Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B^{++}'Grade (CGPA2.96)

Name of the Faculty: Science &Technology

(As per New Education Policy 2020)

Syllabus: Mathematics

Name of the Course: B.Sc. I (Sem. I & II)

(Syllabus to be implemented from June 2024)

Preamble:

The B.Sc. I Mathematics program is designed to provide students with a strong foundation in the fundamental concepts and principles of Mathematics. Mathematics, as the language of nature and science, plays a pivotal role in understanding complex systems, solving real-world problems, and advancing technology. In the first year of this program, students will be equipped with analytical and logical thinking skills that are essential for exploring deeper mathematical theories and for applying mathematical methods to a variety of fields. This program also encourages the development of problem-solving techniques, computational skills and the ability to think abstractly.

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 includeconceptual understanding in basic Phenomena, statements, theorems and development of appropriate problem solving skills suitable for applications and sufficient logical connectivity has provided.

Program Outcomes:

1. Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
2. Ability to pursue advanced studies and research in pure and applied mathematical science.
3. Ability to relate scientific knowledge to real-world phenomena and applications.
4. Equipped with the skills and knowledge to pursue careers in industries such as research, teaching, healthcare, environmental science, data science, or technology.
5. Develop critical thinking and analytical reasoning skills to identify, assess and solve complex scientific problems.

Program Specific Outcomes:

1. A student should be able to recall basic facts about Mathematics and should be able to display knowledge of conventions such as notations, terminology.
2. Enabling students to develop a positive attitude towards Mathematics as an interesting and valuable subject of study.
3. Formulate and develop mathematical arguments in a logical manner.
4. Utilize Mathematics to solve theoretical and applied problems by critical understanding, analysis.
5. Develop the ability to conduct independent research in Mathematics or related interdisciplinary fields.
6. Develop a strong foundation in core areas of Mathematics, including calculus, algebra, analysis, geometry and differential equations.
7. Understanding of ethical issues in Mathematics and its applications.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Syllabus of : B. Sc. Part-I-Mathematics (Major)

PAH SOLAPUR UNIVERSITY, SOLAPUR Course Name- Mathematics (As per NEP 2020)					
Semester – I					
Course Code	**Title of Papers**	Distribution of Marks for Examination			**Total credit**
		CA	UA	Total	
DSC1-1 (2+2)	Paper-I- Algebra and calculus **G04-0110**	20	30	50	2
DSC1-2 (2+2)	To be selected from Other than Botany	40	60	100	4
DSC1-3 (2+2)	To be selected from Other than Botany	40	60	100	4
PRDSC1-1 (2)	Practical based on DSC1-1 **G04-0110 P**	20	30	50	2
GE 1/OE1(2)	**Quantitative Aptitudes for Competitive Examinations G04-GE-OE- 0110**	20	30	50	2
SEC 1 (2)	**Programming in C Part-I G04-SEC-0110**	20	30	50	2
L1-1 (2)	English **ENG-0110**	20	30	50	2
IKS (2)	IKS **IKS- 0110**	20	30	50	2
VEC1 (2)	Constitution of India **ICD-0110**	20	30	50	2
FP/RP/CC	-	-	-	-	-
Total Marks + Credit for Semester - I		**220**	**330**	**550**	**22**
Semester - II					
DSC1- 2-1 (2+2)	**Geometry and Differential Equation G04-0210**	20	30	50	2
DSC1-2-2 (2+2)	To be selected from Other than Botany	40	60	100	4
DSC1-2-3 (2+2)	To be selected from Other than Botany	40	60	100	4
PRDSC1-2	Practical based on PRDSC1-2 **G04- 0210P**	20	30	50	2
GE/OE-2 (2)	**Logical Reasoning (Verbal) G04-GE-OE -0210**	20	30	50	2
SEC 2 (2)	**Programming in C Part-II G04-SEC- 0210**	20	30	50	2
L1-2(2)	English **ENG- 0210**	20	30	50	2
VEC2(2)	(Environmental Studies) **ENG-24**	20	30	50	2
FP/RP/CC	NCC/NSS/Culture/sports/Social activities	20	30	50	2
Total Marks + Credit for Semester - II		**220**	**330**	**550**	**22**
Total Marks + Credit for Semester - I		220	330	550	22

