B.Sc. MATHEMATICS SYLLABUS

(Common Core Syllabus Under CBCS)

With Effect From The Academic Year 2025-26 Onwards

Accredited with **'A$^+$ '** *by* **NAAC**

Department of Mathematics
Kakatiya University
Warangal, Telangana- 506009

Mathematics Course Structure

KAKATIYA UNIVERSITY , WARANGAL.
B.Sc. CBCS COMMON CORE SYLLABUS FOR ALL UNIVERSITIES IN TELANGANA STATE
APPROVED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc. MATHEMATICS
(Effect from the academic year 2025 – 2026 onwards)

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
FIRST YEAR-SEMESTER- I				
BS 101	**Major – 1 : Mathematics** **Differential Equations**	DSC-1A	5T+1Tutorial = 6	5
BS 102	Major – 2	DSC-2A	4T+2P = 6	4+1 = 5
BS 103	Minor	DSC-3A	4T+2P = 6	4+1 = 5
BS 104	English	AEC-1A	5	5
BS 105	Second Language	AEC-2A	5	5
	TOTAL CREDITS		**28**	**25**
FIRST YEAR-SEMESTER- II				
BS 201	**Major – 1: Mathematics** **Real Analysis**	DSC-1B	5T+1Tutorial = 6	5
BS 202	Major – 2	DSC-2B	4T+2P = 6	4+1 = 5
BS 203	Minor	DSC-3B	4T+2P = 6	4+1 = 5
BS 204	English	AEC-1B	5	5
BS 205	Second Language	AEC-2B	5	5
	TOTAL CREDITS		**28**	**25**
SECOND YEAR-SEMESTER- III				
CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 301	**Major – 1: Mathematics** **Differential & Vector Calculus**	DSC-1C	5T+1Tutorial = 6	5
BS 302	Major – 2	DSC-2C	4T+2P = 6	4+1 = 5
BS 303	Minor	DSC-3C	4T+2P = 6	4+1 = 5
BS 304	English	AEC-1C	5	5
BS 305	Second Language	AEC-2C	5	5
	TOTAL CREDITS		**28**	**25**
SECOND YEAR-SEMESTER- IV				
BS 401	**Major – 1: Mathematics** **Algebra**	DSC-1D	5T+1Tutorial = 6	5
BS 402	Major – 2	DSC-2D	4T+2P = 6	4+1 = 5
BS 403	Minor	DSC-3D	4T+2P = 6	4+1 = 5
BS 404	English	AEC-1D	5	5
BS 405	Second Language	AEC-2D	5	5
	TOTAL CREDITS		**28**	**25**

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
THIRD YEAR-SEMESTER -V				
BS 501	**Major – 1: Mathematics** **Linear Algebra**	DSC-1E	5T+1Tutorial = 6	5
BS 502	Major – 2	DSC-2E	4T+2P = 6	4+1 = 5
BS 503	**MDC: Basic Mathematics**	MDC-1	4	4
BS 504	Skill Enhancement Course – 1	SEC-1	2	2
BS 505	Skill Enhancement Course – 2	SEC-2	2	2
BS 506	Value Added Course – 1	VAC-1	3	3
	TOTAL CREDITS		**23**	**21**
THIRD YEAR-SEMESTER- VI				
BS 601	**Major – 1: Mathematics** **(A) Numerical Analysis** **OR** **(B) Integral Transforms** **OR** **(C) Analytical Solid Geometry**	DSC-1F	5T+1Tutorial = 6	5
BS 602	Major – 2	DSC-2F	4T+2P = 6	4+1 = 5
BS 603	Skill Enhancement Course – 3	SEC-3	2	2
BS 604	Skill Enhancement Course – 4	SEC-4	2	2
BS 605	Value Added Course – 2	VAC-2	3	3
BS 606	Internship/ Project Work		4	4
	TOTAL CREDITS		**23**	**21**
	GRAND TOTAL			**142**

DSC: Discipline Specific Course,   **AEC:** Ability Enhancement Course,   **MDC:** Multi-Disciplinary Course,

SEC: Skill Enhancement Course.   **VAC:** Value Added Course

Note: Under the proposed CBCS structure for Undergraduate Programmes (2025-2026), students will pursue two Majors and one Minor, collectively reffered to as Discipline Specific Course (DSC). Both Major and Minor courses will remain integrated up to the fourth semester, after which students will have the option to drop one Minor course in both the fifth and sixth semesters. The syllabus and credits for Major and Minor courses will remain consistent up to the fourth semester, wilh the Major continuing through the fifth and sixth semesters.

