SOLAPUR UNIVERSITY, SOLAPUR

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Faculty of Science

Choice Based Credit System Syllabus

B.Sc.III (Sem-V&VI)-Mathematics

With effect from June-2018

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, Partial differencial Equation, Integral calculus, Metric Space, Numerical Analysis ,Laplace transform, Programmimg 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 Mathematicshave to complete 8 theory courses 4 each semester , four practicals 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 be 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.

Solapur University Solapur
Faculty of Science
Syllabus for B.Sc III –Mathematics Semester System
Choice Based Credit System (CBCS Pattern) (w.e.f .2018-19)
To be implemented from Academic Year 2018-19

Subject/ Core Course	Name and Type of paper		No of Papers/ Practicals	Hrs /Week			Total Marks per Paper	UA	CA	Credit
	Type	Name		L	T	P				
Class :	B.SC –III Semester –V									
	Ability Enhancement Course (AECC)	English		4			100	70	30	4
	Core	Subject	Algebra - II	3	--	--	100	70	30	3
	Core		Complex Analysis	3	--	--	100	70	30	3
	Core		Integral Calculus	3	--	--	100	70	30	3
	DSE-1	Subject	Partial Differential Equations (Elective - A)	3	--	--	100	70	30	3
	DSE-2		Mathematical Analysis (Elective - B)	3	--	--	100	70	30	3
Grand Total				**16**			**500**	**350**	**150**	**12**

Subject/ Core Course	Name and Type of paper		No of Papers/ Practicals	Hrs /Week			Total Marks per Paper	UA	CA	Credit
	Type	**Name**		**L**	**T**	**P**				
Class :	B.SC –III Semester –VI									
	Ability Enhancement Course (AECC)	English		4			100	70	30	4
	Core	Subject	Metric Space	3	--	--	100	70	30	3
	Core		Numrical Analysis	3	--	--	100	70	30	3
	Core		Programming in C	3	--	--	100	70	30	3
	DSE-1	Subject	Integral transform (Elective-A)	3	--	--	100	70	30	3
	DSE-2		Graph Theory & Combinatorics (Elective - B)	3	--	--	100	70	30	3
Total Theory				**16**			**500**	**350**	**150**	**12**

	Core	Subject		--	--	5	100	70	30	5
	Core	Subject		--	--	5	100	70	30	5
	Core	Subject		--	--	5	100	70	30	5
	DSE	Subject		--	--	5	100	70	30	5
Total Practicals				--	--	20	400	280	120	20
Grand Total					**16**	**20**	**900**	**630**	**270**	**44**

Equivalent Subject for Old Syllabus

Sem-V

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

Sem-VI

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

SOLAPUR UNIVERSITY, SOLAPUR

Syllabus for

B.SC.-III (MATHEMATICS)

CBCS pattern Syllabus w.e.f. June - 2018

Structure of the revised course :-

SEMESTER - V

(I) Theory Papers :-

Paper	Title of the Paper	Marks
IX	Algebra – II	70 + 30 = 100
X	Complex Analysis	70 + 30 = 100
XI	Integral Calculus	70 + 30 = 100
XII	Partial Differential Equations (Elective - A)	70 + 30 = 100
XII	Mathematical Analysis (Elective - B)	70 + 30 = 100

SEMESTER - VI

1. Theory Papers :-

Paper	Title of the Paper	Marks
XIII	Metric Spaces	70 + 30 = 100
XIV	Numerical Analysis	70 + 30 = 100
XV	Programming in C	70 + 30 = 100
XVI	Integral Transform (Elective-A)	70 + 30 = 100
XVI	Graph Theory and Combinatorics (Elective-B)	70 + 30 = 100

2. Numerical Technique Laboratory (NTL)

NTL No.	Topic	Marks
NTL-III (A)	**S-I : Algebra-II[6]** **S-II : Metric Space [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 : Integral Calculus [6]** **S-II: Programming in C [6]+Study Tour/Book review**	**70 + 30 = 100**
NTL-III (D)	**S-I : Partial Differential Equation(Elective - A) [6]** **or** **S-I : Mathematical Analysis [6] (Elective - B)+ Viva Voce**	**35+ 15=50**
NTL-III (D)	**S-II: Integral Transform[6] (Elective - A)** **or** **S-II : Graph Theory and Combinatorics [6](Elective - B) + Viva Voce**	**35+ 15=50**

