note: The preferable and recommended software for above practical is **Microsoft Visual Studio** because it offers wide applications.

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.

❖ **Reference books:**

1. Let Us C: Authentic Guide to C programming Language: Yashavant Kanetkar

2. Computing Fundamentals and C programming: E. Balgurusamy

3. C Programming for Beginners: Dr, Madhav Bokare and Ms. Nishigandha Kurale

Preferable Infrastructure Requirement: A well-equipped computer lab with **Microsoft Visual Studio** 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-301 / MAJ MAT-303 / MAJ MAT-305 /MDC MAT-307) : 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.	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 :
	     a) Unit Test / Internal Examination (MCQ or Descriptive)
	     b) Seminar
	     c) Assignments
	     d) Attendance
	 The Department Head will be final authority for finalizing the distribution of internal evaluation marks in every semester.

❖ **Practical (MAJ MAT-302-P / MAJ MAT-304-P / MAJ MAT-306-P /MDC MAT-308-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-301 / MAJ MAT-303 / MAJ MAT-305 /MDC MAT-307) : 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-302-P / MAJ MAT-304-P / MAJ MAT-306-P / MDC MAT-308-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 Lab Practical	3
2	Based on Lab Practical	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: IV (FOUR) SUBJECT: MATHEMATICS
PAPER: LINEAR ALGEBRA-II
PAPER Code: MAJ MAT-401/MIN MAT - 407
(3 Credits)

Unit 1

Eigen value and eigen vectors of a Matrix, Theorems and examples,Algebraic and geometrical multiplicity of an eigen values.

Unit 2

Cayley- Hamilton Theorem and application, Diagonalization of a Matrix by Similarity transformation, Power of matrix, Orthogonally diagonalizable matrix.

Unit 3

Quadratic Form, linear transformation of quadratic form, Canonical Form using linear and orthogonal transformation, Index , signature and definiteness of a quadratic form.

❖ **Reference Books :**

1. An introduction to Linear Algebra: V. Krishnamurthy

2. SurekhBijganit (in gujarati) : Dr. L. K. Patel

3. Linear Algebra: G Paria.

4. Linear Algebra :A.R.Vasistha

KSKV Kachchh University, BHUJ
B.Sc.: Semester: IV (FOUR) SUBJECT: MATHEMATICS
PAPER: LINEAR ALGEBRA – II - Practical
PAPER Code: MAJ MAT-402 -P/ MIN MAT-408-P
(1 Credit)

Practical No.	Description
1	Write basic code of an array in C programming.
2	Write code to insert and delete an element from an array in C programming.
3	Write code to reverse an array in C programming.
4	Write code to find the largest and smallest number in an array in C programming.
5	Write code to find sum of n numbers using an array in C programming.
6	Write code to sort element of an array in C programming.
7	Write code to remove duplicate element of an array in C programming.
8	Write code to reverse an array in C programming.

Note: The preferable and recommended software for above practical is **Microsoft Visual Studio** because it offers wide applications.

❖ **Reference books:**

1. Let Us C: Authentic Guide to C programming Language: Yashavant Kanetkar

2. Computing Fundamentals and C programming: E. Balgurusamy

3. C Programming for Beginners: Dr, Madhav Bokare and Ms. Nishigandha Kurale

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 **Microsoft Visual Studio** or equivalent.

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

KSKV Kachchh University, BHUJ
B.Sc.: Semester: IV (FOUR) SUBJECT: MATHEMATICS
PAPER: LINEAR ALGEBRA -III
PAPER Code: MAJ MAT-403
(3 Credits)

Unit 1

Matrix associated with a linear map, Linear map associated with a matrix, The set $M_{m,n}$, Linear operations on $M_{m,n}$, Isomorphism between $M_{m,n}$ and L (U , V), Dimension of $M_{m,n}$ and L (U , V), Linear functional, Dual space, Dual basis, Dual basis Existence Theorem,

Unit 2

Inner product spaces, properties of inner product space, Cauchy – Schwartz inequality, Triangle inequality, Pythagorean theorem, angle between the vectors, Orthogonality, Orthogonal set.

Unit 3

Orthonormal set, Orthonormal basis, Gram – Schmidt orthogonalization process, orthogonal complement of a subspace, orthogonal transformation.

