STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015-2016)

NUMBER THEORY AND CRYPTOGRAPHY

CODE : 15MT/PE/NC14 **CREDITS : 4**
L T P : 4 0 0
TOTAL TEACHING HOURS : 52

OBJECTIVES OF THE COURSE

- To provide an introductory course in Number theory
- To introduce the fast growing and relevant topic of cryptography as an application of Number theory

Unit 1 **(8 hrs.)**

Elementary Number Theory

1.1 Time Estimates for doing Arithmetic
1.2 Divisibility and the Euclidean Algorithm

Unit 2 **(8 hrs.)**

Elementary Number Theory (contd.)

2.1 Congruences
2.2 Some Applications to Factoring

Unit 3 **(12 hrs.)**

Finite Fields and Quadratic Residues

3.1 Finite Fields
3.2 Quadratic Residues and Reciprocity

Unit 4 **(12 hrs.)**

Cryptography

4.1 Some Simple Cryptosystems
4.2 Enciphering Matrices

Unit 5 **(12 hrs.)**

Public Key

5.1 Public Key Cryptography
5.2 RSA
5.3 Pseudoprimes
5.4 The Rho Method

TEXT BOOK

Koblitz, Neal, *A Course in Number Theory and Cryptography,* second edition, New York: Springer – Verlag, 2002.

Chapter 1: Sec. 1 – 4
Chapter 2: Sec. 1, 2
Chapter 3: Sec. 1, 2
Chapter 4: Sec. 1, 2
Chapter 5: Sec. 1, 2

BOOKS FOR REFERENCE

Christof Paar, Srivastava,R.J, *Understanding Cryptography*, New York: Springer, 2010.

Delfs Hans , Srivastava,R.J, *Introduction to cryptography, Principles and applications,* New York: Springer, 2002.

Ireland K., and Michael Rosen, *A Classical Introduction to Modern Number Theory*, second edition, New York: Springer Verlag, 2004.

JOURNALS
Journal of Number Theory
INTEGERS: Electronic Journal of Combinatorial Number Theory
Turkish Journal of Analysis and Number Theory
International Journal of Number Theory

WEB RESOURCES
http://www.math.utk.edu/~finotti/papers/grad.pdf
http://www.cse.iitd.ernet.in/~bagchi/courses/discrete-book/ch2.pdf
http://almuhammadi.com/sultan/crypto_books/Koblitz.2ndEd.pdf

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: $2 \times 2 = 4$ (Two questions to be set)
Section B: $2 \times 6 = 12$ (Three questions to be set)
Section C: $2 \times 17 = 34$ (Three questions to be set)

Third Component :

List of evaluation modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B : $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE : BRANCH I - MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

ANALYSIS OF ALGORITHMS

CODE : 15MT/PE/AA14 **CREDIT : 4**
L T P : 4 0 0
TOTAL TEACHING HOURS : 52

OBJECTIVES OF THE COURSE

- To introduce different methods to solve problems in an abstract setup
- To analyse algorithms to choose the better algorithm

Unit 1 **(8 hrs.)**

Analysis of Algorithm

1.1 Input Classes
1.2 Space Complexity
1.3 Cases to Consider
1.4 Rates of Growth
1.5 Divide and Conquer Algorithms
1.6 Recurrence Relations

Unit 2 **(10 hrs.)**

Searching and Selection Algorithms

2.1 Binary Search - Case Analysis
2.2 Selection

Unit 3 **(11 hrs.)**

Sorting Algorithms

3.1 Insertion Sort - Case Analysis
3.2 Heap sort - Case Analysis
3.3 Quick sort - Case Analysis

Unit 4 **(13 hrs.)**

Matching Algorithm

4.1 String Matching
4.2 Finite Automata
4.3 Knuth-Morris-Pratt Algorithm

Graph Algorithms

4.4 Data Structures for Graphs
4.5 Depth First and Breadth First Traversal Algorithms
4.6 Minimum Spanning Tree Algorithms

4.7 The Dijkstra-Prim Algorithm
4.8 The Kruskal Algorithm

Unit 5 **(10 hrs.)**

Nondeterministic Algorithms
5.1 NP-Complete Problems
5.2 Conditions for NP
5.3 Job Scheduling – Graph Coloring

TEXT BOOK

McConnell, Jefferey J. *Analysis of Algorithms: An Active Learning Approach***,** New Delhi: Narosa Publishing House, 2002.