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. **05Marks**

Book Reviews : Any Mathematics Book except Text Book **05Marks**

Seminar : Any topic in mathematics. **05Marks**

Book Reviews : Mathematics Book other than text book **05Marks**

Study Tour : Visit to any Industry / Research Institution / Educational Institution. **05Marks**

Viva Voce : Viva voce on Project, Seminar, Book review and Study Tour. **05Marks**

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

Instructions :

1. Each Theory Paper is allotted 45 periods per semester.
2. All **Numerical Technique Laboratory (NTL)** (similar to Practicals) will be conducted in the batch as a whole Class.
3. Total evaluation of B.Sc. III **(1200 Marks.)**

   [Theory papers **(800 Marks)**

   + [Practicals **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.**

Nature of paper of Numerical Technique Laboratory

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

Section - I

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 05
IV)	Journal	Marks 05
		Total Marks 70

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. **[05]**

4.1 Homomorphism of rings, ideals

4.2 Quotient Rings

Unit - 3: Vector Spaces **[10]**

Vector spaces, subspaces, linear combination and system of linear equation, linear dependence and independence, basis and dimensions.

Unit - 4: Linear transformation and matrices **[15]**

Linear transformation, null spaces and range, matrix representation of linear transformation, composition of linear transformation and matrix multiplication, invertibility and isomorphism.

Unit - 5: Inner product space **[05]**

Inner products and Norms.

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

Reference Books:

1. A First Course in Abstract Algebra by J. B. Fraleigh, Pearson Education 7th edition.
2. University Algebra by N.S. Gopalkrishnan
3. Fundamental of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen, Mc. Graw Hill International Edition.
4. Liner Algebra by Vivek Sahai & Vikas Bist, Narosa Publishing House.
5. Topics in algebra by John Wiley & Sons and by I.N. Herstein
6. Abstract algebra by K.S. Bhambri and Khanna Vijay

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: Integral Calculus

Unit - 1. Improper Integrals:

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. **[20]**

Unit - 2: Beta and Gamma function:

Definition, Properties, Transformations of Gamma function and Beta function and relation between them, Some important deductions, Duplication formula. **[15]**

Unit - 3: Multiple integrals:

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. **[10]**

Recommended Book:

Unit 1: 16.1 to 16.18

Integral Calculas by Shanti Narayan and P.K. Mittal S.Chand publication Revised Edition - 2005.

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.

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) 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.

Paper- XII: Mathematical Analysis (Elective - B)

Unit - 1: Functions of a Single Variable (I) **[15]**

1.1 Limits

1.2 Continuous functions

1.3 Functions continuous on closed intervals

1.4 Uniform continuity

Unit - 2: Functions of a Single Variable (II) **[15]**

2.1 The Derivative

2.2 Continuous functions

2.3 Increasing and decreasing Functions

2.4 Darboux's Theorem

2.5 Rolle's Theorem

2.6 Lagrange's Mean Value Theorem

2.7 Cauchy's Mean Value Theorem

2.8 Higher Order Derivatives

Unit - 3: Functions **[15]**

3.1 Power series

3.2 Exponential functions

3.3 Logarithmic functions

3.4 Trigonometric functions

3.5 Functional fquations

3.6 Functions of bounded variation

3.7 Vector - Valued functions

Recommended Books :

1) Mathematical Analysis by S. C. Malik and Savita Arora by S. New Age International Publishers.
2) Methods of Real Analysis by R.R. Goldberg.

Reference Books:

1) Elements of Real Analysis : Shanti Narayan, Dr. M. D. Raisinghania, S. Chand Publication

2) Principles of Mathematical Analysis - Water Rudin ,McGraw Hill
3) Intraduction to Real Analysis by R.G. Bartle ,Donald R. Sherbert.

