Scheme of B.A./B.Sc. (Mathematics)

(Scheme UG A2: Undergraduate Programmes (Single Major)

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/MAT/CC 101	3	--	2	3	-	1	4	25	50	5	20	100
CC-A2	Discrete Mathematics	240/MAT/CC 102	3	--	2	3	-	1	4	25	50	5	20	100
CC-A3	Vector Calculus	240/MAT/CC 103	3	--	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-1	One from Pool		1	-	2	1	-	1	2	5	20	5	20	50
Multidisciplinary Course(s)														
MDC-1	One from Pool		2	-	2	2	-	1	3	15	35	5	20	75
Ability Enhancement Course(s)														
AEC-1	One from Pool		2	-	-	2	-		2	15	35	-	-	50
Skill Enhancement Course(s)														
SEC-1	One from Pool		2	-	2	2	-	1	3	15	35	5	20	75
Value-added Course(s)														
VAC-1	One from Pool		**2**	-	-	**2**	-	-	2	15	35	-	-	50
Total Credits			**18**		**12**	**18**		**6**	**24**					**600**

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A4	Algebra	240/MAT/CC201	3	--	2	3	-	1	4	25	50	5	20	100
CC-A5	Advanced Calculus	240/MAT/CC202	3	--	2	3	-	1	4	25	50	5	20	100
CC-A6	Descriptive Statistics	240/MAT/CC203	3	--	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-2	One from Pool		1	-	2	1	-	1	2	5	20	5	20	50
Multidisciplinary Course(s)														
MDC-2	One from Pool		2	-	2	2	-	1	3	15	35	5	20	75
Ability Enhancement Course(s)														
AEC-2	One from Pool		2	-	-	2	-		2	15	35	-	-	50
Skill Enhancement Course(s)														
SEC-2	One from Pool		2	-	2	2	-	1	3	15	35	5	20	75
Value-added Course(s)														
VAC-2	One from Pool		**2**	**-**	**-**	**2**	**-**	**-**	2	15	35	-	-	50
Total Credits			**18**		**12**	**18**		**6**	**24**					**600**

Semester 3

Course Code	Course Title	Course ID	L (Hrs)	T	P	L Credits	T	P	Credits	MARKS TI	TE	PI	PE	Total
Core Course(s)														
CC-A7	Ordinary and Partial Differential Equations	240/MAT/CC301	3	--	2	3	-	1	4	25	50	5	20	100
CC-A8	Statics	240/MAT/CC302	3	--	2	3	-	1	4	25	50	5	20	100
CC-A9	Probability Theory & Distributions	240/MAT/CC303	3	--	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-3	One from Pool		2	-	4	2	-	2	4	15	35	15	35	100
Multidisciplinary Course(s)														
MDC-3	One from Pool		2	-	2	2	-	1	3	15	35	5	20	75
Ability Enhancement Course(s)														
AEC-3	One from Pool		2	-	-	2	-		2	15	35	-	-	50
Total Credits			**15**		**12**	**15**		**6**	**21**					**525**

Semester 5

Course Code	Course Title	Course ID	L (Hrs)	T	P	L Credits	T	P	Credits	MARKS TI	TE	PI	PE	Total
Core Course(s)														
CC-A13	Groups and Rings	240/MAT/CC501	3	--	2	3	-	1	4	25	50	5	20	100
CC-A14	Integral Transforms	240/MAT/CC502	3	--	2	3	-	1	4	25	50	5	20	100
CC-A15	Numerical Analysis	240/MAT/CC503	3	--	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-5/ VOC-2	One from Pool		2	-	4	2	-	2	4	15	35	15	35	100
Skill Enhancement Course(s)														
Internship			-	-	8	-	-	4	4	-	-	30	70	100
Total Credits			**11**		**18**	**11**	**-**	**9**	**20**					**500**

Semester 6

Course Code	Course Title	Course ID	L (Hrs)	T	P	L Credits	T	P	Credits	MARKS TI	TE	PI	PE	Total
Core Course(s)														
CC-A16	Mathematical Analysis	240/MAT/CC601	3	--	2	3	-	1	4	25	50	5	20	100
CC-A17	Linear Algebra	240/MAT/CC602	3	--	2	3	-	1	4	25	50	5	20	100
CC-A18	Dynamics	240/MAT/CC603	3	--	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-6	One from Pool		2	-	4	2	-	2	4	15	35	15	35	100
MIC-7/VOC-3	One from Pool		2	-	4	2	-	2	4	15	35	15	35	100
Skill Enhancement Course(s)														
SEC-3	One from Pool		2	-	2	2	-	1	3	15	35	5	20	75
Total Credits			**15**		**16**	**15**		**8**	**23**					**575**

1. *The curriculum of semester 7 and 8 will is provided in due course of time.*

Multidisciplinary Course from the department for pool of the Courses in the University

(These courses are to be offered to students of different discipline/Subject)

Semester 1

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MDC-1	Introductory Mathematics		2		2	2		1	3	15	35	5	20	75

Semester 2

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MDC-2	Essential Mathematics		2		2	2		1	3	15	35	5	20	75

Semester 3

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MDC-3	Statistical tools for data analysis		2		2	2		1	3	15	35	5	20	75

Minor Course from the department for pool of the Courses in the University

(These courses are offered by each department for students of other departments/same department to gain a broader understanding beyond the major discipline)

Semester 1

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MIC-1	Basic Calculus		1		2	1		1	2	5	20	5	20	50
	Correlation and Regression		1		2	1		1	2	5	20	5	20	50

Semester 2

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MIC-2	Basic Algebra		1		2	1		1	2	5	20	5	20	50
	Basic Analysis		1		2	1		1	2	5	20	5	20	50

Semester 3

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MIC-3	Statistical Methods		2	-	4	2	-	2	4	15	35	15	35	100

Semester 6

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS				
										TI	TE	PI	PE	Total
MIC-6	Numerical Methods		2	-	4	2	-	2	4	15	35	15	35	100

Vocation Course from the department for pool of the Courses in the University

(These courses are offered by each department for students of other departments/same department and is focused on practical work, preparing students for a particular skilled profession.

Semester 4

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
MIC-4/ VOC-1	Programming in C		2	-	4	2	-	2	4	15	35	15	35	100

Semester 5

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
MIC-5/ VOC-2	Python		2	-	4	2	-	2	4	15	35	15	35	100

Semester 6

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
MIC-7/ VOC-3	MATLAB & R Software		2	-	4	2	-	2	4	15	35	15	35	100

Skill Enhancement Course from the department for pool of the Courses in the University

(These courses are offered by each department for students of other departments/same department and is designed to provide value-based and/or skill-based knowledge and should contain both theory and lab/hands-on/training/field work.)

