University of Mysore

Bachelor of Science (B.Sc.)
Curriculum Structure for undergraduate
Mathematics - III and IV Semester (from 2024-25 onward)

Sem	Sl. No	Code	Title of the Paper	Teaching Hours/ Week	Credit Pattern L:T:P	Credit Value	Marks (Weightage)		
							C1	C2	C3
III	1	DSC-MAT-03	Differential Equations – I & Numerical Analysis – I	3+4	3:0:2	5	10%	10%	80%
	2	DSET-MAT 03A	Numerical Analysis II	3	3:0:0	3	10%	10%	80%
	3	DSET – MAT 03B	Advanced Calculus	3	3:0:0	3	10%	10%	80%
IV	1	DSC-MAT-04	Algebra III & Calculus III	3+4	3:0:2	5	10%	10%	80%
	2	DSET-MAT-04	Real Analysis & Number Theory	3	3:0:0	3	10%	10%	80%
	3	DSEP-MAT-04	Introduction to LaTeX	2	0:0:2	2	10%	10%	80%

Assessment pattern for theory

Assessments broadly comprise of two components names formative and summative which should be in the proportion 20%:80%.

1. **Formative or Internal Assessments.** This should comprise of two components namely C_1 and C_2. Each of C_1 and C_2 should carry equal weights. Assuming that the theory paper is for 100 marks, the splits are as follows:

(a) C_1 **Component.** A test must be conducted for 10 marks in the eighth week.

(b) C_2 **component.** Any of the assessments such as seminar/assignment/quiz can be conducted for 10 marks or a test can be conducted for 10 marks.

2. **Summative assessment.** This may be named as C_3 component and this should be conducted for 80 marks. The question paper pattern should be as follows:

PART - A

1. **Question 1.** Answering 10 questions out of 12 questions each carrying 2 marks. (Total 20 marks) and four questions from each of the unit should be given.

PART-B

2. **Question 2.** (From Unit 1 and carries 10 marks)

    1. (5 marks)
    2. (5 marks)

OR

3. **Question 3.** (From Unit 1 and carries 10 marks)

    1. (5 marks)
    2. (5 marks)

PART -C

4. **Question 4.** (From Unit 2 and carries 10 marks)

    1. (5 marks)
    2. (5 marks)

OR

5. **Question 5.**(From Unit 2 and carries 10 marks)
    1. (5 marks)
    2. (5 marks)

Part - D

6. **Question 6.** (From Unit 3 and carries 10 marks)
    1. (5 marks)
    2. (5 marks)

OR

7. **Question 7.**(From Unit 3 and carries 10 marks)
    1. (5 marks)
    2. (5 marks)

PART E

8. **Question 8.** Answering 6 out of 9 question each carrying 5 marks (Total 30 marks) and three questions from each of the unit should be given.

Assessment pattern for Practical

Assessment comprises of two components namely formative and summative which should be in the proportion of 20%-80%. Assuming it is for 50 marks, the split should be as follows:

(a) **Formative or internal Assessments:** This should be for 10 marks and should comprise of two components namely C_1 and C_2 and each should carry same weight.

(i) C_1 **Component.** A test should be conducted for 5 marks in the eighth week

(ii) Assignment comprising of two programs of his/her own apart from the programs prescribed in the lab manual (if any) has to be submitted for 05 marks in the fifteenth week.

(b) **Summative assessment.** This may be named as C_3 component and this should be an examination conducted for 40 marks of 3 hours duration. Practical record and viva voce should be evaluated for 5 marks each. A written examination of executing programs for remaining 30 marks should be conducted. The question paper pattern should be as follows:

Question. Answering 3 out of 4 questions each carrying 10 marks. Question from each unit should be given.

SYLLABUS

Semester - III
CORE PAPER
Differential Equations - I & Numerical Analysis - I
Code - DSC-MAT-03

Unit 1 - Introduction to Differential equations **16 Hours**

Differential Equations - Recapitulation of basics of differential equations.
Solutions to differential equations of first order - Classical techniques - Variable separable, reducible to variable separable, Homogeneous, reducible to homogeneous, Exact, reducible to exact (by determining integrating factors), Linear differential equations, Bernouli differential equations;.
Equations of First order and higher degree – Solvable for p, Solvable for x, Solvable y, Clairaut's equations – Singular and General solutions.

