**DHANALAKSHMI SRINIVASAN COLLEGE OF ARTS AND SCIENCE FOR**
**(AUTONOMOUS)**
(AFFILIATED TO BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPAL
(NATIONALLY RE-ACCREDITED WITH 'A' GRADE BY NAAC)
PERAMBALUR-621 212,TAMIL NADU
DEPARTMENT OF MATHEMATICS
**PG - ALLIED MATHEMATICS – COURSE STRUCTURE UNDER CB**
(CANDIDATES ADMITTED FROM 2020-2021 ONWARDS)

| SEM | DEPARTMENT | COURSE TITLE | COURSE CODE | INSTR PERIODS / WEEK | CREDIT | EXAM HOURS | INTER |
|---|---|---|---|---|---|---|---|
| I | MBA | MATHEMATICS AND STATISTICS | 20PBA1C4 | 4 | 4 | 3 | 25 |
| | MCA | MATHEMATICAL FOUNDATION FOR COMPUTER APPLICATIONS | 20PCA1C3 | 4 | 4 | 3 | 25 |
| | M.SC PHYSICS | MATHEMATICAL PHYSICS | 20PPH1C1 | 5 | 5 | 3 | 25 |
| | M.SC PHYSICS | NUMERICAL METHODS AND C PROGRAMMING | 20PPH1E1 | 5 | 4 | 3 | 25 |
| | **TOTAL** | | | **18** | **17** | | **100** |
| | M.COM & M.COM (CA) | QUANTITATIVE TECHINIQUES FOR BUSINESS DECISIONS | 20PCO2C5/ 20PCOA2C5 | 6 | 5 | 3 | 25 |
| | M.SC BIO-CHEMISTRY | BIO-STATISTICS AND BIO INFORMATICS | 20PBC2E2A | 4 | 3 | 3 | 25 |
| | MBA | OPERATIONS RESEARCH | 20PBA2C11 | 4 | 4 | 3 | 25 |
| | MCA | OPERATIONS RESEARCH AND NUMERICAL METHODS | 20PCA2C9 | 5 | 4 | 3 | 25 |
| | **TOTAL** | | | **19** | **16** | | **100** |

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Rajah Serfoji Govt. College (A
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P. PARAMASI
S. Railway

Head of the Department
Department of Mathematics
Dhanalakshmi Srinivasan
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Women (Autonomous)
Perambalur-621 212.

**MATHEMATICS AND STATISTICS**

**MASTER OF BUSINESS ADMINISTRATION**

**Semester : I**

**Max. Marks: 75**

**Course Code: 20PBA1C4**

**Credit: 04**

**Total Periods: 60**

**Exam Hours: 03**

Objective:

To make students understand and the basic mathematical and Statistical concepts in the resolution of managerial decision problems.

Course Learning Outcomes:

1. Evaluate differentiation and hyperbolic function
2. Recognize the probability and theorems of probability
3. Appreciate the sampling and measures of central value
4. Compare the correlation and regression

UNIT I (12Periods)

Differentiation – Differential Co-efficient of $x^n$, $e^x$, $\log_e x$, cos x, sin x, tan x – Inverse function, Hyperbolic function, Inversion hyperbolic function, Differentiation of hyperbolic functions, Differentiation of the inverse hyperbolic function

UNIT II

(12Periods)

Probability - Theorems of probability – Conditional Probability – Bayes Theorem – Random variable – Probability Mass function – Probability Density function – Continuous distribution function

UNIT III (12Periods)

Sampling – Methods of sampling, size of sampling, merits & limitations of sampling – Measures of central value – Mean, Median, Mode, Geometric Mean, Harmonic Mean – Measures of Dispersion – Range, Mean Deviation, Standard Deviation, Co-efficient of variation, Quartile Deviation.

## UNIT IV
## (12Periods)

Sampling Distribution - Testing of hypothesis for mean – Variance – proportions & differences using normal – t-chi-square & F-distributions – Tests for independence of distributions of attributes & goodness of fit.

## UNIT V (12Periods)

Correlation & Regression – Scatter Diagram, Karl Pearson's co-efficient of correlation, properties of correlation co-efficient, calculation of co-efficient of correlation for a bivariate distribution – Regression – Lines of regression, Regression equations, Angle between regression lines

## TEXT BOOKS:


1. S.Narayanan and T.K. Manicavachagom Pillay, Calculus Volume I, S.Viswanathan (Printers & Publishers) Pvt Limited, Chennai -2011.
2. A. Singaravelu, Dr. S. Sivasubramaniyan & R. Ramaa Probability and Statistics revised edition 2007
3. Dr. K. Subramani, Dr. A. Santha, Statistical for Management, Scitech publications india Pvt Limited


UNIT I - Chapter 2 of [1]
UNIT II - Chapter 1 of [2]
UNIT III - Chapter 1 1.11-1.14 of [3]
UNIT IV - Chapter 4 of [2]
UNIT V - Chapter 5 5.1.1-5.1.8 of [3]

## BOOKS FOR REFERENCE:


1. Business statistics, Bharat Jhunjhunwala – S.Chand.co.
2. Mathematics for Economics and finance – Martin Anthony and Normanbiggs – Low price Edition – Cambridge University press

# MATHEMATICAL FOUNDATION FOR COMPUTER APPLICATIONS

## MASTER OF COMPUTER APPLICATIONS

**Semester : I** **Max. Marks : 75**

**Course Code: 20PCA1C3**

**Credit: 04**

**Total Periods: 60**

**Exam Hours : 03**

Objective:

To enlighten the Discrete Mathematical Structures with Applications to Computer Science

Course Learning Outcomes:

1. Understanding the mathematical logic and set theory
2. Plan and deliver the binary relations and its properties
3. Know about the lattices and examples of lattices and their properties
4. Write the basic concepts of graph theory

**UNIT- I** **(12 Periods)**

**Mathematical Logic** : Connectives , Conditional and Bi-conditional Statement. Well-formed Formulas, tautologies - Equivalence of Formulas - Duality Law. Set Theory: Definition of set - Empty set -Inclusion and Equality of set - Power set - Proper subset - Union and Intersection of Sets - Disjoint Sets - Mutually disjoint - Complement of set - Relative and Absolute complement - Venn diagram – De Morgan's law - Cartesian Products

**UNIT- II** **(12 Periods)**

**Binary Relations**: Binary relation Properties of Binary relations in a Set - Relations Matrix and Graph of a Relation - Equivalence relations ,Compatibility relations and composition of relation. Functions: Definition of function, into, onto, one-to-one and one-to-one correspondence mapping. Composition of functions and Inverse functions.