Semester 1

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
SEC-1	Calculation Skills with Vedic Mathematics		2		2	2		1	3	15	35	5	20	75

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
SEC-2	Numerical Ability Enhancement Skills		2		2	2		1	3	15	35	5	20	75

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
SEC-3	Quantitative Aptitude		2		2	2		1	3	15	35	5	20	75

Value Added Course from the department for pool of the Courses in the University

(All the departments will offer value added course for semester 4 for the students of same or different departments. In the first year, students will study (i) Human Values and Ethics and (ii) Environmental Studies as value added course)

Semester 4

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
VAC-3	History of Mathematics		2	-	-	2	-	-	2	15	35	-	-	50

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	P	L Credits	T	P	Credits	MARKS TI	TE	PI	PE	Total
Core Course(s)														
CC-A5	Abstract and Linear Algebra	240/MATP/ CC501	3	--	2	3	-	1	4	25	50	5	20	100

Semester 6

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

Scheme of
B.Sc. Physical Science-(Statistics)
AND
B.A. Multidisciplinary-(Statistics)

(Scheme UG A2: 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	Descriptive Statistics	240/STAT/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	Probability Theory	240/STAT/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	Probability Distributions	240/STAT/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	TE	PI	PE	Total
Core Course(s)														
CC-A4	Sampling & Design of Experiments	240/STAT/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	TE	PI	PE	Total
Core Course(s)														
CC-A5	Elementary Inference	240/STAT/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	TE	PI	PE	Total
Core Course(s)														
CC-A6	Operations Research	240/STAT/CC601	3	--	2	3	-	1	4	25	50	5	20	100

Semester-V	
Session: 2026-27	
Part A – Introduction	
Subject	Mathematics
Semester	V
Name of the Course	Group and Rings
Course Code	CC-A13
Course ID	240/MAT/CC501
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 the idea of a group, subgroup, cyclic groups, normal groups and quotient groups. 2. Understand and apply the concepts of homomorphism, isomorphism, automorphisms and inner automorphisms of a group. Learn about the permutation groups, centre of a group and solve related problems. 3. Have knowledge of the concepts of a ring, subring, ideal, integral domain, field of quotient and theorems based on these concepts. 4. Explore polynomial rings, Euclidean rings, unique factorization domains, and apply Eisenstein's criterion to study factorization properties over commutative rings. 5. Attain the deeper knowledge and understanding of groups and rings, their underlying principles and theories, by solving some problems based on them.

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	---	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	Definition of a group, Elementary properties of groups, Subgroups and subgroup criteria, Cosets, Index of a sub-group, Coset decomposition, Lagrange's theorem and its consequences, Cyclic groups, Normal subgroups, Quotient groups.	**45 hrs**
II	Homomorphisms, Isomorphisms, Automorphisms and inner Automorphisms of groups, Automorphisms of cyclic groups, Permutation groups, Even and odd permutations, Alternating groups, Cayley's theorem, Centre of a group.	
III	Introduction to rings, Subrings, Integral domains and fields, Characteristic of a ring, Ring homomorphism, Ideals: principal, prime and maximal ideals, Quotient ring, Field of quotients of an integral domain.	
IV	Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain.	

Practical

The practical component of the course has one parts of Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook: **30 hrs**

1. Problems to find the order and inverse of the elements of a group.
2. Problems to find the generators of a cyclic group.
3. Problem to find all possible subgroups of a finite group.
4. Problems to verify Lagrange's theorem.
5. Problems to verify Cayley's theorem and theorem of isomorphism.
6. Problems to find index of a group.
7. Problems related to automorphisms of finite or infinite cyclic groups.
8. Problems related to the multiplication of permutations and to write a permutation as the product of transpositions.
9. Problems to find the inverse of a permutation.
10. Problems to determine whether a subset of a ring is an ideal or not.
11. Problems related to maximal and prime ideals.
12. Problems to find the units of a commutative ring with unity.
13. Problems to determine whether a polynomial is irreducible over the field of rational numbers or not.
14. Problem to determine whether an integral domain is Euclidean domain or not.
15. 15. Problem to determine whether an integral domain is unique factorization domain or not.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. J.A. Gallian (2017). *Contemporary Abstract Algebra (9th ed.)*. Cengage Learning India Private Limited, Delhi. Indian.
2. M. Artin (2011). *Abstract Algebra* (2nd Edition). Pearson.
3. V. Sahai and V. Bist (2010). *Algebra* (3rd Edition). Narosa Publishing House.
4. N. Herstein (2008). *Topics in Algebra* (2nd Edition). Wiley India Pvt. Ltd.

5. R. Joseph J. (1995). An Introduction to The Theory of Groups (4th ed.). Springer-
6. Verlag, New York.
7. Dummit, David S. & Foote, Richard M. (2016). Abstract Algebra (3rd ed.).
8. D.A.R. Wallace (1998). *Groups, Rings and Fields*. Springer.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	V		
Name of the Course	Integral Transforms		
Course Code	CC-A14		
Course ID	240/MAT/CC502		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	The course will enable the students to: 1. Understand Laplace transforms including existence theorem, linearity, shifting theorems, derivatives, integrals, differentiation, integration, and convolution theorem. 2. Evaluate inverse Laplace transforms and solve ordinary differential equations using Laplace transform techniques. 3. Analyze piecewise continuous and periodic functions using Fourier transforms and their properties such as linearity, shifting, modulation, convolution, and derivatives. 4. Explain the relation between Fourier and Laplace transforms, apply Parseval's identity, and solve differential equations using Fourier transforms.		
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	---	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	Laplace Transforms, Existence theorem for Laplace Transform, Linearity of the Laplace transforms, Shifting Theorems, Laplace transforms of derivatives and integrals, Differentiation and Integration of Laplace transform Convolution theorem.	**45 hrs**
II	Inverse Laplace transforms, Convolution Theorems, Inverse Laplace transforms of derivatives and integrals, Solution of Ordinary differential equations using Laplace transforms	
III	Piecewise continuous functions and periodic functions, Systems of orthogonal functions Fourier transforms, Linearity Properties of Fourier transforms, shifting modulation, Convolution theorem of the Fourier transform, Fourier transforms of Derivatives.	
IV	Relation between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, Solution of Differential equations using Fourier transforms.	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:** 1. Problems based on linearity property of Laplace transforms for sums and scalar multiples of functions. 2. Problems on Laplace transforms of derivatives and their applications. 3. Problems on differentiation and integration properties of Laplace transforms.	**30 hrs**

4. Problems based on Convolution Theorem of Laplace transforms.
5. Problems on inverse Laplace transforms using convolution theorem.
6. Problems on Fourier transforms of standard functions.
7. Problems based on linearity property of Fourier transforms.
8. Problems based on Convolution Theorem of Fourier transforms.
9. Problems on relation between Fourier transform and Laplace transform.
10. Problems on verification of Parseval's identity for Fourier transforms.

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

1. Learn to compute Laplace transforms of basic functions such as polynomial, exponential, trigonometric and logarithmic functions in maxima software.
2. Solve problems based on the First Shifting Theorem of Laplace transforms by using maxima software.
3. Find Laplace transforms of derivatives and apply them to solve differential equations.
4. Find Laplace transforms of integrals of given functions.
5. Solve problems using the Convolution Theorem of Laplace transforms.
6. Evaluate inverse Laplace transforms using convolution theorem.
7. Learn to compute Fourier transforms of standard functions using MAXIMA.
8. Apply the Convolution Theorem of Fourier transforms for given functions.
9. Establish the relation between Fourier transform and Laplace transform through suitable examples.
10. Verify Parseval's identity for Fourier transforms for given functions.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. B. Patra (2018). *An Introduction to Integral Transforms*. CRC Press.
2. J. L. Schiff (1999). *The Laplace Transform-Theory and Applications*. Springer.