Credits Under Non-CGPA
(Community Engagement & Service)

1.	NSS/NCC/Sports/Extracurricular	Up to 6 Credits (2 in each year)
2.	IKS	Up to 4 (2 in each, after I & II years)

Credits Under CGPA

Major – 1	30
Major – 2	30
Minor	20
AEC (Ability Enhancement Course) – English	20
Second Language	20
MDC (Multi-Disciplinary Course)	4
SEC (Skill Enhancement Course)	8
VAC (Value Added Course)	6
Project	4
Total Credits	**142**

B.Sc.(Mathematics) Course Structure
With Effect From 2025-2026 Academic Year Onwards

Year	Paper	Semester	Subject	Hours/Per Week		Credits	Marks (IA)	Marks (EE)	Total Marks
				Theory	Tutorials				
1	DSC- 1A	I	Differential Equations	5	1	5	25	100	125
	DSC- 1B	II	Real Analysis	5	1	5	25	100	125
2	DSC- 1C	III	Differential & Vector Calculus	5	1	5	25	100	125
	DSC- 1D	IV	Algebra	5	1	5	25	100	125
3	DSC- 1E	V	Linear Algebra	5	1	5	25	100	125
	DSC- 1F	VI	**(A)** Numerical Analysis **OR** **(B)** Integral Transforms **OR** **(C)** Analytical Solid Geometry	5	1	5	25	100	125
3	SEC- 4	VI	Number Theory **OR** Quantitative Aptitude	2	-	2	10	40	50
3	MDC-1	V	Basic Mathematics (Multi - Discipline)	4	-	4	20	80	100

Tutorials : Problems solving session for each 20 students one batch.

IA: Internal Assessment

EE: End Examination

DSC: Discipline Specific Course

SEC: Skill Enhancement Course

MDC: Multi-Disciplinary Course

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
Theory Model Question Paper (End Examination) for Semesters - I, II, III, IV
With Effect From the Academic Year 2025-2026 Onwards
B. Sc (Mathematics) – CBCS
[DSC Subjects only]

Time:3 Hours]   [Max.Marks:100

Section-A
(Short Answer Type)

I. Write any Eight (8) questions of the following   **(8×5=40 Marks)**

1
2 ⎱— UNIT-I
3

4
5 ⎱— UNIT-II
6

7
8 ⎱— UNIT-III
9

10
11 ⎱— UNIT-IV
12

Section-B
(Essay Answer Type)

II. Answer all Questions .   **(4×15=60 Marks)**

13 a)
(OR)   UNIT-I
   b)

14 a)
(OR)   UNIT-II
   b)

15 a)
(OR)   UNIT-III
   b)

16 a)
(OR)   UNIT-IV
   b)

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
Scheme of Internal Assessment-I- from the Academic Year 2025-2026 Onwards
[DSC Subjects only]
Course : B. Sc : Mathematics

Time: 90 Min.   **Max. Marks: 25**

Answer ALL Questions. Each Question Carries Equal Marks   (10 × 2 ½ = 25 Marks)

