

# **Sadakathullah Appa College**

**(Autonomous)**

**(Reaccredited by NAAC at an 'A' Grade and ISO 9001:2015 Certified Institution)**

**Rahmath Nagar, Tirunelveli – 627 011, Tamil Nadu.**

## **PG DEPARTMENT OF MATHEMATICS**



### **CBCS SYLLABUS**

**For**

## **M.Sc. Mathematics**

**(Applicable for students admitted in June 2019 and onwards)**

**(As per the Resolutions of the Academic Council Meetings  
held on 03-03-2018, 17-10-2018 and 02-03-2019).**



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**POST GRADUATE DEPARTMENT OF MATHEMATICS**  
**CBCS SYLLABUS M.Sc. MATHEMATICS (2018 - 2021)**  
**COURSE STRUCTURE (CBCS)**  
**(Applicable for students admitted in June 2019 and onwards)**

<b>I SEMESTER</b>			<b>II SEMESTER</b>		
<b>COURSE</b>	<b>H/W</b>	<b>C</b>	<b>COURSE</b>	<b>H/W</b>	<b>C</b>
DSC 1	6	4	DSC 5	6	4
DSC 2	6	4	DSC 6	5	4
DSC 3	6	4	DSC 7	6	4
DSC 4	6	4	P-I	6	4
DSE 1	6	4	DSE 2	4	4
			IDC 1	3	3
<b>TOTAL</b>	<b>30</b>	<b>20</b>	<b>TOTAL</b>	<b>30</b>	<b>23</b>
<b>III SEMESTER</b>			<b>IV SEMESTER</b>		
DSC 8	6	4	DSC 12	6	4
DSC 9	6	4	DSC 13	6	4
DSC 10	6	4	DSC 14 - Project	8	8
DSC 11	5	4	DSE 4	4	4
DSE 3	4	4	P-II	6	4
IDC 2	3	3			
<b>TOTAL</b>	<b>30</b>	<b>23</b>	<b>TOTAL</b>	<b>30</b>	<b>24</b>
<b>I - IV SEMESTER</b>					
MOOC*		2#			

<b>DISTRIBUTION OF HOURS, CREDITS, NO. OF PAPERS, &amp; MARKS</b>				
<b>SUBJECT</b>	<b>HOURS</b>	<b>CREDITS</b>	<b>NO. OF PAPERS</b>	<b>MARKS</b>
DSC (THEORY & PRACTICALS), PROJECT	90	64	15	1500
DSE THEORY & PRACTICALS	24	20	5	500
IDC	6	6	2	200
MOOC*		2#	1	
<b>TOTAL</b>	<b>120</b>	<b>90+2#</b>	<b>23</b>	<b>2200</b>

**COURSE STRUCTURE**  
**POST GRADUATE DEPARTMENT OF MATHEMATICS**  
**CBCS Syllabus – M.Sc., Mathematics (2019-2020 onwards)**

SEM	CO	TITLE OF THE PAPER	S.CODE	H/W	C	MARKS		
						I	E	T
I	DSC 1	Groups Rings & Fields	18PCMA11	6	4	25	75	100
	DSC 2	Real Analysis – I	18PCMA12	6	4	25	75	100
	DSC 3	Mathematical Statistics	18PCMA13	6	4	25	75	100
	DSC 4	Ordinary & Partial Differential Equations	18PCMA14	6	4	25	75	100
	DSE 1	A) Classical Mechanics	18PEMA1A	6	4	25	75	100
B) Discrete Mathematics		18PEMA1B						
Total				30	20			500
II	DSC 5	Linear Algebra	18PCMA21	6	4	25	75	100
	DSC 6	Real Analysis – II	18PCMA22	5	4	25	75	100
	DSC 7	LaTex and MATLAB	18PCMA23	6	4	25	75	100
	P-I	LaTex and MATLAB Practical	18PCMA2P	6	4	40	60	100
	DSE 2	A) Calculus of Variations and Integral Equation	18PEMA2A	4	4	25	75	100
		B) Numerical Analysis	18PEMA2B					
IDC -I	Advanced Discrete Mathematics	18PIMA21	3	3	25	75	100	
Total				30	23			600
III	DSC 8	Graph Theory	18PCMA31	6	4	25	75	100
	DSC 9	Complex Analysis	18PCMA32	6	4	25	75	100
	DSC 10	Measure Theory and Integration	18PCMA33	6	4	25	75	100
	DSC 11	Operations Research	18PCMA34	5	4	25	75	100
	DSE 3	A) Differential Geometry	18PEMA3A	4	4	25	75	100
		B) Analytical Number Theory	18PEMA3B					
IDC -II	Numerical and Statistical Method	18PIMA31	3	3	25	75	100	
Total				30	23			600
IV	DSC 12	Topology	18PCMA41	6	4	25	75	100
	DSC 13	Functional Analysis	18PCMA42	6	4	25	75	100
	DSC 14	Project	18PCMA43	8	8			100
	DSE 4	A) Programming in C++ and Data Structures	18PEMA4A	4	4	25	75	100
		B) Java Programming	18PEMA4B					
	P-II	A) Programming in C++ and Data Structures Practical	18PEMA4PA	6	4	40	60	100
B) Java Programming Practical		18PEMA4PB						
Total				30	24			500
I-IV		Massive Open Online Course *		-	2#			
<b>GRAND TOTAL</b>				<b>120</b>	<b>90+2#</b>			<b>2200</b>

\* As per the guidelines of the UGC all the UG and the PG students shall enrol for one Massive Open Online Course offered through SWAYAM, NPTEL, etc.

# Two extra credits will be given on completion of the course.

<b>I SEMESTER</b>			
<b>DSC 1</b>	<b>GROUPS, RINGS &amp; FIELDS</b>		<b>18PCMA11</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit:18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To know the richness in the techniques of Mathematics by the way of studying class equation, Sylow's theorem, direct products and finite abelian Groups.
- To understand the in-depth concept of Euclidean Rings.
- To know that study of field theory plays a key role in algebra which has impact on the theory of equations.

**UNIT I**

A Counting Principle - Another Counting Principle - Sylow's Theorem (2<sup>nd</sup> proof only)

**UNIT II**

Direct Products - Finite Abelian groups.

**UNIT III**

Euclidean Rings - A Particular Euclidean Ring - Polynomial Rings - Polynomials over the rational fields.

**UNIT IV**

Extension Fields – The Transcendence of  $e$  - Roots of Polynomials.

**UNIT V**

More About Roots – The Elements of Galois Theory (Fundamental Theorem of Galois theory statement only).

**TEXT BOOK:**

**I.N. Herstein** - Topics in Algebra (Second Edition) - Wiley India (P) Ltd, New Delhi.

**UNIT-I:** Chapter 2(Section 2.5, 2.11, 2.12)

**UNIT-II:**Chapter 2(Section 2.13, 2.14)

**UNIT-III:**Chapter 3(Section 3.7 to 3.10)

**UNIT-IV:**Chapter 5(Section 5.1 to 5.3)

**UNIT-V:**Chapter 5(Section 5.5, 5.6)

<b>I SEMESTER</b>			
<b>DSC 2</b>	<b>REAL ANALYSIS- I</b>		<b>18PCMA12</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit:18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To enable the students to learn enough examples, theorems and techniques in analysis.
- To provide deep understanding of the Metric space concepts.
- To learn more about convergence, continuity and differentiation.