SEMESTER-I				
Subject (Major)	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
Mathematics DSC1- 1	Paper-I- Algebra and calculus **G04-0110**	2	2	30
Practical-I (DSC1-1)	Practical-I **G04-0110P**	2	4 (hours/week/batch)	60
SEMESTER-II				
Mathematics DSC1- 2	Paper-II- Geometry and Differential Equation **G04-0210**	2	2	30
Practical-II (DSC1-2)	Practical-II **G04-0210P**	2	4 (hours/week/batch)	60

Semester -I

Paper Name: Algebra and Calculus (Major)	Course Code: G04-0110
Paper Number : DSC 1-1	Credits: 02

Course Objectives: The course will enable the students to

1) Find limit, continuity and partial derivatives of function of two variable
2) Find eigenvalues and corresponding eigenvectors for a square matrix.
3) Solve the system of homogeneous and non-homogeneous linear equations.
4) Employ De Moivre's theorem in a number of applications to solve numerical problems.

Course Outcomes: At the end of the course students will be able to:

1) Learn partial derivative, successive derivative of given function.
2) Learn solutions of linear homogeneous and non homogeneous equations
3) Understand the roots of real as well as complex numbers

4) Learn conceptual various variations while advancing from one variable to several variable in calculus, vector calculus.

(Contact Hours-30)

Unit I (A): Matrices and Linear Equations:

Elementary transformations, Rank of a Matrix (Echelon and Normal form), Characteristic equation of a matrix, Cayley Hamilton theorem and its use in finding the inverse of a matrix. Application of matrices to a system of linear (both Homogeneous and Non-homogeneous) equations, Eigen values and Eigen vectors. [8]

Unit I (B): Complex numbers:

Introduction to Complex Number, De Moivre's Theorem and its applications, Roots of Unity, Roots of Complex Numbers [7]

Unit. II (A): Differentiation:

Successive differentiation, n^{th} derivatives of some standard functions, Leibnitz's Theorem, Taylor's theorem and Maclaurin's Theorem (Statements only), Series expansions of e^x, $\sin x$, $\cos x$,$(1+x)^n$ $\log(1+x)$. [8]

Unit. II (B): Function of two variables and Vector Calculus:

Limit and Continuity of function of two variables, Partial derivatives, Partial derivative of higher orders, Homogeneous functions, Euler's Theorem on Homogeneous functions and its corollaries. Scalar point function, Vector point function, Gradient, Directional derivatives, Divergence, Curl and its properties. [7]

Semester –I

Paper Name: **Practical-I (Major)**	Course Code: G04-0110-P
Paper Number : DSC 1-1	Credits: 02

Course Objectives: The course will enable the students to

1) Solve system of linear equation.
2) Solve the system of homogeneous and non-homogeneous linear equations.
3) Be familiar with the techniques of limit, continuity and derivative of functions of two variables.
4) Find directional derivative, gradient, divergence, curl.
5) Apply Euler theorem and its corollaries

Course Outcomes: At the end of the course students will be able to

1 Find rank, normal form of matrix.
2 Find n^{th} roots of a complex number.
3 Calculate higher order partial derivatives.
4 Determine the homogeneous function of any degree and apply Euler's theorem

(Contact Hours- 60)

Title of the Practical	Contact Hours	Credits
Assignment No. 1. Rank of Matrix.(Row echelon and Normal form) Assignment No. 2. Inverse of Matrix by Cayley-Hamilton Method. Assignment No. 3. Solution of system of Linear Homogenous and Non-homogenous equation Assignment No. 4. Eigen values and Eigen vectors. Assignment No. 5. n^{th} roots of a complex number. Assignment No. 6 Applications of Leibnitz's Theorem. Assignment No. 7. Partial Differentiation Assignment No. 8. Examples on Euler's Theorem on Homogeneous functions Assignment No. 9. Numerical examples on directional derivative, gradient. Assignment No.10. Numerical examples on divergence, curl.	**60**	**2.0**

Semester –II

Paper Name: Geometry and Differential Equation (Major)	Course code : G04-0210
Paper Number: DSC 1-2	Credits: 02

Course Objectives: The course will enable the students to

1) Explain the properties of two and three dimensional shapes;
2) Explain rotation , translation and rotation followed by translation and translation followed by rotation with change of axis
3) Solve exact differential equation, Bernoulli's equation.
4) Solve linear differential equation with constant coefficient.