1
2
3   — UNIT-I
4
5

6
7
8   —UNIT-II
9
10
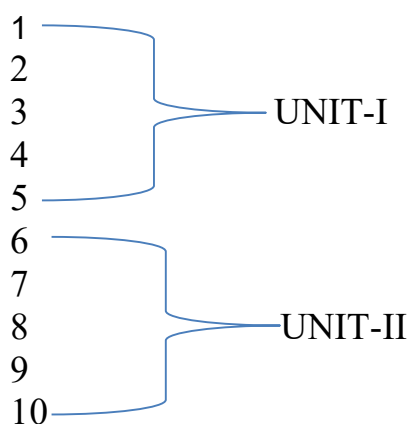
KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
Scheme of Internal Assessment-II- from the Academic Year 2025-2026 Onwards
[DSC Subjects only]
Course : B. Sc- Mathematics

Time: 90 Min.   **Max. Marks: 25**

Answer ALL Questions. Each Question Carries Equal Marks   **(10 × 2 ½ = 25 Marks)**

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1 ─┐
2  │
3  ├─── UNIT-III
4  │
5 ─┘
6 ─┐
7  │
8  ├─── UNIT-IV
9  │
10─┘
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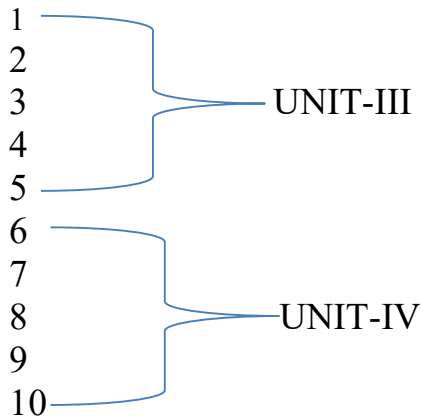
SEMESTER- I

DIFFERENTIAL EQUATIONS

Theory: 5 hours /week and Tutorials: 1 hour /week

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DSC-IA

Objective: The main aim of this course is to introduce the student to the techniques of solving Differential Equations and to apply their skills in solving some of the problems of Engineering and Science.

Outcome: After learning the course, the student will be equipped with various tools to solve few types of Differential Equations that arise in several branches of science.

UNIT- I

Differential Equations of First Order and First Degree: Introduction- Equations in Which Variables are Separable – Homogeneous Differential Equations - Differential Equations Reducible to Homogeneous Form – Linear Differential Equations - Differential Equations Reducible to Linear Form – Exact Differential Equations – Integrating Factors – Change in Variables (Text Book : 2.1 to 2.9)

UNIT- II

Equations of First Order But Not of The First Degree: Case I: Equations Solvable for p -Case II : Equations Solvable for y - Equations Solvable for x – Equations that do not Contain x *(or y)* - Equations Homogeneous in x and y – Equations of First Degree in x and y – Clairaut's Equation.

Applications of First Order Differential Equations: Growth and Decay – Dynamics of Tumor Growth – Radioactivity and Carbon Dating – Compound Interest – Orthogonal Trajectories.

(Text Book : 3.1 to 3.2 & 4.1 to 4.4 & 4.20)

UNIT- III

Higher Order Linear Differential Equations: Introduction - Solution of Homogeneous Linear Differential Equations of Order n with Constant Coefficients - Solution of the Non-Homogeneous Differential Equations with Constant Coefficients by Means of Polynomial Operators - Method of Undetermined Coefficients. (Text Book : 5.1 to 5.4)

UNIT- IV

Method of variation of Parameters – Linear Differential Equations with Non-Constant Coefficients – The Cauchy – Euler Equation – Legendre's Linear Equations – Miscellaneous Differential Equations.

Total Differential Equations – Simultaneous Total Differential Equations – Equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. (Text Book : 5.5 to 5.9 & 2.10 to 2.12)

TEXT BOOK:

Zafar Ahsan, Differential Equations and Their Applications (Second Edition)

REFERENCE BOOKS :

1. Frank Ayres Jr, Theory and Problems of Differential Equations.
2. Ford, L.R ; Differential Equations.
3. Daniel Murray, Differential Equations.
4. S. Balachandra Rao, Differential Equations with Applications and Programs.
5. Stuart P Hastings, J Bryce McLead; Classical Methods in Ordinary Differential Equations.

