Scheme of
B.Sc. Physical Science-(Mathematics)
AND
B.A. Multidisciplinary-(Mathematics)
(Scheme UG A1: Undergraduate Programs)

Semester 1

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A1	Calculus	240/MATP/ CC101	3	--	2	3	-	1	4	25	50	5	20	100

Semester 2

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A2	Algebra	240/MATP/ CC201	3	--	2	3	-	1	4	25	50	5	20	100

Semester 3

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A3	Ordinary and Partial Differential Equations	240/MATP/ CC301	3	--	2	3	-	1	4	25	50	5	20	100

Semester 4

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A4	Sequence and Series	240/MATP/ CC401	3	--	2	3	-	1	4	25	50	5	20	100

Semester 5

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A5	Integral Transforms	240/MATP/ CC501	3	--	2	3	-	1	4	25	50	5	20	100

Semester 6

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A6	Mathematical Analysis	240/MATP/ CC601	3	--	2	3	-	1	4	25	50	5	20	100

Marks

Semester-III			
Session: 2025-26			
Part A – Introduction			
Subject	Mathematics		
Semester	III		
Name of the Course	Ordinary and Partial Differential Equations		
Course Code	CC-A3		
Course ID	240/MATP/CC301		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs) CLO 5 is related to the practical Component.	After completing this course, the learner will be able to: 1. Gain foundational knowledge of ordinary differential equations and learn techniques to solve first-order solvable differential equations. 2. Develop technical skills to solve homogeneous and non-homogeneous second-order linear ODEs with constant and variable coefficients. 3. Understand the theory of total differential equations and basic concepts of partial differential equations (PDEs), and learn methods for solving first-order linear PDEs in multidisciplinary contexts. 4. Acquire knowledge of second-order PDEs, apply theory to find integral and orthogonal surfaces, and develop skills in using methods such as Charpit's and Jacobi's to solve compatible systems. 5. To attain problem-solving skills for differential equations using appropriate methods and techniques, and gain hands-on experience in solving them with MAXIMA software.		
Credits	**Theory**	**Practical**	**Total**
	3	1	4
Contact Hours	3	2	5

Internal Assessment Marks	25	5	30
End Term Assessment Marks	50	20	70
Examination Time	3 Hours	3 Hours	100

Part B - Course Content

Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topic	Contact Hours
I	Genesis of ordinary differential equations, Solutions of differential equations of first order and first degree, Exact differential equations, First order higher degree equations solvable for x, y and p, Lagrange's equations, Clairaut's form and singular solutions, Orthogonal trajectories in Cartesian coordinates and polar coordinates. Self orthogonal family of curves.	12
II	Linear differential equations with constant coefficients, Linear non-homogenous differential equations. Linear differential equation of second order with variable coefficients. Reduction of order of a differential equation, method of undetermined coefficients, method of variation of parameters. Cauchy-Euler equation.	12
III	Ordinary simultaneous differential equations, total differential equations. Partial Differential Equations: Formation, order and degree. Linear and Non-linear PDEs, Complete solution, Singular solution and General solution of a PDE. Linear PDE of first order, Solution of Lagrange's linear equations.	11
IV	Solution of PDE passing through a given curve. Surfaces orthogonal to a given system of surfaces. Compatible system of first order equations. Jacobi's method. Charpit's general method of solution, Special types of first order PDEs, Second order partial differential equations with constant coefficients.	10

Practical

The practical component of the course has two parts — **30**

(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:

1. Problems solving for differential equations which are reducible to homogeneous.
2. Problems solving for differential equations which are exact differential equations.
3. Problems solving for linear differential equations with constant coefficient.
4. Problems solving for linear differential equations with variable coefficient.
5. Problems solving for differential equations by method of variation of parameters.
6. Problems solving for differential equations by method of undetermined coefficients.
7. Problems solving for simultaneous differential equations.
8. Problems solving for different PDEs using Lagrange's method.
9. Problems solving for PDEs with Charpit's method and Jacobi's method.

(B) The following practicals will be done using MAXIMA software and their record will be maintained in the practical note book:

1. Solutions of first and second order differential equations.
2. Plotting of family of solutions of differential equations of first, second and third order.
3. Solution of differential equations using method of variation of parameters.
4. Growth and decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Density-dependent growth model.
7. Predatory-prey model (basic Volterra model, with density dependence, effect of DDT, two prey one predator).
8. To find the solutions linear differential equations of second order using built in functions of MAXIMA software.
9. To find numerical solution of a first order ODE using plotdf built in function of MAXIMA.
10. To find exact solutions of first and second order ODEs using ode2 and ic1/ic2 built in functions of MAXIMA.
11. To find exact solutions of first and second order ODEs using desolve and atvalue built in functions of MAXIMA.