Course Outcomes: At the end of the course students will be able to

1) Explain the properties of three-dimensional shapes.
2) Introduce the analytical geometry of 2 dimensional space.
3) Identify the equation in various form of circle, planes, sphere, cones etc.
4) Understand the genesis of ordinary differential equations.
5) Learn various techniques of getting exact solutions of solvable first order differential equations and linear Differential equations of higher order.

(Contact Hours-30)

Unit I (A):-Change of Axis:

Translations, Rotations, Translations and Rotations, Invariants, Identifications of conics from general form of second degree equations.

[8]

Unit I (B):-Plane:

General equation of plane, Normal equation, Intercept form, Angle betweentwo planes, Plane through three points, Plane through a given point, Two sides of a Plane, Distance of a point from a plane, Family of planes.

[7]

Unit II(A):- Differential Equations of first order and first degree:

Exact differential equations, Necessary and Sufficient condition for exactness, Integrating Factor with four rules, Linear differential equations of the form: $\frac{dy}{dx} + Py = Q$, Bernoulli Equation. $\frac{dy}{dx} \pm Py = Qy^n$ **[8]**

Unit II(B):- Linear Differential Equations with Constant Coefficients: **[7]**

Complementary function and particular integral, General solution of $f(D)y = X$, Solution of $f(D)y = 0$ for non-repeated , repeated for both real roots and complex roots. Solution of $f(D)y = X$, where X is of the form e^{ax} , sin ax ,cos ax , x^m , $e^{ax}\,V$

Semester –II

Paper Name: Practical-II: Mathematics (Major)	Course code : G04-0210-P
Paper Code: DSC 1-2	Credits: 02

Course Objectives: The course will enable the students to
1) Identify the conics, translation of axis, and rotation of axis
2) Solve differential equation of first order and first degree.
3) Solve linear differential equation with constant coefficient.

Course Outcomes: At the end of the course students will be able to
1) Learn the equation in various forms of circle, planes, sphere, cones etc.
2) Learn problems based on spheres, planes and conics
3) Understand polar equations and Cartesian equations
4) Enable to solve ordinary differential equations.
5) Learn to find complementary function and particular integral.

(Contact Hours- 60)

Title of the Practical	Contact Hours	Credits
Assignment No. 1. Translation. Assignment No. 2. Rotations. Assignment No. 3. Identification of Conics Assignment No. 4. Family of Planes. Assignment No. 5. Exact differential equation Assignment No. 6. Linear and Bernoulli Equation. Assignment No. 7. Solution of $f(D)y = 0$ Assignment No. 8 Solution of $f(D)y = X$, where $X = e^{ax}$ Assignment No. 9 Solution of $f(D)y = X$, where $X = x^m$, $X = e^{ax}V$ Assignment No.10 Solution of $f(D)y = X$, where $X = sin(ax), cos(ax)$	**60**	**2**

Recommended Books:-

1. Text Books of Matrices by Shanti Narayan.
2. Modern Algebra by A. R. Vashishta, Krishna Prakashan Media Co. Meerut.
3. Differential Calculus by Shanti Narayan S. Chand Publication
4. A text book of Vector Calculus, by Shanti Narayan.
5. Analytical Solid Geometry of Three dimensions, by P. K. Jain and Khalil Ahmad ,Wiley Eartern Ltd. 1994.
6. Ordinary and Partial Differential Equations By M. D. Raisinghania S. Chand Publication,New Delhi, 19th edition.
7. Differential equations, by G. S. Diwan, D. S. Agashe. Popular Prakashan Bombay.