**UNIT- III** **(12 Periods)**

**Algebraic Structure** : Semi group and Monodies - Definitions and Examples - Homomorphism of Semi group and Monodies - Sub semi group and Sub monodies. Grammars and Language : Definition of Grammar and types of Grammars. Notions of Syntax analysis.Groups : Definition and Example - Simple problems . Cosets and Lagrange's theorem.

**UNIT- IV** **(12 Periods)**

**Lattices** : Definition and Examples. Some properties of Lattices. Theorems related to Isotonicity , Distributive inequalities and Modular inequality. Boolean Forms and Free Boolean Algebra - Values of Boolean Expressions and Functions. Representation and Minimization of Boolean Functions.

**UNIT- V** **(12 Periods)**

**Graph Theory**: Basic Concepts of Graph theory - Basic Definitions - Path - Reach ability - Connectedness - Matrix Representation of Graphs - Trees - Basic Definitions – Different types of Trees . Storage representation and Manipulation of graphs.

**TEXT BOOK**:

1. Discrete Mathematical Structures with Applications to Computer Science – J.P.Tremblay, R.Manohar McGraw-Hill

**REFERENCE BOOK**:

1. Discrete Mathematics - Johnson Baugh McGraw-Hill
2. Discrete Computational Structures - KorfhafeRr Academic Press
3. Graph theory and Applications – NarasinghDeo

**QUANTITATIVE TECHINIQUES FOR BUSINESS DECISIONS**
**MASTER OF COMMERCE/M.Com., (CA)**

**Semester : II**
**Max. Marks : 75**
**Course Code : 20PCO2C5/20PCOA2C5**
**Credit : 05**
**Total Periods : 90**
**Exam Hours : 03**

Objective:

To acquaint the students with the Statistical tools and techniques for managerial decisions

Course Learning Outcomes:

1. Determine the concept and basic definition of probability
2. Know the about correlation and regression
3. Solve the significance tests in small samples
4. Illustrate linear programming and transportation problem

UNIT I (18 Periods)

Probability - Theorems of probability – Conditional Probability – Bayes Theorem – Random variable – Probability Mass function – Probability Density function – Continuous distribution function

UNIT II (18 Periods)

Correlation – Karl person coefficient – Limit of correlation coefficient – Rank Correlation – Repeated Rank Correlation – Regression – Line Regression – Angle between two lines of regression – Regression coefficient

UNIT III (18 Periods)

Significance Tests in Small Samples ( t - test) – Testing the significance of the mean of a random sample – Testing difference between means of two samples (Independent and Dependent Samples) – Chi-square test- Analysis of Variance (One way and two way classification).

UNIT IV (18 Periods)

Linear Programming – Formulation of Problem - Graphical Method – Simplex Method

UNIT V (18 Periods)

Transportation Problem – Initial Basic Feasible Solution - North West Corner Method – Least Cost Method – Vogel's Approximation Method - Assignment Problems

TEXT BOOKS

1. A. Singaravelu, Dr. S. Sivasubramaniyan & R. Ramaa Probability and Statistics revised edition 2007
2. P. Panneerselvam, Operations Research Second Edition 2006

UNIT I - Chapter 1 of [1]
UNIT II - Chapter 3 of [1]
UNIT III - Chapter 4, 5 of [1]
UNIT IV - Chapter 2 of [2]
UNIT V - Chapter 3 &4 of [2]

BOOKS FOR REFERENCE

1. "Fundamentals of Mathematical Statistics", Gupta,S.C. and V.K.Kapoor, Sultan Chand & Sons, New Delhi, 8th Edition., 1983.
2. "Fundamentals of Applied Statistics", Gupta.S.C. and V.K.Kapoor, Sultan Chand &Sons, New Delhi, 2nd Edition., 1978

# OPERATION RESEARCH
## MASTER OF BUSINESS ADMINISTRATIONS

**Semester : II**
**Max. Marks : 75**
**Course Code : 20PBA2C11**
**Credit : 04**
**Total Periods : 60**
**Exam Hours : 03**

Objective:

To acquaint the student with the applications of Operations Research to business and industry

Course Learning Outcomes:

1. Write the introduction to operation research, scope, phases
2. Analyze the transportation problem by Vogel's approximation
3. Solve network analysis and PERT problems
4. Recognize the inventory theory and theory of games
5. .

UNIT I (12 Periods)

Introduction to Operations Research, scope, phases- merits and limitations – concept of optimization, Theory of simplex methods to solve canonical

UNIT II (12 Periods)

Transportation problem by Vogel's approximation method; assignment problem, linear Programming complete enumeration method

UNIT III (12 Periods)

Network analysis – drawing of Arrow diagram – critical path method – calculation of critical path duration, total, free and independent floats, PERT problems

UNIT IV (12 Periods)

Inventory Theory, Deterministic models – purchase problem without and with shortages, with price breaks, production problem without shortages. Decision under risk – expected money value criterion – decision trees – decision under uncertainty – minimax criterion

UNIT V (12 Periods)

Theory of Games – pure and mixed Strategies, Principles of dominance, graphical methods, simplex methods

TEXT BOOKS

1. P. Panner Selvam, Operations Research Second Edition 2006
   - UNIT I - Chapter 2
   - UNIT II - Chapter 3 & 4
   - UNIT III - Chapter 10
   - UNIT IV - Chapter 7 & 11
   - UNIT V - Chapter 12

BOOKS FOR REFERENCE:

1. Operations Research principles and Applications – G. Srinivasan –PHI learning.
2. Introduction to operations Research – Billy E. Gilett – TATA Mcgraw hill.

## OPERATION RESERCH AND NUMERICAL METHODS
## (MCA)

**Semester : II**
**Max. Marks: 75**
**Course Code:**
**Credit : 04**
**Total Periods: 75** **Exam Hours: 03**

Objectives

Understand main components of graph theory

Course Learning Outcomes:

1. Solve linear programming and transportation problem
2. Write the solution of linear equation
3. Compare numerical differentiation and numerical integration
4. Illustrate the Picard's and fourth order runge-kutta methos

**UNIT –I** **(15 Periods)**

Linear Programming - Formulation of Problems – Graphical Method – Simplex Method.

**UNIT –II** **(15 Periods)**

Transportation problem – Initial Basic Feasible Solution – North West Corner Method – Least Cost Method – Vogel's Approximation Method – Assignment problem.

**UNIT -III** **(15 Periods)**

Solution of system of linear equations: Gauss- Elimination method, Gauss Jordan method, Gauss-Seidal method, Crout method.

**UNIT IV** **(15 Periods)**

Numerical differentiation, Numerical integration, Trapezoidal, Simpson's one third and three eight rules.

