Dr.M.G.R
Educational and Research Institute
UNIVERSITY

(Decl.U/S 3 of the UGC Act 1956)

Maduravoyal, Chennai

Department of Mathematics

M.Sc – Mathematics (Full Time)

Curriculum and Syllabus

2016 Regulation

Dr. M.G.R. Educational And Research Institute • Deemed to be University • Registrar Office Periyar E.V.R. High Road Maduravoyal Chennai-95

C. B. Palaniveli

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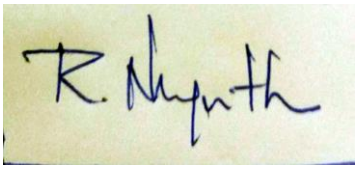
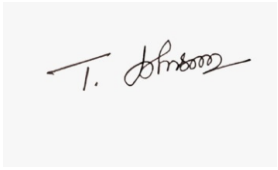
DEPARTMENT OF MATHEMATICS

LIST OF ELECTIVES						
S.No	**Sub. Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	**HMMA16E01**	Mathematical Modeling & Applications	4	0	0	4
2	**HMMA16E02**	Fluid Dynamics	4	0	0	4
3	**HMMA16E03**	Probability Theory & Stochastic Processes	4	0	0	4
4	**HMMA16E04**	Modern Applied Algebra	4	0	0	4
5	**HMMA16E05**	Fuzzy Sets And Fuzzy Logic	4	0	0	4
6	**HMMA16E06**	Statistical Quality Control	4	0	0	4
7	**HMMA16E07**	Graph Theory	4	0	0	4
8	**HMMA16E08**	Discrete Mathematics	4	0	0	4





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HMMA16E01 **MATHEMATICAL MODELING AND APPLICATIONS** **4 0 0 4**

UNIT I

Introduction to Mathematical Modeling- Mathematical Modeling through Ordinary Differential Equations – Linear ,Non-linear Growth and Decay- Compartment Models – Models Through Systems of Ordinary Differential Equations- Models in Population Dynamics –Modeling of Epidemics – Modeling in Economics – Modeling through Linear Differential Equations of Second Order. (Ch.1 pp.01-13, Ch.2 pp.30-43, Ch.3 pp. 53-69, Ch.4 pp. 88-93 of Book 1) **12 Hours**

UNIT II

Modeling through Difference Equations – Some Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Models in Economics and Finance- Models in Population Dynamics and Genetics –Models in Probability Theory . (Ch.5 pp.96 – 121 of Book 1) **12 Hours**

UNIT III

Partial Differential Equations – Initial and Boundary Conditions - Modeling through Partial Differential Equations – Mass Balance Equations – Momentum Balance Equations – Variational Principles – Probability Generating Function – Model for Traffic Flow. (Ch. 6 pp.124 – 150 of Book 1) **12 Hours**

UNIT IV

Review of Basic Graph Theory - Modeling through Graphs , Directed Graphs , Signed Graphs and Weighted Digraphs and Unoriented Graphs – Modeling through Functional Equations .(Ch.7 pp.151-176, Ch.8 pp.177-183 of Book 1) **12 Hours**

UNIT V

Introduction to Calculus of Variations – Euler's Equations – Functionals dependent on First and Second Derivatives – Brachistochrone Problem – Isoperimetric Problems – Variational Methods of Solving Partial Differential Equations – Mathematical Modeling of Geometrical Problems and problems in Mechanics using Calculus of Variations. (Ch.9 pp.205 – 212 of Book) **12 Hours**

Total No. of hours: 60.

TEXT BOOKS:

1. Kapur J.N (2003) *Mathematical Modeling*, New Age International Publishers.
2. Elsgolts l. (1971) *Differential Equations and Calculus of Variations*, Mir Pub.