❖ **Reference Books :**

1. An introduction to Linear Algebra: V. Krishnamurthy

2. SurekhBijganit (in gujarati) : Dr. L. K. Patel

3. Linear Algebra: G Paria.

4. Linear Algebra :A.R.Vasistha

KSKV Kachchh University, BHUJ
B.Sc.: Semester: IV (FOUR) SUBJECT: MATHEMATICS
PAPER: LINEAR ALGEBRA – III - Practical
PAPER Code: MAJ MAT-404 - P
(1 Credit)

Practical No.	Description
1	Basics programming of Matrix in C programming.
2	Write a program of addition of two given matrices in C programming.
3	Write a programme to find the maximum and minimum element and their index in a matrix in C programming.
4	Write a programme to Print the transpose of a given matrix in C programming.
5	Write a programme to rotate a given matrix 90 degrees clockwise in C programming.
6	Write a programme for the multiplication of two matrices in C programming.
7	Write a programme to draw a matrix by Wave printing in C programming.
8	Write a programme to draw a matrix by SPIRAL printing in C programming.

Note: The preferable and recommended software for above practical is **Microsoft Visual Studio** because it offers wide applications.

❖ Reference books:

1. Let Us C: Authentic Guide to C programming Language: Yashavant Kanetkar

2. Computing Fundamentals and C programming: E. Balgurusamy

3. C Programming for Beginners: Dr, Madhav Bokare and Ms. Nishigandha Kurale

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 **Microsoft Visual Studio** or equivalent.

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

KSKV Kachchh University, BHUJ
B.Sc.: Semester: IV (FOUR) SUBJECT: MATHEMATICS
PAPER: ADVANCED CALCULUS – III
PAPER Code: MAJ MAT-405
(3 Credits)

Unit 1   **[15marks]**

Expansion of real functions of one and two variables using Taylor's formula, Expansion of real functions of one and two variables using Maclaurin's formula.

Unit 2   **[15 marks]**

Double Points for the real functions of two variables, Types of Double points

Unit 3   **[15 marks]**

Vector Calculus : Gradient of a scalar function, Divergence of a vector function, Curl of a vector function.

❖ **Reference Books :**

1. Advanced Calculus: David Widder (Prentice-Hall, inc)
2. Differential Calculus: Shanti Narayan (S. Chand & Co)
3. Integral Calculus: Shanti Narayan (S. Chand & Co)
4. Advanced Calculus Vol. 2 : Tom Apostol (published by John Wiley & Sons)

KSKV Kachchh University, BHUJ
B.Sc.: Semester: IV (FOUR) SUBJECT: MATHEMATICS
PAPER: Advanced Calculus – III - Practical
PAPER Code: MAJ MAT-406 - P
(1 Credit)

Practical No.	Description
1	Basics programming for the mathematical functions in C programming.
2	Write a programme for calculating nPr and nCr for a given data in C programming.
3	Write a programme to find first n Fibonacci numbers in C programming.
4	Write a programme to print Pascal Triangle in C programming.
5	Write a programme to find the Power of n in C programming.
6	Write a programme to find LCM of two numbers in C programming.
7	Write a programme to find GDC of two numbers in C programming.
8	Write a programme to find the prime factors of a given number in C programming.

Note: The preferable and recommended software for above practical is **Microsoft Visual Studio** because it offers wide applications.

❖ **Reference books:**

1. Let Us C: Authentic Guide to C programming Language: Yashavant Kanetkar

2. Computing Fundamentals and C programming: E. Balgurusamy

3. C Programming for Beginners: Dr, Madhav Bokare and Ms. Nishigandha Kurale

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Preferable Infrastructure Requirement: A well-equipped computer lab with **Microsoft Visual Studio** 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-401 / MAJ MAT-403 / MAJ MAT-405 /MDC MAT-407) : 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.	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 : e) Unit Test / Internal Examination (MCQ or Descriptive) f) Seminar g) Assignments h) Attendance The Department Head will be final authority for finalizing the distribution of internal evaluation marks in every semester.

- ❖ **Practical (MAJ MAT-402-P / MAJ MAT-404-P / MAJ MAT-406-P /MDC MAT-408-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-401 / MAJ MAT-403 / MAJ MAT-405 /MDC MAT-407) : 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

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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

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❖ **Practical (MAJ MAT-402-P / MAJ MAT-404-P / MAJ MAT-406-P / MDC MAT-408-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 Lab Practical	3
2	Based on Lab Practical	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.