SEMESTER - VI

Paper- XIII: Metric Spaces

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

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

1.6 Limit of a function on the real line

1.7 Metric Spaces

1.8 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. 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 Nasrayan 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. 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

Paper - XV : Programming in C

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 Set
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 Arthmetic 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 statement

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 Initialising 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. Numerical Methods in Engineering & Science with Programs in C and C++ Nineth Edition by B.S. Grewal Khanna publishers New Delhi.
2. Numerical Analysis and Programming in C by Pundir and Pundir (Pragati Prakashan)
3. A Book on C, Macmillan, by Berry, R.E. and Meekings.
4. C Programming Language : An applied perspective, John Wiley & Sons
5. The C Programming Tutor, Prentice-Hall, by Wortman, L.A. and Sidebottom.
6. C made Easy, Osbone MeGraw-Hill by Schildt, H.C.
7. Let us C by Yashwant Kanetkar BPB Publications, New-Delhi.
8. Programming in C by Schaum's Outline Series, Tata McGraw Hill, EEE.

Paper - XVI : Integral Transforms (Elective - A)

Unit 1 : Laplace Transform. **[15]**

Integral Tansform (Definition), Laplace Transform (Definition), Linearity property of Laplace Transform, Piecewise continuous functions, Existence of Laplace Transform, Functions of exponential order functions of Class A, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Laplace Transform of the derivatives of F(t), Laplace Transform of the n^{th} order derivatives of F(t), Initial value theorem, Final value theorem, Laplace Transform of Integrals, Multiplication by t, Multiplication by t^n, Division by t, Evalution of Integrals, periodic functions.

Unit 2 : The Inverse Laplace Transform. **[15]**

Inverse Laplace Transform, Null Function, Linearity Property, Table of Inverse Laplace Transform, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Use of Partial function, Inverse Laplace Transform of the derivatives, Inverse Laplace Transform of Integrals, Multiplication by powers of p, Division by powers of p, Convolution (definition), Convolution theorem, Heaviside's expansion formula, Beta function.

Unit 3 : Application of Laplace Transforms. **[15]**

Ordinary Differential equations with constant coefficients, Ordinary Differential equations with variable coefficients, Simultaneous ordinary differential equations, Partial differential equations.

Recommended Books for Paper - XIII (Integral Transform) :

Integral Transform by *Vasistha* A.R. Gupta, R.K.Krishna Prakashan *Media Pvt. Ltd. 11. Shivaji Road, Meerut India.*

Unit 1 : 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, 1.19, 1.20, 1.21.

Unit 2 : 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17

Unit 3 : 3.1, 3.2, 3.3, 3.4

Reference Books :

1. The Laplace Transform by Rainville E.D.
2. Integral Transform byDr. J.R. Goyal and K.P. Gupta, Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co.Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRC Press.
5. An introduction to Lapace Tranforms and Fourier series by Phill Dyke , Springer publication.

Paper XVI: Graph Theory and Combinatorics (Elective-B)

Unit 1: Graph **[5]**

Introduction,Basic terminology,Simple graph,Multigraph and Psuedograph, Degree of a vertex, types of graph.

Unit 2: Colorings of graph **[10]**

Vertex Coloring - evaluation of vertex chromatic number of some standard graphs, critical graph. Upper and lower bounds of Vertex chromatic Number - Statement of Brooks theorem. Edge coloring - Evaluation of edge chromatic number of standard graphs such as complete graph, complete bipartite graph, cycle, Statements of Vizing Theorem. Chromatic polynomial of graphs - Recurrence Relation and properties of Chromatic polynomials. Vertex and Edge cuts vertex and edge connectivity and the relation between vertex and edge connectivity. Equality of vertex and edge connectivity of cubic graphs. Whitney's theorem on 2 - vertex connected graphs.

Unit - 3 : Planar graph **[15]**

Definition of planar graph. Euler formula and its consequences. Non-planarity of K_5, K(3,3). Dual of a graph. Polyhedran in R and existence of exactly five regular polyhedral- (Platonic solids) Colorability of planar graphs - 5 color theorem for planar graphs, statement of 4 color theorem. Networks and flow and cut in a network - value of a flow and the capacity of cut in a network, relation between flow and cut. Maximal flow and minimal cut in a network and Ford-Fulkerson theorem.