3 R. Bhatia (2003). *Fourier Series (2nd ed.). Texts and Readings in Mathematics*, Hindustan Book Agency, Delhi.
4 Y. Katznelson (2004*). An Introduction to Harmonic Analysis (3rd ed.)*. Cambridge University Press.
5 E. Kreyszig (2011). *Advanced Engineering Mathematics (10th edition)*. Wiley.
6 M. R. Spiegel (2005). *Laplace Transforms*. Schaum's Outline Series.
7 I. N. Sneddon (1974). *The Use of Integral Transforms*. McGraw Hill.

Session: 2026-27

Part A – Introduction

Subject	Mathematics
Semester	V
Name of the Course	Numerical Analysis
Course Code	CC-A15
Course ID	240/MAT/CC503
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC
Course Learning Outcomes(CLOs)	**After completing the syllabus, student will be able to:** 1. Learn about interpolation with equal and unequal intervals 2. Apply forward, backward, central and divided difference formulae for interpolation. 3. Understand the method of numerical differentiation and various methods for finding solution of eigen value problems. 4. Know how to solve integration and ordinary differential equation using numerical data.

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	---	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	Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula.	45 hrs
II	Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula. Numerical Differentiation: Derivative of a function using interpolation formulae. Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method, QR method,,Lanczos method.	
III	Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one- third and three-eighth rule, Chebychev formula, Gauss Quadrature formula.	
IV	Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method.	

Practical

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

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

1. To find approximate value of a function by Newton Forward Interpolation formula
2. To find approximate value of a function by Newton Backward Interpolation formula.
3. To find approximate value of a function using Lagrange's Interpolation formula.
4. To find approximate value of a function by Gauss forward Interpolation formula.
5. To find approximate value of a function by Gauss backward Interpolation formula.
6. To find first and second order derivatives using interpolation formulas.
7. To evaluate a definite integral using Trapezoidal Rule.

8. To evaluate a definite integral using Simpson 1/3 rule.
9. To evaluate a definite integral using Simpson 3/8 rule.
10. To solve an ordinary differential equation using Euler's method.
11. To find solution of an ordinary differential equation using modified Euler's method.
12. To solve an ordinary differential equation using Runge-Kutta second order and fourth order methods.

(B) The following practical's will be done using C/C++ software and their record will be maintained in the practical note book:

1. Program to find approximate value of a function by Newton Forward Interpolation formula
2. Program to find approximate value of a function by Newton Backward Interpolation formula.
3. Program to find approximate value of a function using Lagrange's Interpolation formula.
4. Program to find first and second order derivatives using interpolation formulas.
5. Program to evaluate a definite integral using Trapezoidal Rule.
6. Program to evaluate a definite integral using Simpson 1/3 rule.
7. Program to evaluate a definite integral using Simpson 3/8 rule.
8. Program to solve an ordinary differential equation using Euler's method.
9. Program to find solution of an ordinary differential equation using modified Euler's method.
10. Program to solve an ordinary differential equation using Runge-Kutta second order and fourth order methods.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. B. Ram (2000). *Numerical Methods*. Pearson Publication.
2. R.S. Gupta (2010). *Elements of Numerical Analysis*. Macmillan's India.
3. M. K. Jain, S. R. K. Iyengar and R.K. Jain(1996). *Numerical Method, Problems and Solutions*. New Age International (P) Ltd.
4. M. K. Jain, S.R.K. Iyengar and R.K. Jain (1999). *Numerical Method for Scientific and Engineering Computation*. New Age International (P) Ltd.
5. C. E. Froberg (1965). *Introduction to Numerical Analysis (2nd Edition)*. Addison-Wesley Publishing Company
6. M. J. Maaron(1982). *Numerical Analysis-A Practical Approach*, Macmillan Publishing Co., Inc., New York.
7. R.Y. Rubnistein (1981). *Simulation and the Monte Carlo Methods*. John Wiley.

Semester-VI			
Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	VI		
Name of the Course	Mathematical Analysis		
Course Code	CC-A16		
Course ID	240/MAT/CC601		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Recall fundamentals of metric, definition and basic idea of metric. 2. Discuss and analyze the continuity and its further properties. 3. To be familiar with complex numbers and their geometrical interpretation. 4. Understand the concept of complex numbers, various mappings and the some important theorems.		
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	---	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	Metric spaces: definition and examples, discrete metric, usual metric on $\mathbb{R}$ and $\mathbb{R}^n$, open and closed balls, neighbourhoods, open and closed sets, interior, limit and boundary points. Closure and derived sets, dense sets and subspaces of a metric space.	**45 hrs**
II	Sequences and continuity in metric spaces, convergent sequences and their properties, bounded and Cauchy sequences, subsequence's, complete metric spaces, continuous functions between metric spaces, sequential and uniform continuity, basic ideas of homeomorphism and isometry.	
III	Extended Complex Plain, Stereographic projection, function of a complex variable, Continuity, Differentiability, Analytic functions and their properties, Cauchy Riemann equations in Cartesian and polar coordinates, Power series, Radius of convergence.	
IV	Mapping by elementary function: Translation, rotation, Magnification and inversion. Conformal Mapping and application, Mobius transformations, Fixed point, Cross ratio, Inverse points and critical mappings.	

Practical

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

their record will be maintained in the Practical Notebook:

1. Problems of determining whether a given function is a metric or not?
2. Problems of proving that a given function is not a metric.
3. Problems of establishing a relationship between a metric space and Hausdorff space.
4. Problem of establishing a relationship between a convergent sequence and Cauchy sequence in a metric space.
5. Problem of finding examples of a Cauchy sequence which is not convergent in Q.
6. Problem pertaining to continuity and differentiability of a complex function.
7. Problem pertaining to analytic functions.
8. Problem pertaining to radius of convergence.
9. Problem of translation and rotation function.
10. Problem pertaining to Mobius transformation.

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

1. Learn to run a program to compute distance between two points using Euclidean
2. Learn to run a program to verify metric axioms for a given function numerically.
3. Learn to run a program to compute distance between two points using Euclidean
4. Learn to run a program to find diameter of a finite set.
5. Learn to run a program check Cauchy sequence numerically.
6. Learn to run a program to plot complex numbers on Argand plane.
7. Learn to run a program to compute modulus and argument of a complex number.
8. Learn to run a program to visualize translation and rotation.
9. Learn to run a program to visualize inversion.
10. Learn to run a program to study Mobius transformation.
11. Learn to run a program to visualize stereographic projection (sphere over complex plane)
12. Learn to run a program to plot image of lines/circles under complex transformations..

