Shri Sangameshwar Education Society's

Sangameshwar College, Solapur [Autonomous]

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 4(4.2)
26th March, 2022

UG Science Programme: B.Sc.-III to be implemented from A.Y. 2022-2023

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in: Mathemaics

Structure of Choice Based Credit System for Undergraduate Science **Programme B.Sc. III (Mathematics)**: To be implemented from **A.Y.2022-2023**

Table: 5

Semester	Course		Course Code	Teaching Scheme/week		
				Hours	Lectures	Credits
V	AECC-C	ENGLISH FOR COMMUNICATION-III	2231501	3.2	4	2
	DSE-1A	Theory Paper-IX: Ring and Linear Algebra	2231531	2.4	3	3
		Practical-IV: Ring and Linear algebra + Metric Spaces	2231636	4	5	2
	DSE-2A	Theory Paper-X: Complex Analysis	2231532	2.4	3	3
		Practical-V: Complex Analysis + Numerical analysis	2231637	4	5	2
	DSE-3A	Theory Paper-XI: Real Analysis	2231533	2.4	3	3
		Practical-VI: Real Analysis + Programming in C++	2231638	4	5	2
	ANY ONE from DSE-4A (1) & 4A (2)					
	DSE-4A (1)	Theory Paper-XII: Partial Differential Equations	2231534	2.4	3	3
		Practical-VII: Partial Differential Equations OR Number Theory	2231639	4	5	2
	DSE-4A (2)	Theory Paper-XII: Number Theory	2231535	2.4	3	3
		Practical-VII: Integral Calculus OR Graph Theory	2231639	4	5	2
	SGSEC-3	Theory Paper-III: ELEMENTARY COURSE IN LATEX	2231536	2.4	3	2

		Total		**31.2**	**39**	**24**
VI	AECC-D	ENGLISH FOR COMMUNICATION-IV	2231601	3.2	4	2
	DSE-1B	Theory Paper-XIII: Metric spaces	2231631	2.4	3	3
		Practical-IV: Ring and Linear algebra + Metric Spaces	2231636	4	5	2
	DSE-2B	Theory Paper-XIV: Numerical Analysis	2231632	2.4	3	3
		Practical-V: Complex Analysis + Numerical analysis	2231637	4	5	2
	DSE-3B	Theory Paper-XV: Programming in C++	2231633	2.4	3	3
		Practical-VI: Real Analysis + Programming in C++	2231638	4	5	2
	ANY ONE from DSE-4B (1) & 4B (2)					
	DSE-4B (1)	Theory Paper-XVI: Integral Calculus	2231635	2.4	3	3
		Practical-VII: Partial Differential Equations OR Number Theory	2231639	4	5	2
	DSE-4B (2)	Theory Paper-XVI: Graph Theory	2231635	2.4	3	3
		Practical-VII: Integral Calculus OR Graph Theory	2231639	4	5	2
		Total		**28.8**	**36**	**22**
Total Semester V and VI				**60**	**75**	**46**

Table: 6

Semester	Course		EXAMINATION Marks			Credits
			CA	SEE	Total	
V	AECC-C	Theory-IV: ENGLISH FOR COMMUNICATION-III	15	35	50	2
	DSE-1A	Theory Paper-IX: Ring and Linear Algebra	30	70	100	3
	DSE-2A	Practical-IV: Ring and Linear algebra + Metric Spaces	30	70	100	3
	DSE-3A	Theory Paper-X: Complex Analysis	30	70	100	3
	ANY ONE from DSE-4A (1) & 4A (2)	Theory Paper-XII: Partial Differential Equations OR Paper-XII: Number Theory	30	70	100	3
	SEC-3	ELEMENTARY COURSE IN LATEX	15	35	50	2
	Total		**135+15**	**315+35**	**450+50**	**16**
VI	AECC-D	Theory-V: ENGLISH FOR COMMUNICATION-IV	15	35	50	2
	DSE-1B	Theory Paper-XIII: Metric spaces	30	70	100	3
	DSE-2B	Theory Paper-XIV: Numerical Analysis	30	70	100	3
	DSE-3B	Theory Paper-XV: Programming in C++	30	70	100	3

	ANY ONE from DSE-4B(1) & 4B(2)	Theory Paper-XVI: Integral Calculus OR Theory Paper-XVI: Graph Theory	30	70	100	3
	DSE-1A & DSE-1B	Practical-IV: Ring and Linear algebra + Metric Spaces	30	70	100	4
	DSE-2A & DSE-2B	Practical-V: Complex Analysis + Numerical analysis	30	70	100	4
	DSE-3A & DSE-3B	Practical-VI: Real Analysis + Programming in C++	30	70	100	4
	DSE-4A & DSE-4B	Practical-VII: Partial Differential Equations+ Integral Calculus OR Graph Theory OR Number Theory	30	70	100	4
		Total	**240+15**	**560+35**	**800+50**	**30**
Total Semester V and VI			**405**	**945**	**1350**	**46**

CA: Continuous Assessment SEE: Semester End Examination

Note:

The above structure (Table-5 and Table-6) is for Sem-V and Sem-VI of the undergraduate B.Sc.-III programmes* under science faculty.

* B.Sc.-III Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology.

DSE: Discipline Specific Elective Core Course (When a Student opts a particular course$ as a principal course from the core courses opted at B.Sc.- II excluding Geography and Psychology).

$ Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology

AECC: Ability Enhancement Compulsory Course SEC: Skill Enhancement Course

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC courses.

Programmes	Total Marks	Credits
B.Sc.-I	1200+100+50	52
B.Sc.-II	1300+50	56
B.Sc.-III	1250+100	46
Total	**3750+250+50**	**154**

Details Of Approved Syllabus Of B. Sc. Part-III (MATHEMATICS)

1) Preamble

From the academic year 2022–2023, the Sangameshwar College (Autonomous), Solapur has introduced a new syllabus for the third year B. Sc. Program in Mathematics based on the Credit Based Semester and Grading system. Mathematics has played a crucial role in the advancement of science and technology. The application of Mathematics to real-world problems has risen by leaps and bounds in recent years. The board of studies in Mathematics has designed

the syllabus for B.Sc. III Mathematics, taking into account rapid changes in science and technology as well as new techniques in various fields of Mathematics and allied courses such as physics, statistics, and computer sciences. The current B.Sc. syllabi for Semesters V and VI have been established in accordance with the U. G. C. Model curriculum to ensure that students learn the mathematics required for these branches, as well as basic mathematical concepts and rigorous procedures, in a gentle and gradual manner. In the theory courses of Linear algebra, Complex Analysis, Real Analysis, Partial differential Equation, Mathematical analysis, Integral calculus, Metric Space, Numerical Analysis, Graph Theory, Programming In C++.

Students will learn a variety of theorem deductions, corollaries, and lemmas. Nature's universal truth is change. As a result, our goal is for students to master a variety of problem-solving approaches. Students pursuing a T.Y. B.Sc. in Mathematics must complete eight theory courses (four per semester) and four practical courses entitled "Numerical Techniques in Laboratory" (NTL A, B, C, and D Courses) (Annual). Students practise problem-solving strategies for practical courses A, B, C, and D in this 400-point practical course. The curriculum contains all of the necessary information.

2) Aims

Give the students a sufficient knowledge of fundamental principles, methods, and a clear perception of the innumerable power of mathematical ideas and tools and teach them how to use them by modeling, solving, and interpreting. Reflecting the subject's breadth and developing mathematical tools for further research in various fields of science.