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SEMESTER- II
REAL ANALYSIS
Theory: 5 hours /week and Tutorials: 1 hour /week

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DSC-IB

Objective: The course is aimed at exposing the student to the foundations of analysis which will be useful in understanding various physical phenomena.

Outcome: After the completion of the course the student will be in a position to appreciate the beauty and applicability of the course.

UNIT-I

Real Numbers: Field Structure and Order Structure-Bounded and Unbounded Sets- Completeness in the Set of Real Numbers- Absolute Value of a Real Number   (Text Book : Chapter 1: 2 to 5)

Open Sets, Closed Sets and Countable Sets : Limit Points of a Set-Closed Sets-Countable and Uncountable Sets (Text Book : Chapter 2 : 2 to 4)

 Real Sequences: Sequences-Limit points of a Sequence-Convergent Sequences-Non-Convergent Sequences (Definitions)-Cauchy's General Principle of Convergence- Algebra of Sequences- Some Important Theorems-Monotonic Sequences.(Text Book : Chapter 3: 1 to 2 & 4 to 9)

UNIT-II

Infinite Series : Introduction-Positive Term Series- Comparison Tests for Positive Term Series-Cauchy's Root test- D'Alembert's Ratio Test-Integral Test-Alternating Series(Leibnitz Test).
 (Text Book : Chapter 4 : 1 to 5, 8 & 10.1)

 Functions of a Single Variable (I): Limits-Continuous Functions-Functions Continuous on Closed Intervals. (Text Book : Chapter 5: 1 to 3)

UNIT -III

Functions of a Single Variable (II): The Derivative-Increasing and Decreasing Functions- Rolle's Theorem-Lagrange's Mean Value Theorem- Cauchy's Mean Value Theorem- Higher Order Derivatives. (Text Book : Chapter 6: 1, 3 & 5 to 8)

UNIT -IV

The Riemann Integral: Definition and Existence of the Integral-Refinement of Partitions-Darboux's Theorem-Conditions of Integrability-Integrability of the Sum and Difference of Integrable Functions-The Integral as a Limit of Sums-Some Integrable Functions-Integration and Differentiation-The Fundamental Theorem of Calculus. (Text Book : Chapter 9: 1 to 9)

TEXT BOOK :
>   S.C. Malik and Savita Arora, Mathematical Analysis, Fourth Edition, New Age International
>   Publishers

 REFERENCE BOOKS:
1.   Kenneth A Ross, Elementary Analysis-The Theory of Calculus
2.   William F. Trench, Introduction to Real Analysis
3.   Lee Larson, Introduction to Real Analysis I
4.   Shanti Narayan and Mittal, Mathematical Analysis
5.   Brian S. Thomson, Judith B. Bruckner, Andrew M. Bruckner; Elementary Real analysis

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SEMESTER- III
DIFFERENTIAL AND VECTOR CALCULUS
Theory: 5 hours /week and Tutorials: 1 hour /week

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DSC-IC

Objective: The course is aimed at exposing the student to some basic notions in Differential Calculus.

Outcome: After the completion of the course the student realizes wide-ranging applications of the subject.

UNIT- I

Partial Differentiation: Introduction - Functions of Two Variables - Neighbourhood of a Point (a, b) - Continuity of a Function of Two Variables- Continuity at a Point - Limit of a Function of Two Variables - Partial Derivatives - Geometrical Representation of a Function of Two Variables - Homogeneous Functions. (Text Book 1 : 11.1 to 11.8)

UNIT- II

Theorem on Total Differentials-Composite Functions- Differentiation of Composite Functions- Implicit Functions- Equality of $f_{xy}(a, b)$ and $f_{yx}(a, b)$, Taylor's Theorem for a Function of Two Variables- Maxima and Minima of Function of Two variables- Lagrange's Method of Undetermined Multipliers- Jacobians . (Text Book 1 : 11.9 to 11.11 & 9.6, 9.7 & 12.1)

UNIT- III

Gradient, Divergence and Curl : Introduction-Gradient- Divergence-Curl -Formulas Involving ∇- Invariance (Text Book 2: Chapter 4: 4.1 to 4.6)