**UNIT- V** **(15 Periods)**

Solution of ordinary differential (first order, second order and simultaneous) equations by euler's, Picard's and fourth-order Runge- Kutta methods

**TEXT BOOKS AND REFERENCE:**.

1. S. Kalavathy, Operation research, Vikas Publishing House Private Ltd.,
2. Devi Prasad, An introduction to Numerical Analysis, Narosa Publication house, New Delhi 2006.
3. T. Veerajan & T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi, 2004

## MATHEMATICS AND STATISTICS
## MASTER OF BUSINESS ADMINISTRATION

**Semester : I**

**Max. Marks: 75**

**Course Code: 20PBA1C4**

**Credit: 04**

**Total Periods: 60**

**Exam Hours: 03**

Objective:

To make students understand and the basic mathematical and Statistical concepts in the resolution of managerial decision problems.

Course Learning Outcomes:

5. Evaluate differentiation and hyperbolic function
6. Recognize the probability and theorems of probability
7. Appreciate the sampling and measures of central value
8. Compare the correlation and regression

UNIT I (12Periods)

Differentiation – Differential Co-efficient of $x^n$, $e^x$, $\log_e x$, cos x, sin x, tan x – Inverse function, Hyperbolic function, Inversion hyperbolic function, Differentiation of hyperbolic functions, Differentiation of the inverse hyperbolic function

## UNIT II
(12Periods)

Probability - Theorems of probability – Conditional Probability – Bayes Theorem – Random variable – Probability Mass function – Probability Density function – Continuous distribution function

## UNIT III (12Periods)

Sampling – Methods of sampling, size of sampling, merits & limitations of sampling – Measures of central value – Mean, Median, Mode, Geometric Mean, Harmonic Mean – Measures of Dispersion – Range, Mean Deviation, Standard Deviation, Co-efficient of variation, Quartile Deviation.

## UNIT IV
(12Periods)

Sampling Distribution - Testing of hypothesis for mean – Variance – proportions & differences using normal – t-chi-square & F-distributions – Tests for independence of distributions of attributes & goodness of fit.

## UNIT V (12Periods)

Correlation & Regression – Scatter Diagram, Karl Pearson's co-efficient of correlation, properties of correlation co-efficient, calculation of co-efficient of correlation for a bivariate distribution – Regression – Lines of regression, Regression equations, Angle between regression lines

## TEXT BOOKS:


4. S.Narayanan and T.K. Manicavachagom Pillay, Calculus Volume I, S.Viswanathan (Printers & Publishers) Pvt Limited, Chennai -2011.
5. A. Singaravelu, Dr. S. Sivasubramaniyan & R. Ramaa Probability and Statistics revised edition 2007
6. Dr. K. Subramani, Dr. A. Santha, Statistical for Management, Scitech publications india Pvt Limited


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UNIT II - Chapter 1 of [2]
UNIT III - Chapter 1 1.11-1.14 of [3]
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UNIT V - Chapter 5 5.1.1-5.1.8 of [3]

## BOOKS FOR REFERENCE:


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# MATHEMATICAL FOUNDATION FOR COMPUTER APPLICATIONS

## MASTER OF COMPUTER APPLICATIONS

**Semester : I** **Max. Marks : 75**

**Course Code: 20PCA1C3**

**Credit: 04**

**Total Periods: 60**

**Exam Hours : 03**

Objective:

To enlighten the Discrete Mathematical Structures with Applications to Computer Science

Course Learning Outcomes:

5. Understanding the mathematical logic and set theory
6. Plan and deliver the binary relations and its properties
7. Know about the lattices and examples of lattices and their properties
8. Write the basic concepts of graph theory

**UNIT- I** **(12 Periods)**

**Mathematical Logic** : Connectives , Conditional and Bi-conditional Statement. Well-formed Formulas, tautologies - Equivalence of Formulas - Duality Law. Set Theory: Definition of set - Empty set -Inclusion and Equality of set - Power set - Proper subset - Union and Intersection of Sets - Disjoint Sets - Mutually disjoint - Complement of set - Relative and Absolute complement - Venn diagram – De Morgan's law - Cartesian Products

**UNIT- II** **(12 Periods)**

**Binary Relations**: Binary relation Properties of Binary relations in a Set - Relations Matrix and Graph of a Relation - Equivalence relations ,Compatibility relations and composition of relation. Functions: Definition of function, into, onto, one-to-one and one-to-one correspondence mapping. Composition of functions and Inverse functions.

**UNIT- III** **(12 Periods)**

**Algebraic Structure** : Semi group and Monodies - Definitions and Examples - Homomorphism of Semi group and Monodies - Sub semi group and Sub monodies. Grammars and Language : Definition of Grammar and types of Grammars. Notions of Syntax analysis.Groups : Definition and Example - Simple problems . Cosets and Lagrange's theorem.

**UNIT- IV** **(12 Periods)**

**Lattices** : Definition and Examples. Some properties of Lattices. Theorems related to Isotonicity , Distributive inequalities and Modular inequality. Boolean Forms and Free Boolean Algebra - Values of Boolean Expressions and Functions. Representation and Minimization of Boolean Functions.

**UNIT- V** **(12 Periods)**

**Graph Theory**: Basic Concepts of Graph theory - Basic Definitions - Path - Reach ability - Connectedness - Matrix Representation of Graphs - Trees - Basic Definitions – Different types of Trees . Storage representation and Manipulation of graphs.

**TEXT BOOK**:

1. Discrete Mathematical Structures with Applications to Computer Science – J.P.Tremblay, R.Manohar McGraw-Hill

**REFERENCE BOOK**:

1. Discrete Mathematics - Johnson Baugh McGraw-Hill
2. Discrete Computational Structures - KorfhafeRr Academic Press
3. Graph theory and Applications – NarasinghDeo

**QUANTITATIVE TECHINIQUES FOR BUSINESS DECISIONS**
**MASTER OF COMMERCE/M.Com., (CA)**

**Semester : II**
**Max. Marks : 75**
**Course Code : 20PCO2C5/20PCOA2C5**
**Credit : 05**
**Total Periods : 90**
**Exam Hours : 03**

Objective:

To acquaint the students with the Statistical tools and techniques for managerial decisions

Course Learning Outcomes:

5. Determine the concept and basic definition of probability
6. Know the about correlation and regression
7. Solve the significance tests in small samples
8. Illustrate linear programming and transportation problem

UNIT I (18 Periods)

Probability - Theorems of probability – Conditional Probability – Bayes Theorem – Random variable – Probability Mass function – Probability Density function – Continuous distribution function

UNIT II (18 Periods)

Correlation – Karl person coefficient – Limit of correlation coefficient – Rank Correlation – Repeated Rank Correlation – Regression – Line Regression – Angle between two lines of regression – Regression coefficient

UNIT III (18 Periods)

Significance Tests in Small Samples ( t - test) – Testing the significance of the mean of a random sample – Testing difference between means of two samples (Independent and Dependent Samples) – Chi-square test- Analysis of Variance (One way and two way classification).