3) Objective of the Course

i) To design the syllabus with specific focus on key Learning Areas.

ii) To equip student with necessary fundamental concepts and knowledge base

iii) To develop specific problem solving skills.

iv) To impart training on abstract concepts, analysis, deductive techniques.

v) To prepare students for demonstrating the acquired knowledge.

vi) To encourage student to develop skills for developing innovative ideas.
vii) Enhancing students' overall development and equipping them with the mathematical modelling abilities, problem-solving skills, creative talent, and power of communication necessary for various kinds of employment.
viii) A student should get adequate exposure to global and local concerns that explore many aspects of the Mathematical sciences.

PROGRAM OUTCOMES OF B.Sc. PROGRAM

PO1 Acquire skill, training and knowledge to enhance thinking, comprehension and application abilities to compete, succeed and excel globally**.**

PO2 Gain knowledge and experience (through theory, experiments, tutorials, projects and industrial / field visits), to achieve ultimate progress and improvement, to be capable of employment and meet the global competencies.

PO3 Identify, formulate and analyze problems. Create, select, and apply suitable techniques, resources, and modern scientific tools to accomplish verified conclusions with an understanding of the limitations.

PO4 Apply moral principles and commit to the norms of scientific practice in every endeavor. Validate expertise to conduct wide range of scientific experiments to solve problems.

PO5 Communicate efficiently scientific events with the Scientific community and with Society at large with capability to comprehend and pen operative reports and design documentation, make effective presentations, and give and receive clear instructions.

PO6 Reveal knowledge with thoughtful expression of the scientific principles in

one's own work, as an individual member and capable leader in a team, to manage projects in multidisciplinary environments.

PROGRAMME SPECIFIC OUTCOMES - B.Sc. MATHEMATICS

PSO1: **Solid Foundation in Knowledge:** Bachelor Degree in Mathematics is the culmination of in-depth knowledge of many core branches of mathematics, viz. Algebra, Calculus, Geometry, Differential Equations, Metric Space, Real and Complex Analysis including some related areas like Computer Science and Statistics. Thus, this programme helps students in building a solid foundation for further higher studies and research in Mathematics.

PSO2: **Competency in Skills:** The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning, critical understanding, analysis and synthesis in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, can also be utilised in modelling and solving real life problems.

PSO 3: **Problem Solving:** Students undergoing this programme learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. This helps them to learn behave responsibly in a rapidly changing interdependent society.

PSO4: **Interdisciplinary and Research Skills**: Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.

PSO 5: **Proficiency in Employments**: This programme will help students to enhance their employability for Government jobs, jobs in banking, insurance and investment sectors, data analysis jobs, and jobs in various other public and private enterprises.

Shri Sangameshwar Education Society's

Sangameshwar College, Solapur

[Autonomous]

Syllabus for

B.Sc III Mathematics (CBCS Pattern)

Discipline Specific Elective Course (DSE)

Semester – V

(I) Theory Papers:

Paper No.	**Title of the Paper**	**CA**	**SEE**	**Total Marks**
IX	Ring and Linear Algebra	30	70	100
X	Complex Analysis	30	70	100
XI	Real Analysis	30	70	100
XII	Partial Differential Equations (Elective - A)	30	70	100
	Number Theory (Elective - B)	30	70	100

Semester – VI

(II) Theory Papers:-

Paper No.	**Title of the Paper**	**CA**	**SEE**	**Total Marks**
XIII	Metric Spaces	30	70	100
XIV	Numerical Analysis	30	70	100
XV	Programming in C++	30	70	100

XVI	Integral Calculus (Elective A)	30	70	100
	Graph Theory (Elective - B)	30	70	100

Numerical Technique Laboratory (NTL)

NTL No.	Topic	Marks
NTL-III (A)	**S-I : Ring and Linear Algebra[6]** **S-II : Metric Spaces[6]** **+Seminar**	**70 + 30 = 100**
NTL-III (B)	**S-I : Complex Analysis [6]** **S-II : Numerical Analysis [6] + Project**	**70 + 30 = 100**
NTL-III (C)	**S-I : Real Analysis [6] S-II : Programming in C++ [6] + Study Tour/ Book review**	**70 + 30 = 100**
NTL-III (D)	**S-I : Partial Differential Equation [6]** **OR** **S-I: Number Theory [6]**	**70 + 30 = 100**
	S-II : Integral Calculus [6] **OR** **S-II: Graph Theory [6] +** **Viva Voce**	**70 + 30 = 100**

Note: [ ] The number enclosed in the brackets represents the number of assignments.

Numerical Technique Laboratory (NTL) - III: MATHEMATICS PRACTICAL-IV TO VII

NTL - III (A) - III (D) includes [Seminar / Project / Study Tour/ Book Review/ Viva-Voce]

Project: Biography of One Mathematician or One Mathematics Topic (which is not included in the syllabus up to B.Sc.-III Mathematics) about five Pages**.** **10Marks**

Seminar: Any topic in mathematics. **10Marks**

Book Reviews: Mathematics Book other than text book **10Marks**

Study Tour: Visit to any Industry / Research Institution / Educational Institution. **10Marks**

Viva Voce: Viva voce on Project, Seminar, Book review and Study Tour**. 10Marks**

(Free internet should be availed for collection of Material for Project, Seminar.)

Distribution of Marks
Theory Paper (Marks 100)

Semester End Examination (SEE):	**70 Marks**
Continuous Assessment (CA):	**30 Marks**

Scheme of Continuous Assessment

1. Unit Test:	**20 Marks**
2. Home Assignment:	**10 Marks**

Distribution of Practical Marks (100)

Practical examination will be at the end of sixth semester. The candidate has to perform eight practical, one from each group.

A. Annual Practical Examination (70) Marks: (SEE)

a) Problems from NTL (A) **70**: [S – I: 25 M + S – II: 25 M + Seminar: 10 M + J: 10 M]

b) Problems from NTL (B) **70**: [S – I: 25 M + S – II: 25 M + Project: 10 M + J: 10 M]

c) Problems from NTL (A) **70**: [S – I: 25 M + S – II: 25 M +Study tour/Book preview: 10 M + J: 10 M]

d) Problems from NTL (A) **70**: [S – I: 25 M + S – II: 25 M + Viva voce: 10 M + J: 10 M]

B. Practical: Continuous Assessment (30 Marks)

Scheme of Marking:

1. Unit Test: **20 Marks**

2. Home assignment/oral/Seminars/Conference /Industrial Visit/Group Discussion etc. on each NTL **10 Marks**

Instructions:

1. Each Theory Paper is allotted 36 hours per semester.
2. All Numerical Technique Laboratories (NTL) will be conducted treating the whole class as a single batch.
3. Total evaluation of B.Sc. III (1350 Marks.)

[Theory papers (950 Marks) + Practical NT L-III (A) to III (D) (400 Marks)]

4. The annual **Numerical Technique Laboratory [NTL - III (A) to III (D)]** will carry **100** Marks each.

5. Department of Mathematics should provide TWENTY computers per batch.

Nature of Paper of Numerical Technique Laboratory

(For NTL - III (A) to NTL - III (D))

Q. I A. Attempt any two out of four (each of 10 marks)	**Marks 20**
B. Attempt any one out of two (each of 05 marks)	**Marks 05**
Q. II A. Attempt any two out of four (each of 10 marks)	**Marks 20**
B. Attempt any one out of two (each of 05 marks)	**Marks 05**
III. Seminar/Project/Study Tour/Viva-voce/Book Review	**Marks 10**
IV. Journal	**Marks 10**
	Total Marks 70

C. Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – V

Academic Council 5(5.2)
15th June, 2022

DSE-1A Theory-I MATHEMATICS - IX (2231531)

Title: Ring and Linear Algebra

Credits: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

To learn about

- Ring, Subring, Integral domain, Field, Isomorphism and Characteristic of ring.
- Ideals and Quotient ring.
- Vector spaces, Subspaces, Linear combination, Linear dependence and independence, Basis and dimensions.