Unit 2 - Numerical Methods & Differential equations of highre order **16 Hours**

Brief discussion on the significance of numerical techniques; **Error analysis** - Significant digits, absolute , relative, percentage errors, rounding off and truncation errors, general error formula, error in series approximation, Taylor series approximation.
Numerical techniques for solving differential equations - Euler's method, Euler's modified method, Runge Kutta fourth order method, Picard's method.

Ordinary Linear differential equations with constant coefficients - Complementary function - particular integral - inverse differential operators.

Unit 3 - Second Order Differential equations **16 Hours**

Cauchy-Euler differential equations - Solutions of ordinary second order linear differential equations with variable coefficients - Methods:

1. When a part of complementary function is given

2. Changing the independent variable

3. Changing the dependent variable

4. By the method of variation of parameters

5. Exact Method

Total differential equations - Necessary and sufficient condition for the equation $Pdx + Qdy + Rdz = 0$ to be exact (proof only for the necessary part) – Simultaneous equations of the form $\frac{dx}{P} = \frac{dx}{Q} = \frac{dz}{R}$.

References:

1. G. F. Simmons, *Differential equations with applications and historical notes*, McGraw Hill Education; 2nd edition.

2. E. Kreyszig, *Advances Engineering Mathematics*, John Wiley & Sons Inc; 10th edition.

3. M D Raisinghania, *Ordinary and partial differential equations*, S. Chand Publications, 20th Edition.

4. D. A. Murray, *Introductory Course in Differential Equations*, Khosla publications.

5. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers

6. E.Isaacson and H.B.Keller, Analysis of Numerical methods, Dover Publications.

7. S.S. Sastry, *Introductory methods of Numerical Analysis*, 5thEdition, PHI Learning Private Limited.

8. B.S. Grewal, *Numerical Methods for Scientists and Engineers*, Khanna Publishers.

9. B.D.Gupta, *Numerical Analysis*, Konark Publishers Pvt.Ltd.

10. S.R.K. Iyengar and R.K. Jain, *Numerical methods*, New Age International Pvt. Ltd

Semester III
PRACTICAL 1: DIFFERENTIAL EQUATIONS I & NUMERICAL ANALYSIS I
(4 hours /Week per batch of not more than 19 students)
Mathematics practical with FOSS tools for computer programs

Suggested software: Maxima/Scilab/Python/Maple/Matlab/Mathematica/R. A total of 10 programs should be taught with at least 3 from each of the units.

A detailed manual will be provided.

ELECTIVES

Elective: DSET - MAT - 03A
Numerical Analysis II

Unit 1 - Solutions to system of equations **16 Hours**

Solutions to algebraic and transcendental equations - Bisection method, Regula-Falsi method, iterative method Newton-Raphson method and secant method (Brief discussion of the rationale behind techniques and problems on their applications).
System of Linear Algebraic Equations - Direct Methods– Gauss elimination method, Gauss-Jordan elimination method and Tringularization method; Iterative methods – Jacobi method, Gauss-Jacobi method, Gauss- Seidal method,Successive- Over Relaxation method(SOR) method.

Unit 2 - Polynomial interpolations **16 Hours**

Finite differences - Forward, backward and central differences and shift operators: definitions, properties and problems; Polynomial interpolation - Newton-Gregory forward and backward interpolation formulas, Gauss's Forward and backward interpolation formulas, Lagrange interpolation polynomial, Newton's divided differences and Newton's general interpolation formula (Discussion on setting up the polynomials, differences between them and problems on their applications).

Unit 3 - Numerical differentiation and integration 16 Hours

Formula for derivatives (till second order) based on Newton-Gregory forward and backward interpolations (Derivations and problems based on them). Numerical Integration- General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule and Weddell's rule (derivations for only general quadrature formula, trapezoidal rule and Simpson's 1/3rd rule and problems on the applications of all formulas).