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**	➢ **Theory 50** • Written Examination ➢ **Practicum 20** • Lab record, viva-voce, write up and execution of the

• Seminar/Demonstration/Viva-voce/Lab records etc.: 5	program

Part C-Learning Resources

Recommended Books:

1. T. M. Apostol (1985), *Mathematical Analysis*, Narosa Publishing House, New Delhi.
2. R.R. Goldberg (1970), *Methods of Real Analysis*, Oxford & IBH Publishing Co., New Delhi.
3. D. Somasundaram and B. Choudhary (1997), *A First Course in Mathematical Analysis*, Narosa Publishing House, New Delhi.
4. S. Narayan (1980), *A Course of Mathematical Analysis*, S. Chand & Co., New Delhi.
5. R.V. Churchill and James Ward Brown (2009), *Complex Variables and Applications*, McGraw Hill Publishing Company.
6. H.S. Kasana (2011), *Complex Variable Theory and Applications*, PHI Learning Private Ltd.
7. D. G. Zill and P. D. Shanahan (2010), *A First Course in Complex Analysis with Applications*, Jones & Bartlett Publication, 2nd Edition.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	VI		
Name of the Course	Linear Algebra		
Course Code	CC-A17		
Course ID	240/MAT/CC602		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to : 1. Understand the concepts of vector spaces, subspaces, linear span, linear independence, basis, and dimension of finitely generated vector spaces. 2. Apply the theory of linear transformations, matrices, null space, range space, and the rank–nullity theorem. 3. Analyze algebra of linear transformations, dual and bi-dual spaces, and annihilators of subspaces. 4. Determine eigenvalues, eigenvectors, minimal polynomial, and perform diagonalization of linear transformations. 5. Understand inner product spaces, orthogonal bases, Gram–Schmidt process, adjoint and unitary linear transformations.		
	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	---	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	Vector spaces, Subspaces, Linear sum and direct sum of subspaces, Linear span, Linearly independent and dependent subsets of a vector space, Finitely generated vector spaces, Existence theorem for basis of a finitely generated vector space, Invariance of the number of elements in basis of a finitely generated vector space, Dimension, Quotient space and its dimension.	**45 hrs**
II	Homomorphisms: Linear transformations and linear functionals on vector spaces, Matrix of a linear transformation, Null space and range space of a linear transformation, Rank and nullity theorem, Singular and non-singular linear transformation, Change of basis.	
III	Algebra of linear transformations, Dual spaces, Bi-dual spaces, Annihilator of subspaces of finite dimensional vector space. Eigen values, Eigen vectors, Minimal polynomial and diagonalization of a linear transformation.	
IV	Inner product spaces, Cauchy-Schwarz inequality, Orthogonal sets and basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt orthogonalization process. Adjoint of a linear transformation and its properties, Unitary linear transformations.	

Practical

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

their record will be maintained in the Practical Notebook:

1. Problems based on Extension theorem.
2. Problems based on Existence theorem.
3. Problems to verify rank and nullity theorem.
4. Problems to find coordinates of a vector relative to an ordered basis.
5. Problems to determine basis and dimension of quotient space of a given finite dimensional vector space.
6. Problems related to change of basis.
7. Problems related to bi-dual spaces.
8. Problems related to the diagonalization of a linear transformation.

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

1. Practical problems to determine rank of a matrix associated with linear transformation.
2. Practical problems to determine Nullity of a matrix associated with linear transformation.
3. Practical problems to verify rank-nullity theorem.
4. Practical problems to find null space of matrix associated with linear transformation.
5. To determine eigen values of a matrix associated with linear transformation.
6. To determine normalized eigen vector of a matrix associated with linear transformation.
7. Practical problems related to inner product of vectors or functions.
8. Problems related to Gram-Schmidt orthogonalization process.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. I.N. Herstein (1975). *Topics in Algebra*. Wiley Eastern Ltd., New Delhi.

2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal (1994). *Basic Abstract Algebra (2nd edition)*. Cambridge University Press.
3. V. Sahai and V. Bist (1999). *Linear Algebra*. Narosa Publishing House.
4. I.S. Luther and I.B.S. Passi (1996). *Algebra Vol.-II*. Narosa Publishing House.
5. K. M. Hoffman and R. Kunze (1971). *Linear Algebra, 2nd Edition*, PRENTICE-HALL, INC., Englewood Cliffs, New Jersey.
6. S. Andrilli and D. Hecker (2016). *Elementary Linear Algebra* (5th ed.). Elsevier India.
7. B. Kolman and D. R. Hill (2001). *Introductory Linear Algebra with Applications (7th ed.)*. Pearson Education, Delhi.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	VI		
Name of the Course	Dynamics		
Course Code	CC-A18		
Course ID	240/MAT/CC603		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Analyze velocity and acceleration components along radial, transverse, tangential, and normal directions. 2. Solve the problems based on simple harmonic motion and elastic strings 3. Understand the concepts of work, power, energy, conservative forces, and impulsive forces in mechanical systems 4. Apply Newton's laws of motion and describe motion of a particle on smooth and rough plane curves. 5. Describe the motion of a projectile, Kepler's laws of motion and motion of a particle in three dimensions.		
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	---	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	Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.	45 hrs
II	Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.	
III	Motion on smooth and rough plane curves. Projection motion of a particle in a plane. Vector angular velocity	
IV	General motion of a rigid body: Central Orbits, Kepler's laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems.	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:** 1. Problems on the magnitude and direction of velocity, acceleration along a plane curve. 2. Problems on the magnitude and direction of radial velocity, transverse velocity. 3. Problems on the magnitude and direction of radial acceleration, transverse	**30 hrs**

acceleration along a plane curve.

4. Problems on the magnitude and direction of tangential velocity, normal velocity along a plane curve.
5. Problems on the magnitude and direction of tangential acceleration, normal acceleration along a plane curve.
6. Problems on the work done by a constant force, variable force and in stretching an elastic string.
7. Problems on the rate of doing work (power).
8. Practical problems on Kepler's laws for planetary motion
9. Problems based on principle of conservation of energy

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

1. To find the magnitude and direction of velocity.
2. To find the magnitude and direction of radial velocity along a plane curve.
3. To find the magnitude and direction of tangential velocity along a plane curve
4. To find the magnitude and direction of acceleration.
5. To find the magnitude and direction of radial acceleration along a plane curve.
6. To find the magnitude and direction of tangential acceleration along a plane curve.
7. To find the rate of doing work.
8. To find work done by a constant force.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. S. L. Loney (2006). *An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies*, Cambridge University Press.
2. F. Chorlton (1985). *Dynamics*. CBS Publishers, New Delhi.
3. A.S. Ramsey (2002). *Dynamics Part-1&2*. CBS Publisher & Distributors.