**UNIT I**

Basic topology: Finite, countable and uncountable sets – Metric spaces – compact sets – Perfect sets – Connected sets.

**UNIT II**

Numerical sequences and Series: Convergent sequences – Subsequences – Cauchy sequences – Upper and lower limits – Some special sequences.

**UNIT III**

Series – Series of Nonnegative terms – The number  $e$  – The Root and Ratio tests – Power series – Summation by parts – Absolute convergence– Addition and Multiplication of Series – Rearrangements.

**UNIT IV**

Continuity: Limits of functions – Continuous functions – Continuity and compactness – Continuity and connectedness – Discontinuities – Monotonic Functions – Infinite Limits and Limits at Infinity.

**UNIT V**

Differentiation: The Derivative of a Real Function – Mean Value Theorems – The Continuity of Derivatives – L’ Hospital’s Rule – Derivatives of Higher order – Taylor’s Theorem – Differentiation of vector-valued functions.

**TEXT BOOK:**

**Walter Rudin**–“Principles of Mathematical Analysis” – 3<sup>rd</sup> Edition, McGraw Hill International Editions.

- Unit I** : Chapter 2(full)
- Unit II** : Chapter 3(section 3.1-3.20)
- Unit III** : Chapter 3(section 3.21-3.55)
- Unit IV** : Chapter 4(full)
- Unit V** : Chapter 5(full)



<b>I SEMESTER</b>			
<b>DSC 3</b>	<b>MATHEMATICAL STATISTICS</b>		<b>18PCMA13</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To understand the concept of Probability and Probability Distributions.
- To learn the basic concepts of Mathematical Statistics.
- To know about the theory of sampling.

**UNIT I**

Conditional Probability and Stochastic Independence: Conditional Probability – Marginal and Conditional distributions – The correlation coefficient – Stochastic Independence

**UNIT II**

Some Special Distributions: The Binomial, Trinomial and Multinomial distributions – The Poisson distribution – The Gamma distribution & chi-square distribution – The normal distribution – The Bivariate normal distribution.

**UNIT III**

Distributions of functions of Random variables: Sampling Theory - Transformation of variables of the discrete type – Transformation of variables of the continuous type – The t and F Distributions.

**UNIT IV**

Extensions of the Change of variable Technique – Distribution of order statistics – The moment generating function technique – Distributions of  $\bar{X}$  and  $nS^2/\sigma^2$  – Expectations of functions of random variables.

**UNIT V**

Limiting Distributions: Limiting Distributions – Stochastic convergence – Limiting moment generating functions – The central limit theorem – Some theorems on Limiting Distributions.

**TEXT BOOK:**

**Robert V.Hogg and Allen T.Craig**-Introduction to Mathematical Statistics- Pearson Education Asia, Chapters 2, 3, 4 and 5

**Unit I** : Chapter 2(section 2.1 to 2.4)

**Unit II** : Chapter 3(section 3.1 to 3.5)

**Unit III** : Chapter 4(section 4.1 to 4.4)

**Unit IV** : Chapter 4(section 4.5 to 4.9)

**Unit V** : Chapter 5(section 5.1 to 5.5)

<b>I SEMESTER</b>			
<b>DSC4</b>	<b>ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS</b>		<b>18PCMA14</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To discuss several methods for finding power series solutions to differential equations of first order and second order.
- To understand the difference between ordinary and regular singular points.
- To learn more about the concepts of first order partial differential equations.

**UNIT I**

Introduction: A review of power series - Series solutions of first order equations - Second Order Linear equations and Ordinary points

**UNIT II**

Regular singular points - Regular singular point (continued) - Gauss Hyper Geometric equation - Point at infinity.

**UNIT III**

Legendre Polynomials- Properties of Legendre Polynomials - Bessel functions. The Gamma Function- Properties of Bessel Functions

**UNIT IV**

Partial Differential Equations - Origin of First order Partial Differential Equations Cauchy's problem for first order equations- Linear equations of the first order – Integral surfaces passing through a given curve – Surfaces orthogonal to a given system of surfaces.

**UNIT V**

Cauchy's method of characteristics - Compatible systems of first order equations - Charpit's method - Special type of first order equations- Solution satisfying the given conditions - Jacobi's Method

**TEXT BOOK:**

1. **G.F. Simmons**- Differential equation with application and historical notes – TataMcGraw Hill Publishing Company Ltd, New Delhi.  
**UNIT I** : Section 25 to 27  
**UNIT II** : Section 28 to 31  
**UNIT III** : Section 32 to 35
2. Ian N. Sneddon – Elements of Partial Differential Equations – Dover Publications, Inc-Mineola, New York.  
**UNIT IV** : Chapter 2 (Section 1 to 6)  
**UNIT V** : Chapter 2 (Section 8 to 13)

<b>I SEMESTER</b>			
<b>DSE 1A</b>	<b>CLASSICAL MECHANICS</b>		<b>18PEMA1A</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To learn more about of the mechanics of a partical, Lagrange's equations.
- To study the concepts and advantages of Hamilton's principle.
- To learn about Central force problems, Kepler's problem.

**UNIT I**

**Survey of the Elementary Principles:** Mechanics of a particle - Mechanics of a system of particles – Constraints - D'Alembert's principle and Lagrange's Equations.

**UNIT II**

Velocity-dependent potentials and the dissipation functions - Simple applications of the Lagrangian formulation - single particle in space (Cartesian co-ordinates, plane polar co-ordinates)-Atwood's machine-bead sliding on rotating wire.

**UNIT III**

**Variational Principles and Lagrange's Equations:**Hamilton's principle - Some techniques of the calculus of variations - Derivation of Lagrange's equations from Hamilton's principle - Extension of Hamilton's principle to nonholonomic systems - Advantages of a variational principle formulation – Conservation theorems and symmetry properties.

**UNIT IV**

**The Two-Body Central Force Problem:**Reduction to the equivalent one-body problem - The equations of motion and first integrals - The equivalent one-dimensional problem, and classification of orbits – The virial theorem – The differential equation for the orbit, and integrable power-law potentials.

**UNIT V**

Conditions for closed orbits (Bertrand's theorem) - The Kepler problem: Inverse Square law of force -The motion in time in the Kepler problem - The Laplace-Runge-Lenz vector-scattering in a central force field.

**TEXT BOOK:**

**Herbert Goldstein-** Classical Mechanics-Second Edition-Narosa Publishing House Pvt.Ltd

**Unit I** : Chapters 1 (Section 1.1 to 1.4)

**Unit II** : Chapters 1 (Section 1.5 to 1.6)

**Unit III** : Chapters 2 (Section 2.1 to 2.6)

**Unit VI** : Chapters 3 (Section 3.1 to 3.5)

**Unit V** : Chapters 3 (Section3.6 to 3.10)

<b>I SEMESTER</b>			
<b>DSE 1B</b>	<b>DISCRETE MATHEMATICS</b>		<b>18PEMA1B</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To study the basic concepts of Propositional Logic, Predicates and quantifiers
- To study on Pigeon Hole Principle, Permutation and combination.
- To learn about Boolean Functions, Logic Gates and Minimization.

**UNIT I:**

Propositional Logic – Propositional equivalence – Predicates and quantifiers.

**UNIT II:**

The Basics of counting – The Pigeonhole principle – Generalized permutation and combination.

**UNIT III:**

Relation and their properties – n-ary relations and their applications – representing relation – closures of relations.

**UNIT IV:**

Boolean functions – Representing Boolean functions.