Suggested Evaluation Methods

Internal Assessment:	**End Term Examination:**
➢ **Theory 25** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 10 • Mid-Term Exam: 10 ➢ **Practicum 5** • Seminar/Demonstration/Viva-voce/Lab records etc.: 5	➢ **Theory 50** • Written Examination ➢ **Practicum 20** • Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. E. Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons.
2. B. Rai & D. P. Choudhury (2006). *Ordinary Differential Equations - An Introduction*. Narosa Publishing House Pvt. Ltd. New Delhi.
3. S. L. Ross (2014). *Differential Equations* (3rd edition). Wiley India Pvt. Ltd.
4. G. F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis
5. I. N. Sneddon (2006). *Elements of Partial Differential Equations*. Dover Publications.

Session: 2025-26			
Part A – Introduction			
Subject	Mathematics		
Semester	IV		
Name of the Course	Sequence and Series		
Course Code	CC-A4		
Course ID	240/MATP/CC401		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs) CLO 5 is related to the practical Component.	After completing this course, the learner will be able to: 1. Understand basic concepts of compact set, denumerability, sequences, their limits and boundedness. 2. Learn about the convergence and divergence of a sequence. 3. Attain skills to determine convergence of a series of real numbers by applying various tests. 4. To know absolute and conditional convergence of alternating series and apply theory to check the convergence of arbitrary series.		
	Theory	**Practical**	**Total**
Credits	3	1	4
Contact Hours	3	2	5
Internal Assessment Marks	25	5	30
End Term Assessment Marks	50	20	70

Examination Time	3 Hours	3 Hours	100

Part B - Course Content

Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topic	Contact Hours
I	Open covers, Compact sets and Heine-Borel Theorem. Denumerable and non-denumerable sets, Denumerability of integers, rationals and non-denumerability of real numbers. Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences,	11
II	Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Sub sequential limits. Limit superior and limit inferior. Infinite series: Convergence and divergence of Infinite Series, Comparison tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.	12
III	D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test. Alternating series, Leibnitz's test, Absolute and conditional convergence,	11
IV	Arbitrary series: Abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only).	11

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and**	**30**

their record will be maintained in the Practical Notebook:

1. Problem demonstrating that the set of rational numbers is not order complete.
2. Practical Problems on finding lub and glb of a set.
3. Problem solving to find limit point of a set using Bolzano Weierstrass Theorem.
4. Problems solving using monotone convergence theorem.
5. Practical problems demonstrating the use of Cauchy's first and second theorems for convergence of sequences.
6. Problem solving on limit inferior and limit superior of a sequence.
7. Practical problem on convergence/divergence of positive term series demonstrating the application of various convergence tests.
8. Problem solving on
   i. Conditional convergence and
   ii. Absolute convergence of an alternating series.
9. Practical problem to demonstrate Cauchy product of two convergent series need not be convergent.
10. Practical problem to demonstrate Cauchy product of two divergent series need not be divergent.
11. Practical problem to demonstrate the denumerability of the cartesian product of denumerable sets.
12. Practical problem to demonstrate the non-denumerability of the set of irrationals.

(B) The following practicals will be done using MAXIMA software and their record will be maintained in the practical note book:

1. Testing the convergence of infinite series of positive terms by the use of sequence of partial sums.
2. Testing the convergence of an infinite positive term series
3. Testing the absolute convergence of an alternating series and comment about conditional convergence.
4. Practical problems on the convergence of series with arbitrary terms.
5. Testing the convergence/divergence/oscillation behavior of sequences of real numbers.
6. Determine the lub and glb of the subset of real numbers and observe whether they belong to the set or not.

Suggested Evaluation Methods

Internal Assessment:	End Term Examination:
➢ **Theory 25** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 10 • Mid-Term Exam: 10 ➢ **Practicum 5** • Seminar/Demonstration/Viva-voce/Lab records etc.: 5	➢ **Theory 50** • Written Examination ➢ **Practicum 20** • Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. T. M. Apostol (2008). *Mathematical Analysis: A Modern Approach to Advanced Calculus*. Pearson Education.
2. C. Aliprantis& O. Burkinshaw (1998). *Principles of Real Analysis* (3rd edition). Academic D Pres.
3. R. G. Bartle & D. R. Sherbert (2015). *Introduction to Real Analysis* (4th edition). Wiley India.
4. G. G. Bilodeau, P. R. Thie & G. E. Keough (2015). *An Introduction to Analysis* (2nd edition), Jones and Bartlett India Pvt. Ltd.
5. E. Hewitt & K. Stromberg (2013). *Real and Abstract Analysis*. Springer-Verlag.
6. K. A. Ross (2013). *Elementary Analysis*: *The Theory of Calculus* (2nd edition). Springer.
7. W. Rudin (1976). *Principles of Mathematical Analysis* (3rd edition), Tata McGraw Hill.
8. R. R. Goldberg (1970). *Real Analysis*. Oxford & I. B. H. Publishing Co., New Delhi.
9. S. Narayan & P. K. Mittal (2005). *A Course in Mathematical Analysis*. S. Chand and company, New Delhi.
10. S. C. Malik & S. Arora (2021) . *Mathematical Analysis*. Wiley Eastern Ltd., Allahabad.