Unit - 4 : Combinatorics **[15]**

Applications of Inclusion Exclusion Principle - Rook Polynomial, Forbidden position problems Introduction to partial franctions and using Newton's binomial theorem for real power find series, expansion of some standard functions. Forming recurrence relation and getting a generating function. Solving a recurrence relation using ordinary generating functions. System of Distinct Representatives

and Hall's theorem of SDR. Introduction to matching, M alternating and M augmenting path, Berge theorem. Bipartite graphs.

Recommended Books

A first look at Graph theory- John Clark and Derek Holton, World Scientific Publishing Company.

Reference Books :

1. A text book of Discrete Mathematics by Dr.Swapan Kumar Sarkar S.Chand Publication.

   Scope of syllabus: Unit 1. Art 13.1, 13.2, 13.3, 13.4, 13.5
2. Grapgh Theory with Applications by Bondy and Murty
3. Graph theory and applications by Balkrishnan and Ranganathan
4. Graph theory by West D. G.
5. Introduction to Combinatorics by Richard Brualdi
6. Graph theory by Behzad and Chartrand
7. Instroductory Graph theory by Choudam S.A
8. Combinatorics by Cohen
9. Graph Theory by Harrary
10. Graph Theory by Narsingh Deo

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

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

NTL-III(A) (Algbra - 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:MetricSpace-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 $S_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$.

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) (Integral Calculus + Programming in C)

Section - I : Integral Calculus

Assignment-1 : Improper Integral - I

Assignment-2 : Improper Integral - II

Assignment-3 : Beta and Gamma function - I

Assignment-4 : Beta and Gamma function - II

Assignment-5 : Multiple integrals - I (change of order Change of Variable)

Assignment-6 : Multiple integrals - II (Area and Volume)

Section- II : Programming in C

(Run and write following C programs only)

Assignment No.7 : Sample Programms - 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 Programms - II

Star pattern, Reverse of a given number, Fibbonacci sequence, Factorial ${}^{n}C_{r}$, ${}^{n}P_{r}$, Roots of the quadratic equation.

Assignment No.9: Sample Programms - III

Maximum and Minimum, Sum of the series $1+2+3+\ldots..+n$, $1^2+2^2+3^2+\ldots.+n^2$, $1^2+2^3+3^2+..n^3$, $1^2+3^2+\ldots.+(n-1)^2$, $2^2+4^2+6^2+\ldots+(2n)^2$

Assignment No.10: Sample Programms - 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, Simpon's 1/3 Rule, Simpsons's 3/8 th Rule.

NTL-III(D) (Partial Differential Equation or Mathematical Analysis)

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 Charpit method.

Assignment-3 : Non linear partial differential equation of standerd from I, II, III & IV.

Assignment-4 : Find C.F. 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 : Mathematical Analysis (Elective-B)

Assignment-1 : Limits, Continuous Functions.

Assignment-2: Functions Continuous on closed Intervals, Uniform continuity.

Assignment-3: Increasing and decreasing functions, continuous functions.

Assignment-4: Rolle's theorm, Lagrange's MVT & Cauchy's MVT, High Order derivatives.

Assignment-5: Exponential Functions, logarithmic functions, Trigonometric functions.

Assignment-6: Functional Equations, Functions of Bounded Variations, Vector - valued functions.

Section- II : Integral Transform (Elective-A)

Assignment-7 : Laplace Transforms (Numerical examples)

Assignment-8: Inverse Laplace Transform (Numerical Examples)

Assignment-9: Applications of Laplace Transform Ordinary Differential equations with constant coefficients,

Assignment-10: Applications of Laplace Transform Ordinary Differential equations with variable coefficients,

Assignment-11: Applications of Laplace Transform Simultaneous Ordinary Differential equations.

Assignment-12: Applications of Laplace Transform Partial Differential equations.

OR

(Graph Theory & Combinatorics)

Section- II : Graph Theory & Combinatorics (Elective-B)

Assignment-7 : Coloring of Graphs

Assignment-8: Chromatic polynomials and connectivity.

Assignment-9: Planar graphs

Assignment-10: Flow theory

Assignment-11: Inclusion Exclusion Principle and Recurrence relation.

Assignment-12: SDR and Mathching.

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