**UNIT V:**

Logic Gates – Minimization.

**TEXT BOOK:**

1. **Discrete Mathematics and its Applications (Sixth Edition)** – Kenneth H. Rosen. WCB/ McGraw Hill Publications

**Unit I:** Sections: 1.1 - 1.3.

Problems: Section 1.1(1 - 38), Section 1.2 (1 - 35) and Section 1.3(1 -34)

**Unit II:** Sections: 5.1, 5.2 and 5.5

Problems: Section 5.1(1 - 40), Section 5.2(1 - 22) and Section 5.5(1 - 9)

**Unit III:** Sections: 7.1 – 7.4 except Warshall's algorithm

Problems: Section 7.1 (All exercise problems),  
Section 7.2(1 - 27), Section 7.3(1 - 22)  
and Section 7.4(1 - 22)

**Unit IV:** Sections: 10.1 and 10.2

**Unit V:** Sections: 10.3 and 10.4

<b>II SEMESTER</b>			
<b>DSC 5</b>	<b>LINEAR ALGEBRA</b>		<b>18PCMA21</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit:18</b>	<b>Credit:4</b>

**OBJECTIVES:**

- To study the basic concepts of linear dependence, basis, homomorphisms of vector spaces and Inner product spaces.
- To understand an extremely rich structure called algebra of linear transformations and the canonical forms.
- To learn about Trace, Transpose and determinants.

**UNIT I**

Elementary Basic Concepts of Vector Spaces - Linear Independence and Bases - Dual Spaces.

**UNIT II**

Inner Product Spaces - Modules.

**UNIT III**

The Algebra of Linear Transformations - Characteristic roots - Matrices.

**UNIT IV**

Canonical Forms: Triangular form - Nilpotent Transformations.

**UNIT V**

Determinants - Hermitian, Unitary and Normal Transformations.

**TEXT BOOK:**

**I.N. Herstein** - Topics in Algebra (Second Edition) - Wiley India (P.)Ltd, New Delhi

**UNIT I** : Chapter 4 (Section 4.1 to 4.3)

**UNIT II** : Chapter 4 (Section 4.4 to 4.5)

**UNIT III** : Chapter 6 (Section 6.1 to 6.3)

**UNIT IV** : Chapter 6 (Section 6.4, 6.5)

**UNIT V** : Chapter 6 (Section 6.9 , 6.10)

<b>II SEMESTER</b>			
<b>DSC 6</b>	<b>REAL ANALYSIS II</b>		<b>18PCMA22</b>
<b>Hrs / Week:5</b>	<b>Hrs / Sem: 75</b>	<b>Hrs / Unit:15</b>	<b>Credit:4</b>

**OBJECTIVES:**

- To enable the students to learn enough examples, theorems and techniques in analysis.
- To learn about Riemann integration, Sequence and series of functions and Equicontinuous families of functions.
- To impart a deep knowledge in some special functions and functions of several variables.

**UNIT I**

The Riemann–Stieltjes Integral: Definition and Existence of the Integral – Properties of the Integral – Integration and differentiation.

**UNIT II**

Sequences and Series of Functions: Discussion of main problem – Uniform convergence – Uniform convergence and continuity – Uniform convergence and Integration.

**UNIT III**

Uniform convergence and Differentiation - Equicontinuous Families of functions.

**UNIT IV**

Some Special Functions: Power Series – The Exponential and Logarithmic Functions – The Trigonometric Functions – The Algebraic Completeness of the Complex Field – Fourier Series

**UNIT V**

Functions of Several Variables: Differentiation – The Contraction principle – The Inverse Function Theorem – The Implicit function theorem.

**TEXT BOOKS:**

Walter Rudin – Principles of Mathematical Analysis, (3<sup>rd</sup> Edition), McGraw Hill International Editions.

**UNIT I** : Chapter 6(section 6.1 \_ 6.22)

**UNIT II** : Chapter 7(section 7.1 – 7.16)

**UNIT III** : Chapter 7(section 7.17 – 7.25)

**UNIT IV** : Chapter 8(section 8.1 \_ 8.12)

**UNIT V** : Chapter 9(Section 9.10 - 9.29)

IISEMESTER			
<b>DSC 7</b>	<b>LATEX AND MATLAB</b>		<b>18PCMA23</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 6 x 15 = 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

### OBJECTIVES

- To learn the latest techniques in Latex for the preparation of printable document in an enhanced manner.
- To avoid difficulty while typing project or thesis comparing other mathematical software.
- To solve mathematical equations and to draw graphs using MATLAB.

### UNIT – I

**Introduction** - Basics of a Latex file- **Text, Symbols and Commands:** Command names and arguments – Environments– Declarations – Lengths – Special characters - **Document Layout and Organization:** Document class – Page style – Parts of the document – Table of contents –**Displayed Text:** Changing font style – Centering and indenting – Lists – Generalized lists Theorem like-declarations -**Text in Boxes:** Boxes - Footnotes and marginal notes.

### UNIT – II

**Tables:** Tabular stops – Tables - **Mathematical Formulas:** Mathematical Environment – Main elements of math mode – Mathematical symbols - Additional Elements - Fine tuning mathematics - **Drawing with Latex:** The picture environment – Extended pictures.

### UNIT - III

**Introduction-** What is the Basics of MATLAB - Matrices and Vectors - Matrix and array operations.

### UNIT IV

**Interactive computation:** Character strings – A special note on array operations – Command Line Function - Using built in functions and Online help – Saving and Loading data - Plotting simple graphs.

### UNIT V

**Application:** Linear Algebra – Curve Fitting and Interpolation – Data Analysis and Statistics – Numerical Integration– **Ordinary Differential Equation:** A first order linear ODE and A second order non-linear ODE.

### TEXT BOOKS:

1. Guide to LATEX by **Helmut Kopka** and **Patrick W.Daly**, Fourth Edition, Addison – Wesley, Pearson Education, 2004.  
**UNIT I** : Chapter 1: Sections: 1.5, 2.1 – 2.5, 3.1 – 3.4, 4.1 – 4.5, 5.1-5.2  
**UNIT II** : Chapter 2: Sections: 6.1 – 6.2, 7.1 – 7.5, 16.1 –16.2.
2. Getting Started with MATLAB – A quick introduction for Scientist and Engineers by Rudra Pratap, Oxford University Press 2003.  
**UNIT III** : Chapter 3: Sections:1.1, 1.6, 3.1, 3.2  
**UNIT IV** : Chapter 4: Sections: 3.3 – 3.8.  
**UNITV** : Chapter 5: Sections: 5.1 – 5.4, 5.5 (5.5.1,5.5.2 only).

<b>IISEMESTER</b>		
<b>P-I</b>	<b>LATEX AND MATLAB PRACTICALS</b>	<b>18PCMA2P1</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Credit: 4</b>

### **LATEX PRACTICALS**

1. Write a LaTeX coding for Simple LaTeX program.
2. Write a LaTeX coding for Basic Mathematical Equation.
3. Write a LaTeX coding for Mathematical Equation with Mathematics Formulae.
4. Write a LaTeX coding for Mathematical Equation with Delimiters.
5. Write a LaTeX coding for Chess Board.
6. Write a LaTeX coding for Rangoli.
7. Write a LaTeX coding for Lotus.
8. Write a LaTeX coding for Natural Scene with Home.
9. Write a LaTeX coding for Tamil letters.
10. Write a LaTeX coding for your name in Colour & Tamil letters.
11. Write a LaTeX coding for Different types of Graphs in Graph Theory
12. Write a LaTeX coding for Time Table.
13. Write a LaTeX coding for Class Schedule Time Table.
14. Write a LaTeX coding for Draw different types of Boxes.
15. Write a LaTeX coding for Preparing a paper in Journal.
16. Write a LaTeX coding for Beamer presentation with lists.