UNIT IV (18 Periods)

Linear Programming – Formulation of Problem - Graphical Method – Simplex Method

UNIT V (18 Periods)

Transportation Problem – Initial Basic Feasible Solution - North West Corner Method – Least Cost Method – Vogel's Approximation Method - Assignment Problems

TEXT BOOKS


3. A. Singaravelu, Dr. S. Sivasubramaniyan & R. Ramaa Probability and Statistics revised edition 2007
4. P. Panneerselvam, Operations Research Second Edition 2006

UNIT I - Chapter 1 of [1]
UNIT II - Chapter 3 of [1]
UNIT III - Chapter 4, 5 of [1]
UNIT IV - Chapter 2 of [2]
UNIT V - Chapter 3 &4 of [2]


BOOKS FOR REFERENCE


3. "Fundamentals of Mathematical Statistics", Gupta,S.C. and V.K.Kapoor, Sultan Chand & Sons, New Delhi, 8th Edition., 1983.
4. "Fundamentals of Applied Statistics", Gupta.S.C. and V.K.Kapoor, Sultan Chand &Sons, New Delhi, 2nd Edition., 1978

# OPERATION RESEARCH
## MASTER OF BUSINESS ADMINISTRATIONS

**Semester : II**
**Max. Marks : 75**
**Course Code : 20PBA2C11**
**Credit : 04**
**Total Periods : 60**
**Exam Hours : 03**

Objective:

To acquaint the student with the applications of Operations Research to business and industry

Course Learning Outcomes:

6. Write the introduction to operation research, scope, phases
7. Analyze the transportation problem by Vogel's approximation
8. Solve network analysis and PERT problems
9. Recognize the inventory theory and theory of games
10..

UNIT I (12 Periods)

Introduction to Operations Research, scope, phases- merits and limitations – concept of optimization, Theory of simplex methods to solve canonical

UNIT II (12 Periods)

Transportation problem by Vogel's approximation method; assignment problem, linear Programming complete enumeration method

UNIT III (12 Periods)

Network analysis – drawing of Arrow diagram – critical path method – calculation of critical path duration, total, free and independent floats, PERT problems

UNIT IV (12 Periods)

Inventory Theory, Deterministic models – purchase problem without and with shortages, with price breaks, production problem without shortages. Decision under risk – expected money value criterion – decision trees – decision under uncertainty – minimax criterion

UNIT V (12 Periods)

Theory of Games – pure and mixed Strategies, Principles of dominance, graphical methods, simplex methods

TEXT BOOKS

2. P. Panner Selvam, Operations Research Second Edition 2006
   - UNIT I - Chapter 2
   - UNIT II - Chapter 3 & 4
   - UNIT III - Chapter 10
   - UNIT IV - Chapter 7 & 11
   - UNIT V - Chapter 12

BOOKS FOR REFERENCE:

3. Operations Research principles and Applications – G. Srinivasan –PHI learning.
4. Introduction to operations Research – Billy E. Gilett – TATA Mcgraw hill.

**OPERATION RESERCH AND NUMERICAL METHODS**
**(MCA)**

**Semester : II**
**Max. Marks: 75**
**Course Code:**
**Credit : 04**
**Total Periods: 75** **Exam Hours: 03**

Objectives

Understand main components of graph theory

Course Learning Outcomes:

5. Solve linear programming and transportation problem
6. Write the solution of linear equation
7. Compare numerical differentiation and numerical integration

8. Illustrate the Picard's and fourth order runge-kutta methos

**UNIT –I** **(15 Periods)**

Linear Programming - Formulation of Problems – Graphical Method – Simplex Method.

**UNIT –II** **(15 Periods)**

Transportation problem – Initial Basic Feasible Solution – North West Corner Method – Least Cost Method – Vogel's Approximation Method – Assignment problem.

**UNIT -III** **(15 Periods)**

Solution of system of linear equations: Gauss- Elimination method, Gauss Jordan method, Gauss-Seidal method, Crout method.

**UNIT IV** **(15 Periods)**

Numerical differentiation, Numerical integration, Trapezoidal, Simpson's one third and three eight rules.

**UNIT- V** **(15 Periods)**

Solution of ordinary differential (first order, second order and simultaneous) equations by euler's, Picard's and fourth-order Runge- Kutta methods

**TEXT BOOKS AND REFERENCE:**.

1. S. Kalavathy, Operation research, Vikas Publishing House Private Ltd.,
2. Devi Prasad, An introduction to Numerical Analysis, Narosa Publication house, New Delhi 2006.
3. T. Veerajan & T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi, 2004

## CORE COURSE - I
## ABSTRACT ALGEBRA

**Semester : I** **Max. Marks: 75**

**Course Code: 20PMM1C1** **Credit: 05**

**Total Periods: 90** **Exam Hours: 03**

Objectives:

To give foundation in Algebraic structures like Groups & Rings

Course Learning Outcomes:

1. Understand the concepts of homomorphism, permutation groups and their properties
2. Relate ring theory and more ideals and quotient rings
3. Learn properties of polynomial ring and determine inner product spaces

4. Realize importance of Galois theory and its more about roots

## UNIT I (18 Periods)

Group Theory - A counting principle - Normal Subgroups and Quotient groups - Homomorphism - Cayley's theorem - Permutation groups - Another counting principle - Sylow's theorems

## UNIT II (18 Periods)

Ring Theory: Homeomorphisms - Ideals and quotient rings - More ideals and quotient rings -Euclidean Rings - A particular Euclidean Ring.

## UNIT III (18 Periods)

Polynomial rings - Polynomials over the rational field - polynomials over commutative Rings -Inner Product spaces.

## UNIT IV (18 Periods)

Fields: Extension fields - Roots of Polynomials - More about roots.