Multiple Integrals : Double Integrals- Double Integrals in Polar Form (Book 3: 13.1 & 13.3)

Vector Integration : Introduction- Ordinary Integrals of Vector Valued Functions - Line Integrals-Surface Integrals- Volume Integrals. (Text Book 2: Chapter 5: 5.1 to 5.5)

UNIT- IV

The Divergence Theorem, Stoke's Theorem and Related Integral Theorems : Introduction-Main Theorems- Related Integral Theorems (Text Book 2: Chapter 6: 6.1 to 6.3)

TEXT BOOKS:

1. Shanti Narayan, P.K. Mittal Differential Calculus, S.CHAND, NEW DELHI, Fifteenth Edition

2. Vector Analysis , Second Edition (Schaum's Outlines) , By Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman.

3. Calculus and Analytical Geometry by George B. Thomas, Ross. L. Finney (Nineth Edition)

REFERENCE BOOKS:

1. William Anthony Granville, Percey F Smith and William Raymond Longley; Elements of the Differential and Integral Calculus

2. Joseph Edwards, Differential calculus for Beginners

3. Smith and Minton, Calculus

4. Elis Pine, How to Enjoy Calculus

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SEMESTER – IV
ALGEBRA
Theory: 5 hours /week and Tutorials: 1 hour /week

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DSC-ID

Objective: The course is aimed at exposing the student to learn some basic algebraic structures like groups, rings etc.,

Outcome: On successful completion of the course the student will be able to recognize algebraic structures that arise in matrix algebra, linear algebra and will be able to apply skills learnt in understanding various such subjects.

UNIT – I

Group Theory: Definition of a Group, Some Examples of Groups - Some Preliminary Lemmas – Subgroups - A Counting Principle. (Text Book : 2.1 to 2.5)

UNIT – II

Group Theory: Normal Subgroups and Quotient Groups –Homomorphsims -Cayley's Theorem - Permutation Groups.(Text Book : 2.6, 2.7, 2.9, 2.10)

UNIT – III

Ring Theory: Definition and Examples of Rings - Some Special Classes of Rings - Homomorphisms. (Text Book : 3.1 to 3.3)

UNIT – IV

Ring Theory: Ideals and Quotient Rings -More Ideals and Quotient Rings – Euclidean Rings - Polynomial Rings. (Text Book : 3.4, 3.5, 3.7, 3.9)

TEXT BOOK :

   I. N. Herstein : Topics in Algebra, John Wiley & Sons (Second Edition)

REFERENCE BOKS :

1. Bhattacharya. P.B, Jain. S.K and Nagpaul. S.R : Basic Abstract Algebra
2. Fraleigh. J.B: A First Course in Abstract Algebra.
3. Joseph A Gallian: Contemporary Abstract Algebra (9th Edition).

Annexure – I (Credits)
Proposed CBCS Structure from 2025-26 for Under Graduate Courses

Courses		Papers	Total Credits	Credits for each paper / Semester BA						Credits for each paper / Semester B.Com.						Credits for each paper / Semester B.Sc.					
				I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Core Courses DSC	Major-1	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Major -2	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
MIL/AEC (First Language)	English	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Second Language (Telugu, Hindi, Urdu, etc.)		4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Multi-Disciplinary Course	MDC 1	1	4	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4	-
Sec 1, 2		2	4					2	2					2	2					2	2
Sec 3, 4		2	4					2	2					2	2					2	2
Value added course (VAC)	VAC 1, 2	2	6	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3
Internships	Internship / Project	1	4	-	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4
Total Credits in each semester			142	25	25	25	25	21	21	25	25	25	25	21	21	25	25	25	25	21	21
Total Credits in UG				142						142						142					
Credits under Non-CGPA (Community engagement and service)	NSS /NCC /sports / Extra curricular	6		Upto 6 (2 in each year)						Upto 6 (2 in each year)						Upto 6 (2 in each year)					
	IKS	4		Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)					