Chapter 1	Sections 1.1, 1.1.1, 1.1.2, 1.2, 1.2.1, 1.4, 1.4.1, 1.5, 1.5.1, 1.5.2, 1.6
Chapter 2	Sections 2.2, 2.2.1, 2.2.2, 2.2.3, 2.3
Chapter 3	Sections 3.1, 3.1.1, 3.1.2, 3.5, 3.5.1, 3.5.2, 3.7, 3.7.1, 3.7.2
Chapter 5	Sections 5.1, 5.1.1, 5.1.2
Chapter 6	Sections 6.2, 6.2.1, 6.2.2, 6.3, 6.3.1, 6.3.2, 6.3.3, 6.4, 6.4.1, 6.4.2
Chapter 8	Sections 8.1 – 8.4

BOOKS FOR REFERENCE

Goodman and Hedetniemi. *Introduction to the Design and Analysis of Algorithms.* New Delhi: McGraw-Hill International Editions, 1997.

Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar. *Fundamentals of Computer Algorithms.* 2nd ed. New Delhi: Galgotia Publciation Pvt. Ltd., 2007.

Loudon, Kyle. *Mastering Algorithms with C.* Mumbai: Shroff Publishers & Distributors Pvt. Ltd., 1999.

Gajavelli S.S., Bhishma Rao, *Discrete Structures and Graph Theory*, Chennai: Scitech Publications Pvt. Ltd., 2003.

JOURNALS

Journal of Algorithms & Computational Technology
Journal of Mathematical Modelling and Algorithms in Operations Research

WEB RESOURCES

Sedgewick Robert, Flajolet Phillippe, An Introduction to the Analysis of Algorithms, Pearson Education, Inc, 2013 (e-book)

www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
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Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

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Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

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M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

SOFT SKILLS

CODE : 15MT/PK/SS22 **CREDITS : 2**

L T P : 2 0 0

TOTAL TEACHING HOURS : 26

OBJECTIVES OF THE COURSE

- To empower and create opportunities for self development
- To instill confidence and face challenges

Unit 1 **(6 hrs)**

Behavioural Traits

1.1 Self Awareness
1.2 Communication Skills – Verbal and Non Verbal
1.3 Leadership Qualities
1.4 Etiquette and mannerisms
1.5 Experiential Learning – Based on activities

Unit 2 **(5 hrs)**

Team Work

2.1 Interpersonal Skills
2.2 People Management
2.3 Creative Thinking
2.4 Critical Thinking
2.5 Experiential Learning – Based on activities

Unit 3 **(5 hrs)**

Time Management

3.1 Importance of time management
3.2 Planning and Prioritizing
3.3 Organizing skills
3.4 Action Plan
3.5 Experiential Learning – Based on activities

Unit 4 **(5 hrs)**

Conflict Resolution

4.1 Reasons for conflict
4.2 Consequences of conflict
4.3 Managing emotions
4.4 Methods of resolving conflicts
4.5 Experiential Learning – Based on activities

Unit 5 **(5 hrs)**

Career Mapping

5.1 Goal Setting and Decision Making
5.2 Career Planning
5.3 Resume Writing
5.4 Handling Interviews
5.5 Experiential Learning – Based on activities

Workshop on Societal Analysis

BOOKS FOR REFERENCE

Khera, Shiv, (2002), **You Can Win,** Macmillan India Ltd., Delhi.

Mishra, Rajiv K., (2004), **Personality Development : Transform Yourself,** Rupa and Co., New Delhi.

Newstrom, John W. and Scannell, Edward E., (1980), **Games Trainers Play: Experiential Learning,** Tata McGraw Hill, New Delhi.