Reference Books:-Algebra,(B. Sc. – I Paper-I) by Prof. S. J. Alandkar, Prof. N. I. Dhanshetti, Prof. A. S. Dhone Prof. R. D. Mahimkar, [Nirali Prakashan].

1. Algebra (B.Sc.-I Paper-I) by Dr. B. P. Jadhav, Prof.A.M.Mahajan, Prof. S..P..Gade, Prof. B.D. Kokare [Phadke Prakashan]
2. Calculus, (B. Sc. – I Paper-II) Mathematics- Paper-II by Prof. S. J. Alandkar,Prof. N.I.Dhanshetti, Prof. Dhone A. S. Prof. R. D. Mahimkar, Nirali Prakashan.
3. Calculus (B. Sc. I, Paper- II) by Dr. B. P. Jadhav , Prof.A.M.Mahajan , , Prof.S.P.Gade,Prof Kokare B.D . [Phadke Prakashan]
5 Geometry, (B.Sc.-I Paper-III) By Prof. S. J. Alandkar, Prof. N. I. Dhanshetti, Prof. Dhone A. S. Prof. R. D. Mahimkar,Nirali Prakashan.
6 Geometry (B.Sc.-I Paper-III) by Dr. B. P. Jadhav , Prof.A.M.Mahajan Prof.S.P.Gade, Prof. Kokare B.D. [Phadke Prakashan].
7 Differential Equation , (B.Sc. – I Paper-IV) By Prof. S. J. Alandkar, Prof. N. I. Dhanshetti, Prof. Dhone A. S. and Prof. R.D. , Mahimkar, Nirali Prakashan.
8 Differential Equations (B. Sc. I, Paper- IV) by Dr. B. P. Jadhav ,Prof.A.M.Mahajan , Prof.S.P.Gade, Prof. Kokare B.D . [Phadke Prakashan].
9. Calculus,(B. Sc. – I Paper-II)Mathematics-Paper-II by Prof.S.J.Alandkar, Prof.N.I.Dhanshetti, Prof. Dhone A.S. Prof.R.D.Mahimkar, Nirali Prakashan
10. Calculus(B.Sc.I,Paper-II)byDr.B.P.Jadhav ,Prof.A.M.Mahajan, Prof.S.P.Gade, Prof Kokare B.D. [PhadkePrakashan]
11. Geometry,(B.Sc.-IPaper-III)ByProf.S.J.Alandkar,Prof.N. I.Dhanshetti,Prof.DhoneA.S. Prof.R.D.Mahimkar,NiraliPrakashan.
12. Geometry(B.Sc.-IPaper-III)byDr.B.P.Jadhav,Prof.A.M.MahajanProf.S.P.Gade, Prof.KokareB.D.[PhadkePrakashan].
13. DifferentialEquation,(B.Sc.–IPaper-IV)ByProf.S. J. Alandkar,Prof. N. I.Dhanshetti, Prof.DhoneA.S.and Prof.R.D., Mahimkar,NiraliPrakashan.
14. Differential Equations (B. Sc. I, Paper- IV) by Dr. B. P. Jadhav ,Prof.A.M.Mahajan , Prof.S.P.Gade, Prof. KokareB.D.[PhadkePrakashan].

Syllabus of B. Sc. Part-I- Generic/ Open Elective (Mathematics)

GE/OE (Mathematics)

(Semester- I)

(Theory)

SEMESTER-I				
Subject (Minor)	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
OE-1 Mathematics	Quantitative Aptitude for Competitive Examinations	2	2	30

Paper Name: Quantitative Aptitudes for Competitive Examinations	**Course code : G04-GE-OE-110**
Paper Code: GE- 1	**Credits: 02**

Course Objectives:

During this course, the student is expected to

1. Equip students with the ability to solve a wide variety of mathematical problems efficiently and accurately, focusing on time management during competitive exams.
2. Prepare students for a wide range of competitive examinations.

Course Outcome:

At the end of this course, students will be able to

1. Students will acquire strong analytical and logical reasoning skills.
2. Students will gain confidence in applying mathematical knowledge to solve quantitative aptitude questions under the pressure of competitive exams.

