Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited–२०२२

"B^{++}" Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

Choice Based Credit System

Syllabus: Mathematics

Name of the Course: B. Sc. III (Sem. -V & VI)

(Syllabus to be implemented June 2024)

1) Preamble

B.Sc. III Mathematics is framed to provide the tools to get the easy and precise outcome to various applications of science and technology. Also logical development of various algebraic statements can be made to develop the innovative approach of various concepts and it can be applied to various abstract things. 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

Various deductions of theorems, corollaries and lemmas will be acquired by Students. Change is the Universal truth of the nature .So our aim is that Students should learn various techniques to find solutions. Students who opted T.Y.B.SC Mathematics have to complete 8 theory courses 4 each semester , four practical entitled (Numerical Techniques in Laboratory) NTL A,B,C,D Courses (Annual). In the practical course of 400 marks students exercise the problem solving techniques for practical course A,B,C,D . The details are mentioned in the syllabus.

2) Aims

The aim of the course is to generate Intelligent and Skillful human beings with adequate theoretical and practical knowledge of the various mathematical systems. To include conceptual understanding in basic Phenomena, statements, theorems and development of appropriate problem solving skills suitable for applications and sufficient logical connectivity is provided.

3) Objective of the Course

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

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

3) To develop specific problem solving skills.

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

5) To prepare students for demonstrating the acquired knowledge.

6) To encourage student to develop skills for developing innovative ideas.

7) A student is able to apply their skills and knowledge that is translate information presented verbally into mathematical form select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

8) A Student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.

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Syllabus for B.Sc III –Mathematics Semester Pattern

Choice Based Credit System (w.e.f .2024-25)

To be implemented from Academic Year 2024-25

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class :	**B.Sc.- III Semester – V**									
Ability Enhancement Course(AECC)		**English (Business English)**	**Paper- III**	**4.0**	**--**	**--**	**100**	**80**	**20**	**4.0**
Discipline Specific Elective (DSE) **(Students can opt any one subjects among the three Subjects excluding interdisciplinary offered at B.Sc II.**		**DSE- 1 A**	**Paper- IX**	**3**	**--**	**--**	**100**	**80**	**20**	**4.0**
		DSE- 2 A	**Paper –X**	**3**	**--**	**--**	**100**	**80**	**20**	**4.0**
		DSE- 3 A	**Paper- XI**	**3**	**--**	**--**	**100**	**80**	**20**	**4.0**
		DSE- 4 A	**Paper- XII**	**3**	**--**	**--**	**100**	**80**	**20**	**4.0**
		(Add-on /- self learning)- MOOC/SWAYAM/ Skill based - certificate course – institute or university /internship/ apprenticeship		**--**	**--**	**--**	**--**	**--**	**--**	**4.0**
Grand Total				**16**	**--**	**--**	**500**	**400**	**100**	**24**
Class :	**B.Sc.- III Semester –VI**									
Ability Enhancement Course(AECC)		**English (Business English)**	**Paper IV**	**4.0**	**--**	**--**	**100**	**80**	**20**	**4.0**
DSE (Students can opt any one subjects among the three Subjects excluding		**DSE- 1B**	**Paper -XIII**	**3.0**	**--**	**--**	**100**	**80**	**20**	**4.0**
		DSE- 2B	**Paper- XIV**	**3.0**	**--**	**--**	**100**	**80**	**20**	**4.0**
		DSE- 3 B	**Paper- XV**	**3.0**	**--**	**--**	**100**	**80**	**20**	**4.0**

interdisciplinary offered at B.Sc. II.	**DSE- 4 B**	**Paper- XVI**	**3.0**	**--**	**--**	**100**	**80**	**20**	**4.0**
Total(Theory)			**16**	**--**	**--**	**500**	**400**	**100**	**20**
DSE (Practical Annual Exam)	**DSE- 1 A & B**	**Practical- IX & XIII**	**--**	**--**	**4**	**100**	**80**	**20**	**4.0**
	DSE -2 A & B	**Practical- X&XIV**	**--**	**--**	**4**	**100**	**80**	**20**	**4.0**
	DSE- 3 A & B	**Practical- XI&XV**			**4**	**100**	**80**	**20**	**4.0**
	DSE- 4 A & B	**Practical- XII & XVI**			**4**	**100**	**80**	**20**	**4.0**
Total (Practicals)					**16**	**400**	**320**	**80**	**16**
Grand Total			**32**		**16**	**1400**	**1120**	**280**	**60**