## UNIT V (18 Periods)

The elements of Galois Theory - Finite fields

## TEXT BOOK(S)

1. I.N. Herstein, Topics in Algebra, Second Edition, Wiley Eastern Limited.

UNIT I - Chapter 2 Section 2.5, 2.6, 2.7, 2.9, 2.10, 2.11, 2.12
UNIT II - Chapter 3 Section 3.3, 3.4, 3.5, 3.7, 3.8
UNIT III - Chapter 3 & 4 Section 3.9, 3.10, 3.11, 4.4
UNIT IV - Chapter 5 Section 5.1, 5.3, 5.5
UNIT V - Chapter 5 & 7 Section 5.6, 7.1

## BOOKS FOR REFERENCE


1. David S.Dummit and Richard M.Foote, Abstract Algebra, Third Edition, Wiley Student Edition,2015.
2. Vijay, K. Khanna, and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt

Limited, 2008 (Third Edition)

## CORE COURSE - II
## REAL ANALYSIS

**Semester : I** **Max. Marks: 75**

**Course Code: 20PMM1C2** **Credit: 05**

**Total Periods: 90** **Exam Hours: 03**

Objectives:

To give the students a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced learning in Pure Mathematics.

Course Learning Outcomes:

1. Understand basic properties of R, Such as its characterization as a complete and ordered field.
2. Classify and explain upper and lower limits, test of convergence, power series.
3. Recognize the difference between continuous and discontinuous
4. Determine the integration and differentiation and weierstras theorem and the

implicit function theorem.

UNIT I (18 Periods)

Basic Topology: Finite, Countable and Uncountable Sets – Metric spaces – Compact sets – Perfect sets – Connected sets. Numerical Sequences and Series: Sequences – Convergence – Subsequences – Cauchy Sequences – Upper and Lower Limits - Some Special Sequences – Tests of convergence – Power series – Absolute convergence – Addition and multiplication of series –Rearrangements.

UNIT II (18 Periods)

Continuity: Limits of functions – Continuous functions – continuity and Compactness– Continuity and connectedness – Discontinuities – Monotonic functions – Infinite limits and limits at infinity. Differentiation: Derivative of a real function – Mean value Theorems - Intermediate value theorem for derivatives – L'Hospital's Rule – Taylor's Theorem – Differentiation of vector valued functions.

UNIT III (18 Periods)

Riemann – Stieltjes Integral: Definition and Existence – Properties – Integration and Differentiation – Integration of vector valued functions.

UNIT IV (18 Periods)

Sequences and series of functions: Uniform Convergence and Continuity – Uniform Convergence and Differentiation – Equi continuous families of functions – The Stone – Weierstrass Theorem.

UNIT V (18 Periods)

Functions of several variables: Linear Transformations - Differentiation – The Contraction Principle – The Inverse Function Theorem - The Implicit Function Theorem.

TEXT BOOK(S)

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, Mcgraw Hill, 1976.
   - UNIT I -Chapters 2 and 3
   - UNIT II -Chapters 4 and 5
   - UNIT III -Chapter 6
   - UNIT IV -Chapter 7
   - UNIT V -Chapter 9 Section 9.1 to 9.29

BOOKS FOR REFERENCE

1. Tom P. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969

## CORE COURSE - III
## GRAPH THEORY

**Semester : I** **Max. Marks: 75**

**Course Code: 20PMM1C3** **Credit: 05**

**Total Periods: 90** **Exam Hours: 03**

Objectives:

To give a rigorous study of the basic concepts of Graph Theory and applications of Graph Theory in other disciplines

Course Learning Outcomes:

1. Understand the basic concepts of graphs, directed graphs
2. Understand the properties of trees, counting the number of spanning trees

3. Understand eulerian graph and Hamiltonian graphs
4. Apply the knowledge of graphs to solve the real life problem

## UNIT I :BASIC RESULTS (18 Periods)

Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness- Operations on Graphs - Directed Graphs: Basic Concepts - Tournaments.

## UNIT II :CONNECTIVITY (18 Periods)

Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees: Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.

## UNIT III: INDEPENDENT SETS AND MATCHINGS (18 Periods)

Vertex Independent Sets and Vertex Coverings - Edge Independent Sets – Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

## UNIT IV: GRAPH COLOURINGS (18 Periods)

Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials

## UNIT V: PLANARITY (18 Periods)

Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.

## TEXT BOOK(S)

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008

UNIT I - Chapter 1 & 2 Section 1.1 to 1.4, 1.7, 2.1 and 2.2
UNIT II - Chapter 3 & 4 Section 3.1, 3.2, 4.1, 4.3 to 4.4
UNIT III - Chapter 5 & 6 Section 5.1 to 5.4, 6.1, 6.2
UNIT IV - Chapter 7 Section 7.1 to 7.4, 7.7
UNIT V - Chapter 8 Section 8.1 to 8.6

## BOOKS FOR REFERENCE

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.

2. Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraph,CRC press,2010

## ELECTIVE - I
## DISCRETE MATHEMATICS

**Semester : I** **Max. Marks: 75**

**Course Code: 20PMM1E1A** **Credit: 04**

**Total Periods : 90** **Exam Hours: 03**

Objectives:

To study the concepts like Boolean algebra, coding theory and obtain the knowledge in grammar and Languages

Course Learning Outcomes:

1. Construct mathematical arguments using logical connectives and quantifiers
2. Validate and correctness of an argument using statement and predicate calculus

3. Understand how lattices and Boolean algebra are used as tools and mathematical models in the study of networks
4. Learn how to work with some of the discrete structures which include sets, relations,function, graphs and recurrence relation

## UNIT I (18 Periods)

Relations and Functions: Binary relations, equivalence relations and partitions, partial order relations, inclusion and exclusion principle, Hasse diagram, Pigeon hole principle. Functions, inverse functions, compositions of functions, recursive functions

## UNIT II (18 Periods)

Mathematical Logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and quantifiers.

## UNIT III (18 Periods)

Lattices: Lattices as Partially Ordered Sets. Their Properties, Lattices as algebraic Systems, Sub lattices, Direct Product and homomorphism. Some Special Lattices - Complete, Complemented and Distributive Lattices, Isomorphic Lattices.

## UNIT IV (18 Periods)

Boolean Algebra: Various Boolean identities, the switching Algebra Example, Sub Algebras, Direct Production and Homomorphism. Boolean Forms and their Equivalence, Midterm Boolean forms, Sum of Products, Canonical Forms. Minimization of Boolean Functions: Design Examples Using Boolean Algebra, Finite-state Machine

## UNIT V (18 Periods)

Computability and Languages: Russell's Paradox and Non computability, Ordered Sets, Languages, Phrase structure grammars, Types of Grammars and Languages, Remarks and Reference

## TEXT BOOK(S)


1. Trembly. J.P &Manohar.P., "Discrete Mathematical Structures with Applications to Computer Science" McGraw- Hill.
2. Liu, C.L., "Elements of Discrete Mathematics", McGraw-Hill Book co.
3. K.D Joshi, "Foundations of Discrete Mathematics", Wiley Eastern Limited.