- Linear transformation, null spaces and range, Matrix representation of linear transformation, composition of linear transformation and matrix multiplication, Inevitability and Isomorphism.
- Inner Product space and Norms, Ortho-normalization Gram Schmidt process.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Get knowledge of ring, integral domain, sub-ring and field.
- Get an idea of homomorphism of ring, ideals and quotient ring.
- Familiar with vector spaces, basis and dimension of vector space.
- Understand and Linear transformation and their representation as matrices.
- Understand the inner product space.

Unit - 1: Introduction to Rings. **[10]**
1.1 Definitions and Examples
1.2 Integral Domains. Subrings
1.3 Fields
1.4 Isomorphism, Characteristic of rings

Unit - 2: Quotient Rings. **[4]**
2.1 Homomorphism of rings, ideals
2.2 Quotient Rings

Unit - 3: Vector Spaces **[10]**
3.1 Vector spaces, subspaces
3.2 Linear combination and system of linear equation
3.3 Linear dependence and independence, basis and dimensions.

Unit - 4: Linear transformation and matrices **[12]**
4.1 Linear transformation, null spaces and range
4.2 Matrix representation of linear transformation, composition of linear transformation and matrix multiplication
4.3 Inevitability and isomorphism.

Unit - 5: Inner product space **[4]**
5.1 Inner products and Norms.
5.2 Ortho-normalization Gram Schmidt process.

Recommended books (Scope of Syllabus):
Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition.
Unit - 1: Chapter - VI: Art. 24, 25, 26, 27
Unit - 2: Chapter - IX: Art. 38, 39
Linear Algebra Fourth Edition by Stephen H. Friedberg, Arnold J. Insel Lawrence E. Spence Prentice Hall of India New Delhi (EEE)
Unit 3: Chapter - I (Vector Spaces): Art. 1.2 to 1.6
Unit 4: Chapter-II (Linear transformation and matrices):Art.2.1to2.4

Unit 5: Chapter - VI (Inner product space) Art. 6.1, 6.2

Reference Books:

1. Contemporary Abstract Algebra by Joseph A. Gallian, Fourth edition Narosa Publication.
2. A First Course in Abstract Algebra by J. B. Fraleigh, Pearson Education 7th edition.
3. University Algebra by N.S. Gopalkrishnan
4. Fundamental of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen, Mc. Graw Hill International Edition.
5. Liner Algebra by Vivek Sahai & Vikas Bist, Narosa Publishing House.
6. Topics in algebra by John Wiley & Sons and by I.N. Herstein
7. Abstract algebra by K.S. Bhambri and Khanna Vijay.
8. An introduction to Linear Algebra by V. Krishnamurthy, Ewp. East West Pvt Ltd.

B.Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – V

Academic Council 5(5.2)
15th June, 2022

DSE-2A Theory-II MATHEMATICS - X (2231532)

Title: Complex Analysis

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

To learn about

- Analytic function, Necessary and Sufficient condition of analytic function, C-R equations and C-R equations in polar form.
- Method of constructing analytic function.
- Complex integral, some properties of complex integral, Line integrals, Expansions of Analytic functions as power series.
- Classification of singularities, Calculus of residues and its applications in the evaluation of integrals.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Get an idea of complex differentiation, Necessary and sufficient condition of analytic function, Cauchy-Riemann Equations.
- Understand complex integral, Taylor's, Maclaurin's and Laurent's series, Type of Singularities.
- Develop an understanding of residues, Cauchy residue theorem, Evaluation of integrals.

Unit - 1. Analytic Functions **[8]**

Limits and Continuity, Complex Differentiation, Analytic function, Necessary and sufficient condition of analytic function, C-R equations, Method of constructing a regular function and analytic function, Simple method of constructing analytic function, Polar from of Cauchy-Riemann Equations.

Unit - 2: Complex Integration **[16]**

Introduction, Some basic definitions, Complex integral, Reduction of complex integrals to real integrals, Some properties of complex Integrals, An estimation of a complex integral, Line integrals as functions of arcs, Cauchy's Fundamental Theorem (Theorem-I), Cauchy Goursat Theorem [Statement Only], Cauchy's Integral formula [Statement only], its consequences and examples, Derivative and higher order derivatives of an analytic function [Statement(s) only] and examples, Expansions of Analytic functions as power series (Taylor's Maclaurin's and Laurent's Series [Statement only]) and its examples, The zeros of an analytic function, Different Types of Singularities, Some Theorems on Poles and other Singularities (Theorem-I to IV only) and its examples, The point at infinity

Unit - 3: Calculus of Residues **[12]**

Residue at simple pole, Residue at a Pole of order greater than unity, Residue at infinity, Cauchy's Residue Theorem. Evaluation of Definite integrals, Integration round the unit Circle.

Evaluation of $\int_0^{2\pi} f(cos\theta,\ sin\theta)d\theta$.

Recommended Book (Scope of Syllabus):

1. Functions of Complex Variable by J.N. Sharma Revised by Dr. Shanti Swarup, (38 Edition) Krishna Prakashan Media Ltd., Meerut.

Chapter - 2 (Analytic Functions): 1 to 7

Chapter - 6 (Complex Integration): 1 to 8, 9 (Statement only), 19 (Theorem-1, Theorem- II (Statements only), 20, 21, 22 [Theorems I to IV only], 23. 24.

Chapter- 7 (Calculus of Residues): 1 to 6.

Reference Books:-

1. Graduate texts in mathematics functions of one complex variable – J.B.Conway.

2. Theory of functions of a complex variables- Shanti Narayan , P.K.Mittal, Chand Publication.

3. A function of complex variable by A.R.Vashishtha.

4. Complex variables and applications by J.W.Brown , J.R.Churchill.
5. A pathway to complex analysis by S. Kumaresen. Techno world
6. Complex analysis Through Examples and Exercise. Endre Pap. Kuwer Academic Publishers.

B.Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – V

Academic Council 5(5.2)
15th June, 2022

DSE-3A Theory-III MATHEMATICS - XI (2231533)

Title: Real Analysis

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

This course is intended to expose you to the basic ideas of Real Analysis. In particular,

1. To learn about:

- Operation on sets, function between sets, properties of functions and countable sets.

- Learn to work with infinite sequences and series.
- Sequences and Limits of Sequences, algebra of limits and convergence and divergence of sequences.
- Bounded and monotone sequences.
- Calculate the limit superior, limit inferior, and the limit of a sequence.
- Find the sequence of partial sums of an infinite series.
- Find the sum of a convergent series.
- Recognize alternating, convergent, conditionally and absolutely convergent series.
- The tests/tools to find the convergence/divergence of a series using comparison test, practical test, p-test, root test etc.

2. The course is all about mathematical proofs. You will have to

- Study examples
- Memorize definitions and theorems.
- Learn certain proof techniques.

Definitions, theorems, techniques etc. these are your mathematical tools and as a bare minimum you have to know what they are.

- Learn when certain theorems apply and when they do not.
- Explain what a definition or theorem says.
- Identify the correct definitions and theorems to deal with unknown problems.
- Combine different definitions, theorems and techniques.
- Solve problems you have never seen before.
- Draw conclusions from your proofs.
- Learn how to avoid common pitfalls.
- Explain your solutions to others.

3. Actively participate in this class:

- Be present; ask questions; answer questions; take notes.