### **MATLAB PRACTICALS**

1. To find the addition, subtraction and multiplication of any two matrix using MATLAB coding.
2. To find the determinant, inverse and Eigen value of given matrix using MATLAB coding.
3. To delete and display the rows and columns of a Matrix using MATLAB coding.
4. To solve a linear system of three equations using MATLAB coding.
5. Create a Simple inline function and Anonymous function and compute its value using MATLAB coding.
6. To find the roots of the polynomial using MATLAB coding.
7. To draw a line using MATLAB coding.
8. To draw a curve using MATLAB coding.
9. To plot the various graphs using MATLAB coding.
10. To solve the partial fraction using MATLAB coding.



<b>II SEMESTER</b>		
<b>DSE 2A</b>	<b>CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS</b>	<b>18PEMA2A</b>
<b>Hrs / Week: 4</b>	<b>Hrs / Sem: 60</b> <b>Hrs / Unit:12</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To know the relation between differential and integral equations, and how to change from one to another.
- To study the basic concepts of maxima and minima in Calculus of Variations with its applications.
- To understand the relation between differential and integral equations and to study the concept of Green's function.
- To learn about Fredholm equations and Hilbert Schmidt theory.

**UNIT I**

Calculus of Variations and Applications: Maxima and minima - The simplest case - Illustrative examples - Natural boundary conditions and transition conditions.

**UNIT II**

Constraints and Lagrange multipliers - Variable end points - Sturm-Liouville problems - Lagrange's equations.

**UNIT III**

Integral Equations: Introduction - Relation between differential and integral equations - The Green's function.

**UNIT IV**

Fredholm equations with separable kernels - Illustrative example.

**UNIT V**

Iterative methods for solving equations of the second kind - Fredholm theory

**TEXTBOOK:**

Francis B. Hildebrand, Methods of Applied Mathematics, Second Edition, Prentice Hall, INC. Englewood Cliffs, New Jersey

- UNIT I** : Chapter 2 (Section 2.1 to 2.4)
- UNIT II** : Chapter 2 (Section 2.7 to 2.9 & 2.11)
- UNIT III** : Chapter 3 (Section 3.1 to 3.3)
- UNIT IV** : Chapter 3 (Section 3.6 & 3.7)
- UNIT V** : Chapter 3 (Section 3.9 & 3.11)

<b>II SEMESTER</b>		
<b>DSE 2B</b>	<b>NUMERICAL ANALYSIS</b>	<b>18PEMA2B</b>
<b>Hrs / Week: 4</b>	<b>Hrs / Sem:60    Hrs / Unit:12</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To study the basic concepts of maxima and minima in Calculus of Variations with its applications.
- To understand the relation between differential and integral equations and to study the concept of Green's function.
- To learn about Fredholm equations and Hilbert Schmidt theory.

**UNIT I:**

Interpolation: Newton's Interpolation Formula – Lagrange's Interpolation formula – Divided differences – Newton's Divided differences formula – Inverse Interpolation.

**UNIT II:**

Numerical differentiation – Derivatives using Newton's forward, backward, difference formulae.

**UNIT III:**

Numerical Integration – Gaussian Quadrature formula – Numerical evaluation of double integrals.

**UNIT IV:**

Numerical solutions of ordinary differential equations – Taylor's series Method – Euler's Method – RungeKutta Method.

**UNIT V:**

Predictor corrector Method – Milnes Method – Adams-Bashforth Method.

**TEXT BOOK:**

Numerical Methods, S. Arumugam and others, Scikech (2001)

**Unit I** : Chapter 7 ( Sections 7.1 to 7.3)

**Unit II** : Chapter 8 ( Sections 8.1 to 8.3)

**Unit III** : Chapter 8 (Sections 8.5 to 8.7)

**Unit IV** : Chapter 10 (Sections 10.1,10.3 , 10.4)

**Unit V** : Chapter 10 (Sections 10.5 to 10.7)

<b>III SEMESTER</b>			
<b>DSC 8</b>	<b>GRAPH THEORY</b>		<b>18PCMA31</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To provide an in-depth knowledge of graph theoretical concepts.
- To motivate the students to do research in discrete and applied mathematics.
- To learn about coloring and Ramsey numbers.

**UNIT I**

Trees: Bridges - Trees. Connectivity: Cut vertices - Blocks - Connectivity.

**UNIT II**

Traversability: Eulerian graphs–Hamiltonian graphs. Digraphs: Strong Digraphs.

**UNIT III**

Matchings and Factorizations: Matchings - Factorization - Decompositions and Graceful Labelings.

**UNIT IV**

Planarity: Planar graphs –Embedding Graphs on surfaces. Coloring: Vertex coloring.

**UNIT V**

Edge coloring –The Heawood Map coloring theorem. Ramsey Numbers: The Ramsey number of graphs. Distance: The centre of a graph.

**TEXT BOOK:**

Gary Chartrand and Ping Zhang - Introduction to Graph Theory, Edition 2006. Tata McGraw-Hill Publishing Company Limited, New Delhi.

**UNIT I** : Chapter 4(4.1, 4.2), Chapter 5(5.1, 5.2, 5.3).

**UNIT II** : Chapter 6(6.1, 6.2), Chapter 7(7.1).

**UNIT III** : Chapter 8(8.1, 8.2, 8.3)

**UNIT IV** : Chapter 9(9.1, 9.2), Chapter 10 (10.2).

**UNITV** : Chapter 10 (10.3, 10.4), Chapter 11(11.1), Chapter 12 (12.1).

III SEMESTER			
<b>DSC 9</b>	<b>COMPLEX ANALYSIS</b>		<b>18PCMA32</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To learn the basic concepts of analytic functions and power series.
- To understand the concepts of Complex Integration using and Cauchy's integral formula and Residue theorem
- To acquire the knowledge of Harmonic functions.

**UNIT I**

**Complex Functions:** Introduction to the Concept of Analytic Function  
- Elementary Theory of Power Series

**UNIT II**

**Conformality:** Arcs and closed curves - Analytic functions in Regions- Conformal Mapping - Length and Area. **Linear Transformations:** The Linear Group - The cross ratio - Symmetry.

**UNIT III**

**Complex Integration:** Fundamental Theorems - Cauchy's Integral Formula.

**UNIT IV**

**Local Properties of Analytical Functions:** Removable Singularities and Taylor's Theorem – Zeros and Poles - The Local Mapping - **The Calculus of Residues.**

**UNIT V**

**Harmonic Functions:** Definition and Basic Properties –The Mean-value Property – Poisson's Formula – Schwarz's Theorem - Power Series expansions.

**TEXT BOOK:**

Lars V. Ahlfors-Complex Analysis - Third Edition - McGraw- Hill International Company, Singapore.