Summary of the Structure of B.Sc.Programme

as per CBCS pattern

Class	Semester	Marks-Theory	Credits-Theory	Marks-Practical	Credits-Practical	Total – credits
B.Sc.-III	V	500	24	--	--	24
	VI	500	20	400	16	36
Total		1000	44	400	16	60

B.Sc.Programme :

Total Marks : Theory + Practical's = 1000 +400 = 1400

Credits : Theory + Practical's = 44 + 16 = 60

Numbers of Papers: Theory: Ability Enhancement Course (AECC) : 02

Theory: Discipline Specific Elective Paper (DSE) :02

Theory: DSC : 08

Skill Enhancement Courses : 02

Total : Theory Papers : 10

: Practical Papers : 08

Abbreviations:

L: Lectures

T: Tutorials

P: Practical

UA: University Assessment

CA: College Assessment

DSC / CC: Core Course

AEC: Ability Enhancement Cours

DSE: Discipline Specific Elective Paper

SEC: Skill Enhancement Course

GE: Generic Elective

CA: Continuous Assessment

ESE: End Semester Examination

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B.SC.-III (MATHEMATICS) Syllabus for

CBCS pattern Syllabus w.e.f. June – 2024

Structure of the revised course:-

SEMESTER – V

(I) Theory Papers:-

Paper	Title of the Paper	Marks
IX	Algebra – II	80+ 20 = 100
X	Complex Analysis	80+ 20 = 100
XI	Real Analysis	80+ 20 = 100
XII	Partial Differential Equations (Elective - A)	80+ 20 = 100
	Operations Research (Elective - B)	80+ 20 = 100

SEMESTER – VI

(II) Theory Papers:-

Paper	Title of the Paper	Marks
XIII	Metric Spaces	80+ 20 = 100
XIV	Numerical Analysis	80+ 20 = 100
XV	Integral Calculus	80+ 20 = 100
XVI	Graph Theory (Elective - A)	80+ 20 = 100
	Programming in C (Elective - B)	80+ 20 = 100

Equivalent Subject for Old Syllabus

Sem-V

S. No.	Name of the Old Paper	Name of the New Paper
1	Paper-IX : Algebra – II	Paper-IX : Algebra - II
2	Paper-X : Complex Analysis	Paper-X : Complex Analysis
3	Paper-XI : Integral Calculus	Paper-XI : Real Analysis
4	Paper-XII : Partial Differential Equations (Elective - A)	Paper-XII : Partial Differential Equations (Elective - A)
	Paper-XII : Mathematical Analysis (Elective - B)	Paper-XII : Operations Research (Elective - B)

Sem-VI

Sr. No.	Name of the Old Paper	Name of the New Paper
1	Paper-XIII : Metric Spaces	Paper-XIII : Metric Spaces
2	Paper-XIV : Numerical Analysis	Paper-XIV : Numerical Analysis
3	Paper-XV : Graph Theory	Paper-XV : Integral Calculus
4	Paper-XVI : Integral Calculus (Elective - A)	Paper-XVI : Graph Theory (Elective - A)
	Paper-XVI : Paper-XVI : Programming in C (Elective - B)	Paper-XVI : Programming in C (Elective - B)

Numerical Technique Laboratory (NTL)

NTL No.	Topic	Marks
NTL-III (A)	**S-I : Algebra-II[6]** **S-II : Metric Space[6]** **+Seminar**	**80+ 20 = 100**
NTL-III (B)	**S-I : Complex Analysis [6]** **S-II : Numerical Analysis [6] + project**	**80+ 20 = 100**
NTL-III (C)	**S-I : Real Analysis [6]** **S-II : Integral Calculus[6]** **+Study Tour/Book review**	**80+ 20 = 100**
NTL-III (D)	**S-I : Partial Differential Equation [6]** **OR** **S-I: Operations Research[6]**	**80+ 20 = 100**
	S-II : Graph Theory [6] **OR** **S-II: Programming in C [6] + Viva Voce**	**80+ 20 = 100**

Note: [ ] Number inside bracket indicated **number of assignments**.