- Contribute your thoughts and ideas.
- Communicate with other students outside class. Working with a group of other students is highly encouraged, but not during the exams!
- Present your ideas to other students.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Have a working knowledge on the concepts and theorems of functions of one variable.
- Study various types of sets and relations, and concept of countable and uncountable
- Be able to comprehend and critically reflect on mathematical statements and their proofs and to write their own formal proofs of mathematical results.
- Have developed a higher capacity for abstract and rigorous mathematical reasoning.
- Have gained a thorough grounding in modern Real Analysis, including key concepts such as convergence, continuity of a sequence of real numbers.
- Study concept of sequence and series and hence find sum of infinite terms with different methods.
- Understand the series of real numbers with practical tests to check the behavior of the series.

Unit - 1. Sets and Function **[12]**

1.1 Sets and elements
1.2 Operations on sets
1.3 Functions
1.4 Real Valued functions
1.5 Equivalence , countability

Unit - 2. Sequences of real numbers **[12]**

2.1 Definition of sequence and subsequence

2.2 Limits of sequence

2.3 Convergent sequence

2.4 Divergent sequence

2.5 Bounded sequence

2.6 Monotonic sequence

2.7 Operations on convergent sequence

2.8 Operations on convergent sequence

2.9 Limit superior and limit inferior

2.10 Cauchy sequence

Unit - 3. Series of real numbers **[12]**

3.1 Convergence and divergence

3.2 Series with non negative terms

3.3 Alternating Series

3.4 Conditional convergence and absolute convergence

3.5 Test for absolute convergence (Comparison test, Ratio test, Root test)

3.6 Series whose terms from non increasing sequences

Recommended Book (Scope of Syllabus):

Scope: Methods of Real Analysis by R. R. Goldberg John wiley & sons 1976

Unit – 1: Problems on sets and function (Art: 1.1 to 1.5)

Unit – 2: Problems on real Sequences (Art: 2.1 to 2.10)

Unit – 3: Problems on Series of real number (Art: 3.1 to 3.4, 3.6, and 3.7)

Reference Books:-

1. A First course in Mathematical Analysis by D.Somasundaram & B.Choudhary Narosa Publishing House.

2. Mathematical Analysis second edition by S.C.Malik and Svita Arora.

3. Principles of Mathematical Analysis by Rudin W. McGraw – Hill , New York.

4. A Course of Mathematical Analysis by Shanti Narayan S.Chand and company New Delhi.

5. A Course of Mathematical Analysis by Shanti Narayan revised by P K Mittal S.Chand and company New Delhi.

6. Introduction to real analysis by Robert Bartle and Donald Sherbert Fourth edition John Wiley and sons.

7. Real analysis by N L Carothers. Cambridge University Press.

8. Introduction to real analysis by S K Mapa SARAT book distributor.

9. Real Analysis by Hari Kishan A pragati edition.

B.Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – V

DSE-4A (1) Theory-IV MATHEMATICS - XII (2231534)

Title: Partial Differential Equations

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

- Introduce to partial differential equations.
- Introduce students, how to solve linear Partial Differential with different methods.
- To learn about

  - To classify the partial differential equations.

  - Formation of PDEs.

  - How to derive the methods of solution for PDE.

  - CI, PI, SI and GI of LPDE with constant coefficients.

  - Short methods of finding particular integrals of homogeneous and non-homogeneous LPDEs.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Learn formation of PDE and methods to solve first order Partial Differential Equations
- Learn linear and non-linear PDEs and their methods of solution.
- Find the solution of Homogeneous and non-Homogeneous linear PDE using various methods
- Find CI, PI, GI, and SI.

Unit - 1: Linear Partial differential equation of order one **[12]**

1.1 Formation of partial differential equation by eliminating arbitrary constants

1.2 Formation of partial differential equation by eliminating arbitrary functions.

1.3 Types of integrals of partial differential equation

1.4 Lagrange's Method of solving linear partial differential equation of order one namely $Pp + Qq = R$ (Working rule for solving $Pp+Qq = R$ by Lagrange's Method).

1.5 Integral surface passing through a given curve

Unit-2: Non Linear partial differential equation of order one **[12]**

2.1 Complete integral, particular integral, singular integral and general integral.

2.2 Solution of first order partial differential equation by Charpit's Method.

2.3 Special methods of solution applicable to certain standard form I, II, III, IV.

Unit-3: Homogeneous linear partial differential equation with constant Coefficient [12]

3.1 Homogeneous and Non – Homogeneous linear partial differential equation with constant coefficient

3.2 Solution of a linear partial differential equation with constant coefficients

3.3 Method of finding complementary function and working rule for finding complementary function (C.F.)

3.4 Method of finding particular integral (P.I.)

3.1 Short methods when $f(x,y)$ is $\varphi(ax+by)$ and $x^m y^n$.

Unit- 4: Non-homogeneous linear differential equations with constant coefficient

[7]

4.1 Non-homogeneous linear partial differential equations with constant coefficients

4.2 Reducible and irreducible linear differential operators

4.3 Reducible and irreducible linear differential equations with constant coefficients

4.4 Theorem when the operator function F(D,D') is reducible

4.5 Determination of complementary function(C.F.) and its working rule.

4.6 Method of finding CF

4.7 Determination of P.I. of non-homogeneous linear differential equations (General and special methods of fining P.I.)

Recommended Book (Scope of syllabus):

1. Ordinary and partial differential equation by M.D. Raisinghania, S. Chand Co. [PART - III] 19th edition.

Unit - 1: Chapter -1: 1.1 to 1.12, 2.1 to 2.12

Unit - 2: Chapter -3: 3.1 to 3.21

Unit - 3: Chapter - 4: 4.1 to 4.13

Unit – 4: Chapter – 5: 5.1 to 5.15

Reference Books:

1) Elements of partial differential equations by IAN Sneddon (International students edition by MC Graw Hill Book)

2) Differential equations Sharma & Gupta (Krishna Prakashan Media (P) Ltd. Meerut)

3) Introduction to Partial differential equations – K. Sankara Rao, PHI Publication

4) Partial Differential Equations by J.M. Kar.

5) Partial differential equations with Numerical solutions Nagendra Kumar and Rakesh Kumar.

6) Ordinary and Partial Differential equations by Nita H Shah EEE.

7) Partial Differential equations by Phoolan Prasad. New Age international publications.

OR

Academic Council 5(5.2)
15th June, 2022

DSE-4A (2) Theory-IV MATHEMATICS - XII (2231535)

Title: Number Theory

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

To learn about:

- The theory of congruences, Chinese reminder theorem, Fermats theorem, and Wilsons theorem.
- The Mobius inversion formula, Euler's Phi functiona and theorem.
- The Euler‟s criterion, The Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruences with composite moduli.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Understand Theory of Congruence's.
- Get an idea of Number Theoretic Function.
- Develop an understanding of Prime roots and Indices.

Unit I: Theory of Congruence's

Theory of congruences, Basic properties of congruences, Binary and decimal representation of integers, Linear congruences and Chinese Remainder theorem, Pierre de Fermat theorem, Fermat's little theorem and pseudo primes, Wilson‟s theorem.

[12]

Unit-II: Number Theoretic Functions

The sum and number of divisors ,The Mobius Inversion Formula ,The greatest integer function, an application to the calendar , Eulers Phi Function , Eulers Theorem and properties. [12]

Unit III: Prime Roots and Indices

The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots, Euler‟s criterion, The Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruences with composite moduli. [12]

Reference Books:

1. David M. Burton, "*Elementary Number Theory*" Tata McGraw-Hill Pub. VI Edition.
2. Tom M. Apostol, "*Introduction to Analytic number theory*" Narosa Publishing house 1980.
3. A course in arithmetic- J.P. Serre. GTM Vol.7, Springer Verlage 1973
4. Number theory by Kenneth H Rosen. Pearson.
5. Number Theory by Pundir and Pundir. Pragati Prakashan.