**UNIT I** : Chapter 2(1.1 to 1.4 and 2.1 to 2.5)

**UNIT II** : Chapter 3(2.1 to 2.4 and 3.1 to 3.3)

**UNIT III** : Chapter 4(1.1 to 1.5 and 2.1 to 2.3)

**UNIT IV** : Chapter 4(3.1 to 3.3 and 5.1 to 5.3)

**UNIT V** : Chapter 4(6.1 to 6.4) Chapter 6 (1.1 to 1.3)

<b>III SEMESTER</b>		
<b>DSC 10</b>	<b>MEASURE THEORY AND INTEGRATION</b>	<b>18PCMA33</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b> <b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To Introduce the Lebesgue Measure and Lebesgue Integrals, Measure and Integration.
- To understand the concept of measurable functions & some basic theorems on measurable functions
- To learn about measure spaces, signed measures and product measures.

**UNIT I**

Lebesgue Measure: Introduction - Outer Measure - Measurable Sets and Lebesgue Measure –Anon Measurable set - Measurable Functions - LittleWood’s three principles.

**UNIT II**

The Lebesgue Integral: Riemann Integral - The Lebesgue Integral of a bounded function over a set of finite measure - The Integral of a non negative function - The general Lebesgue Integral - Convergence in Measure.

**UNIT III**

Differentiation and Integration: Differentiation of monotone functions - Functions of bounded variation - Differentiation of an integral - Absolute continuity.

**UNIT IV**

Measure and Integration: Measure Spaces - Measurable functions- Integration -General convergence Theorems - Signed Measures - The Radon Nikodym Theorem.

**UNIT V**

Measure and Outer Measure: Outer Measure and Measurability - The Extension Theorem - Product Measures - Integral Operators.

**TEXT BOOK:**

H.L.Royden-Real Analysis, Dorling Kindersley (India) Pvt. Ltd - Third Edition, Pearson Education.

- Unit I** : Chapter 3(1 to 6)
- Unit II** : Chapter 4(1 to 5)
- Unit III** : Chapter 5(1 to 4)
- Unit IV** : Chapter 11(1 to 6)
- Unit V** : Chapter 12 (1, 2, 4 and 5)

<b>III SEMESTER</b>		
<b>DSC 11</b>	<b>OPERATIONS RESEARCH</b>	<b>18PCMA34</b>
<b>Hrs / Week:5</b>	<b>Hrs / Sem: 75</b>	<b>Hrs / Unit: 15</b>
		<b>Credit: 4</b>

**OBJECTIVES:**

- To understand the concept of dynamic programming, game theory and decision theory.
- To understand basic techniques for effective decisions-making.
- To understand the concept of Queuing theory and develop linear programs from standard business problems
- To provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate.

**UNIT I**

Introduction to Linear Programming: Graphical LP Solution – Graphical Sensitivity Analysis – Computer Solution of LP Problems.

**UNIT II**

The Simplex Method: LP Solution space in Equation form – Simplex Iterations with TORA – Artificial starting solution. Simplex Method Application – Degeneracy.

**UNIT III**

Decision Analysis: Decision making under risk – Decision making under uncertainty.

**UNIT IV**

Network Models: Network Representation – critical path (CPM) Computations – Construction of the Time Schedule – Linear Programming Formulation of CPM – PERT Networks.

**UNIT V**

Queuing theory: Elements of Queuing Model – Role of Exponential distribution - single and Multi-Server Models.

**Theory: Problem = 60: 40**

**TEXT BOOKS:**

1. **HAMDY A. TAHA**, Operations Research An Introduction, 7th Edition, MacMillan Publishing Company, New York.
2. **KantiSwarup, P.K. Gupta and Man Mohan**, Operation Research, Eleventh Edition, Sultan Chand & Sons, New Delhi.

**UNIT I:** Chapter2 (Section 2.2,2.3)

**UNIT II:**Chapter3 (Section 3.1,3.3.3,3.4,3.5)

**UNIT III:** Chapter 14 (Section 14.2,14.3)

**UNIT VI:** Chapter 6 (Section 6.6.1 – 6.6.5)

**UNIT V:**Chapter17 (Section 17.2,17.3,17.6.1- 17.6.4)

III SEMESTER			
<b>DSE 3A</b>	<b>DIFFERENTIAL GEOMETRY</b>		<b>18PEMA3A</b>
<b>Hrs / Week:4</b>	<b>Hrs / Sem:60</b>	<b>Hrs / Unit: 12</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To introduce the basic concepts in three dimensional Euclidean space.
- To introduce the essential ideas and method of differential geometry.
- To learn about the Geodesics, Canonical geodesics, geodesic curvature.

**UNIT I**

The theory of space curves – Definitions, Arc length – Tangent – Normal and Binormal - Curvature and Torsion.

**UNIT II**

Contact between curves and surfaces – Tangent Surface – Involutives and evolutes.

**UNIT III**

Definition of a surface – Curves on a surface – Helicoids.

**UNIT IV**

Metric – Direction Coefficients - Families of curves - Geodesics.

**UNIT V**

Canonical geodesic equation, Normal Property of geodesics (Christoffel symbols not included). Geodesic curvature,

**TEXT BOOK:**

T.J. Willmore - An Introduction to Differential Geometry, Oxford University Press, (17<sup>th</sup> Impression), New Delhi, 2002, (Indian Print)

**Unit I** : **Chapter 1:** Section: 1.1 – 1.4. problem:chapter1:1-4

**Unit II** : **Chapter 1:** Section: 1.5- 1.7 and.problem:chapter1:8-12

**Unit III** : **Chapter 2:** Section: 2.1, 2.2, 2.4,.problem: chapter 2:1-4

**Unit IV** : **Chapter 2:** Section: 2.5-2.7.problem: chapter 2:6-8

**Unit V** : **Chapter 2:** Section: 2.10-2.12,2.15.problem: chapter 2:10-12

III SEMESTER		
<b>DSE 3B</b>	<b>ANALYTICAL NUMBER THEORY</b>	<b>18PEMA3B</b>
<b>Hrs / Week:4</b>	<b>Hrs / Sem: 60</b>	<b>Hrs / Unit: 12</b>
		<b>Credit: 4</b>

**OBJECTIVES:**

- To introduce the fundamental theorem of arithmetic.
- To have a deep knowledge in Analytical Number Theory.
- To learn about congruences and linear congruences.

**UNIT I:**

**The Fundamental Theorem of Arithmetic:** Introduction – Divisibility- Greatest Common Divisor – Prime Numbers –Fundamental Theorem of Arithmetic – The series of reciprocals of the Primes

**UNIT II:**

**The Fundamental Theorem of Arithmetic:**The Euclidean Algorithm – The greatest common divisor of more than two numbers.Arithmetical Function and Dirichlet multiplication: Introduction – The Mobious Function  $\mu(n)$  – The Euler Totient Function  $\varphi(n)$  – A relation connecting  $\varphi$  and  $\mu$  - A product formula for  $\varphi(n)$  – The Dirichlet Product of arithmetic functions – Dirichlet inverses and Mobius inversion formula –The Mangoldt function  $\Lambda(n)$ .

**UNIT III:**

**Arithmetical Function and Dirichlet multiplication:** Multiplicative functions –Multiplicative functions and Dirichlet multiplication –The inverse of a completely multiplicative functions –Liouville’s function  $\lambda(n)$  –The divisor functions  $\sigma_a(n)$  –Generalized convolutions. **Averages of Arithmetical Functions:** Introduction –The big oh notation.Asymptotic equality of functions –Euler’s summation formula –Some Elementary asymptotic formulas.