PATTERN OF EVALUATION (Totally Internal)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

FUZZY SET THEORY AND APPLICATIONS

CODE : 15MT/PE/FT14 **CREDIT: 4**
L T P: 4 0 0
TOTAL TEACHING HOURS: 52

OBJECTIVES OF THE COURSE

- To introduce the concept of Fuzzy Mathematics
- To cite the applications of Fuzzy Mathematics in various fields

Unit 1 **(11 hrs.)**

Fuzzy Sets and Operations

1.1 Fuzzy Sets – Basic Concepts
1.2 Characteristics and Significance of the Paradigm Shift
1.3 Operations on Fuzzy Sets
1.4 Types of Fuzzy Sets
1.5 Properties of α – cuts

Unit 2 **(10 hrs.)**

Properties of Fuzzy Sets

2.1 Extension Principle for Fuzzy Sets
2.2 Crisp and Fuzzy Relations – Binary Relations
2.3 Fuzzy Relational Equations

Unit 3 **(10hrs.)**

Operations on Fuzzy Sets

3.1 Fuzzy Complements
3.2 Fuzzy Union – fuzzy Intersection – Combination of Operations

Unit 4 **(10 hrs.)**

Fuzzy Arithmetic

4.1 Fuzzy Numbers
4.2 Linguistic Variables
4.3 Arithmetic Operation of Fuzzy Intervals
4.4 Arithmetic Operation of Fuzzy Numbers
4.5 Fuzzy Equations

Unit 5 **(11 hrs.)**

Applications

5.1 Concept of Fuzzy Logic

5.2 Fuzzy Controllers

5.3 Application of Fuzzy Logic to Engineering, Medicine, Industry and Electronics

TEXT BOOKS

UNITS : 1 - 4

Klir George J. and Yuan Bo, Fuzzy Sets & Fuzzy Logic Theory and Applications**,** New Delhi : Prentice Hall India, 2009.

Chapter 1 Sections 1.3 – 1.5
Chapter 2 Sections 2.1, 2.3
Chapter 4 Sections 4.1 – 4.4, 4.6

Klir George J. and Folger Tina A., Fuzzy Sets, Uncertainty and Information**,** New Delhi : Prentice Hall India, 2004.

Chapter 2 Sections 2.2 – 2.5
Chapter 3 Sections 3.1, 3.2, 3.8

UNIT : 5

Klir George J. and Yuan Bo, *Fuzzy Sets & Fuzzy Logic Theory and Applications***,** New Delhi : Prentice Hall India, 2009.

Terano Toshiro Asai Kiyoji, Sugeno Michio, *Applied Fuzzy Systems***,** New York : A.P. Professional, 1994.

BOOKS FOR REFERENCE

Cengiz Kahraman, Estronge P.H, *Fuzzy applications in Industrial engineering*, Studies in Fuzziness and soft computing, Springer, 2006.

Huaguang Zhang, *Fuzzy modeling and Fuzzy control*, Control Engeering, Birkhauser, 2006.

John Harris, Nix Eileen, *An Introduction to Fuzzy Logic Applications*, Springer, 2010.

Lotfi A.Zadeh*, Fuzzy Sets and Their Applications to Cognitive and Decision Processes,* New York, Academic Press, 1975.

Michael Hanss, Deshmukh S.K, *Applied Fuzzy Arithmetic*, Springer, 2005.

WEB RESOURCES

John N. Mordeson, Premchand S. Nair**,** Fuzzy Mathematics: An Introduction for Engineers and Scientists, Second Edition, Physica-Verlag Heidelberg (2001) ISBN: 3790814202 | 324 pages | PDF | 6.6 MB. e – book

JOURNALS

Fuzzy Sets and Systems ISSN 0165-0114, Publisher: Elsevier - Netherlands

Iranian Journal of Fuzzy Systems ISSN 1735-0654, Publisher: University of Sistan and Baluchestan

Advances in Fuzzy Mathematics ISSN 0974-0201, Research India Publications

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
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Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

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M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

MECHANICS

CODE: 15MT/PE/ME14 **CREDITS: 4**
L T P: 4 0 0
TOTAL TEACHING HOURS: 52

OBJECTIVES OF THE COURSE

- To introduce various principles in dynamical systems
- To teach the techniques involved in calculus of variations
- To formulate equations of motion using different principles