Academic Council 5(5.2)
15th June, 2022

DSE-1B Theory- V MATHEMATICS - XIII (2231631)

Title: Metric spaces

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

To learn about:

- The various spaces and their properties like Schaurtzs and Minkowskis etc.
- Limit, continuity and algebra of real valued functions.
- The metric as a distance function and their applications.
- The continuous metric spaces
- Closet and open sets
- Open covering and Heine-Borel Property

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Equip students with basic mathematical tools such as open & close sets, continuity, completeness, totally boundedness and compactness which can be used to study general topology and real & complex analysis.
- Enhance abstract thinking and visualization of students.
- Generalize the notion of distance, convergence and continuity of functions in metric spaces.
- Define the closure of a set and open balls and used them in writing proofs.
- Understand the concept of Heine-Borel property and their results.
- Increase problem solving ability by solving examples and counter-examples of various concepts involved.

Unit - 1: Limits and metric spaces [12]

1.1 The Class l^2 (Schwartz, Minkowski inequality)

1.2 Limit of a function on the real line

1.3 Metric Spaces

1.4 Limits in metric spaces

Unit - 2: Continuous functions on metric spaces **[12]**

2.1 Functions continuous at a point on the real line

2.2 Reformulation

2.3 Function continuous on a metric space

2.4 Open Sets

2.5 Closed Sets

Unit - 3: Completeness and Compactness **[12]**

3.1 More about open sets

3.2 Bounded sets and totally bounded sets

3.3 Complete metric spaces

3.4 Compact metric spaces

3.5 Continuous functions on compact metric spaces.

Recommended Book (Scope of Syllabus):

Scope: Methods of real analysis by R.R. Goldberg John Wiley & Sons 1976.

Unit - 1: Art: 3, 10, 4.1 to 4.3.

Unit - 2: Art: 5.1 to 5.5.
Unit - 3: Art: 6.1, 6.3, 6.4, 6.5, and 6.6.

Reference books:

1. A first course in mathematical analysis by D. Somasundaram & B.Choudhary Narosa Publishing House.

2. Mathematical Analysis second edition by S.C. Malik & Savita Arora.

3. Principles of Mathematical analysis by Rudin W. McGraw-Hill, New York.

4. A Course of Mathematical Analysis by Shanti Narayan S. Chand & Company New Delhi.

5. Metric space – Pundir and Pundir.

6. Analysis IV Metric spaces by R Kumar Vardhaman Publications.

7. Metric Spaces by P K Jain and Khalil Ahmad. Narosa publication house.

8. Topics In Analysis -II Metric Spaces by M K Singal and Asha Rani Singal. R Chand and Co.

B.Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – VI

Academic Council 5(5.2)
15th June, 2022

DSE-2B Theory- VI MATHEMATICS - XIV (2231632)

Title: Numerical Analysis

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

To learn about

- Finite differences, Differences of polynomial and Relation between the operators.
- Newton's forward and backward interpolation formula, Central difference interpolation formula Gauss's forward and backward interpolation formula, Stirling's formula and Lagrange's interpolation formula.
- Numerical differentiation, Formula for derivatives, Maxima and minima of a tabulated function, Numerical Integration, Quadrature formulae (Trapezoidal rule, Simpson's 1/3 Rule and Simpson's 3/8 th rule).
- Formation of difference equations, Linear difference equation, Rules for finding the Complementary function, Rules for finding the Particular Integral and Difference equations reducible to linear form.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Understand finite differences.
- Get knowledge of interpolation.
- Get an idea of numerical differentiation and integration.
- Understand difference equation.

Unit - 1: Finite Differences **[8]**

1.1 Introduction

1.2 Finite differences

1.3 Differences of Polynomial

1.4 Relation between the operators

Unit - 2: Interpolation **[12]**

2.1 Introduction

2.2 Newton's forward interpolation formula

2.3 Newton's backward interpolation formula

2.4 Central difference interpolation formula

2.5 Gauss's forward interpolation formula

2.6 Gauss's backward interpolation formula

2.7 Stirling's formula

2.8 Interpolation with unequal Intervals

2.9 Lagrange's Interpolation Formula

Unit - 3: Numerical Differentiation and Integration **[8]**

3.1 Numerical differentiation

3.2 Formula for derivatives

3.3 Maxima and minima of a tabulated function

3.4 Numerical Integration

3.5 Quadrature formulae (Trapezoidal rule, Simpson's 1/3 Rule and Simpson's 3/8 th rule)

Unit - 4: Difference Equations **[8]**

4.1 Introduction

4.2 Definitions

4.3 Formation of difference equations

4.4 Linear difference equation

4.5 Rules for finding the Complementary function

4.6 Rules for finding the Particular Integral

4.7 Difference equations reducible to linear form

Recommended Book (Scope of Syllabus):

Numerical Methods in Engineering & Science with Programs in C and C++ Nineth Edition by B.S. Grewal Khanna Publishers New Delhi.

Chapter – 6: (Finite differences): Art. 1, 2, 3, 7

Chapter – 7: (Interpolation): Art 1, 2, 3, 4, 5, 6, 7, 11, 12

Chapter – 8: (Numerical Differentiation and Integration) Art. 1, 2, 3, 4, 5 (except IV and V)

Chapter – 9: (Difference Equations) Art. 1 to 7.

Reference books:

1. Numerical Analysis and Programming in C by Pundir and Pundir (Pragati Prakashan)
2. Numerical Analysis by P. Kandasamy , K. Thilagavathy, K Gunavathi , S,Chand Publications.
3. Introductory Methods of Numerical Analysis by S.S.Sastry and by PHI
4. Numerical methods for scientific and Engineering computation by M K Jain S R K Iyengar R K Jain. New Age International Publishers.
5. Numerical Analysis with programming language C by Nizhum Rahman. LAP LAMBERT Academic Publishers.
6. Numerical Analysis by Schied F by McGraw Hill.
7. Numerical Analysis by S Ranganatham, Dr Prasad, Dr Ramesh Babu. S Chand
8. Numerical Methods by Arumugam et al. Scitech publications.
9. Numerical Methods by Dr. P Kandasamy, Dr. K Thilagavathy, Dr. K Gunavathi. S. Chand and company.

B.Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – VI

Academic Council 5(5.2)
15th June, 2022

DSE-3B Theory- VII MATHEMATICS - XV (2231633)

Title: Programming in C++

Credit: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

- To develop programming skills using the fundamentals and basics of the C language.
- To study the advantages of user defined data types that provides flexibility for application development.
- To enable effective usage of tokens, identifiers, operators, variables and constants.
- To enable effective usage of arrays, structures, functions and pointers.

- Derive appropriate numerical methods to solve algebraic and transcendental equations.
- Derive appropriate numerical methods to solve a linear system of equations.
- To learn how to write programs using C++.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Describe the procedural and object oriented paradigm with concepts of keywords, identifiers, functions, classes, data and objects.
- Describe the concept of Input and Output management.
- Demonstrate the use of various concepts of Jump and conditional statements
- Describe the concepts of array and file handling
- Understand the memory management techniques using pointers, constructors, destructors, etc.
- Write C++ Progammes to find series, addition and subtraction of numbers, matrix addition and subtraction, generate pattern, SI and CI, temp conversion, etc.