UNIT I - Chapter 2 of [1], Chapter 4 of [2], Chapter 2 of [3]
UNIT II - Chapter 1 of [1]
UNIT III - Chapter 4 of [1]
UNIT IV - Chapter 4 of [1]
UNIT V - Chapter 2 of [2]


## BOOKS FOR REFERENCE


1. Kolman, Busy & Ross, "Discrete Mathematical Structures", PHI.

2. Trembly. J.P. & Manohar.P., “Discrete Mathematical Structures with Applications to Computer Science” McGraw-Hill

## ELECTIVE - I
## COMBINATORICS

**Semester : I** **Max. Marks: 75**

**Course Code: 20PMM1E1B** **Credit: 04**

**Total Periods : 90** **Exam Hours: 03**

Objectives:

To introduce the notion of different types of distributions of objects and generating functions and study the Polya’s enumeration theorems

Course Learning Outcomes:

1. Explain permutation tand combinations recurrence relation, the root polynomials
2. Classify and explain the distinct objects and non distinct objects
3. Understand the permutations with for bidden positions

4. Learn polya's fundamental theorem and generation of polya's theorem

## UNIT I (18 Periods)

Permutations and combinations - distributions of distinct objects - distributions of non distinct objects - Stirlings formula

## UNIT II (18 Periods)

Generating functions - generating function for combinations - enumerators for permutations - distributions of distinct objects into non-distinct cells -partitions of integers – the Ferrer's graphs - elementary relations

## UNIT III (18 Periods)

Recurrence relation - linear recurrence relations with constant coefficients solutions by the technique of generating functions - a special class of nonlinear difference equations - recurrence relations with two indice

## UNIT IV (18 Periods)

The principle of inclusion and exclusion - general formula - permutations with restriction on relative positions - derangements - the rook polynomials - permutations with forbidden positions

## UNIT V (18 Periods)

Polya's theory of counting - equivalence classes under a permutation group Burnside theorem - equivalence classes of functions - weights and inventories of functions - Polya' s fundamental theorem – generation of Polya's theorem.

## TEXT BOOK(S)

1. Introduction of Combinatorial Mathematics, C.L. Liu, McGraw Hill, 1968 Chapters 1 to 5.

## BOOKS FOR REFERENCE


1. Combinatorial Theory, Marshall Hall Jr.,John Wiley & Sons, second edition.
2. Combinatorial Mathematics, H.J. Rayser, Carus Mathematical Monograph, No.14.

## APPLICATION ORIENTED COURSE - I
## ORDINARY DIFFERENTIAL EQUATIONS

**Semester : I** **Max. Marks: 75**

**Course Code: 20PMM1A1** **Credit: 03**

**Total Periods : 90** **Exam Hours: 03**

Objectives:

To give an in-depth knowledge of differential equations and their applications and study the existence, uniqueness, stability behavior of the solutions of the ODE

Course Learning Outcomes:

1. Approximate gauss's hyper geometric equation
2. Understand properties of Legendre polynomials and Bessel function
3. Cary out the oscillation and boundary value problems
4. Solve the types of critical points stability, stability by liopunov's direct method

UNIT I (18 Periods)

The general solution of the homogeneous equation– he use of one known solution to find another – The method of variation of parameters – Power Series solutions. A review of power series– Series solutions of first order equations – Second order linear equations; Ordinary points.

UNIT II (18 Periods)

Regular Singular Points – Gauss's hyper geometric equation – The Point at infinity - Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions.

UNIT III (18 Periods)

Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial Value Problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.

UNIT IV (18 Periods)

Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions– Sturm Comparison Theorems – Eigen values, Eigen functions and the Vibrating String.

UNIT V (18 Periods)

Nonlinear equations - Autonomous Systems; the phase plane and its phenomena –Types of critical points; Stability – critical points and stability for linear systems –Stability by Liapunov's direct method – Simple critical points of nonlinear systems.

TEXT BOOK(S)

1. G.F. Simmons, Differential Equations with Applications and Historical Notes, TMH, New Delhi, 1984.
   UNIT I - Chapter 3: Sections 15, 16, 19 and Chapter 5: Sections 25 to 27
   UNIT II - Chapter 5: Sections 28 to 31 and Chapter 6: Sections 32 to 35
   UNIT III - Chapter 7: Sections 37, 38 and Chapter 11: Sections 55, 56
   UNIT IV - Chapter 4: Sections 22 to 24
   UNIT V - Chapter 8: Sections 42 to 44

BOOKS FOR REFERENCE

1. W.T. Reid, Ordinary Differential Equations, John Wiley & Sons, New York, 1971
2. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, McGraw Hill Publishing Company, New York, 1955.

## CORE COURSE - IV
## LINEAR ALGEBRA

**Semester : II** **Max. Marks: 75**

**Course Code: 20PMM2C4** **Credit: 05**

**Total Periods : 90** **Exam Hours: 03**

Objectives:

To give the students a thorough knowledge of the various aspects of Linear Algebra and train the students in problem-solving as a preparatory for competitive exams

Course Learning Outcomes:

1. Understand the concept of linear equations matrices and elementary row operations
2. Relate the linear transformations by matrices
3. Learn Lagrange interpolation, commutative ring
4. Realize important of diagonalization and sum decompositions

UNIT I (18 Periods)

Matrices: Systems of linear Equations - Matrices and Elementary Row operations -Row-reduced echelon Matrices - Matrix Multiplication - Invertible Matrices -Bases and Dimension.(Only revision of Vector spaces and subspaces)

UNIT II (18 Periods)

Linear Transformations: The algebra of linear transformations - Isomorphism of Vector Spaces -Representations of Linear Transformations by Matrices - Linear Functional– TheDouble Dual - The Transpose of a Linear Transformation.

UNIT III (18 Periods)

Algebra Of Polynomials: The algebra of polynomials - Lagrange Interpolation - Polynomial Ideals -The prime factorization of a polynomial - Commutative rings – Determinant functions.

UNIT IV (18 Periods)

Determinants: Permutations and the uniqueness of determinants - Classical Adjoint of a (square) matrix - Inverse of an invertible matrix using determinants -Characteristic values -Annihilating polynomials.

UNIT V (18 Periods)

Diagonalization: Invariant subspaces - Simultaneous triangulation and simultaneous Diagonalization Direct - sum Decompositions - Invariant Direct sums – Primary Decomposition theorem.