References:

1. E.Isaacson and H.B.Keller, *Analysis of Numerical methods*, Dover Publications.
2. S.S. Sastry, *Introductory methods of Numerical Analysis*, PHI Learning Private Limited, 5th Edition.
3. E Kreyszig, *Advanced Engineering Mathematics*, Wiley India Pvt.Limited
4. B.S. Grewal, *Numerical Methods for Scientists and Engineers*, Khanna Publishers.
5. M.K.Jain, S.R.K. Iyengar and R.K.Jain, *Numerical Methods for Scientific and Engineering computation*, New Age International, 4th Edition.
6. H.C.Saxena, *Finite Difference and Numerical Analysis*, S.Chand Publishers
7. B.D.Gupta, *Numerical Analysis*, Konark Publishers Pvt.Ltd.
8. S.R.K. Iyengar and R.K. Jain, *Numerical methods*, New Age International Pvt. Ltd

Elective: DSET - MAT - 03B
Advanced Calculus

Unit 1 - Introductory concepts for curve tracing:

Recalling polar coordinates (relation with cartesian coordinates, formula for the angle between the curves & derivatives of arc in polar and cartesian

forms. Simple problems), Pedal equations, curvature of plane curves - radius of curvature in polar, parametric and carteisan forms, Pedal equations, center of curvature and circle of curvature, Envelopes and Evolutes (definition and methods of finding envelopes).

Unit 2 - Curve tracing
asymptotes and methods of finding asymptotes; asymptotes parallel to coordinate axes; Procedure of tracing of cartesian curves (such as - $y^2(a-x) = x^2(a+x)$, $y = x^3/(a-x)$, $y^2(a^2+x^2) = x^2(a^2-x^2)$).

Unit 3 - Vector Calculus

Vectors – Scalars – Vector Field – Scalar field (definition and problems); Vector differentiation – The vector differential operator, Gradient – Divergence – Curl – Standard derivations – vector integration - Green's theorem in plane (definition and problems).

References:

1. M. R. Spiegel, *Theory and problems of vector calculus*, McGraw-Hill Inc., US

2. Shanthinarayan and J N Kapur, *A text book of Vector calculus*, S. Chand Publications.

3. K. S. Chandrashekhar, *Engineering Mathematics II*, Sudha Publications.

4. H. S. Dhami, *Differential Calculus*, New Age International Pvt Ltd Publishers

Semester - IV
CORE PAPER
Algebra III & Calculus III
Code - DSC-MAT-04

Unit 1 - Introduction to Number theory and Group theory 16 Hours

Division algorithm, Divisibility, Prime and composite numbers, Greatest Common divisor(GCD), co-primes (definition & Properties), Eucledian algorithm for finding the GCD, Fundamental theorem of arithmetic, Congruences (definition, properties & problems on finding remainders), Euler's Φ function(only definition), Wilson's theorem, Euler's theorem and Fermat's little theorem(only statements, no problems).
Introduction to Group Theory: Definition and examples of groups; some general properties of groups; Groups of permutations - Cyclic permutations, even-odd permutations;

Unit 2 - Subgroups and homomorphism 16 Hours

Subgroups; Cyclic subgroups, Properties of cyclic subgroups; Cosets, Index of a group, Lagrange's theorem, consequences, Normal subgruops, Quotient groups; Homomorphisms - Kernel of homomorphism, Isomorphism, Automorphism, Fundamental theorem of homomorphism; Cayley's theorem.

Unit 3 - Line and Multiple integrals 16 Hours

Line integral: Definition of line integral and basic properties, examples on evaluation of line integrals. Double integral: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas using double integrals. Triple integral: Definition of triple integrals and evaluation- change of variables, volume as triple integral.