Unit 1 **(10 hrs.)**

Elementary Principles of Mechanics, Variational Principles and Lagrange's Equations

1.1 Mechanics of a Particle
1.2 Mechanics of a System of Particles – Constraints
1.3 D'Alembert's Principle and Lagrange's Equations
1.4 Simple Applications of the Lagrangian Formulation
1.5 Hamilton's Principle

Unit 2 **(10 hrs.)**

Calculus of Variations

2.1 Some Techniques of the Calculus of Variations
2.2 Derivation of Lagrange's Equations from Hamilton's Principle
2.3 Extension of Hamilton's Principle to Non-holonomic systems
2.4 Cyclic Coordinates
2.5 General Conservation Theorem Relating to Cyclic Coordinates

Unit 3 **(12 hrs.)**

The Kinematics and Equations of Motion of a Rigid Body

3.1 Independent Coordinates of a Rigid Body
3.2 Euler Angles – Euler's Theorem on the Motion of a Rigid Body
3.3 Rate of Change of a Vector
3.4 Coriolis Force
3.5 Angular Momentum and Kinetic Energy of Motion about a Point
3.6 Eigen Values of Inertia Tensor and Principal Axes Transformation
3.7 Euler's Equations of Motion

Unit 4 **(10 hrs.)**

The Hamilton Equations of Motion

4.1 Legendre Transformations and the Hamilton Equations of Motion
4.2 Routh's Procedure
4.3 Derivation of Hamilton's Equations from a Variational Principle

Unit 5 **(10 hrs.)**

Canonical Transformations

5.1 Equation of Canonical Transformations - Examples
5.2 Symplectic Approach to Canonical Transformations

TEXT BOOK

Goldstein H., *Classical Mechanics* (Reprint 2001), London: Addison – Wesley Publishing Company, 1980.

Chapter 1	Sections 1.1 to 1.4, 1.6.
Chapter 2	Sections 2.1 to 2.4, 2.6
Chapter 4	Sections 4.1, 4.4, 4.6, 4.9, 4.10.
Chapter 5	Sections 5.1,5.4,5.5.
Chapter 8	Sections 8.1, 8.3, 8.5, 8.6
Chapter 9	Sections 9.1 to 9.3

BOOKS FOR REFERENCE

Corben, H.C., Stehle Philip, *Classical Mechanics*, (II Edition), New York: Robert E. Krieger Publishing Co., 1960.

Greenwood Donald, T., *Classical Dynamics,* New Delhi: Prentice Hall of India, 1979.

Starzhinskii, V.M., *An Advanced Course of Theoretical Mechanics*, Moscow: MIR Publishers, 1982.

Synge John, L., Byron Griffith, A., *Principles of Mechanics***,** (III Edition), New York: McGraw Hill Book Co., 1970.

Venkatachalapathy S.G., *Classical Mechanics.* Chennai: Margham Publications, 2006.

JOURNALS

Journal of Fluid Mechanics / Volume 356 / February 1998, pp 353- 379/Effects of the Coriolis force on the stability of Stuart vortices

Journal of Applied Mathematics and Mechanics / Canonicial Transformations and the Hamilton-Jacobi Theorem in the Optimum Control Theory

WEB RESOURCES

http://gsjournal.net/Science-Journals/ResearchPapersMechanicsElectrodynamics
Canonical Transformations in Quantum Mechanics/ scitation.aip.org

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

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Third Component :

List of Evaluation Modes:
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Theorem Writing Technique
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End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

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Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

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M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015-2016)

MATHEMATICAL MODELING

CODE: 15MT/PE/MM14 **CREDITS: 4**
L T P: 4 0 0
TOTAL TEACHING HOURS: 52

OBJECTIVES OF THE COURSE

- To translate real life situations into mathematical models
- To solve problems using mathematical tools

Unit 1 **(10 hrs.)**

Traffic Flow Model

1.1 Freeway Traffic
1.2 Macroscopic Traffic Flow Models
1.3 Conservation of Cars
1.4 Traffic Density
1.5 Microscopic Traffic Flow Model
1.6 Linear Car following Model