TEXTBOOK(S)

1. Kenneth Hoffman and Ray Alden Kunze, Linear Algebra, Second Edition, Prentice Hall of India Private Limited, New Delhi, 1975.
   - UNIT I - Chapter 1 & 2 Section 1.2-1.6 and 2.3
   - UNIT II - Chapter 3
   - UNIT III - Chapter 4 & 5 Section 4.1 - 4.5 and 5.1 - 5.2
   - UNIT IV - Chapter 5 & 6 Section 5.3, 5.4 and 6.1 - 6.3
   - UNIT V - Chapter 6 Section 6.4 - 6.8

BOOKS FOR REFERENCE

1. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice-Hall of India Ltd, 2004.
2. A.R. Rao, P. Bhimashankaram, Linear Algebra, Second Edition, Tata McGraw

Hill, 2000

## CORE COURSE - V
## COMPLEX ANALYSIS

**Semester : II** **Max. Marks: 75**

**Course Code: 20PMM2C5** **Credit: 05**

**Total Periods : 90** **Exam Hours: 03**

Objectives:

To learn the various intrinsic concepts and the theory of Complex Analysis and study the concept of Analyticity, Complex Integration and Infinite Products in depth

Course Learning Outcomes:

1. Define and analyze limits and continuity for functions of complex variables
2. Evaluate complex cauchy's theorem for a rectangle
3. Understand the reflection principle
4. Evaluate chains and cycles and the calculus of residues

UNIT I (18 Periods)

Elementary Point Set Topology: Sets and Elements – Metric Spaces – Connectedness –Compactness – Continuous Functions – Topological Spaces; Conformality: Arcs and Closed Curves – Analytic Functions in Regions – Conformal Mapping – Length and Area; Linear Transformations: The Linear Group – The Cross Ratio – Symmetry

UNIT II (18 Periods)

Fundamental theorems in complex integration: Line Integrals – Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk; Cauchy's Integral Formula: The Index of a Point with Respect to a Closed Curve – The Integral Formula – Higher Derivatives.

UNIT III (18 Periods)

Local Properties of Analytic Functions - Removable Singularities - Taylor's Theorem – Integral representation of the nth term - Zeros and Poles – Algebraic order of f(z) – Essential Singularity - The Local Mapping – The Open Mapping Theorem – The Maximum Principle.

UNIT IV (18 Periods)

The General Form of Cauchy's Theorem: Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions; The Calculus of Residues: The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals

UNIT V (18 Periods)

Harmonic Functions: Definition and Basic Properties – The Mean-value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle; Power series expansions-Weierstrass's Theorem – The Taylor Series – The Laurent Series;

TEXT BOOK(S)

1. Lars V. Ahlfors, Complex Analysis, Third Ed. McGraw-Hill Book Company, Tokyo, 1979.
   UNIT – I -Chapter 3 Section 1.1 to 1.6, 2.1 to 2.4, 3.1-3.3
   UNIT – II -Chapter 4 Section 1.1 to 1.5, 2.1 to 2.3
   UNIT – III -Chapter 4 Section 3.1, 3.2, 3.3, 3.4
   UNIT – IV -Chapter 4 Section 4.1 to 4.7, 5.1 to 5.3
   UNIT – V -Chapter 4 Section 6.1 to 6.5, and Chapter 5 Section 1.1 to 1.3

BOOKS FOR REFERENCE

1. Serge Lang, Complex Analysis, Addison Wesley, 1977.
2. Karunakaran, Complex Analysis, Alpha Science international Ltd,Second Edition,2005.

## CORE COURSE - VI
## MEASURE THEORY AND INTEGRATION

**Semester : II** **Max. Marks: 75**

**Course Code: 20PMM2C6** **Credit: 05**

**Total Periods : 90** **Exam Hours: 03**

Objectives:

To generalize the concept of integration using measures and develops the concept of analysis in abstract situations

## Course Learning Outcomes:

1. Understand the lebesgue out measure
2. Evaluate the abstract measure spaces
3. Define signed measures and halin decomposition
4. Analysis the product measure and fubini's theorem

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## UNIT I (18 Periods)

Measure on Real line - Lebesgue outer measure - Measurable sets - Regularity -Measurable function - Borel and Lebesgue measurability

## UNIT II (18 Periods)

Integration of non-negative functions - The General integral - Integration of series -Riemann and Lebesgue integrals.

## UNIT III (18 Periods)

Abstract Measure spaces - Measures and outer measures - Completion of a measure - Measure spaces - Integration with respect to a measure

## UNIT IV (18 Periods)

Convergence in Measure- Almost uniform convergence - Signed Measures and Halin Decomposition - The Jordan Decomposition

## UNIT V (18 Periods)

Measurability in a Product space – The product Measure and Fubini's Theorem

## TEXT BOOK(S)

1. G. De Barra, Measure Theory and Integration, New age international (p) Limited.

   UNIT I - Chapter 2 Sections 2.1 to 2.5
   UNIT II - Chapter 3 Sections 3.1 to 3.4
   UNIT III - Chapter 5 Sections 5.1 to 5.6
   UNIT IV - Chapter 7 Sections 7.1 and 7.2, Chapter 8 Sections 8.1 and 8.2
   UNIT V - Chapter 10 Sections 10.1 and 10.2

## BOOKS FOR REFERENCE


1. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited
   Publishers, New Delhi, 1986, Reprint 2000.
2. Richard L. Wheeden and AntoniZygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977

**ELECTIVE - II**

**MATHEMATICAL MODELING**

**Semester : II** **Max. Marks: 75**

**Course Code: 20PMM2E2A** **Credit: 04**

**Total Periods: 90** **Exam Hours: 03**

Objectives:

To study the mathematical models through ODE and Difference equations and train the students to develop mathematical models in real life problems

## Course Learning Outcomes:

1. Analyze the mathematical modeling through ordinary differential equation
2. Compare the difference of planetary motion and circular motion
3. Determine the linear difference equations with constant coefficients
4. Illustrate mathematical modeling through graphs

## UNIT I (18 Periods)

Mathematical Modeling through Ordinary Differential Equations of First order**:** Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamics problems – Geometrical problems.

## UNIT II (18 Periods)

Mathematical Modeling through Systems of Ordinary Differential Equations of First Order: Population Dynamics – Epidemics – Compartment Models – Economics –Medicine, Arms Race, Battles and International Trade – Dynamics.

## UNIT III (18 Periods)

Mathematical Modeling through Ordinary Differential Equations of Second Order: Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modeling through Linear Differential Equations of Second Order –Miscellaneous Mathematical Models.