REFERENCES:

1. Thomas, Saaty, Joyce, M.A, *Thinking With Models*, Pergamon Press.
2. Murthy, D.P.N , Page, N.W, Rudin, E.V (1990) *Mathematical Modeling*, Pergamon Press.
3. Mayer, W.J (1992), *Concepts of Mathematical Modeling*, McGraw Hill.

HMMA16E02 **FLUID DYNAMICS** **4 0 0 4**

UNIT I

Scalar and Vector Fields – Gradient and Direction Differentiator – Normal Flux - Divergence – Line Integrals – Relations between Surface and Volume Integrals –Relations between Line and Surface Integrals – Conservative Vector Fields – General Orthogonal Curvilinear Coordinates – Some Cartesian Tensor Notation . (pp.14-62 of the Text) **12 Hours**

UNIT II

Real Fluids and Ideal Fluids – Velocity of a Fluid at a Point – Streamlines and pathlines-Velocity Potential – Vorticity Vector – Local and Particle Rates of Change – The Equation of Continuity – Acceleration – Conditions at a Rigid Boundary – General Analysis of Fluid Motion – Pressure at a Point in a Fluid at Rest and in a Moving Fluid – Euler's Equations of Motion – Bernoulli's Equation – The Case of Steady Motion Under Conservative Body Forces.
(pp.70 – 110 of the Text) **12 Hours**

UNIT III

Flows involving Axial Symmetry – Special Two Dimensional Flows – Impulsive Motion – Aspects of Vortex Motion – Sources, Sinks and Doublets – Images in a Rigid Infinite Plane – Images in Solid Spheres – Axi - Symmetric Flows – Stokes Stream Function – Stream Function for Axi - symmetric Irrotational Motions . (pp.110 – 159 of the Text) **12 Hours**

UNIT IV

Two-Dimensional Flow – Use of Cylindrical Coordinates – The Stream Function – Complex Potential for Two - Dimensional Irrotational Incompressible Flow – Complex Velocity Potentials for Standard Two-Dimensional Flows – Two- Dimensional Image Systems – Milne -Thomson Circle Theorem – Theorem of Blasius – The Use of Conformal Transformations.
(pp.160 – 201 of the Text) **12 Hours**

UNIT V

Viscous Flow : Stress Components in a Real Fluid – Relations between Cartesian Components of Stress –Translational Motion of a Fluid Element – The Rate of Strain Quadric and Principal Stresses – Properties – Stress Analysis in Fluid Motion – Relations between Stress and Rate of Strain – Coefficient of Viscosity and Laminar Flow – The Navier - Stokes Equations of Motion – Problems - Steady Viscous Flow in Tubes of Uniform Circular Cross-Section – Diffusion of Vorticity – Energy Dissipation due to Viscosity – Steady Flow past a Fixed Sphere – Dimensional Analysis: Reynolds Number.
(pp.310 – 345 of the Text) **12 Hours**

Total No. of hours: 60

TEXT BOOKS:

1. Frank Chorlton (2003) *Textbook of Fluid Dynamics*, CBS Pub., New Delhi.

REFERENCES:

1. Batchelor, G.K. (2000) *An Introduction To Fluid Dynamics*, Camb. Univ. Press.
2. Chorin, A.J. Marsden, J.E (1993) *A Mathematical Introduction to Fluid Mechanics*, Springer.
3. Acheson, D.J. (1990) *Elementary Fluid Dynamics*, Clarendon Press, Oxford.

HMMA16E03 **PROBABILITY THEORY & STOCHASTIC PROCESSES** **4 0 0 4**

UNIT I

Probability Theory-Introduction- Sample space and events – Conditional probabilities – Independent Events – Baye's formula – simple problems. (Sections 1.1- 1.6 of the Text) **12 Hours**

UNIT II

Random variables- Discrete Random variables- Continuous random variables – Expectation of a random variable- Joint distributed random variables – Moments and Moment generating functions-Limit theorems –Conditional expectations - simple problems. (Sections 2.1 - 2.7., 3.4., 3.5 of the Text) **12 Hours**