Unit 2 **(10 hrs.)**

Image Compression: Iterated functions

2.1 Introduction
2.2 Affine Transformation in the Plane
2.3 Iterated Function Systems
2.4 Iterated Contractions and Fixed Points
2.5 The Hausdorff Distance
2.6 Fractal Dimension
2.7 Photographs as Attractions

Unit 3 **(12 hrs.)**

The DNA computer

3.1 Introduction
3.2 Adlemans Hamiltonian Path Problems
3.3 Turing Machines and Recursive Functions
3.4 Turing Machines and Insertion Deletion Systems
3.5 NP – Complete Problems
3.6 DNA Computers

Unit 4 **(10 hrs.)**

Nonlinear Difference Equations

4.1 Recognizing a Nonlinear Difference Equation

4.2 Steady State Stability and Critical Parameters
4.3 The Logistic Difference Equation
4.4 Beyond $r = 3$

Unit 5 **(10 hrs.)**

Application of nonlinear difference equation to population

5.1 Density Dependence in Single Species Population
5.2 Two Species Iterations: Host – Parasite Systems
5.3 The Nicholson – Bailey Model
5.4 Modifications of the NB Model

TEXT BOOKS

Clive L. Dym, *Principles of Mathematical Modeling*, Elsevier, India Pvt Ltd, 2006.

Leah Edelstein - Keshet, *Mathematical Models in Biology*, SIAM, Random House, New York, 2005.

Christiane Rousseau and Yvan Sain - Aubin, *Mathematics and Technology*, Translator: Chris Hamilton, Springer science and Business media, L.L.C, 2008.

BOOKS FOR REFERENCE

Gershenfeld Neil, *The Nature of Mathematical Modeling*, New York: Cambridge University Press, 1999.

Kapur, J. N., *Mathematical Modeling*, New York: John Wiley & Sons, 1988.

Temam Roger M., Miranville Alain M., *Mathematical Modeling in Continuum Mechanics*, second edition, New York: Cambridge University Press, 2005.

JOURNALS

Journal of Mathematical Modelling and Algorithms in Operations Research
Mathematical Modelling of Natural Phenomena
Applied Mathematical Modelling Mathematical Modelling and Analysis
Journal of Mathematical Modelling

WEB RESOURCES

http://libgen.org/
http://www.sfu.ca/~vdabbagh/Chap1-modeling.pdf
http://www.maths.bris.ac.uk/~madjl/course_text.pdf

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

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Third Component :

List of Evaluation Modes:
Seminars
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Problem Solving

End Semester Examination:
Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set without omitting any unit)
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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016

PROBABILITY AND RANDOM PROCESS

CODE: 15MT/PE/PR14 **CREDIT : 4**
L T P : 4 0 0
TOTAL TEACHING HOURS : 52

OBJECTIVES OF THE COURSE

- To introduce the different techniques of stochastic process and Markov Chains
- To introduce standard concepts and methods of stochastic modeling
- To provide new perspective, methodology, models and intuition and aid in other mathematical and statistical studies

Unit 1 **(12hrs.)**

Random Variables

1.1 Definition, Discrete, Continuous - Distribution Function, p.d.f, p.m.f.
1.2 Expectation, Moments

Special probability distributions

1.3 Binomial, Geometric, Poisson, Uniform
1.4 Exponential, Erlang, Normal

Unit 2 **(12hrs.)**

Multiple Random Variables

2.1 Joint c.d.f.- Properties-Conditional Distributions
2.3 Conditional Mean - Covariance - Correlation Function

Unit 3 **(12hrs.)**

Introduction to Random Processes

3.1 Definition, Classification, Characterizing a Random Process
3.2 Cross- correlation, Cross-covariance Functions
3.3 Stationary Random Process- Ergodic Process
3.4 Power Spectral Density- Discrete
3.5 Time Random Process

Unit 4 **(12hrs.)**

Models of Random Processes

4.1 Bernoulli Process - Random Walk
4.2 Gaussian Process - Poisson Process

Unit 5 **(4hrs.)**

Markov Process

5.1 Discrete Time Markov Chain

5.2 Continuous Time Markov Chain

TEXT BOOK

Oliver, C Ibe. *Fundamentals of Applied Probability and Random Processes.* Elsevier First Indian Reprint 2007

Chapter 2.
Chapter 3: 3.1 to 3.4
Chapter 4: 4.3, 4.4, 4.7 to 4.11
Chapter 5: 5.1 to 5.7
Chapter 8
Chapter 10

BOOKS FOR REFERENCE

Basu A.K., *Introduction to Stochastic Processes*, Narosa Publishing House, New Delhi, 2003.