In Numerical Technique Laboratory: NTL - III (A) - III (D) [Project / Seminar / Study Tour/ Viva-Voce / Book Review]

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 each Theory paper (Marks 100)

University Assessment (UA): **80 Marks**

College Assessment (CA): **20 Marks**

Scheme of College Assessment

1. Unit Test: **10 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. University Practical Examination (80) Marks: (UA)

a) Problems from NTL (A) 80: [S – I: 30 M + S – II: 30 M + Seminar: 10 M + J: 10 M]

b) Problems from NTL (B) 80: [S – I: 30 M + S – II: 30 M + Project: 05 M + J: 10 M]

c) Problems from NTL (A) 80: [S – I: 30 M + S – II: 30 M +Study tour/Book preview: 10 M + J: 10 M]

d) Problems from NTL (A) 80: [S – I: 30 M + S – II: 30 M + Viva voce: 10 M + J: 10 M]

B. Practical: Internal Continuous Assessment (20 marks)

Scheme of Marking: **10 Marks:** Internal Test on each NTL and

10 Marks: Home assignment/oral/Seminars/Conference /Industrial Visit/Group Discussion/Viva, etc. on each NTL

Instructions:

1. Each Theory Paper is allotted 45 periods per semester.

2**.** All **Numerical Technique Laboratories (NTL)** (similar to Practical) will be conducted in the batch as a whole Class.

3. Total evaluation of B.Sc. III (1400 Marks.)

[Theory papers (1000 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 FIVE computers per batch of TEN Students

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Nature of paper of Numerical Technique Laboratory

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

I) Attempt THREE out of SIX (each of 10 marks) **Marks 30**

OR Attempt SIX out of EIGHT (each of 05 marks)

II) Attempt THREE out of SIX (each of 10 marks) **Marks 30**

OR Attempt SIX out of EIGHT (each of 05 Marks)

III) Seminar/Project/Study Tour/Viva-voce/Book Review **Marks 10**

IV) Journal **Marks 10**

Total Marks 80

SEMESTER-V

Paper - IX: Algebra – II

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. **[10]**

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, Inner Product **[15]**

4.1 Linear transformation, null spaces and range

4.2 Matrix representation of linear transformation, composition of linear transformation and matrix multiplication

4.3 Inervertiability and isomorphism.

4.4 Inner products and Norms

Recommended books (Scope of Syllabus):

1. **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

2. **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. 2.1 to 2.4

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

Reference Books:

1. J. B. Fraleigh: A First Course in Abstract Algebra by, Pearson Education 7th edition.

2. N.S. Gopalkrishnan: University Algebra, New Age International Publishers.

3. D.S. Malik & N. Mordeson & M.K. Sen: Fundamental of Abstract Algebra, Mc. Graw Hill International Edition.

4. Vivek Sahai & Vikas Bist: Liner Algebra by Narosa Publishing House.

5. John Wiley & Sons and I.N. Herstein: Topics in algebra, KD Publication

6. K.S. Bhambri and Khanna Vijay: Abstract algebra, S. Chand & Company

Paper – X: Complex Analysis

Unit - 1. Analytic Functions **[10]**

Complex Differentiation, Limits and Continuity, Differentiability Necessary and sufficient condition of analytic function, 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 **[20]**

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 **[15]**

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 Prakasha 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.

Paper – XI: Real Analysis

Unit - 1. Sets and Function **[15]**

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 **[15]**

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 divergent sequence

2.9 Limit superior and limit inferior

2.10 Cauchy sequence

Unit - 3. Series of real numbers **[15]**

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

Real Analysis

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

Unit – 2: (Sequences) Art: 2.1 to 2.10

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

Reference Books:-

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

2. S.C.Malik and Savita Arora: Mathematical Analysis, New Age International Publishers.

3. Rudin W.: Principles of Mathematical Analysis McGraw – Hill , New Yokr.

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

Paper-XII: Partial Differential Equations (Elective-A)

Unit - 1: Linear Partial differential equation of order one [15]

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 [15]

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

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

Unit-3: Linear partial differential equation with constant Coefficient [15]

3.1 Homogeneous and Non – Homogeneous linear partial differential equation with constant coefficient working rule for finding complementary function (C.F.), method of finding particular integral (P.I.)

3.2 Short method when f (x, y) is φ (ax + by) and $x^m y^n$

Recommended Book (Scope of syllabus):

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

Unit - 1: Chapter -1: 1.1, 1.2, 1.2a, 1.2b, 1.3, 1.4, 1.5, 1.5a, 1.5b, 1.5c, 1.5d, 1.6

Unit - 2: Chapter -2: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10

Unit - 3: Chapter - 3: 3.1, 3.2, 3.3, 3.4, 3.4A, 3.4B3.5, 3.6, 3.6A, 3.6B, 3.7, 3.8, 3.9, 3.10

Reference Books:

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

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

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

4) J.M.Kar: Partial Differential Equations, Calcutta Globe Library.