**UNIT IV:**

**Averages of Arithmetical Functions:**The average order of  $d(n)$ –The average order of the divisor functions  $\sigma_a(n)$  –The average order of  $\varphi(n)$  –An application to the distribution of lattice points visible from origin –The average order of  $\mu(n)$  and of  $\Lambda(n)$ . The partial sum of a Dirichlet product-Applications to  $\mu(n)$  and  $\Lambda(n)$ - Another identity for the partial sums of a Dirichlet product.

**UNIT V:**

Some Elementary Theorems on the distribution of Prime Numbers: Introduction –Chebyshev’s function  $\psi(n)$  and  $\vartheta(n)$  –Relations connecting  $\vartheta(x)$  and  $\pi(x)$  –Some equivalent forms of the prime number theorem –Inequalities for  $\pi(n)$  and  $p_n$ –Shapiro’s Tauberian theorem.

**TEXT BOOK:**

Tom M.Apostol-Introduction to analytical number theory

**Unit I** : Chapter 1 (Section 1.1-1.6)

**Unit II** : Chapter 1 (Sections 1.7& 1.8)and Chapter 2 (Section 2.1 - 2.8)

**Unit III** : Chapter 2 (Section (2.9 – 2.14)andChapter 3 (Section 3.1 – 3.4)

**Unit IV** : Chapter 3 (Section 3.5 -3.12)

**Unit V** : Chapter 4 (Section 4.1 -4.6)



<b>IV SEMESTER</b>			
<b>DSC 12</b>	<b>TOPOLOGY</b>		<b>18PCMA41</b>
<b>Hrs / Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit:4</b>

**OBJECTIVES:**

- To introduce basic concepts of Topology.
- To introduce product Topology and quotient Topology.
- To study the countability axioms and Urysohn metrization theorem.

**UNIT I**

Topological spaces – Basis for a Topology – Order Topology – The product Topology on  $X \times Y$  – The Subspace Topology – Closed sets and Limit points.

**UNIT II**

Continuous functions – The Product Topology -The Quotient Topology.

**UNIT III**

Connected spaces, components and local connectedness - compact spaces.

**UNIT IV**

Local compactness –The Countability axioms -The Separation axioms.

**UNIT V**

Normal Spaces – Urysohn lemma –Urysohn metrization theorem. (first version of proof only).

**TEXT BOOK:**

J.R. Munkres–Topology-2<sup>nd</sup> Edition, Eastern Economy Edition – Prentice- Hall of India Pvt. Ltd, New Delhi.

**UNIT I** : Chapter 2 (12 to 17).

**UNIT II** : Chapter 2(18, 19, 22).

**UNIT III** : Chapter 3 (23, 25, 26).

**UNIT IV** : Chapter 3 (29), Chapter 4 (30, 31).

**UNIT V** : Chapter 4 (32, 33, 34)

IV SEMESTER			
<b>DSC 13</b>	<b>FUNCTIONAL ANALYSIS</b>		<b>18PCMA42</b>
<b>Hrs / Week: 6</b>	<b>Hrs /Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To introduce the study of Banach spaces and its applications.
- To introduce the concept of Hilbert spaces, conjugate spaces, adjoint, self adjoint, normal and unitary operators.
- To introduce finite dimensional spectral theory.

**UNIT I**

**Banach Spaces:** The definition and some examples - Continuous linear transformations -The Hahn-Banach theorem.

**UNIT II**

The natural imbedding of  $N$  in  $N^{**}$  - The open mapping theorem - The conjugate of an operator.

**UNIT III**

**Hilbert spaces:** The definition and some simple properties - Orthogonal complements -Orthonormal sets - The conjugate space  $H^*$ .

**UNIT IV**

The adjoint of an operator – Self-adjoint operator - Normal and Unitary operators -Projections.

**UNIT V**

**Finite-Dimensional Spectral Theory:** Matrices - Determinants and the spectrum of an operator – The spectral theorem.

**TEXT BOOK:**

George F.Simmons – Introduction to Topology and Modern Analysis, Tata McGraw-Hill Publishing Company Ltd, New Delhi.

- UNIT I** : Chapter 9(46 to 48)
- UNIT II** : Chapter 9(49 to 51)
- UNIT III** : Chapter 10(52 to 55)
- UNIT IV** : Chapter 10(56 to 59)
- UNIT V** : Chapter 11(60 to 62)

<b>IV SEMESTER</b>		
<b>DSC 14</b>	<b>PROJECT</b>	<b>18PCMA43</b>
<b>Hrs / Week:8</b>	<b>Hrs / Sem: 120</b>	<b>Credit: 8</b>

**OBJECTIVE:**

To make students prepare the project on recent development and research in mathematics based on the guidelines.

**The following are the guidelines to be adhered to**

- The project should be an individual one
- The language for the project is **English**
- The Minimum number of pages should be **60**
- Project observations, suggestions and conclusion shall be formed aspart of the project.
- The Projects will be evaluated both by the Internal as well as External Examiner each for 100 marks. The distribution of mark should be 60 marks for the Project Report and 40 marks for the Viva-voce Examination.The Division of marks for the Project Report is as mentioned below:

<b>Particulars</b>	<b>Internal Examiner</b>	<b>External Examiner</b>
Wording of Title	5	5
Objectives/ Formulation including Hypothesis	5	5
Review of Literature	10	10
Relevance of Project to Social Needs	5	5
Methodology/ Technique/ Procedure Adopted	20	20
Summary/ Findings/ Conclusion	5	5
Bibliography/ Annexure/ Foot notes	10	10
<b>Total</b>	<b>60</b>	<b>60</b>

The average mark of Internal and External Examiner is considered as marks of project report.

<b>IV SEMESTER</b>		
<b>DSE 4A</b>	<b>Programming in C++ and Data Structures</b>	<b>18PEMA4A</b>
<b>Hrs / Week:4</b>	<b>Hrs / Sem: 60      Hrs / Unit: 12</b>	<b>Credit: 4</b>

**OBJECTIVES:**

- To study the C++ language as it plays an important role in the software area.
- To enable the students to face this competitive world by learning the various techniques in developing a program.
- To understand data structure- stacks, queues and graphs.

**UNIT I**

Control Structures– Functions in C++– Classes and objects.

**UNIT II**

Operator Overloading and Type Conversion – Inheritance: Extending Classes.

**UNIT III**

Pointers, Virtual functions and polymorphism-Managing Console I/O operations.

**UNIT IV**

Stacks and Queues -Singly Linked list -Linked stacks and Queues – Polynomial Addition.

**UNIT V**

Graphs – Internal Sorting.

**TEXT BOOK**

1. E. Balagurusamy- Object oriented programming in C++, 4<sup>th</sup> Edition, TataMcGraw-Hill publishing company Limited.

**UNIT I** : Chapter3(Section-3.24),Chapter4(Section-4.1 – 4.11),  
Chapter 5 (Section-5.1 – 5.16)

**UNIT II** : Chapter 7(Section 7.1 – 7.8),Chapter 8(Section -8.1 – 8.12 )

**UNIT III** : Chapter 9(Section -9.1 – 9.7), Chapter 10 (Section -10.1 – 10.6 )

2. Ellis Horowitz & Sartaj Sahni – Fundamental's of Data Structures, Galgotia books source, Gurgaon.

**UNIT IV** : Chapter 3 (Section3.1 – 3.4), Chapter 4 (Section 4.1,4.2,4.4)

**UNIT V** : Chapter 6 (Section 6.1 - 6.5), Chapter 7 (Section 7.1 - 7.6)

IV SEMESTER			
DSE 4B	JAVA PROGRAMMING		18PEMA4B
Hrs / Week: 4	Hrs / Sem: 60	Hrs / Unit: 12	Credit: 4

**Objectives:**

- To have a knowledge of JAVA Language.
- To study Classes, Objects and Methods.
- To study how to develop algorithms and to provide a deep understanding in the field of computer programming.