References:

1. I.N. Herstein, *Topics in Algebra*, Wiley publications, 2nd edition.

2. Joseph Gallian, *Contemporary Abstract Algebra*, Narosa Publishing House, New Delhi, Fourth Edition.

3. J. B. Fraleigh, *A first course in abstract algebra*, Pearson Education India; 7th edition

4. M. Artin, *Algebra*, PHI Learning Pvt. Ltd., New Delhi, India, 2nd edition.

5. Vashista, *A First Course in Modern Algebra*, Krishna Prakasan Mandir,11th edition.

6. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, Vikas publishing house pvt. Ltd, New Delhi, India, 1st edition.

7. D. M Burton, *Elementary Number Theory*, McCraw Hill, 6th edition.

8. Emil Grosswald, *Topics from the Theory of Numbers*, Modern Birhauser.

9. I. Niven, H. S. Zuckerman and H. L. Montgomery, *An Introduction to the Theory of Numbers*, John Willey (New York).

Semester IV

PRACTICAL 1: ALGEBRA III & CALCULUS III

(4 hours /Week per batch of not more than 19 students)

Mathematics practical with FOSS tools for computer programs

Suggested software: Maxima/Scilab/Python/Maple/Matlab/Mathematica/R. A total of 10 programs should be taught with at least 3 from each of the units.

A detailed manual will be provided.

ELECTIVES

Elective: DSET - MAT - 04
Real Analysis & Number Theory

Unit 1 - Riemann Integration 1 **16 hours**

Introduction to sequence of numbers (definition). Meaning of convergence, divergence and limit of a sequence (Mentioning of $\epsilon - N$ definition but more focus on intuition & visualization), properties of limits (only mention), limits of some standard sequences such as $\frac{1}{n}, \left(1+\frac{1}{n}\right)^n, n^{\frac{1}{n}}$ and x^n (only mention), evaluation of simple limits.
Definition and examples for partition of an interval, Refinement and common refinement of a partition; Lower and upper Riemann (Darboux) sums - Definition, properties and problems; Riemann integral - Lower and Upper integrals (definition and problems), Darboux's theorem and criterion for integrability, integrability of sum, difference, product, quotient and modulus of integrable functions. Problems on integrability verification.

Unit 2 - Improper Integrals **16 Hours**

Improper Integrals (definition only) – Gamma and Beta functions and results following the definitions – Connection between Beta and gamma functions – applications of evaluation of integrals – Duplication formula.

Unit 3 - Advanced Number theory **16 Hours**

Recalling congruence; Linear congruence - Criteria for existence of solution with proof, problems; Fermat's little theorem, Euler's theorem and Wilson's theorem (with proof and problems); Pseudo primes and absolute pseudo primes; Simultaneous linear congruence (Chinese remainder theorem - without proof); Introduction to cryptography - coding and decoding based on Caesar's, Vigener's ciphers; Method of Lester Hill (for a block of two).

References:

1. W. Rudin, *Principles of Mathematical Analysis*, McGraw Hill Education, 3rd Edition

2. T. Apostol, *Mathematical Analysis*, Narosa Publishing House (India)

3. Ajit Kumar and S. Kumaresan, *A basic Course in Real Analysis*, Taylor and Francis Group

4. R. R. Goldberg, *Methods of Real Analysis*, Oxford and IBH Publishing

5. S.C. Malik and S. Arora, *Mathematical Analysis*, India: New Age International (India) Pvt. Ltd, 5th Edition

6. S. C. Malik, *Principles of Real Analysis*, New Age Internation (India), Pvt. Limited, 4th Edition.

7. D. M Burton, *Elementary Number Theory*, McCraw Hill, 6th edition.

8. Emil Grosswald, *Topics from the Theory of Numbers*, Modern Birhauser.

9. I. Niven, H. S. Zuckerman and H. L. Montgomery, *An Introduction to the Theory of Numbers*, John Willey (New York).

Elective: DSEP - MAT - 04
Basics of LaTeX typesetting/Microsoft Equation Editor 3.0

For Latex typesetting: Overall focus should be on -

1. A brief introduction to LaTeX language and difference between LaTeX and word.

2. Installation of MikeTex

3. Installation of platforms TeX Studio/TeXmaker/WinEdt

4. Uses of learning LaTeX.

Following typesetting skills should be mainly focused:

1. Writing preamble and the knowledge of packages & document classes required.

2. Basics of typesetting - Basic alignment/paragraph writing/line spacing/word spacing/margin/font coloring/font size/font style

3. Mathematical Typesetting - Mathematical Typesetting - Basic symbols/commands for mathematical typesetting - packages required; Typesetting of various symbols, matrices, vectors etc.