4. A.P. Roberts (2003). *Statics and Dynamics with Background in Mathematics*. Cambridge University Press.
5. P.L. Srivastava(1964). *Elementary Dynamics*. Ram NarainLal, Beni Prasad Publishers Allahabad.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	V		
Name of the Course	Abstract and Linear Algebra		
Course Code	CC-A5		
Course ID	240/MATP/CC501		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	The course will enable the students to: 1. Understand the fundamental concepts of group theory. 2. Analyze and distinguish between different types of subgroups. 3. Understand the fundamental concepts of ring theory. 4. Understand the concept of vector spaces and subspaces. 5. Understand the concept of basis and dimension in finitely generated vector spaces and understand the existence theorem for basis.		
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	--	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	Definition of a group with example and properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's theorem and its consequences, Normal subgroups. Quotient groups.	**45 hrs**
II	Introduction of Homomorphisms and isomorphisms of a group, Fundamental Theorem on Homomorphism of Groups. Introduction to rings, subrings, integral domains and field.	
III	Vector spaces, subspaces, direct sum of subspaces, linear span, Linearly Independent and Linearly Dependent subsets of a vector space. Finitely generated vector space. Existence theorem for basis of a finitely generated vector space. Dimension.	
IV	Quotient space and its dimension. Homomorphisms and isomorphisms of a vector spaces, Linear transformation and linear forms of a vector spaces. Properties of linear Transformation.	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:** 1. To verify whether the set $G = \{0,1,2,3, \ldots . n-1\}$ under addition modulo n forms a group. 2. To check whether the set of even integers forms a subgroup of integers under addition.	**30 hrs**

3. To find all generators of the cyclic group $\mathbb{Z}_n$.
4. To verify that the number of cosets equals the index of the subgroup.
5. To find all possible orders of subgroups of a group of order n.
6. To construct the quotient group G/H.
7. To find the kernel and image of a homomorphism.
8. To find zero divisors in a given ring.
9. To find the span of a given set of vectors.
10. To determine the dimension of a vector space.

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

1. Write a program in Maxima to verify whether the set $G = \{0,1,2,3, \ldots \ldots n-1\}$under addition modulo n forms a group.
2. Write a program in Maxima to check whether integers under addition form a group.
3. Write a program in Maxima to find generators of $\mathbb{Z}_n$.
4. Write a program in Maxima to check whether a subgroup is normal.
5. Write a program in Maxima to check whether a function is a homomorphism.
6. Write a program in Maxima to find zero divisors in $\mathbb{Z}_n$.
7. Write a program in Maxima to find basis and dimension of a vector space.
8. Write a program in Maxima to find dimension of quotient space.
9. Write a program in Maxima to find image of a vector under transformation.
10. Write a program in Maxima to find kernel of a linear transformation.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. J. A. Gallian (2017). *Contemporary Abstract Algebra* (9th ed.). Cengage Learning India Private Limited, Delhi.
2. M. Artin (2011). *Abstract Algebra* (2nd ed.). Pearson.

3. V. Sahai and V. Bist (2010). *Algebra* (3rd ed.). Narosa Publishing House.
4. I. N. Herstein (2008). *Topics in Algebra* (2nd ed.). Wiley India Pvt. Ltd.
5. J. J. Rotman (1995). *An Introduction to the Theory of Groups* (4th ed.). Springer-Verlag, New York.
6. D. S. Dummit and R. M. Foote (2016). *Abstract Algebra* (3rd ed.). Wiley.
7. D. A. R. Wallace (1998). *Groups, Rings and Fields*. Springer.
8. S. H. Friedberg, A. J. Insel, and L. E. Spence (2003). *Linear Algebra*. Pearson.
9. G. Strang (2006). *Introduction to Linear Algebra*. Wellesley-Cambridge Press.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	VI		
Name of the Course	Mathematical Analysis		
Course Code	CC-A6		
Course ID	240/MATP/CC601		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Recall fundamentals of metric, definition and basic idea of metric. 2. Discuss and analyze the continuity and its further properties. 3. To be familiar with complex numbers and their geometrical interpretation. 4. Understand the concept of complex numbers, various mappings and the some important theorems.		
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	---	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	Metric spaces: definition and examples, discrete metric, usual metric on $\mathbb{R}$ and $\mathbb{R}^n$, open and closed balls, neighbourhoods, open and closed sets, interior, limit and boundary points. closure and derived sets, dense sets and subspaces of a metric space.	**45 hrs**
II	Sequences and continuity in metric spaces, convergent sequences and their properties, bounded and Cauchy sequences, subsequence's, complete metric spaces, continuous functions between metric spaces, sequential and uniform continuity, basic ideas of homeomorphism and isometry.	
III	Extended Complex Plain, Stereographic projection, function of a complex variable, Continuity, Differentiability, Analytic functions and their properties, Cauchy Riemann equations in Cartesian and polar coordinates, Power series, Radius of convergence.	
IV	Mapping by elementary function: Translation, rotation, Magnification and inversion. Conformal Mapping and application, Mobius transformations, Fixed points, Cross ratio, Inverse points and critical mappings.	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:** 1. Problems of determining whether a given function is a metric or not? 2. Problems of proving that a given function is not a metric. 3. Problems of establishing a relationship between a metric space and Hausdorff	**30 hrs**

space.

4. Problem of establishing a relationship between a convergent sequence and Cauchy sequence in a metric space.
5. Problem of finding examples of a Cauchy sequence which is not convergent in Q.
6. Problem pertaining to continuity and differentiability of a complex function.
7. Problem pertaining to analytic functions.
8. Problem pertaining to radius of convergence.
9. Problem of translation and rotation function.
10. Problem pertaining to Mobius transformation.

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

1. Learn to run a program to compute distance between two points using Euclidean
2. Learn to run a program to verify metric axioms for a given function numerically.
3. Learn to run a program to compute distance between two points using Euclidean
4. Learn to run a program to find diameter of a finite set.
5. Learn to run a program check Cauchy sequence numerically.
6. Learn to run a program to plot complex numbers on Argand plane.
7. Learn to run a program to compute modulus and argument of a complex number.
8. Learn to run a program to visualize translation and rotation.
9. Learn to run a program to visualize inversion.
10. Learn to run a program to study mobius transformation.
11. Learn to run a program to visualize stereographic projection (sphere over complex plane)
12. Learn to run a program to plot image of lines/circles under complex transformations.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **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 (1985), *Mathematical Analysis*, Narosa Publishing House, New Delhi.
2. R.R. Goldberg (1970), *Methods of Real Analysis*, Oxford & IBH Publishing Co., New Delhi.
3. D. Somasundaram and B. Choudhary (1997), *A First Course in Mathematical Analysis*, Narosa Publishing House, New Delhi.
4. S. Narayan (1980), *A Course of Mathematical Analysis*, S. Chand & Co., New Delhi.
5. R.V. Churchill and James Ward Brown (2009), *Complex Variables and Applications*, McGraw Hill Publishing Company.
6. H.S. Kasana (2011), *Complex Variable Theory and Applications*, PHI Learning Private Ltd.
7. D. G. Zill and P. D. Shanahan (2010), *A First Course in Complex Analysis with Applications*, Jones & Bartlett Publication, 2nd Edition.