Paper- XII: Operations Research (Elective - B)

Operations Research

Unit 1. Introduction to Operations Research [5]

History, Evolution, scope and Limitations.

Unit 2. Linear Programming Problem (LPP) [15]

Statement of LPP, objective function, constraints, non negative constraints, formulation of problems as LPP, Definitions of decision variable, Slack variables, surplus variables and artificial variable, general form of LPP, standard form of LPP, canonical form of LPP, Definitions of a solution, feasible solution, basic feasible solution and an optimum solution of LPP, Solution of LPP by graphical method, simplex method, Big-M method. Duality Theory- Primal LPP, Dual LPP, Writing dual of primal problem, Examples.

Unit 3. Transportation Problem (TP) [15]

Statement of TP, balanced and unbalanced TP, formulation of TP as LPP, Initial Basic Feasible Solution , methods of obtaining initial basic feasible solution of TP : North-West Corner method, matrix minima or Least cost method, and Vogel's approximation Method, Optimum solution of TP by using Modified Distribution Method i.e.MODI Method, Examples

Unit 4. Assignment Problem (AP) [10]

Statement of AP, formulation of AP as LPP, balanced AP and unbalanced AP, relation of AP with TP, Optimal solution of AP by using Hungerian Method, AP with restrictions, Maximization in AP i.e. AP with maximum profit, Examples.

Reference Books:

1) H.A.Taha: Operations Research, Pearson Education.

2) Kantiswarup Gupta: Operations Research, S.Chand & Sons

3) S. Vajda: Linear Programming , London Methuen; New York, Eiley.

4) S. D. Sharma: Operation Research, Kedar Nath Ram Nath & Company.

SEMESTER - VI

Paper- XIII: Metric Spaces

Unit - 1: Limits and metric Spaces **[15]**

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 **[15]**

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 **[15]**

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.

Metric Spaces

Unit - 1: Limits and metric spaces Art: 3, 10, 4.1 to 4.3

Unit - 2: Continuous functions on metric spaces Art: 5.1 to 5.5

Unit - 3: Completeness and Compactness Art: 6.1, 6.3, 6.4, 6.5, 6.6

Reference books:

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

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

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

4. Shanti Nasrayan: A Course of Mathematical Analysis S. Chand & Company New Delhi. 5. Metric space – Pundir and Pundir.

Paper- XIV: Numerical Analysis

Unit - 1: Finite Differences **[10]**

1.1 Introduction

1.2 Finite differences,

1.3 Differences of Polynomial

1.4 Relation between the operators

Unit - 2: Interpolation **[15]**

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 [10]

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 [10]

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 Diffentiation and Integration) Art. 1, 2, 3, 4, 5 (except IV and V) Chapter – 9: (Difference Equations) Art. 1 to 7.

Reference books:

1. Pundir and Pundir, Numerical Analysis and Programming in C, Pragati Prakashan.

2. P.Kandasamy , K.Thilagavathy,K Gunavathi, Numerical Analysis, S,Chand Publications.

3. S.S.Sastry : Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited.

Paper - XV: Integral Calculus

Unit - 1. Improper Integrals: **[20]**

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: **[15]**

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.

Recommended Book:

Integral Calculus 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. S.C. Malik and Savita Arora: Mathematical Analysis, New Age International Publishers.

Paper-XVI: Graph theory (Elective-A)

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 onword).

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. Dr. Ranjeet singh, Manish Soni: Discrete Mathematics University Book House (P) Ltd. Jaipur.

2. Purna Chandra Biswal,: Discrete Mathematics and Graph theory, PHI, Eastern Economy Edition.

3. M.K.Sen, B.C.Chakraborty: Introduction to Discrete Mathematics, Books and Allied (P) Ltd.

4. D.P.Acharya, Sreekumar: Fundamental Approach to Discrete Mathematics New age Publishers

Paper - XVI: Programming in C (Elective-B)