Karlin, S., and H.M. Taylor. *A First Course in Stochastic Processes*, 2nd ed., New York: Academic Press, 1975.

Medhi, J. *Stochastic Process*, New York: Wiley Eastern Limited, 1984.

Resnick, Sidney I. *Adventures in Stochastic Processes*, Boston: Birkhauser, 2002.

Taylor H.W., and S. Karlin. *An Introduction to Stochastic Modeling*, 3rd ed., New York: Academic Press, 1998.

JOURNAL

An International Journal of Probability and Stochastic Processes

Aditi Journal of Probability Theory and Stochastic Processes

AStA Advances in Statistical Analysis

Stochastic Analysis and Applications

ESAIM: Probability and Statistics

WEB RESOURCES

http://www.springer.com/statistics/journal/10182
http://www.springer.com/statistics/journal/10463
http://www.imstat.org/aos/

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End Semester Examination:
Total Marks: 100 **Duration: 3 Hours**

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
Post Graduate Elective Course Offered by Department of Mathematics to students for M.A., M.Com. & M.Sc. Degree Programme

SYLLABUS
(Effective from the academic year 2015 -2016)

FORMAL LANGUAGES AND AUTOMATA THEORY

CODE: 15MT/PE/FL24 **CREDITS : 4**
L T P : 4 0 0
TOTAL TEACHING HOURS: 52

OBJECTIVES OF THE COURSE

- To introduce basic concepts of graph theory, formal languages and automata theory
- To enhance compiling techniques and expose to computing device

Unit 1 **(14 hrs.)**

Graph Theory

1.1 Introduction to Graph Theory, Definition of a Graph and Examples
1.2 Degrees and Subgraphs
1.3 Isomorphism of Graphs
1.4 Matrix Representation of a Graph
1.5 Walks, Trails and Paths
1.6 Connectedness and Components (concepts only)
1.7 Characterisation of Trees
1.8 Connectivity of a Graph
1.9 Eulerian Graphs (concepts only)
1.10Hamiltonian Graphs (concepts only)

Unit 2 **(10 hrs.)**

Automata Theory

2.1 Finite Automata (FA) – Introduction and Definition
2.2 Representation of Finite Automaton
2.3 Acceptability of a String by a Finite Automaton
2.4 Language accepted by a Finite Automaton

Unit 3 **(10 hrs.)**

Automata Theory (contd.)

3.1 Non-deterministic Finite Automata (NFA)
3.2 Acceptability of a String by NFA
3.3 Equivalence of FA and NFA (concept only)
3.4 Procedure for finding an FA equivalent to a given NFA
3.5 Properties of Regular Sets (concepts only)

Unit 4 **(12 hrs.)**

Finite State Machines

4.1 Finite-state Machines
4.2 The Monoid of a Finite-State Machine
4.3 The Machine of a Monoid

Formal Languages

4.4 Phase-Structure Grammars
4.5 Chomsky Hierarchy of Languages
4.6 Finite Automata and Regular Languages
4.7 Derivation Trees for Content-Free Grammars
4.8 Normal Forms for Content free Grammar (concepts only)

Unit 5 **(6 hrs.)**

Project

5.1 Application of Finite Automata and Formal Language
5.2 Design of Vending Machine
5.3 Document Language Design
5.4 Cryptography
5.5 DNA Computing

TEXT BOOKS

Arumugam S. and Ramachandran S., *Invitation to Graph Theory*, Chennai: Scitech Publications (India) Pvt. Ltd., Reprint December 2013.

Chapter 1 Sec. 1.1, 1.2
Chapter 2 Sec. 2.1 – 2.4, 2.8
Chapter 4 Sec. 4.1, 4.2, 4.4
Chapter 5 Sec. 5.1, 5.2
Chapter 6 Sec. 6.1

Venkataraman M.K., Sridharan N., and Chandrasekaran N., *Discrete Mathematics*, Chennai: The National Publishing Company, Reprint 2007.