Session: 2026-27			
Part A – Introduction			
Subject	Statistics		
Semester	V		
Name of the Course	Elementary Inference		
Course Code	CC-A5		
Course ID	240/STAT/CC501		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Students will be able to understand the concepts of parameters, statistics, sampling distributions, point estimation, bias, and standard error. 2. Students will be able to explain the properties of estimators such as unbiasedness, efficiency, consistency, and sufficiency. 3. Students will be able to estimate unknown parameters using Method of Moments and Maximum Likelihood Estimation (MLE). 4. Students will be able to formulate and perform hypothesis testing using null and alternative hypotheses, significance level, and critical region.		
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	---	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	Parameter and Statistic, Sampling Distribution of statistic. Point and estimate of a parameter, Concept of bias of Standard error of an estimate. Standard errors of mean (SEM), sample proportion, deviation, Unbiasedness, efficiency, consistency and sufficiency.	**45 hrs**
II	Method of moments and maximum likelihood Testing of Hypotheses: Null and alternative hypotheses. Simple and composite hypotheses, critical region, level of significance, one tailed and two tailed testing.	
III	Type I and type II errors, Neyman- Pearson Lemma, Test of simple hypothesis against a simple alternative in case of Binomial, Poisson and Normal distribution.	
IV	Large Sample Test: Testing and interval estimation of a single mean and a single proportion and difference of two means of two proportions. Fisher's Z transformation.	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook.** 1. To apply large sample test of significance for single proportion and difference of two proportions and obtain their confidence intervals. 2. To apply large sample test of significance for single mean and to obtain confidence interval. 3. To apply large sample test of significance for difference between two means and	**30 hrs**

standard deviations.

4. To Apply Fisher's Z transformation for testing correlation coefficients.
5. To Apply the Neyman–Pearson Lemma for testing simple hypotheses.
6. To estimate unknown parameters using the Method of Moments.

(B)The following practical will be done using mathematical software (such as Python with libraries like NumPy, SciPy, and Matplotlib or R) and their record will be maintained in the practical note book:

1. Write a Python program to apply large sample teat of significance for single proportion and difference of two proportions and obtain their confidence intervals.
2. Write a Python program to apply large sample teat of significance for single mean and to obtain confidence interval.
3. Write a Python program to apply large sample teat of significance for difference between two means and standard deviations.
4. Write a Python program to apply Fisher's Z transformation for testing correlation coefficients.
5. Write a Python program the Neyman–Pearson Lemma for testing simple hypotheses.
6. Write a Python program to estimate unknown parameters using the Method of Moments.

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. R. V. Hogg and A. T. Craig (1995), *Introduction to Mathematical Statistics*, Prentice Hall.
2. A. M. Mood, F. A. Graybill and D. C. Boes (1974), *Introduction to the Theory of Statistics (3rd Edition)*, McGraw-Hill.
3. S. C. Gupta and V. K. Kapoor (2002), *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
4. J. N. Kapur and H. C. Saxena (1997), *Mathematical Statistics*, S. Chand & Company Ltd.
5. G. Casella and R. L. Berger (2002), *Statistical Inference (2nd Edition)*, Duxbury Press.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics/Statistics		
Semester	V		
Name of the Course	Python		
Course Code	MIC-5/VOC-2		
Course ID			
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	MIC/VOC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to; 1. Develop, document and debug modular python programs to solve computational problems. 2. Select a suitable programming construct and data structure for a situation. 3. Use built-in strings, lists, sets, tuples and dictionary in applications. 4. Define classes and use them in applications. 5. Understand use files for I/O operations.		
Credits	**Theory**	**Practical**	**Total**
	2	2	4
Contact Hours	2	4	6
Internal Assessment Marks	15	15	30
End Term Assessment Marks	35	35	70

Examination Time	2 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	Introduction to Programming using Python: Structure of a Python Program, Functions, Python Interpreter, Python shell, Indentation. Identifiers and keywords, Literals, Strings, Basic operators (Arithmetic operator, Relational operator, Logical , Assignment Operator, Bit wise operator, Identity Operator, Membership Operator)	**30 hrs**
II	Building blocks of Python: Standard libraries in Python, notion of class, object and method.	
III	Creating Python Programs: Input and Output Statements, Control statements:-branching, looping, Exit function, break, continue and pass,. Testing and debugging a program	
IV	Built-in data structures: Mutable and immutable structures Strings, lists, Sets, Tuples and Dictionary and associated operations. Basic searching and sorting methods using iteration.	

Practical

The Following practicals will be done using Python and record of those will be maintained in the practical book 1. Write a program to execution of expressions involving arithmetic, relational, logical, and bitwise operator in the shell window of Python IDLE. 2. Write a program to calculate sum of two numbers. 3. Write a program to find the greatest number among three or more numbers. 4. Write a program to find the factorial of a number. 5. Write a program to find the reverse of two or more digits. 6. Write a program to find the LCM and HCF of two numbers.	**60 hrs**

7. Write a program to find whether a number is prime or not.
8. Write a program to calculate Simple Interest.
9. Write a program to calculate Compound Interest.
10. Write a program to return nth terms of Fibonacci sequence.
11. Write a program to find square root of a number.
12. Write a program to find roots of a quadratic equation.Program
13. Write a program to find the area of a triangle when the lengths of three sides are given.

Suggested Evaluation Methods

Internal Assessment:

➢ **Theory 15**

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 5

➢ **Practicum 15**

- Seminar/Demonstration/Viva-voce/Lab records etc.: 15

End Term Examination:

➢ **Theory 35**

- Written Examination

➢ **Practicum 35**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. A. B. Downey (2015), *Think Python: How to Think Like a Computer Scientist (3rd Edition)*, O'Reilly Media.
2. S. Taneja and N. Kumar (2017), *Python Programming: A Modular Approach*, Pearson Education.
3. M. C. Brown (2001), *The Complete Reference: Python*, McGraw-Hill Education.
4. R. G. Dromey (2006), *How to Solve It by Computer*, Pearson Education.
5. J. V. Guttag (2016), *Introduction to Computation and Programming Using Python*, MIT Press.
6. Y. D. Liang (2013), *Introduction to Programming Using Python*, Pearson Education.

Session: 2026-27			
Part A – Introduction			
Subject	Statistics		
Semester	VI		
Name of the Course	Operations Research		
Course Code	CC-A6		
Course ID	240/STAT/CC601		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Understand the nature, scope, models, and limitations of Operations Research. 2. Formulate and solve Linear Programming Problems using graphical and simplex methods. 3. Formulate transportation problems and find initial feasible solutions using different methods. 4. Solve the assignment problem using optimization techniques.		
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	---	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	Basics of operation research: Nature and definition of O.R, Scope of O.R., Phases of O.R, Models in O.R, Classification of models, Uses and limitation of O.R.	45 hrs
II	Formulation of General Linear Programming Problem and their examples. Graphical method and Simplex method for LP problems. Duality.	
III	Transportation Problem: Formulation of T.P., BFS to TP, Determination of initial feasible solution North-West corner rules Row minima method, column minima method, Matrix minima method (Least cost entry method).	
IV	Vogel's Approximation method (or Unit cost penalty method). Travelling Salesman Problem and its examples. Assignment Problems: Solution using the Hungarian Method and Unbalanced Assignment Problems.	

Practical

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

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

1. To formulate the LPP.
2. To solve the LPP by graphical method
3. To solve the LPP for Simplex method.
4. To solve the transportation problem.
5. To solve the assignment problem.
6. Determination or initial BFS by North West corner Rules, Row minima Method and vogel's Approximation method.