## UNIT IV (18 Periods)

Mathematical Modeling through Difference Equations: Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics –Probability Theory

## UNIT V (18 Periods)

Mathematical Modeling through Graphs: Solutions that can be Modeled through Graphs – Mathematical Modeling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

## TEXT BOOK(S)

1. J.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Delhi, 1988.
   - UNIT I - Chapter 2 Sections 2.1 to 2.6
   - UNIT II - Chapter 3 Sections 3.1 to 3.6
   - UNIT III - Chapter 4 Sections 4.1 to 4.4
   - UNIT IV - Chapter 5 Sections 5.1 to 5.5
   - UNIT V - Chapter 7 Sections 7.1 to 7.5

BOOK FOR REFERENCE

1. J. N. Kapur, Mathematical Models in Biology and Medicine, EWP New Delhi, 1985.

## ELECTIVE - II
## FLUID DYNAMICS

**Semester : II** **Max. Marks: 75**

**Course Code: 20PMM2E2B** **Credit: 04**

**Total Periods: 90** **Exam Hours: 03**

Objectives:

To give the students an introduction to the behavior of fluids in motion and the students a feel of the applications of Complex Analysis in the analysis of the flow of liquids

## Course Learning Outcomes:

1. Differentiate the real fluids and ideal fluids
2. Discussion of some flows involving axial symmetry
3. Understanding the concept of stream function and some worked example
4. Obtain some solvable problems in viscous flow

## UNIT I (18 Periods)

Real Fluids and Ideal Fluids - Velocity of a Fluid at a point – Streamlines and Path lines: Steady and Unsteady Flows – The Velocity potential – The Velocity vector – Local and Particle Rates of Change – The Equation of continuity – Worked examples – Acceleration of a Fluid – Conditions at a rigid boundary – General analysis of fluid motion – Pressure at a point in a Fluid at Rest – Pressure at a point in Moving Fluid – Conditions at a Boundary of Two Inviscid Immiscible Fluids – Euler's equation of motion – Bernoulli's equation – Worked example

## UNIT II (18 Periods)

Discussions of a case of steady motion under conservative body forces – Some potential theorems – Some Flows Involving Axial Symmetry – Some special two-Dimensional Flows-Impulsive Motion. Some three- dimensional Flows: Introduction – Sources, Sinks and Doublets – Images in a Rigid infinite Plane – Axi-Symmetric Flows; Stokes stream function.

## UNIT III (18 Periods)

Some Two- Dimensional Flows: Meaning of a Two- Dimensional Flow – Use of cylindrical polar co-ordinates – The stream function – The Complex Potential for Two- Dimensional, Irrotational , Incompressible Flow – complex velocity potentials for Standard Two Dimensional Flows – Some worked examples – The Milne-Thomson circle theorem and applications – The theorem of Blasius.

## UNIT IV (18 Periods)

The use of conformal Transformation and Hydro dynamical Aspects – Vortex rows. Viscous flow Stress components in a real fluid - relations between cartesian components of stress - Translational Motion of Fluid element – The Rate of Strain Quadraic and Principle Stresses – Some further properties of the rate of strain quardric - Stress analysis in fluid motion – Relations between stress and rate of strain - The coefficient of viscosity and laminar flow – The Navier- Stokes equations of motion of a viscous fluid.

## UNIT V (18 Periods)

Some solvable problems in viscous flow – Steady viscous flow in tubes of uniform cross section – Diffusion of vorticity – Energy Dissipation due to viscosity – Steady Flow past a Fixed Sphere – Dimensional Analysis; Reynolds Number – Prandtl's Boundary Layer.

TEXT BOOK(S)

1. Text Book of Fluid Dynamics by F.Chorlton , CBS Publishers & Distributors, New Delhi ,1985.

   UNIT I - Chapter 2 and Chapter 3 Section 3.1 to 3.6

   UNIT II - Chapter 3 Section 3.7 to 3.11 and chapter 4 Section 4.1, 4.2, 4.3, 4.5

   UNIT II - Chapter 5 Section 5.1 to 5.9 except 5.7

   UNIT IV - Chapter 5 Section 5.10, 5.12 and Chapter 8 Section 8.1 to 8.9

   UNIT V - Chapter 8 Section 8.10 to 8.16.

BOOKS FOR REFERENCE

1. Computational Fluid Dynamics: An Introduction, J.F. Wendt J.D. Anderson, G. Degrez and E. Dick, Springer – Verlag, 1996.

2. Computational Fluid Dynamics, The Basics with Applicatios, J. D. Anderson, McGraw Hill,1995.

**APPLICATION ORIENTED COURSE - II**
**PARTIAL DIFFERENTIAL EQUATIONS**

**Semester : II** **Max. Marks: 75**

**Course Code: 20PMM2A2** **Credit: 03**

**Total Periods : 90** **Exam Hours: 03**

## Objectives:

To give an in-depth knowledge of solving partial differential equations and apply them in Scientific and Engineering problems and study the other aspects of PDE

## Course Learning Outcomes:

1. Know the basics of origins of first order partial differential equations
2. Analyze the special types of first order equation
3. Solve the method of integral transforms
4. Represent the Laplace equation and boundary value problems

## UNIT I (18 Periods)

Partial differential equations- origins 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 -Nonlinear Partial differential equations of the first order.

## UNIT II (18 Periods)

Cauchy's method of characteristics- compatible systems of first order equations - Charpits method- Special types of first order equations- Solutions satisfying given conditions- Jacobi's method

## UNIT III (18 Periods)

Partial differential equations of the second order : The origin of second order equations–second order equations in Physics – Higher order equations in Physics - Linear partial differential equations with constant co-efficient- Equations with variable coefficients-Characteristic curves of second order equations

## UNIT IV (18 Periods)

Characteristics of equations in three variables - The solution of Linear Hyperbolic equations -Separation of variables. The method of Integral Transforms – Non Linear equations of the second order

## UNIT V (18 Periods)

Laplace equation - Elementary solutions of Laplace's equations-Families of equipotential Surfaces- Boundary value problems-Separation of variables –Problems with Axial Symmetry

## TEXT BOOK(S)

1. Ian N. Sneddon, Elements of Partial differential equations**,** Dover Publication –INC, New York, 2006.
   - UNIT I - Chapter 2 Sections 1 to 7
   - UNIT II - Chapter 2 Sections 8 to 13
   - UNIT III - Chapter 3 Sections 1 to 6
   - UNIT IV - Chapter 3 Sections 7 to 11
   - UNIT V - Chapter 4 Sections 2 to 6

## BOOKS FOR REFERENCE

1. M.D. Raisinghania, Advanced Differential Equations, S. Chand and company Ltd., New Delhi,2001

2. E.T. Copson**,** Partial Differential Equations, Cambridge University Press