Unit - 1: Introduction to Object Oriented Programming [4]

1.1 Concept of OOP

1.2 Features of OOP

1.3 Introduction of C++

1.4 Executing and Debugging of a C++ program

Unit - 2: 'C++' Tokens and Type Casting [6]

2.1 Keywords and identifiers

2.2 Operators

2.3 Constants

2.4 Variables

2.5 Data types

2.6 Precedence of operators

2.7 Scope and life time of variables

Unit - 3: Classes & Objects [9]

3.1 Classes & Object Specifier

3.2 Defining data members and member functions

3.3 Array of objects

3.4 Managing console I/O

3.5 ‘C++’ stream classes

3.6 Formatted and unformatted console I/O

3.7 Usage of manipulators

Unit - 4: Function in ‘C++’ **[4]**

4.1 Call by reference, Return by reference

4.2 Function overloading and default arguments

4.3 Inline function

4.4 Static class members

4.5 Friend functions

4.6 Virtual Functions

Unit - 5: Constructors and Destructor **[6]**

5.1 Concept of Constructor

5.2 Types of Constructors

5.3 Memory allocation (new and delete)

5.4 Usage of destructor

Unit - 6: Operator Overloading **[4]**

6.1 Overloading Unary and Binary operators

6.2 Overloading using friend function

Unit - 7: Inheritance **[5]**

7.1 Types of inheritance

7.2 Virtual base classes and abstract base classes

7.3 Constructor and destructor in derived class

Unit - 8: Working with files **[7]**

8.1 File operations

8.2 File pointer and their manipulation

8.3 File updation with random access

Recommended Book (Scope of Syllabus):

E Balagurusamy, "Object Oriented Programming with C++ ", Tata McGraw Hill Publishing Company Limited, New Delhi, ISBN:- 13- 978-07-066907-9

[I] Programs in C by E. Balgurusamy, McGraw Hill, New-Delhi

Unit 1: 1.1- 1.7 **Unit - 2:** 2.1- 2.10 **Unit - 3:** 3.1- 3.16 **Unit 4:** 4.1-4.5

Unit 5: 5.1 - 5.9 **Unit - 6:** 6.1 - 6.5 **Unit - 7:** 7.1- 7.5 **Unit 8:** 8.1 - 8.5

Reference Books:

1. Numerical Methods in Engineering & Science with Programs in C and C++ Nineth Edition by B.S. Grewal Khanna publishers New Delhi.
2. K.R.Venugopal, Rajkumar, T. Ravishankar, "Mastering C++", TMH ,ISBN:0-07-463454-2
3. Farrel,"Object-Oriented Programming using C++",Cenage Pub, ISBN: 9788131505175
4. Parimala N.," Object Orientation through C++", Macmillan India Ltd. Publication, ISBN:- 333 02-1
5. Numerical Analysis and Programming in C by Pundir and Pundir (Pragati Prakashan
6. A Book on C, Macmillan, by Berry, R.E. and Meekings.
7. C Programming Language : An applied perspective, John Wiley & Sons The C Programming Tutor, Prentice-Hall, by Wortman, L.A. and Sidebottom.
8. C made Easy, Osbone McGraw-Hill by Schildt, H.C.
9. Let us C by Yashwant Kanetkar BPB Publications, New-Delhi.
10. Programming in C by Schaum's Outline Series, Tata McGraw Hill, EEE.

B.Sc III Mathematics (CBCS Pattern)
Discipline Specific Elective Course (DSE)
Semester – VI

Academic Council 5(5.2)
15th June, 2022

DSE-4B (1) Theory-VIII MATHEMATICS - XVI (2231634)

Title: Integral Calculus

Credits: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

In this course students will learn the basic ideas, tools and techniques of integral calculus and will use them to solve problems from real-life applications. In particular, students will learn

- To perform integration and other operations for certain types of functions and carry out the computation fluently;
- Approximation techniques for integration;
- To recognize when and explain why such operations are possible and/or required;
- To interpret results and determine if the solutions are reasonable.
- To discuss the convergence of Improper integrals using various tests.
- The convergence, conditional convergence and absolute convergence of an Improper integrals.
- How to apply the Cauchy's, Abel's, and Dirichlet's tests to study the behavior of the Improper integrals of first, second and third kind.
- To usage of Beta and Gamma function to evaluate the complicated integrals.
- To use the techniques to evaluate the multiple integrals and change of order of an integration.

Course Outcomes:

Upon completion of this course, the students will be able to:

- Determine the area and volume by applying the techniques of double and triple integrals
- Apply different methods to discuss the behavior of the Improper Integrals
- Evaluate the Improper Integrals
- Evaluate the integrals by using Beta and Gamma functions.
- Identify the types of Improper Integrals
- Apply the Abels, Dirichlets and Integral tests to discuss the absolute/conditional convergence of an Improper Integral.

Unit - 1. Improper Integrals: **[16]**

Convergence of Improper integrals of the first kind, Test of convergence of a (Positive

integrands), Necessary and sufficient condition for the convergence of improper integrals, Comparison of two integrals, A practical comparison test, Useful comparison integrals, Two useful tests, f(x) not necessarily positive general test for convergence, Absolute and conditionally convergence, Convergence of improper integrals of the second kind, Convergence at infinity (Integrand being positive), Comparison of two integrals, A useful comparison integrals, General test (for convergence at infinity and f(x) may be positive or negative), Cauchy's test for convergence, Absolute and conditionally convergence of improper integrals of second kind, Test for the absolute convergence of the integral of product, Abel's test, Dirichlet's test.

Unit - 2: Beta and Gamma function: **[10]**
Definition, Properties, Transformations of Gamma function and Beta function and relation between them, some important deductions, Duplication formula.

Unit - 3: Multiple integrals: **[10]**
Double Integrals, Cartesian and polar, Applications of Double Integration (Area of regions and Volume of a Solid only), Change of order of integration, Change of Variables, Tri.

Recommended Book:
Integral Calculas by Shanti Narayan and P.K. Mittal S.Chand publication Revised Edition - 2005.
Unit 1: 16.1 to 16.18
Unit 2: 7.1, 7.2, 7.3, 7.4, 7.5
Unit 3: 12.2, 12.3, 12.4, 12.5

Reference books:-

1. N. Pisknov, Differential and Integral Calculus, Peace Publishers, Moscow
2. P. N. Wartikar and J.N. Wartikar, A Text Book of Applied Mathematics, Vol. I, Poona Vidyarthi Griha Prakashan, Poona 30.
3. Tom M. Apostol, Calculus Vol I and II, Wiley Publication.
4. Mathematical Analysis by S.C. Malik and Savita Arora.
5. Application of Integral Calculus by A K Sharma. Discovery Publishing group.

Academic Council 5(5.2)
15th June, 2022

DSE-4B Theory-VIII MATHEMATICS - XVI (2231635)

Title: Graph Theory

Credits: 3 **Marks: 100**

Lectures: 36 Hours

Learning Objectives:

To learn about:

- Graphs – undirected and directed, simple graphs, multigraphs, degree of vertex, indegree and outdegree of vertex, Types: Null graph, Complete graph, regular graph, platonic, cycles, wheels, Bipartite, complete bipartite , subgraphs ,

Isomorphic graphs.

- Union , Intersection, Sum, Ring sum, Complements, product, composition and fusion, Paths, Cycles, Cut – vertex, cut set, Bridge, Connectedness, Matrix representation, Adjacency matrix, Incidence matrix, Planner graphs, Eulerian and Hamiltonian graphs, Eulers formula.
- Trees and their Properties, Rooted trees, Spanning trees, Construction of spanning trees, weighted graphs, Minimal Spanning trees, Tree traversal, Prefix and Postfix notation (Delete binary search tree onward).
- Base – b number system, Decimal, Binary, Octal and Hexadecimal number system and Conversions between these systems.