UNIT III

Stochastic Processes: Introduction – Classification of stochastic processes- Chapman-Kolmogrov equation – Limiting probabilities- Markov Decision processes- Poisson processes – Properties of Poisson processes- Generalizations of Poisson Processes - simple applications of Poisson processes. (Sections 2.8., 4.1- 4.4, 4.10, 5.3, 5.4 of the Text) **12 Hours**

UNIT IV

Introduction to renewal theory- Limit theorems and its applications- Regenerative processes- Computing the renewal function. Reliability theory: Introduction –Reliability of systems of independent components- Expected life time – Systems with repair- simple applications (Sections 7.1., 7.3., 7.5., 7.8., 9.1., 9.3., 9.6., 9.7 of the Text) 1**2Hours**

UNIT V

Introduction to Brownian motion- Gambler's ruin problem –Variations on Brownian motion - Pricing stock options- White Noise- Gaussian processes – Simple Applications (Sections 10.1., 10.3- 10.6 of the Text) **12 Hours**

Total No. of hours: 60

TEXT BOOKS:

1. Ross (2003) *Introduction to Probability Models, 8^{h} edition,* Elsevier..

REFERENCES:

1. Taylor, H.W. Karlin, S (1984) *An Introduction to Stochastic Modelling***,** Academic press.
2. Ross, S.M (1996) *Stochastic processes, 2nd Edition*, John Wiley.
3. Wentzel, W. Ovcharov, L. (1983) *Applied problems in probability theory***,** Mir Publishers, Moscow.

HMMA16E04 **MODERN APPLIED ALGEBRA** **4 0 0 4**

UNIT I
Rings and Ideals: Introduction – Integral Domain and Field – Field of Quotients – Subrings – Morphisms of Rings – Direct Sums – Ideals and Quotient Rings – Divisibility – Euclidean Domains – Unique Factorization Theorem – Prime and Maximal Ideals .
(pp.281 – 309 of Book 1) **12 Hours**

UNIT II
Polynomial Rings and Polynomial Codes: The Ring R[x] - Polynomial Rings over Fields – Polynomial Codes – Advantageous Properties - Shift Registers – Unique Factorization Theorem for Polynomials – Polynomial Functions and Formal Derivatives .
(pp.315 – 339 of Book 1) **12 Hours**

UNIT III
Fields – Quotient Field – Prime Field – Examples and Definitions – Simple Extensions – Finite Extensions - Finite Fields – Cyclotomic Polynomials – Factorization of Polynomials over finite fields- Berlekamp's Algorithm.
(pp.124 – 175 of Book 2) **12 Hours**

UNIT IV
Coding Theory: Introduction to Coding – Hamming distance –Hamming Bounds – Linear Codes – Generator Matrix – Decoding Algorithm – Hamming Code – Cyclic Codes – Special Cyclic Codes – BCH Code – Decoding BCH Codes.
(pp. 183 – 236 of Book 2) **12 Hours**

UNIT V
Cryptology: Classical Cryptosystems – Modular Enciphering – Caesar Cipher, Affine Cipher, Periodic Substitution Cipher – Hill Cipher – Examples – Public Key Cryptosystems - RSA Cryptosystem – Discrete Logarithms and Other Ciphers.
(pp.239 – 279 of Book 2) **12 Hours**

Total No. of hours: 60

TEXT BOOKS:
1. Garrett Birkhoff, Thomas, C. B (1987*) Modern Applied Algebra*, CBS Publishers, New Delhi.
2. Rudolf lidl, Gunter pilz (2004) *Applied Abstract Algebra, 2nd Edition*, Springer.

REFERENCES:
1. Berlekamp, E.R. (1968) *Algebraic Coding Theory*, McGraw Hill.
2. Peterson, W.W. (1961) *Error-Correcting Codes*, M.I.T Press.