Chapter 12 Sec. 1 – 11, 13 – 20

BOOKS FOR REFERENCE

Behera, Nayak and Pallnayak, *Formal Languages and Automata Theory*, Vikas Publication, New Delhi, 2014.

Kamala Krithivasan and Rama. R., *Introduction to Formal Languages*, *Automata Theory and Computation*, Pearson Publishers, Chennai, 2009.

JOURNALS

Formal Languages and Automata Theory
Journal of Graph Theory
Discrete Applied Mathematics
Information Processing Letters

WEB RESOURCES
http://www.iitg.ernet.in/dgoswami/Flat-Notes.pdf

PATTERN OF EVALUATION

Continuous Assessment:
Total Marks: 50 **Duration: 90 Mins.**

Section A: $2 \times 2 = 4$ (Two questions to be set)
Section B: $2 \times 6 = 12$ (Three questions to be set)
Section C: $2 \times 17 = 34$ (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B : $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

Post Graduate Elective Course Offered by Department of Mathematics to students for M. A. / M. Sc. / M.Com. Degree Programmes

SYLLABUS
(Effective from the academic year 2015 – 2016)

STATISTICS FOR RESEARCH

CODE : 15MT/PE/SR34 **CREDITS: 4**
L T P: 4 0 0
TOTAL TEACHING HOURS: 52

ELIGIBILITY CRITERION

Offered to those who have not studied Statistics in the under graduate programme in the major or allied level

OBJECTIVES OF THE COURSE

- To understand and learn research techniques and methodologies
- To acquire basic skills for designing and implementing research projects

Unit 1 **(10 hrs.)**

Sampling Design

1.1 Implications of a Sample
1.2 Characteristics of a Good Sampling Design
1.3 Different Types of Sampling Designs
1.4 Probability and non-Probability Sampling - Sampling Error
1.5 Advantages and Disadvantages of Sampling

Unit 2 **(10 hrs.)**

Descriptive Statistics

2.1 Methods of Data Collection
2.2 Processing and Analysis of Data
2.3 Frequency Distribution
2.4 Measures of Central Tendency

Unit 3 **(10 hrs.)**

Descriptive Statistics

3.1 Measures of Dispersion
3.2 Normal Distribution
3.3 Graphical Representation

Unit 4

Interval Estimation **(10 hrs.)**

4.1 Interval Estimation
4.2 Concept of Setting Confidence Intervals to Population Parameters

4.3 Confidence Interval for Mean, Difference in Means, Variance, Ratio of Variances based on Normal, t, χ^2 and F Distributions - Simple Problems

Unit 5 **(12 hrs.)**

Tests of Significance

5.1 Definitions of Statistical Hypothesis - Null and Alternate Hypothesis – Critical Region – Two Types of Errors – Size and Power of a Test - Level of Significance

5.2 Tests of Significance for Large Samples based on Normal, t, χ^2 and F Distributions with regard to Mean, Variance and Coefficient of Correlation

5.3 Tests of Significance for Small Samples based on Normal, t, χ^2 and F Distributions with regard to Mean, Variance and Coefficient of Correlation

5.4 χ^2 test of Goodness of Fit and Independence of Two Attributes – Simple Problems

TEXT BOOK

Arora P.N and Arora S., *Statistics for Management*, New Delhi: S. Chand & Company Ltd, 2008.

BOOKS FOR REFERENCE

Vital P.R. *Mathematical Statistics*, Chennai : Margam Publications, 2002.

Gupta, S.C. and V.K. Kapoor. *Fundamentals of Mathematical Statistics*. New Delhi: Sultan Chand & Sons, 1979.

Arumugam, S. and Issac. *Statistics*. Palayamkottai : New Gamma Publishing House, 1999.

Kapur J. N. and H.C. Saxena. *Mathematical Statistics*. New Delhi : S. Chand & Co., 1976.

Mood A.M., F.A. Graybill and D.C.Boes. *Introduction of Theory of Statistics*. London: Mc Graw Hill Inc., 1963.