(B) The following practical will be done using mathematical software (such as

Python with libraries like NumPy, SciPy, and Matplotlib or R) and their record will be maintained in the practical note book:

1. To formulate the Linear Programming Problem (LPP) using Python.
2. To solve the Linear Programming Problem by the Graphical Method using Python.
3. To solve the Linear Programming Problem using the Simplex Method in Python.
4. To formulate and solve the Transportation Problem using Python.
5. To solve the Assignment Problem using Python.
6. To determine the initial Basic Feasible Solution (BFS) of the Transportation Problem using Python by applying: North-West Corner Rule Row Minima Method,Vogel's Approximation Method (VAM).

Suggested Evaluation Methods

Internal Assessment:

➢ **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

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. J. K. Sharma (2008), *An Introduction to Operations Research*, Macmillan India Ltd.
2. K. Swarup and P. K. Gupta and Man Mohan (1997), *Operations Research*, Sultan Chand & Sons.
3. P. K. Gupta and D. S. Hira (2008), *Operations Research*, S. Chand & Company Ltd.
4. H. A. Taha (2017), *Operations Research: An Introduction (10th Edition)*, Pearson Education.
5. R. Panneerselvam (2012), *Fundamentals of Operations Research*, PHI Learning Pvt. Ltd.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics/Statistics		
Semester	VI		
Name of the Course	Numerical Methods		
Course Code	MIC-6		
Course ID			
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	MIC		
Course Learning Outcomes(CLOs)	**After completing this course, the learner will be able to:** 1. Understand theoretical concepts of numerical methods for solving algebraic and transcendental equations and attain practical skills for their implementation. 2. Gain deep theoretical knowledge of techniques of solving the system of simultaneous equations by using different numerical methods. 3. Understand the concepts of finite differences and interpolation. 4. Write and execute program of numerical methods based on C language.		
Credits	**Theory**	**Practical**	**Total**
	2	2	3
Contact Hours	2	4	6
Internal Assessment Marks	15	15	30
End Term Assessment Marks	35	35	70

Examination Time	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	Solution of algebraic and Transcendental equations : Bisection Method, Regula-Falsi method, Secant method, Newton-Raphson's method, Newton's iterative method for finding *pth* root of a number, order of convergence of above methods.	**30 hrs**
II	Simultaneous linear algebraic equations : Gauss elimination method, Gauss-Jordon method, Triangulaization method (LU decomposition method), Crout's Method	
III	Iterative method, Jacobi's method, Gauss-Seidel's method, Relaxation Method	
IV	Finite Difference Operators: Forward difference, Backward difference, Shift Operator, central difference operator, their properties and relations. Construction of table using these operators. Interpolation : Newton's forward difference formula, Newton's Backward difference formula	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:** 1. Problem on solving the algebraic and transcendental equation using Bisection Method. 2. Problem on solving the algebraic and transcendental equation using Regula-Falsi Method.	**60 hrs**

3. Problem on solving the algebraic and transcendental equation using Newton Raphson Method.
4. Problem on solving the system of simultaneous equations using Gauss-elimination Method.
5. Problem on solving the system of simultaneous equations using Gauss-Jordon Method.
6. Problem on solving the system of simultaneous equations using Crout's method.
7. Problem on solving the system of simultaneous equations using Triangularisation Method.
8. Problem on solving the system of simultaneous equations using Gauss-Seidel's Method.
9. Construct a table using Forward difference operator.
10. Construct a table using Backward difference operator.

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

1. Write a program to find roots of algebraic and transcendental equations using Bisection method and draw the flowchart.
2. Write a program to find the roots of algebraic and transcendental equations using Newton Raphson method and draw the flowchart.
3. Write a program to find the roots of algebraic and transcendental equations using Regula Falsi method and draw the flowchart.
4. Write a program to find the solution of system of equations using Gauss Elimination method and draw the flowchart.
5. Write a program to find the solution of system of equations using Gauss-Seidel's method and draw the flowchart.
6. Write a program to find the solution of system of equations using Gauss Jordon method and draw the flowchart
7. Write a program to demonstrate Crout's method and draw a flow chart.
8. Write a problem to estimate function using Newton's Forward difference formula.
9. Write a problem to construct a table using finite differences.
10. Write a problem to estimate function using Newton's Backward difference formula.

Suggested Evaluation Methods

Internal Assessment:

➢ **Theory 15**

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 5

➢ **Practicum 15**

- Seminar/Demonstration/Viva-voce/Lab records etc.: 15

End Term Examination:

➢ **Theory 35**

- Written Examination

➢ **Practicum 35**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. S.D. Conte and C.D. Boor (2018). *Elementary Numerical Analysis: An algorithmic Approach*. SIAM.
2. A. Gupta and S.C. Bose (2012). *Introduction to Numerical Analysis (3rd Edition)*. Academic Publishers.
3. M.K. Jain, S.R.K. Iyengar and R. K. Jain (2012). *Numerical Methods for Scientific and Engineering Computation (6^{th} Edition)*. New Age International Publishers.
4. B. Bradie (2007). *A Friendly Introduction to Numerical Analysis*. Pearson India.
5. C. F. Gerald and P. O. Wheatley (2007). *Applied Numerical Analysis (7^{th} Edition)*. Pearson Education India.
6. F.B. Hildebrand (2003). *Introduction to Numerical Analysis (2^{nd} Edition)*. Dover Publication Inc.
7. R. J. Schilling and S. L. Harris (1999). *Applied Numerical Methods for Engineers using MATLAB* and C. S. Chand (G/L) & Company Ltd.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics/Statistics		
Semester	VI		
Name of the Course	Quantitative Aptitude		
Course Code	SEC-3		
Course ID			
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	SEC		
Course Learning Outcomes(CLOs)	**After completing this course, the learner will be able to:** 1. Understand and formulate mathematical equations for various problems and apply appropriate methods to solve them. 2. Apply concepts of work, time and distance, work and wages, simple interest, and compound interest to solve practical problems. 3. Use concepts of set theory and measures of central tendency to analyze data and draw meaningful conclusions. 4. Develop logical reasoning and problem-solving skills through pattern recognition, coding–decoding, blood relations, seating arrangements, probability, and data interpretation.		
Credits	**Theory**	**Practical**	**Total**
	2	1	3
Contact Hours	2	2	4
Internal Assessment Marks	15	5	20

End Term Assessment Marks	35	20	55
Examination Time	2 Hours	---	75

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	Linear Equations, Quadratic equations, System of algebraic equations in two variables and their applications in simple problems: Problems on ages, Clocks.	8
II	Time, distance and speed: Problems based on trains, Boats and Streams, Pipes and Cistern. Work and time: Problems on work and time, Work and wages. Simple interest, Compound Interest.	7
III	Basic idea of set theory to solve practical problems and Venn diagrams. Data interpretation: Raw and grouped data, Bar Graph, Pie Chart, Mean, Median and Mode.	7
IV	Logical Reasoning & Applications: Identifying patterns and next terms, Letter and number coding patterns, Blood Relation problems, Movement and distance calculations. Events and sample space, Basic idea of Probability to solve practical problems.	8

Practical

Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook: 1. To solve problems related to clocks. 2. To write the date of birth of your family members and determine the day of their	30

birth.