HMMA16E05 **FUZZY SETS AND FUZZY LOGIC** **4 0 0 4**

UNIT I
Fuzzy Sets: Introduction - Basic Concepts – α-cuts – Properties – Representations of Fuzzy Sets – Extension Principle . (pp.1 – 30, 35-48 of the Text) **12 Hours**

UNIT II
Operations on Fuzzy Sets: Types – Fuzzy Complements – Fuzzy Intersections –Fuzzy Unions – Combinations of Operations – Aggregation Operations. (pp.50 – 94 of the Text) **12 Hours**

UNIT III
Fuzzy Arithmetic: Fuzzy Numbers – Linguistic Variables – Arithmetic Operations on Intervals – Arithmetic Operations on Fuzzy Numbers - Lattice of Fuzzy Numbers – Fuzzy Equations . (pp.97 – 117 of the Text) **12 Hours**

UNIT IV
Fuzzy Relations: Crisp versus Fuzzy Relations – Projections and Cylindric Extensions – Binary Fuzzy Relations – Binary Relations on a Single Set – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Ordering Relations – Fuzzy Morphisms. (pp. 119 – 144 of the Text) **12 Hours**

UNIT V
Fuzzy Logic: An Overview of Classical Logic – Multi-valued Logics – Fuzzy Propositions – Fuzzy Quantifiers – Linguistic Hedges – Inference from Conditional Fuzzy Propositions - Inference from Conditional and Qualified Propositions – Inference From Quantified Propositions . (pp. 212 – 242 of the Text) **12 Hours**

Total No. of hours: 60

TEXT BOOKS:
1. George Klir, Bo Yuan (2000) *Fuzzy Sets and Fuzzy Logic – Theory & Applications*, Prentice Hall India.

REFERENCES:
1. Zimmermann, H.J. (1985) *Fuzzy set Theory and Its Applications*, Kluwer.

HMMA16E06 **STATISTICAL QUALITY CONTROL** **4 0 0 4**

UNIT I

Quality Assurance in Business and Industries – Meaning of Quality – Quality Assurance – Quality Cost – Methods of Quality Assurance – Responsibility for Quality – Statistical Process Control – Chance and Assignable Causes of Quality Variation - Statistical Basis of Control Charts. (Ch..1.1 – 1.5, Ch.4.1 – 4.2 of the Text) **12 Hours**

UNIT II

Control Charts for Attributes: Control Chart for Fraction Non-conforming – p, np Charts - Variable Sample Size – O.C.Functions – Control Charts for Non-conformities (Defects) – C Chart – Procedures with Constant Sample Size – O.C.Functions. (Ch.5.1 – 5.3.1 & 5.3.4 of the Text) **12 Hours**

UNIT III

Control Charts for Variables: Introduction – Control Charts for X and R – Development and Use of X and R Charts – Control Limits – Specification limits and Natural Tolerance Limits – Probability Limits on the X and R Charts – Interpretation O.C.Functions. (Ch.6.1 – 6.2.2 upto pp.183, pp.187-192 & Ch.6.2.6 of the Text) **12 Hours**

UNIT IV

Acceptance Sampling : Lot-by Lot Acceptance Sampling for Attributes – Acceptance Sampling Problem – Advantages and Disadvantages – Single Sampling Plan for Attributes – OC Curve – Effects of n and c on OC Curve – Type A and Type B – OC Curves – Designing SSP with a specified OC Curve - AOQ & ATI. (Ch.10.1 – 10.1.1, Ch.10.2 of the Text) **12 Hours**

UNIT V

Acceptance Sampling by Variables: Types of Sampling Plans Available – Caution and use of Variables Sampling – Designing a Variables Sampling Plan with a Specified OC Curve – MIL-STD-105D and MIL-STD –414 - Dodge-Romig Sampling Plans & Uses. (Ch. 11.1 – 11.2, 10.5.1-10.5.2, 10.6, 11.3.1-11.3.2 of the Text) **12 Hours**

Total No. of hours: 60

TEXT BOOKS:

1. Douglas Montgomery (2009) *Introduction to Statistical Quality Control*, John Wileyv & Sons.

HMMA16E07 **GRAPH THEORY** **4 0 0 4**

UNIT I
Graphs - Graph Isomorphism - The Incidence and Adjacency Matrices – Sub graphs - Vertex Degrees - Paths and Connection - Cycles - Trees - Cut Edges and Bonds - Cut Vertices.
(Chapter 1 Section 1.1 - 1.7; Chapter 2 Section 2.1 - 2.3) **12 Hours**

UNIT II
Connectivity - Blocks - Euler tours - Hamilton Cycles. (Chapter 3 Section 3.1 - 3.2; Chapter 4 Section 4.1 - 4.2) **12 Hours**

UNIT III
Matchings - Matchings and Coverings in Bipartite Graphs - Edge Chromatic Number - Vizing's Theorem.
(Chapter 5 Section 5.1 - 5.2; Chapter 6 Section 6.1 - 6.2) **12 Hours**

UNIT IV
Independent sets - Ramsey's Theorem - Chromatic Number - Brooks' Theorem - Chromatic Polynomials.
(Chapter 7 Section 7.1 – 7.2; Chapter 8 Section 8.1 – 8.2, 8.4) **12 Hours**

UNIT V
Plane and planar Graphs - Dual graphs - Euler's Formula - The Five-Colour Theorem and the Four-Colour Conjecture.
(Chapter 9 Section 9.1 - 9.3, 9.6) **12 Hours**

Total No. of hours: 60

TEXT BOOKS:
1. Bondy, J.A Murthy, U.S.R (1976) *Graph Theory and Applications*, Macmillan, London.

REFERENCES:
1. J.Clark, J Holton , D.A (1995) *A First look at Graph Theory*, Allied Publishers, New Delhi.
2. Gould, R (1989) *Graph Theory*, Benjamin/Cummings, Menlo Park.
3. Gibbons, A (1989) *Algorithmic Graph Theory*, Cambridge University Press, Cambridge.
4. Wilson, R.J. Watkins, J.J (1989) *Graphs: An Introductory Approach*, John Wiley and Sons, New York.
5. Wilson, R.J (2004) *Introduction to Graph Theory*, Pearson Education, 4th Edition.
6. Choudum, S.A (1987) *A First Course in Graph Theory*, MacMillan India Ltd..

HMMA16E08 **DISCRETE MATHEMATICS** **4 0 0 4**

UNIT I
Statements – Connectives – Tautologies – Equivalence – Duality – Tautological Implications- Normal forms – Theory of Inference for the statement calculus – Predicate calculus – Inference theory of the predicate calculus. **12 Hours**

UNIT II
Basic Concepts – Operations on Sets – Relations and Ordering – Equivalence relations – Partial ordering – Functions – Composition of functions – Inverse functions. **12 Hours**

UNIT III
Semi-groups and Monoids – Groups – Subgroups – Homomorphisms – Cosets – Lagrange's theorem – Normal subgroups – Algebraic Systems with two binary Operations. **12 Hours**

UNIT IV
Lattices as partially ordered sets – Properties of Lattices – Sub lattices – Direct Product – Homomorphism in lattices. Boolean Algebra – Sub algebra – Direct product and Homomorphism in Boolean Algebra. **12 Hours**

UNIT V
Graph theory: Basic Concepts –Digraphs - Isomorphism - Paths – Reachability and Connectedness – Trees – Matrix Representations of Graphs. **12 Hours**

Total No. of hours: 60

TEXT BOOKS:
1. Tremblay, J.P, Manohar, R (1975) *Discrete Mathematical Structures with Applications to Computer Science*, McGraw Hill.

REFERENCES:
1. Kolman, Busby, Ross *Discrete Mathematical Structures*, Pearson Education Series.
2. Liu, J.T *Elements of Discrete Mathematics*, McGraw Hill.

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