(Contact Hours: 30)

Unit-1:Arithmetical Ability-I **[10]**

1.1 Number Systems
1.2 LCM and HCF
1.3 Decimal Fractions
1.4 Simplifications
1.5 Square roots and Cube roots

Unit-2: Arithmetical Ability-II **[10]**

2.1 Average
2.2 Problems on numbers
2.3 Problems on ages
2.4 Surds and Indices
2.5 Percentages

Unit-3:Business Mathematics **[10]**

- **3.1** Profit and Loss
- **3.2** Ratio and Proportion
- **3.3** Partnerships
- **3.4** Simple Interest
- **3.5** Compound Interest
- **3.6** Shares and Stocks
- **3.7** Discount

Reference Books:

1. Quantitative Aptitude by R. S. Aggarwal, S. Chand Publishing House
2. The Pearson Guide to Quantitative Aptitude for Competitive Examinations. By Dinesh Khattar, Pearson.
3. Aptipedia Aptitude Encyclopedia by Face. Wiley. 2nd edition.
4. Shortcuts in Quantitative Aptitude for Competitive Exams by Disha Publications.
5. Fast Track Objective Arithmetic by Rajesh Verma.
6. Magical Book on Quicker Maths by M. Tyra.
7. Quantitative Aptitude Quantum CAT by Sarvesh K. Verma
8. CSAT by Unique Publishers.

SEMESTER-II: OE-2

Paper Name: Logical Reasoning (Verbal)	Course code : G04-GE-OE-210
Paper Code: OE-2	Credits: 02

SEMESTER-II				
Subject (Minor)	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
OE-2 Mathematics	Logical Reasoning (Verbal)	2	2	30

Course Objectives:

During this course, the student is expected to

1. Learn basic principles of logic.
2. Improve reasoning skills

Course Outcome:

At the end of this course, students will be able to

1. Apply logical reasoning in problem solving.
2. Improve reasoning skills

Unit-1:Logical Reasoning (Verbal) -I [10 hrs.]

1.1 Analogy
1.2 Classification
1.3 Coding-decoding
1.4 Blood Relation
1.5 Venn Diagrams

Unit-2[A]:Logical Reasoning (Verbal) -II [10 hrs.]

2.1 Calendars
2.2 Clocks
2.3 Direction and distance
2.4 Decision making
2.5 Input output
2.6 Puzzles
2.7 Data Sufficiency

Unit-2[B]:Logical Reasoning (Verbal) -III [10 hrs.]

3.1 Decision Making
3.2 Alphanumeric series
3.3 Reasoning Analogies
3.4 Artificial Language
3.5 Odd One Out
3.6 Statement and Assumptions
3.7 Statement and Conclusions

Reference Books:-

1) A Modern Approach To Verbal Reasoning Reasoning – R.S. Agarwal. S. Chand.
2) **CSAT – Logical Reasoning and Analytical Ability. Upkars Publication.** Dr M B Lal and Ashok Gupta.

3) A new approach to reasoning by B S Sijwali and InduSijwali. Arihant Publication.
4) Verbal Reasoning by Jaya Ghosh. V&S Publications.
5) Verbal and Analytical reasoning. BS Sijwalii & Indu Sijwali, Arihant Publications India Limited, 24-26, Kalindi Colony, Transport Nagar, Meerut, Uttar
6) Brilliant Passing Verbal Reasoning Tests. Rob Williams. Pearson Education India Pvt. Ltd.

Syllabus of B. Sc. Part-I- Skill Enhancement Courses (Mathematics)

SEC-1 (Mathematics)

Semester- I (Practical)

SEMESTER-I				
Enhancement Courses (Mathematics)	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
SEC-1 Mathematics	**Programming in C Part-I**	2	4	60

Paper Name: Programming in C Part-I	**Course code : G04-SEC-110**
Paper Code: SEC-1	**Credits: 02**

Course Objectives:

During this course, the student is expected to

1. Understand the basic syntax of C++, including variables, data types, operators, and expressions.
2. Gain knowledge of how C++ code is compiled, linked, and executed.