4. Environments - Various environments - center, equation, align, multline, labelling equations.

5. Tables - Creation of table (various kinds), naming the tables, alignments.

6. Boxes - Creation of text box, color textbox, minipage, Inserting image

7. Sectioning - Creation of sections, subsections, susbsubsections and naming the equations, definitions etc. as per the section.

8. Image insertion

9. Introduction to beamer class (preparation of presentations)

10. Introduction to overleaf

LaTeX learning platforms:

1. www.overleaf.com (www.oberleaf.com/learn/latex/Learn_LaTeX_in_30_minutes)

2. *The very short guide to typesetting with LaTeX*
(bu.edu/math/files/2013/08/ShortTex3.pdf)

3. *LaTeX Tutorials - A Primer*
(tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf)

4. Stefan Kottwitz, *LaTeX Beginner's Guide*
(static.latexstudio.net/wp-content/uploads/2015/03/LaTeX_Beginners_Guide.pdf)

For Microsoft Equation Editor 3.0, Points 2 to 8 in the above mentioned list should be focused.

UNIVERSITY OF MYSORE

(Re-accredited by NAAC with A Grade)

(NIRF-2024 Ranked 19th in State Public University Category, 54th in University Category and 86th in Overall Category)

DEPARTMENT OF STUDIES IN MATHEMATICS

Manasagangotri, Mysore-570 006

Dr. K. R. Vasuki
Professor & Chairman BOS
Phone: +91-9916450314

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Proceedings of the annual BoS (UG) meeting held on 16.05.2025 (Friday) at 11.00 AM.

Members present

1. **Dr. K.R.Vasuki, Senior Professor** :
   Chairman (BoS), DoS in Mathematics, Manasagangotri,UOM, MGM.
2. **Dr . R. Rangarajan, Senior Professor** : R. Rangarajan
   DoS in Mathematics, Manasagangotri,UOM, MGM.
3. **Dr. Veena Mathad, Professor** :
   DoS in Mathematics, Manasagangotri, UOM, MGM.
4. **Dr. Chandrashekar M. S., Professor** :
   DoS in Physics, Manasagangotri, UOM, MGM.
5. **Dr. Harinarayana N. S, Senior Professor** : N. S. Harinarayana.
   DOS in Library and Information Science, UOM, MGM.
6. **Mrs. Poornima A.R,** :
   N.I.E, First Grade College, Manandavadi Road, Mysore.
7. **Dr. Ravikumar N.,** :
   Government First Grade College, Bannur
8. **Mr. Nanjunda Swamy M.,** :
   Government First Grade College for Women, Byrapura, T.Narasipura, Tq
9. **Dr. S.K. Narasimhamurthy, Senior Professor** :
   Department of Mathematics, Kuvempu university,
   Shankaraghatta, Shivamogga District.

Member absent:

01. **Dr. Vinay Kumar P.N.,** :
    Government Science College (Autonomous), Hassan.

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The Chairman first welcomed all the members. The following resolutions were made:

1. **Agenda 1:** To discuss and finalize the B.Sc Mathematics III and IV Semesters 2025-26 Syllabus (Only for The second year)

   The Chairman tabled the syllabus for III and IV semester B.Sc Mathematics along with the Question paper pattern to the board.

   Resolution: The proposed syllabus is approved by the members.

2. **Agenda 2:** To prepare the List of Panel of Examiners for the year 2025-26.

   Resolution: Revised the existing one.

The Chairman thanked the members for their valuable suggestions and comments.

With best regards,

Yours sincerely,

Chairman (BOS)
DOS in Mathematics
University of Mysore
Manasagangotri