**UNIT I**

**An Overview of Java Language:** Object oriented programming–A first simple program–A second short program–Two control statements –Using blocks of code –Lexical issues–The java class libraries.**Data types, variables & Arrays:** The primitive types–Integers–Floating-point types –Characters–Booleans–A closer look at Literals –Variables –Type conversion and casting–Arrays. **Operators:** Arithmetic Operators–The Bitwise Operators–Relational Operators –Boolean Logical Operators–The Assignment Operator–The ? Operator–Operator precedence –Using parentheses.

**UNIT II**

**Control statements:** Java's selection statements–Iteration statements–Jump statements. **Introducing Classes:** Class fundamentals – Declaring objects – Assigning object Reference Variables – Introducing methods–Constructors – The this keyword – Garbage collection–The finalize( ) method.**A closer look at methods & classes:** Over loading methods – using objects as parameters – A closer look at argument passing – returning objects – Recursion – Introducing Access control – Understanding static – Introducing final – Introducing Nested & inner classes.

**UNIT III**

**Inheritance:** Inheritance Basics – using super – creating a multilevel hierarchy – when constructors are called– method overriding – Dynamic method dispatch – using abstract classes – using final with inheritance – The object class.**Packages and Interfaces:** Packages - Access protection – importing packages – Interfaces.

**UNIT IV**

**Exception handling:** Exception handling fundamentals – Exception types – Uncaught Exceptions – Using try and catch- Multiple catch clauses – Nested try statements – throw – throws – finally. **Multithreaded Programming:** The java thread model – The main thread – Creating a thread – creating multiple threads – using is Alive() and join() – thread priorities.

**UNIT V**

**The Applet class:** Two types of Applets – Applet basics – Applet architecture – An Applet skeleton – simple Applet display methods – requesting repainting – using the status window – The HTML Applet tag – passing parameters to Applets. **Introducing the AWT: Working with windows,graphics& Text:** AWT classes – window fundamentals – working with frame windows –creating a frame window in an Applet – creating a windowed program – displaying information within a window – working with graphics – working with color.

**TEXT BOOK:**

Herbert Schildt-JAVA – 2, The Complete reference (7<sup>th</sup> edition), Tata McGraw Hill 2001.

**Unit I:** Chapter 2(full), 3(2 to 9,11),4(full)

**Unit II:**Chapter 5(full),6(1 to 8),7(1 to 8,10)

**Unit III:** Chapter 8(full),9(full)

**Unit IV:**Chapter 10(1-9),11(1-6)

**Unit V:**Chapter 21(1 to 9),23(1-8)

V SEMESTER		
<b>P-IIA</b>	<b>PROGRAMMING IN C++ and DATA STRUCTURES PRACTICAL</b>	<b>18PEMA4PA</b>
<b>Hrs/Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Credit: 4</b>

### PROGRAMMING IN C++ PRACTICAL

1. Write a Program to evaluate the following investment equation  
 $V = P (1 + r)^n$  and print the tables which would give the value of V for various combination of the following values of P, r, and n:

P: 1000, 2000, 3000,..... , 10,000

r: 0.10, 0.11, 0.12,..... 0.20

n: 1, 2, 3,....., 10

(Hint: P is the principal amount and V is the value of money at the end of n years. This equation can be recursively written as

$$V = P (1 + r)$$

$$P = V$$

In other words, the value of money at the end of the first year becomes the principal amount for the next year, and so on.

2 ) An election is contested by five candidates. The candidates are number 1 to 5 and the voting is done by marking the candidate number on the ballot paper. Write a program to read the ballots and count the votes cast for each candidates using an array variable count. In case, a number read is outside the range 1 to 5, the ballot should be considered as a 'spoilt ballot', and the program should also count the number of spoilt ballots.

3) Write programs to evaluate the following functions to 0.0001% accuracy.

a)  $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$

b)  $SUM = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$

c)  $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$

4) An electricity board charges the following rates to domestic users to discourage large consumption of energy:

For the first 100 units - 60 P per unit

For next 200 units - 80 P per unit

Beyond 300 units - 90 P per unit

All users are charged a minimum of Rs. 50.00. If the total amount is more than Rs. 300.00 then an additional surcharge of 15% is added.

Write a program to read the names of users and number of units consumed and print out the charges with names.

5) Write a function *power ( )* to raise a number *m* to a power *n*. The function takes a *double* value for *m* and *int* value for *n* and returns the result correctly. Use a default value to 2 for *n* to make the function to calculate squares when this argument is omitted. Write a main that gets the values of *m* and *n* from the user to test the function.

6) Define a class to represent a bank account. Include the following members.

Data members

1. Name of the depositor
2. Account number
3. Type of account

#### 4. Balance amount in the account

Member functions

1. To assign initial values
2. To deposit an amount
3. To withdraw an amount after checking the balance
4. To display name and balance

Write a main program to test the program.

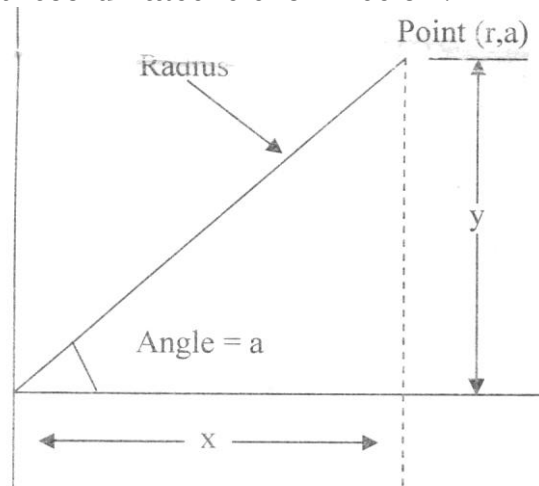
7) Write a class to represent a vector (a series of float values). Include member functions to perform the following tasks:

- a. To create the vector
- b. To modify the value of a given element
- c. To multiply by a scalar value
- d. To display the vector in the form (10, 20, 30.....)

Write a program to test your class.

8) Design a class Polar which describes a point in the plane using polar coordinates radius

and angle. A point in polar coordinates is shown below.



Polar coordinates of a point

Use the overloaded + operated to add two objects of polar

*Note that we cannot add polar values to two points directly. This requires first the conversion of points into rectangular co-ordinates, then adding the corresponding rectangular co-ordinates and finally converting the result back into polar co-ordinates. You need to use the following trigonometric formulae;*

$$\begin{aligned}
 x &= r \cdot \cos(a) \\
 y &= r \cdot \sin(a) \\
 a &= \text{atan}(x/y); && // \text{arc tangent} \\
 r &= \text{sqrt}(x^2 + y^2);
 \end{aligned}$$

9) Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes cur\_acct and sav\_acct to make them more

specific to their requirements. Include necessary member functions in order to achieve the following tasks:

- a. Accept a deposit from a customer and update the balance
- b. display the balance
- c. compute and deposit interest
- d. permit withdrawal and update the balance.
- e. check for the minimum balance, impose penalty, necessary and update the balance.

Do not use any constructors. Use member functions to initialize the class members.