Course Outcome:

At the end of this course, students will be able to

1. Learn to create functions with parameters and return types.
2. Students will be able to write, compile, and execute simple C++ programs using correct syntax and structure.

(Contact Hours: 60)

Pedagogy: 1. Lecture Method 2. Demonstration Method
3. Laboratory Method 4. Heuristic Method
5. Project Method

Unit-1: Overview of C [14]

1.1 Importance of C
1.2 Sample C Program
1.3 Basic structure of C programs
1.4 Programming Style
1.5 Executing a C Program

Unit-2: Constants, Variables and Data Types [16]

2.1 Characters in C
2.2 C token
2.3 Constants
2.4 Keywords and Identifiers
2.5 Variables
2.6 Data Types

Unit-3: Operators and Expressions [16]

3.1 Types of Operators
3.3 Arithmetic expressions
3.4 Evaluation of expressions
3.5 Some computational problems

Unit-4: Managing Input and Output operators [14]

4.1 Reading a character
4.2 Writing a character
4.3 Formatted input
4.4 Formatted output

Course Outcome: Upon successful completion of the course, students will be able to:

- Understand overview of C.
- Learn Constants, Variables and Data Types**.**
- Understand Operators and Expressions**.**
- Learn Managing Input and Output operators.

Reference Books:

1. Programming in C by Kernighan Brian W. 2nd edition Pearson.
2. C Programming in Easy steps by Mike Mc Grath 5th edition in easy steps Limited.
3. Let us C by Yashwant Kanetkar BPB Publications; Nineteenth edition (15 December 2022); BPB Publications, Ansari Road, Dariya Ganj.
4. Programming in ANSIC by E. Balagurusamy. 8th edition, McGraw Hill India.
5. Programming in C by Schaum Series. By Byron Gottfried.

SEMESTER-II				
Enhancement Courses (Mathematics)	**Paper Title**	**Credits**	**Hours/week**	**Total Contact Hours**
SEC-2 Mathematics	**Programming in C Part-II**	2	4	60

Paper Name: Programming in C Part-II	**Paper code : G04-SEC-210**
Paper Number: SEC-2	**Credits: 02**

Course Objectives:
During this course, the student is expected to
1. Use Decision Making, Branching and jumping statements.
2. Effective usage of user-defined functions.

Course Outcome:
At the end of this course, students will be able to:
1. Demonstrate the ability to implement control flow structures like if, else if, else, and switch statements for handling conditions.
2. Create, manipulate, and process one-dimensional and multidimensional arrays to store and organize data.

Unit-1 Decision Making and Branching [16]
1.1 Introduction
1.2 Decision making with IF statement
1.3 Simple if statement
1.4 The IF…. ELSE statement
1.5 Nesting of IF…. ELSE statement
1.6 The Else …. If ladder
1.7 The switch statement
1.8 The ?: operator
1.9 The GOTO statement

Unit-2 Decision Making and Looping [14]
2.1 Introduction
2.2 The WHILE statement
2.3 The DO statement
2.4 The FOR statement
2.5 Jumps in loopsIn

Unit-3 Arrays [16]
3.1 Introduction

3.2 One dimensional array
3.3 Two-dimensional array
3.4 Initializing two dimensional arrays
3.5 Multidimensional arrays

Unit-4 User-defined functions [14]

4.1 Introduction
4.2 Need for user-defined functions
4.3 A multifunction program
4.4 The form of C functions
4.5 Return values and their types

Recommended book (Scope of syllabus)

[1] Programming in C by E. Balagurusamy, McGraw Hill, New- Delhi
Unit-1: 5.1 – 5.9
Unit-2: 6.1 – 6.5
Unit-3: 7.1 – 7.5,
Unit-4: 8.1 – 8.5

Reference Books:

1. Numerical methods in Engineering and Science with programs in C and C++ Ninth 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. Let us C by Yashwant Kanetkar BPB Publications, New-Delhi.
6. Programming in C by Schaum's Series, Tata MacGraw Hill. EEE.