3. Problems related to upstream and downstream of boat.
4. Compare the simple interest and compound interest for a given amount deposited for fixed time at a fixed rate.
5. Draw Venn Diagram for the following
   (i) Union of sets
   (ii) Intersection of sets
   (iii) Difference of sets
6. Problem solving related to pipes and cisterns.
7. Problem solving related to determination of time taken by two trains of given lengths, to cross each other, when their speeds are given.
8. Problems involving formulation and solution of quadratic equations in one variable.
9. Draw a bar-graph for the percentage of expenditure occurred on miscellaneous heads (atleast 5 items) for your family income and write your observation in respect of bar- graph.
10. Draw a pie-chart by taking data of problem (9).
11. Taking the annual export data for three companies for last six years, draw a line-graph.
12. Find the next term in the series: 2, 6, 12, 20, 30, ?
13. If APPLE is coded as 50 and MANGO is coded as 57, what is the code for ORANGE?
14. Pointing to a photograph, Rahul said, "She is the daughter of my grandfather's only son." How is the woman in the photograph related to Rahul?
15. Write down the sample space for tossing three coins one by one and determine the probabilities of occurrence of all possibilities of heads.

Suggested Evaluation Methods

Internal Assessment:

➢ **Theory 15**

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 5

➢ **Practicum 5**

- Seminar/Demonstration/Viva-voce/Lab records etc.: 5

End Term Examination:

➢ **Theory 35**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. R. S. Aggarwal (2022). *Quantitative Aptitude.* S Chand & Company Limited, New Delhi.
2. A. Guha (2020). *Quantitative Aptitude* (7th Edition). Mc Graw Hill Publications.
3. V. Dyke, J. Rogers and H. Adams (2011). *Fundamentals of Mathematics,* Cengage Learning.
4. A.S. Tussy, R. D. Gustafson and D. Koenig (2010). *Basic Mathematics for College Students*. Brooks Cole.
5. C. C. Pinter (2014). *A Book of Set Theory*. Dover Publications.
6. R.V. Praveen (2013). *Quantitave Aptitude and Reasoning (2nd Edition)*, PHI learning Pvt. Ltd. Delhi.

Session: 2026-27			
Part A – Introduction			
Subject	Mathematics/Statistics		
Semester	VI		
Name of the Course	MATLAB & R Software		
Course Code	MIC-7/VOC-3		
Course ID			
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	MIC/VOC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Understand MATLAB basics including variables, data types, vectors, matrices etc. 2. Have technical knowledge about built-in functions, MATLAB graphic features and its applications. 3. Deeper knowledge and understanding to generate plots. 4. Understand the R environment including installation, package management, and basic programming concepts such as loops and user-defined functions. 5. Learn tools and built in functions of MATLAB/R Software in solving stated problems.		
Credits	**Theory**	**Practical**	**Total**
	2	2	4
Contact Hours	2	4	6
Internal Assessment Marks	15	15	30
End Term Assessment Marks	35	35	70

Examination Time	2 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	Introduction, starting and quitting a MATLAB session, Variables and assignments, Data types, Operators, Working with complex numbers, Defining a Vector, Accessing elements within a vector, Basic operations on vectors. Defining Matrices, Matrix functions and Matrix operations.	**30 hrs**
II	Loops: For loops, While loops, Branching (conditional statements) - if statement, If else statement, Else if statement. Solving a linear system, finding eigenvalues and eigenvectors. Polynomials: Representing Polynomials and Polynomial roots. Graphs and plots: Basic 2-D plots, Overlay plots, specialized 2-D plots, 3-D plots, Interpolated surface plots, saving and printing graphs.	
III	Overview of the R language: Installing R and R Studio, Text editors for R, Graphical User Interfaces (GUIs) for R, Creating and storing R workspaces, installing packages and libraries, Mathematical operations. Data Types in R – Numeric, Integer, Character, Logical, Complex and missing data. Data Structures in R • Vectors – Creation, Arithmetic operations of Vectors, Vector Sub setting, Sorting and Sequencing functions. • Matrix and Arrays – Creation, Arithmetic Operations of matrix, Sub setting, Use of Drop Function. • Factors – Converting a vector into factor, assigning levels and labels, ordered Factor. • List – Creating a list, accessing elements from a list, adding a new element and eliminating an existing element form the list, converting list to vectors.	

IV	Data Frames – Creation of Data Frame, adding new columns, rows and removing columns, accessing column using the $ sign, importing a data set (important file formats such as csv, txt and spreadsheet), aggregate function and subsetting of data frames. Programming Fundamentals: Logical operators, conditional statements (if, else, else if statements in R), While loops, for loops, repeat loops. Creating functions in R. Reading data in R (file formats such as csv, txt, and xlsx), Writing data to external files (file formats such as csv, txt, and xlsx), writing a table to a file, print function.	

Practical

The following Practicals numbered 1 to 10 will be performed using MATLAB / SCILAB software, while practicals numbered 11 to 17 will be performed using R software and record of those will be maintained in the practical note book: 1. Practical to demonstrate components in MATLAB/SCILAB environment. 2. Practical to demonstrate tool boxes in MATLAB/SCILAB environment. 3. Practical to demonstrate windows in MATLAB/SCILAB. 4. Program to generate odd/even numbers. 5. Practical to demonstrate basic matrix operations (addition, subtraction, multiplication, transpose, determinant, etc.). 6. Practical to find inverse of a matrix using built-in function. 7. Practical to determine Eigen values and Eigen vectors of a square matrix using built-in functions. 8. Find the roots of the equations using MATLAB. 9. Write a program to show the use of if else structure in MATLAB. 10. Write a program to show the use of FOR loop in MATLAB. 11. Practical to add title, axis labels, line style, color, annotations etc. to a figure/graph. 12. Practical to demonstrate statistical toolbox (mean, median, standard deviation, sort etc.). 13. Program to perform basic mathematical operations in R (addition, subtraction, multiplication, division, powers). 14. Program to create and display Numeric, Integer, Character, Logical, and Complex data types. 15. Program to perform arithmetic operations on vectors. 16. Program to generate sequences and sorting of sequence. 17. Program to perform basic matrix operations. 18. Program demonstrating logical operator if, if-else and else if ladder statement. 19. Program demonstrating for loop and while loop.	**60 hrs**

Suggested Evaluation Methods

Internal Assessment:	**End Term Examination:**
➢ **Theory 15** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 5 ➢ **Practicum 15** • Seminar/Demonstration/Viva-voce/Lab records etc.: 15	➢ **Theory 35** • Written Examination ➢ **Practicum 35** • Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. S. J. Chapman (2020), *MATLAB Programming for Engineers (6th Edition)*, Cengage Learning.
2. W. Palm III (2017), *A Concise Introduction to MATLAB (2nd Edition)*, Tata McGraw-Hill Education.
3. R. Pratap (2010), *Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers*, Oxford University Press.
4. R. K. Bansal, A. K. Goel and M. K. Sharma (2009), *MATLAB and Its Applications in Engineering*, Pearson Education India.
5. S. R. M. Sekhar et al. (2017), *Programming with R*, Cengage Learning India.
6. M. Gardener (2018), *Beginning R: The Statistical Programming Language*, Wiley & Sons