10) Create a base class called shape. Use this class to store two double type, values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function `get_data()` to initialize base class data members and another member function `display_area()` to compute and display the area of figures. Make `display_area()` as a virtual function and redefine this function in the derived classes to suit their requirements.

Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively, and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles, and as base and height in the case of triangles, and used as follows:

Area of rectangle =  $x * y$

Area of triangle =  $\frac{1}{2} * x * y$

11) Write a program to read a list containing item name, item code, and cost interactively and produce a three column output as shown below.

Name	Code	Cost
Turbo C++	1001	250.95
C Primer	905	95.70
.....	.....	.....

*Note that the name and code are left justified and the cost is right justified with a precision of two digits. Trailing zeros are shown.*

#### **DATA STRUCTURE PRACTICAL**

1. Implement Stack Operation    a) PUSH    b) POP
2. Implementation of basic queue operation    a) ADD    b) DELETE
3. Addition and deletion of a node in a linked list
4. Minimum spanning tree
5. Shortest path algorithm
6. Quick sort
7. Merge sort
8. Polynomial addition using linked list (Using C++)



<b>IV SEMESTER</b>			
<b>P-IIB</b>	<b>JAVA PROGRAMMING PRACTICALS</b>		<b>18PEMA4P2</b>
<b>Hrs/Week: 6</b>	<b>Hrs / Sem: 90</b>	<b>Hrs / Unit: 18</b>	<b>Credit: 4</b>

1. Write a JAVA program using simple arithmetic calculation.
2. Write a JAVA program using one dimensional array.
3. Write a JAVA program using classes and objects.
4. Write a JAVA program using overloading.
5. Write a JAVA program using overriding and inheritance
6. Write a JAVA program for payroll using interface
7. Write a JAVA program for matrix addition & multiplication.
8. Write a JAVA program to find NCR value using Recursion.
9. Write a JAVA program to find the volume of sphere & cone
10. Write a JAVA program to check the given number is perfect or not.
11. Write a JAVA program to check the given number is armstrong or not.
12. Write a JAVA program to solve the quadratic equation.
13. Write a JAVA program to find the factorial of a number.
14. Write a JAVA program to find the simple interest.
15. Write a JAVA program to display calendar details.
16. Write a JAVA program using package.
17. Write a JAVA program using Runge-kutta2 method.
18. Write a JAVA program using Runge-kutta4 method.
19. Write a JAVA program to input a year and check whether the year is a leap year or not.
20. Write a JAVA program to reverse the number.
21. Write a JAVA program to find the area and perimeter of triangle, circle.
22. Write a JAVA program to draw lines, rectangles and ovals in Applet.
23. Write a JAVA program to implement smiley face using Applet.
24. Write a JAVA program to create animation using Applet.
25. Write a JAVA program to create a frame window in Applet.

**IDC SUBJECTS OFFERED BY DEPARTMENT OF MATHEMATICS TO  
OTHER MAJOR STUDENTS**

<b>II SEMESTER</b>		
<b>IDC-1</b>	<b>ADVANCED DISCRETE MATHEMATICS</b>	<b>18PIMA21</b>
<b>Hrs / Week: 3</b>	<b>Hrs / Sem: 45      Hrs / Unit:9</b>	<b>Credit: 3</b>

**OBJECTIVE:**

- To introduce the concepts of binary relations between two sets, an equivalence relation and combine relations using set operations and composition.
- To introduce the basic concept of probability and distribution.
- To study the concept of multigraph, directed or undirected, cyclic or acyclic, and determine the connectivity of a graph.

**UNIT I:**

**Set Theory:** Set and Elements – Subsets -Venn Diagram – Set Operations –Algebra of Sets- Duality – Finite Sets – Counting Principle – Classes of Sets – Power Sets – Partitions- Mathematical Induction.

**UNIT II:**

**Relations:**Product of Sets – Relations – Pictorial Representatives of Relations -Composition of Relations – Types of Relations -Closure properties – Closure Properties – Equivalence Relations –Partial Ordering Relations.

**UNIT III:**

**Techniques of Counting:** Introduction – Basic counting Principles - Mathematical Functions - Permutations - Combinations - The Pigeonhole Principle - The Inclusion–Exclusion Principle - Tree Diagrams.

**UNIT IV:**

**Probability:** Introduction – Sample Space and Events – Finite Probability Spaces – Conditional Probability – Independent Events – Independent Repeated Trials, Binomial Distribution- Random Variables.

**UNIT V:**

**Graph Theory:** Introduction- Data Structures – Graphs and Multigraphs – Subgraphs - Isomorphic and Homeomorphic Graphs - Paths, Connectivity - Traversable and Eulerian Graphs, Bridges of Königsberg - Labeled and Weighted Graphs - Complete, Regular, and Bipartite Graphs - Tree Graphs - Planar Graphs.

**TEXT BOOK:**

Seymour Lipschutz and Marc Lars Lipson- Discrete Mathematics – Scham’s Series –Second Edition – Tata McGraw Hill Publications.

**UNIT I** : Chapter 1 (Section 1.1 to 1.10)

**UNIT II** : Chapter 2 (Section 2.1 to 2.9)

**UNIT III** : Chapter 6(Section6.1 to 6.8)

**UNIT IV** : Chapter 7 (Section7.1 to 7.7)

**UNIT V** : Chapter 8 ( Section8.1 to8.9)

<b>III SEMESTER</b>		
<b>IDC- 2</b>	<b>NUMERICAL &amp; STATISTICAL METHODS</b>	<b>18PIMA31</b>
<b>Hrs / Week: 3</b>	<b>Hrs / Sem: 45      Hrs / Unit: 9</b>	<b>Credit: 3</b>

**OBJECTIVE:**

- To understand the foundation for numerical methods and statistics.
- To learn about the root finding problems using several methods.
- To learn about solving techniques of the systems of linear algebraic equations using Gauss elimination and LU decomposition

**UNIT I: Algebraic and Transcendental Equations**

Bisection Method – Iteration Method – The Method of False Position – Newton- Raphson – Method.

**UNIT II: System of Linear Equation**

Gauss Elimination, Gauss Jordan elimination – Triangularization method – Iterative Methods, Jacobi, Gauss-Seidal iteration, Iterative method for A-1.

**UNIT III: Interpolation**

Interpolation with equal intervals – Newton forward and backward formula – Central Difference Interpolation formula – Gauss forward and backward formula – Stirling's formula – Bessel's Formula - Numerical differentiation: Maximum and minimum values of a tabulated function. Numerical Integration: Trapezoidal Rule – Simpson's Rule – Numerical double Integration.

**UNIT IV: Basic Distribution**

Binominal distribution – Poisson distribution – Normal distribution – Properties and Applications.

**UNIT V: Correlation and Regression**

Correlation Coefficient – Rank correlation coefficient of determination – Linear regression – Method of least squares – Fitting of the curve of the form  $ax+b$ ,  $ax^2+bx+c$ ,  $abx$  and  $axb$  – Multiple and partial correlation (3-variable only).

**TEXT BOOK:**

1. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", 3<sup>rd</sup> Edition, S. Chand, 2006.

**UNIT I** : Chapter 3(Section 3.1 to 3.4)

**UNIT II** : Chapter 4(Section 4.1 to 4.4, 4.8)

**UNIT III** : Chapter 8 (Section 8.1 to 8.8, 9.1 to 9.16)

2. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 1994.

**UNIT IV** : Chapter 7 (Section 7.1 to 7.4)

**UNIT V** : Chapter 10 (Section 10.1 to 10.7)