Course Objectives:

- Understand graph- undirected and directed, Types of graphs, Isomorphic graphs.
- Get an idea of operations on graphs.
- Get knowledge of tree and its properties, Spanning trees, Trees traversal, Prefix and Postfix notation.
- Develop an understanding of number system.

Unit – 1: Graph Theory **[12]**

Graphs – undirected and directed, simple graphs, multigraphs, degree of vertex, indegree and outdegree of vertex, Types: Null graph, Complete graph, regular graph, platonic, cycles, wheels, Bipartite, complete bipartite , subgraphs , Isomorphic graphs.

Unit – 2: Operations on Graph **[13]**

Union , Intersection, Sum, Ring sum, Complements, product, composition and fusion, Paths, Cycles, Cut – vertex, cut set, Bridge, Connectedness, Matrix representation, Adjacency matrix, Incidence matrix, Planner graphs, Eulerian and Hamiltonian graphs, Eulers formula.

Unit – 3: Trees **[10]**

Trees and their Properties, Rooted trees, Spanning trees, Construction of spanning trees, weighted graphs, Minimal Spanning trees, Tree traversal, Prefix and Postfix notation (Delete binary search tree onward).

Unit – 4: Number Systems **[10]**

Base – b number system, Decimal, Binary, Octal and Hexadecimal number system and Conversions between these systems.

Recommended Books (Scope of syllabus):

[I] **A text book of Discrete Mathematics** by Swapan Kumar Sarkar (S.Chand Co. 1st

edition

2003) Ch – 13: 13.1 to 13.12 Ch – 14: 41.1 to 14.4

[II] **Essential Computer Mathematics** by Seymour Lipshutz, Schaum's outline series

Ch-1: 1.1 to 1.3 Ch – 2: 2.1 to 2.4

Reference Books

1. Discrete Mathematics by Dr.Ranjeet singh, Manish Soni, University Book House (P) Ltd. Jaipur.
2. Discrete Mathematics and Graph theory by Purna Chandra Biswal, PHI, EEE.
3. Introduction to Discrete Mathematics by M.K.Sen, B.C.Chakraborty, Books and Allied (P) Ltd.
4. Fundamental Approach to Discrete Mathematics by D.P.Acharya, Sreekumar, New age Publishers.
5. Graph Theory by V K Balkrishnan et al McGraw Hill First edition.
6. Graph theory with applications to Engg. And computer science by Narsing Deo. Prentice Hall India Learning Pvt Ltd.
7. A text book of Graph Theory R. Balkrishnan and K Ranganathan. Springer.
8. Graph Theory with applications by C Vasudev. New Age International Pvt Ltd. First Edition.
9. A First Course in Graph Theory by Gary Chartrand and Ping Zhang. Dover Publications Inc.; illustrated edition.

B.Sc-II Mathematics (CBCS Pattern)

Practical Course

Academic Council 5(5.2)
15th June, 2022

Numerical Technique in Laboratory [NTL – III (A, B, C & D)]

NTL – III (A)

Mathematics Practical-IV (2231636)

[DSE-1A &DSE- 1B] Five periods per week

(Ring and Linear algebra + Metric Spaces)

List of Problem solving sessions for Practical-III

Credit: 4 **Marks: 100**

Lectures: 5 periods per week

Section - I: Ring and Linear algebra

Assignment-1: Rings and subrings, Integral domains and Fields

Assignment-2: Isomorphism and Characteristic.

Assignment-3: Homomorphisms of Rings. Ideals, Quotient Rings

Assignment-4: Subspaces, Liner Dependence, independence and basis

Assignment-5: Linear transformation and matrices, Kernel and range.

Assignment-6: Inverse and Composite, Inner Product Space

Section - II: Metric Spaces

Assignment-7: Metric Space-I (Examples on Metric spaces, open set, closed set, boundary set in Metric spaces)

Assignment-8: Metric Space-II (Examples on bounded set, totally bounded set and Diameter of set in Metric spaces)

Assignment-9: Metric Space-III (Examples on Limit of metric space, Cauchy sequence in Metric spaces)

Assignment-10: Metric Space-IV (Contraction, Isometry, homeomorphism in Metric spaces)

Assignment-11: Metric Space-V (Examples on cover, open cover, Dense in Metric spaces)

Assignment-12: Metric Space-VI (Examples on completeness and compactness in Metric Spaces)

NTL – III (B)

Mathematics Practical-V (2231637)

[DSE-2A &DSE- 2B] Five periods per week

(Complex Analysis + Numerical analysis)

List of Problem solving sessions for Practical-III

Credit: 4 **Marks: 100**

Lectures: 5 periods per week

Section - I: Complex Analysis

Assignment-1: Find the regular (analytic) function of which function (real, Imaginary, $+ v$, $u - v$ type.)

Assignment-2: Solving the complex integration Circle, Line and Parabola.

Assignment-3: Obtain the Taylor's and Laurent's series.

Assignment-4: Calculus of residue.

Assignment-5: Integration round the unit circle.

Assignment-6: Evaluation of integral $\int_0^{2\pi} f(cos\theta,\ sin\theta)\ d\theta$.

Section- II: Numerical Analysis

Assignment-7: Finite Differences: Example on Forward, Backward and Central difference formulae, Differences of a Polynomial, Relation between operators, (Forward (Δ), Backward (∇), Central δ, Shift (E)

Assignment-8: Interpolation-I: Examples on Newton's forwards, Newton's backward difference formulae, Central difference formulae.

Assignment-9: Interpolation-II: Examples on Gauss's forward and backward difference formulae, Stirling's formula, Lagrange's interpolation formula.

Assignment-10: Numerical Differentiation: Examples on Numerical differentiation, formula for derivatives and maxima and minima of tabulated function.

Assignment-11: Numerical Integration: Examples on Numerical integration, Trapezoidal rule, Simpson's 1/3 Rule and Simpson's 3/8 th rule.

Assignment-12: Difference Equations: Examples on Formation of difference equations, Linear difference equation, finding to Complementary function, finding the Particular Integral, Difference equations reducible to linear form.

NTL – III (C)

Mathematics Practical-VI (2231638)

[DSE-3A &DSE- 3B] Five periods per week

(Real Analysis + Programming in C++)

List of Problem solving sessions for Practical-III

Credit: 4 **Marks: 100**

Lectures: 5 periods per week

Section - I: Real Analysis

Assignment-1: Sets and Function (Numerical examples on domain, range, mapping (one – one, many – one, into, onto) inverse mapping, extension – restrictions of f and composite function)

Assignment-2: Sequence – I (n^{th} term of sequence, subsequence of sequence, relation between $\in - \delta$ in limit of sequence, existence of limit, boundedness, monotonic)

Assignment-3: Sequence – II (Convergence, Divergence, Limit superior, Limit inferior)

Assignment-4: Series – I (Examples on convergence, divergence, absolute and conditional convergence)

Assignment-5: Series – II (Test for convergence Comparison test, ratio test, p- test, Geometric series, divergence)

Assignment-6: Series – III (Test for convergence Condensation test, Raabe's test, Logarithmic test, Cauchy's integral test)

Section- II: Programming in C++

Assignment No.7: Sample Programs – I: Addition, subtraction, multiplication and division. Area, Volume of a sphere, Temperature Conversion, Simple Interest Calculation, Compound Interest Calculation, Salary Calculation, Bonus and Commission.