Unit 1: Overview of C. **[4]**

1.1 Introduction

1.2 Importance of C

1.3 Sample C programs

1.4 Basic structure of C programs

1.5 Programming style

1.6 Executing a C program

1.7 Points to remember

Unit - 2: Constants, Variables and Data Types **[6]**

2.1 Introduction

2.2 Character Se

t 2.3 C Token

2.4 Constants

2.5 Keywords and Identifiers

2.6 Variables

2.7 Data Types

2.8 Declaration of variables

2.9 Assigning values to variables

2.10 Defining symbolic constants

Unit - 3: Operators and Expressions **[9]**

3.1 Introduction

3.2 Arithmetic Operators

3.3 Relational Operators

3.4 Logical Operators

3.5 Assignment Operators

3.6 Increments and decrement operators

3.7 Conditional operators

3.8 Bit-wise operators

3.9 Special operators

3.10 Arithmetic expressions

3.11 Evaluation of expressions

3.12 Precedence of arithmetic operators

3.13 Some computational problems

3.14 Type conversions in expressions

3.15 Operators precedence and associativity

3.16 Mathematical functions

Unit - 4: Managing Input and Output Operators [4]

4.1 Introduction

4.2 Reading a character

4.3 Writing a character

4.4 Formatted input

4.5 Formatted output

Unit - 5: Decision Making and Branching [6]

5.1 Introduction

5.2 Decision making with IF statement

5.3 Simple IF statements

5.4 The IF…ELSE Statement

5.5 Nesting of If….ELSE Statement

5.6 The ELSE…. IF ladder

5.7 The SWITCH Statement

5.8 The? : Operator

5.9 The GOTO statement

Unit - 6: Decision Making and Looping **[4]**

6.1 Introduction

6.2 The WHILE Statement

6.3 The DO Statement

6.4 The FOR Statement

6.5 Jumps in loops

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

7.1 Introduction

7.2 One dimensional arrays

7.3 Two dimensional arrays

7.4 Initializing two dimensional arrays

7.5 Multidimensional arrays

Unit - 8: User - defined Functions **[7]**

8.1 Introduction

8.2 Need for user - defined functions

8.3 A multifunction program

8.4 The form of C Functions

8.5 Return values and their types

Recommended Book (Scope of Syllabus):

[I] Programs in C by E. Balgurusamy, MeGraw 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. B.S. Grewal Khanna: Numerical Methods in Engineering & Science with Programs in C and C++ Nineth Edition publishers New Delhi.

2. Pundir and Pundir: Numerical Analysis and Programming in C, Pragati Prakashan

3.Berry, R.E. and Meekings: A Book on C, Macmillan,.

4. C Programming Language : An applied perspective, John Wiley & Sons

5.Wortman, L.A. and Sidebottom: The C Programming Tutor, Prentice-Hall,

6. Schildt, H.C.: C made Easy, Osborne MeGraw-Hill

7.Yashwant Kanetkar: Let us C, BPB Publications, New-Delhi.

8. Schaum's Outline Series: Programming in C, Tata McGraw Hill, EEE.

Numerical Techniques Laboratory [NTL-III (A) to III (D)]

Note: Each assignment is of 1.5 periods [50+25 = 75 minutes]

NTL-III (A) (Algebra - II + Metric Spaces)

(Problems on the following topics)

Section - I: Algebra - II

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) (Complex Analysis + Numerical Analysis)

(Problems on the following topics)

Section - I: Complex Analysis

Assignment-1: Find the regular (analytic) function of which function (real, Imaginary,$u+v, u-v$ 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 $\int_0^{2\pi} f(\cos\theta, \sin\theta)\mathrm{d}\theta$.

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) (Real Analysis + Integral Calculus)

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: Integral Calculus

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)

NTL-III (D) (Partial Differential Equation OR Mathematical Analysis + Graph Theory OR Programming in C)

Section – I: Partial Differential Equations

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 Charpit method.

Assignment-3: Non linear partial differential equation of standardF. 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: Operations Research

Assignment-1: Numerical examples based on Unit-1

Assignment-2: Numerical examples based on Linear Programming Problem (LPP) Part-I

Assignment-3: Numerical examples based on Linear Programming Problem (LPP) Part-II

Assignment-4: Numerical Examples Based on Assignment problem

Transportation Problem Part-I

Assignment-5: Numerical Examples Based on Assignment problem Transportation Problem Part-II

Assignment-6: Numerical Examples Based on Assignment problem

Section – II: Graph Theory

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

OR

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 $1+2+3+\ldots..+n$, $1^2+2^2+3^2+\ldots.+n^2$, $1^3+2^3+3^3+\ldots..+n^3$, $1^2+3^2+\ldots.+(n-1)^2$, $2^2+4^2+6^2+\ldots+(2n)^2$

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.

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