Pillai R.S.N., and V. Bagavathi. *Statistics.* New Delhi : S.Chand Company Ltd., 2000.

Subramaniam N. *Probability and Statistics*. Erode : SCM Publisher, 2005.

Richard I. Levin and David S. Rubin. *Statistics For Management***.** New Delhi : Prentice Hall of India Private Ltd., 2000.

JOURNALS

The Annals of Statistics
Journal of Computational and Graphical Statistics

WEB RESOURCES

http://projecteuclid.org/euclid.aos
http://www.tandfonline.com/toc/ucgs20/current#.VO6PrCcas6Yk

PATTERN OF EVALUATION

Continuous Assessment:
Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:
Total Marks: 100 **Duration: 3 hours**

Section A : 5×2 = 10 (One question to be set from each unit)
Section B : 5×6 = 30 (Seven questions to be set, without omitting any unit)
Section C : 3×20 = 60 (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086
M.Sc. DEGREE : BRANCH I - MATHEMATICS

SYLLABUS
(Effective from the academic year 2015-2016)

FINANCIAL MATHEMATICS
(Skill Development Course)

CODE : 15MT/PI/FM24 **CREDITS : 4**

OBJECTIVE OF THE COURSE

- To introduce mathematical models to enhance the understanding of mathematics of finance and financial markets

Unit 1

Geometric Brownian Motion:

1.1 Geometric Brownian Motion
1.2 Geometric Brownian Motion as a Limit of Simpler Models
1.3 Brownian Motion - Simple Problems

Unit 2

Interest Rates and Present Value Analysis:

2.1 Interest Rates
2.2 Present Value Analysis
2.3 Rate of Return
2.4 Continuously Varying Interest Rates - Simple Problems

Unit 3

Pricing Contracts via Arbitrage

3.1 An Example in Options Pricing
3.2 Other Examples of Pricing via Arbitrage

The Arbitrage theorem

3.3 The Arbitrage theorem
3.4 The Multi-period Binomial Theorem
3.5 Proof of the Arbitrage Theorem - Simple Problems

Unit 4

The Black-Scholes Formula

4.1 The Black-Scholes Formula
4.2 Properties of Black-Scholes Option Cost
4.3 The Delta Hedging Arbitrage Strategy
4.4 Some deviations: The Black-Scholes Formula
4.5 The Partial Derivatives – Simple Problems

Unit 5

Valuing by Expected Utility

5.1 Limitations of Arbitrage Pricing
5.2 Valuing Investments by Expected Utility
5.3 The Portfolio Selection Problem
5.4 Value at Risk and Conditional Value at Risk
5.5 The Capital Assets Pricing Model
5.6 Mean Variance Analysis of Risk-Neutral-Priced Call Options
5.7 Rates of Return - Simple Problems

TEXT BOOK

Sheldon M. Ross. *An Elementary Introduction To Mathematical Finance* 2nd ed. Cambridge university press. 2005.

Chapter 3	Sections 3.1 – 3.3
Chapter 4	Sections 4.1 – 4.4
Chapter 5	Sections 5.1 – 5.2
Chapter 6	Sections 6.1 – 6.3
Chapter 7	Sections 7.1 – 7.5
Chapter 9	Sections 9.1 – 9.7

BOOKS FOR REFERENCE

Joseph. Stampfli, and Victor Goodman, *The Mathematics of Finance Modeling and Hedging*, Thomson publishers

Steven Roman, *Introduction to Mathematics of Finance*, Springer

JOURNALS

SIAM Journal on Financial Mathematics (SIFIN)
Journal of Mathematical Finance
Journal of Financial Engineering

WEB RESOURCES

http://www.tcs.tifr.res.in/~sandeepj/avail_papers/chapter.pdf

http://plus.maths.org/content/what-financial-mathematics

PATTERN OF EVALUATION: (**End Semester Examination - 3 Hours**)

Section A: 10×2 = 20 (Ten questions to be set selecting two from each unit)
Section B: 5×8 = 40 (Seven questions to be set without omitting any unit)
Section C: 2×20= 40 (Three questions to be set without omitting any unit)