Assignment No.8: Sample Programs – II: Star pattern, Reverse of a given number, Fibonacci sequence, Factorial ${}^{n}C_{r}$, ${}^{n}P_{r}$, Roots of the quadratic equation.

Assignment No.9: Sample Programs – III: Maximum and Minimum, Sum of the series $1+2+3+\ldots..+n$, $1^2+2^2+3^2+\ldots.+n^2, 1^3+2^3+3^3+ \quad +n^3$, $1^2+3^2+\ldots.+(n-1)^2, 2^2+4^2+6^2+\ldots+(2n)^2$

Assignment No.10: Sample Programs – IV: Sine, Cosine, Exponential series

Assignment No.11: Sample Programs - V: Ascending and descending data. Matrix addition/Subtraction, Matrix multiplication.

Assignment No.12: Sample Programs – VI: Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 th Rule.

NTL – III (D)

Mathematics Practical-VII (2231639)

[DSE-4A &DSE- 4B] Five periods per week

(Partial Differential Equations OR Number Theory + Integral Calculus OR Graph Theory)

List of Problem solving sessions for Practical-III

Credit: 4 **Marks: 100**

Lectures: 5 periods per week

Section – I: Partial Differential Equations (Elective - A)

Assignment-1: Solve linear differential equation of first order by arbitrary constant and arbitrary function, Lagrange's method.

Assignment-2: Non linear partial differential equation of order one by Charpits method.

Assignment-3: Non linear partial differential equation of standard and P.I. for Homogeneous linear partial differential equation with constant coefficient.

Assignment-5: Find C.F. and P.I. for Non-Homogeneous linear partial differential equation with constant coefficient.

Assignment-6: Find C.F. and P.I. for equation reducible to linear differential equation with constant coefficient.

OR

Section – I: Number Theory (Elective – B)

Assignment-7: Problems on linear congruences and Remainder theorem

Assignment-8: Problems on Fermat's theorem, pseudoprimes and Wilson's theorem

Assignment-9: Problems on mobius inversion formula, Eulers Phi function and Eulers properties**.**

Assignment-10: Problems on primitive roots for primes, composite numbers having primitive roots.

Assignment-11: Problems on reciprocity, quadratic congruences with composite moduli.

Assignment-12: Legendre symbol and its properties.

Section - II: Integral Calculus (Elective - A)

Assignment-7: Improper Integral - I
Assignment-8: Improper Integral - II
Assignment-9: Beta and Gamma function - I
Assignment-10: Beta and Gamma function - II
Assignment-11: Multiple integrals - I (change of order Change of Variable)
Assignment-12: Multiple integrals - II (Area and Volume)

OR

Section – II: Graph Theory (Elective - B)

Assignment-7: Operations on graph

Assignment-8: Adjacency and incidence matrix (with graphs)

Assignment-9: Spanning tree and Minimum spanning tree

Assignment-10: Infix/Prefix and postfix and their tree

Assignment-11: Conversion of decimal to binary/octal/Hexadecimal.

Assignment-12: Conversion of binary/octal/Hexadecimal to decimal

Sangameshwar College (Autonomous), Solapur

Skill Enhancement Course

Department: Mathematics (SEC-3)

Course Title: Elementary Course in LATEX (2231536)

Semester-V

Academic Council 5(5.2)
15th June, 2022

Credit: 2 **Marks: 50**

Lectures: 36 hours

Content: **Theory (24 Hours)**

- Introduction to word Processor and Type Setting Software. Introduction to MikTex and TexStudio.
- The structure of a Latex document, Defining class of the document through \document class and using packages through \use package, \begin{document} and \end{ document}
- Text formatting and coloring commands.
- Introduction to Mathematics Environment, Writing Greek Symbols and some basic mathematics type structure like Fractions, Superscript, subscript, Overline, Underline etc.
- Matrix, Determinant and Other similar structure.
- Equations and Arrays
- Inserting pictures and tables, Defining, redefining and using Macros
- Special Environments Enumerates, Tabular, Cases etc.
- Beamer Presentation
- Advance packages

Practical (12 Hours)

- Writing application letter using Tex
- Creating matrix using Tex
- Creating table using Tex

- Creating presentation using Tex
- Mathematics formulae in Tex

- **Course Outcomes :** After successfully completing Elementary Course in LaTeX, students will be able to
  1. Successfully install LaTeX and its related components on a home/ Personal computer.
  2. Independently typeset Mathematical, Scientific and general purpose documents in a well organized manner and atmost accuracy.
  3. Use of LaTeX and various templates acquired from the course to compose Mathematical documents, Presentation and reports.

- **Evaluation:** After completion of the syllabus, exam will be conducted in the following manner:
  Marks: 50

  1. Theory – 50 Marks

- **Reference Books:**
  1. Math into LaTeX and Introduction to LaTeX and AMS LaTeX by George Gratzer
  2. The Not So Short Introduction to LaTeX 2E by Tobias Oetiker, Hubert Partl, Irene Hyna and Elishabeth Schlegl
  3. The LaTeX Companion Second Edition by Frank Mittelbach and Michel Goossens

Abbreviations:

L: Lectures	T: Tutorials
P: Practical	SEE: Semester End Examination
CA: Continuous Assessment	DSC / CC: Discipline Specific Course/ Core Course
AEC: Ability Enhancement Course	DSE: Discipline Specific Elective Paper
SEC: Skill Enhancement Course	GE: Generic Elective

Chairman
BOS in Mathematics

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Academic Council 5(5.2)
15th June, 2022

CBCS BSc. PART III SEMESTER V

AECC- C

ENGLISH FOR COMMUNICATION-III (2231501)

SEE- 35 + CA- 15 = 50 marks

COURSE CREDITS 03L+01T=04 COURSE CONTACT HOUR 60

Course Objectives:

- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:

By the end of the course the students will be able to:

- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:
Module I: Prose

1. The Gift of the Magi: O' Henry
2. The Homecoming: Rabindranath Tagore
3. The California's Tale: Mark Twain

Module II: Poetry

1. The Solitary Reaper: William Wordsworth
2. The Queen's Rival: Sarojini Naidu
3. Oh! How I faint When I

of You Do Write (Sonnet No 80) : William Shakespeare
4. The Road Not Taken: Robert Frost

Module. III: Pronunciation Skills
1) Basic Sounds in English
2) IPA Symbols
3) Phonetic Transcription
4) Stress and Intonation

Module. IV: Soft Skills
1. Types of 21st Century Skills
2. Learning Skills (4Cs)
3. Preparation for Employment

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University, Solapur (With 20% new additions & changes)

CBCS BSc. PART III SEMESTER VI

AECC- D

ENGLISH FOR COMMUNICATION-IV(2231601)
SEE- 35 + CA- 15 = 50 marks

COURSE CREDITS 03L+01T=04 COURSE CONTACT HOUR 60

Course Objectives:
- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:
By the end of the course the students will be able to:
- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:
Module. I: Prose
1. Growing Up: Joyce Cary
2. God See the Truth, but Waits: Leo Tolstoy
3. On the Rule of The Road: A. G. Gardiner

Module. II: Poetry

1. Sita:	Toru Dutt
2. My Last Duchess:	Robert Browning
3. Ode to Beauty:	John Keats
4. Song: Go and Catch a Falling Star:	John Donne

Module. III: Grammar

1. Simple and Multiple Sentences
2. Direct and Indirect Speech

Module. IV: Soft Skills

1. Literacy Skills
2. Life Skills
3. Employability Skills

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University Solapur (With 20% new additions & changes)

Chairman
BOS in English