APPENDIX – F

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

M.Sc., Branch I(c) (CBCS) Mathematics
(Semester)

GENERAL OBJECTIVES

To give an in depth study in Mathematics at the Post Graduate level so that students can understand the motivation and logic behind Mathematical theories and to give various applications of Mathematics to other areas.

SPECIFIC OBJECTIVES

To develop knowledge in basic Mathematics and Mathematical theories so that the students are able to develop skills which enable them to apply Mathematical techniques for solving problems and help them to appreciate the depth of Mathematical ideas which are useful in other areas. Students undergoing this course will make them serve as good teachers at the U.G level and will also prepare them for pursuing research in areas related to Mathematical Sciences.

1. **Eligibility:** A pass in B.Sc., Mathematics or any other degree accepted by M.K.U as equivalent there to.
2. **Duration:** Two years. Each year consists of 2 semesters. The duration of a semester is 90 working days.
3. **Attendance:** 75% of the classes in each semester shortage of attendance can be condoned as per existing university rules.
4. **Evaluation procedure:** A mark statement with

$$CCPA = \frac{\sum (\text{Marks} \times \text{Credits})}{\sum (\text{Credits})}$$

where the summations are over all papers appeared up to the current semester.

PRINCIPAL
Arulmigu Palaniandavar College
of Arts & Culture,
PALANI - 624 601.

5. **Examinations:** 3 Hours duration. Total marks 100 for all papers.

External Internal ratio **75 : 25** with 2 Internal Tests

I Test Between 30-40 days

II Test Between 70-80 days

Test Average: 15 marks

Group Discussion / Seminar / Quiz: 5 marks

Assignments: 5 marks

Total : 25 marks

6. **Implementation:** The revised syllabus will come into effect from the academic year 2013-2014 (i.e., for those who will join the course in July 2013 and afterwards.

7. **Transitory permission:** The candidates of previous scheme may be permitted to write exams in their own schemes up to examinations of April 2015 as a transitory provision.

Classification:

S.No	Range of CCPA	Class
1	50 & above but below 60	II
2	60 & above	I

The detailed list of papers pertaining to various semesters is given below:

S. No	Sub.Code	Title of the paper	Sem-ester	Credits	Cont-act Hours	Duration of Exams (in Hrs)	Marks		
							Exter nal	Inter-nal	Total
1	EMT13C11	Algebra I	I	5	6	3	75	25	100
2	EMT13C12	Analysis I	I	5	6	3	75	25	100
3	EMT13C13	Ordinary Differential Equations	I	4	6	3	75	25	100
4	EMT13C14	Graph theory I	I	5	6	3	75	25	100
5		From List I	I	4	6	3	75	25	100
6	EMT13C21	Algebra II	II	5	6	3	75	25	100
7	EMT13C22	Analysis II	II	5	6	3	75	25	100
8	EMT13C23	Partial Differential Equations	II	4	6	3	75	25	100
9	EMT13C24	Numerical Analysis	II	4	6	3	75	25	100
10		From List II	II	4	6	3	75	25	100
11	EMT13C31	Algebra III	III	5	6	3	75	25	100
12	EMT13C32	Analysis III	III	5	6	3	75	25	100
13	EMT13C33	Topology	III	5	6	3	75	25	100
14	EMT13C34	Statistics I	III	4	6	3	75	25	100
15		From List III	III	4	6	3	75	25	100
16	EMT13C41	Complex Analysis	IV	5	6	3	75	25	100
17	EMT13C42	Number Theory and Cryptography	IV	5	6	3	75	25	100
18	EMT13C43	Functional Analysis	IV	4	6	3	75	25	100
19	EMT13C44	Operations Research	IV	4	6	3	75	25	100
20		From List IV	IV	4	6	3	75	25	100

90

List I	Major Electives	
	EMT13T11	Mechanics
	EMT13T12	Differential Geometry
	EMT13T13	Combinatorial Mathematics
	EMT13T14	Analysis of Algorithms
List II	Major Electives	
	EMT13T21	Fluid Mechanics
	EMT13T22	Graph Theory II
	EMT13T23	Automata Theory and Formal Languages
	EMT13T24	Visual Basic 6.0
List III	Non-Major Electives	
	EMT13N31	Bio Statistics
	EMT13N32	Business Statistics
	EMT13N33	Mathematics for Competitive Examinations
	EMT13N34	Econometrics
List IV	Major Electives	
	EMT13T41	Statistics II
	EMT13T42	Advanced Topology
	EMT13T43	Stochastic Process
	EMT13T44	Fuzzy sets & Logic

DETAILED SYLLABUS

Paper 1: Algebra – I (5 credits)
(All units from the Text-Book)

Unit 1: Another Counting Principle, Sylow's Theorem, Direct Products, Finite Abelian Groups (Chapter 2: Sections 2.11, 2.12, 2.13, 2.14)

Unit 2: Solvable groups and nilpotent groups.(Chapter 1, Section 1.13 (pages 64 to 70))

Unit 3: Ideals and Quotient Rings, More Ideals and Quotient Rings, The Field of Quotients of an Integral Domain (Chapter 3: Sections 3.4, 3.5, 3.6)

Unit 4: Euclidean Rings, A particular Euclidean Rings (Chapter 3: Sections 3.7, 3.8)

Unit 5: Polynomial Rings, Polynomials over the rational field, Polynomials over Commutative Rings (Chapter 3: Sections 3.9, 3.10 and 3.11)

Text Books: Topics in Algebra by I.N. Herstein, Second Edition, John Wiley and Sons, 1999
Chapter 2: Sections 2.11, 2.12, 2.13, 2.14
Chapter 3: Sections 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10 and 3.11
Chapter 4: Sections 4.3, 4.4, 4.5
Unit 2 from **Text Book**: University Algebra by N.S. Gopalakrishnan, New Age International (P) Ltd. Reprinted 2001.

Paper 2: Analysis – I (5 credits)

(All units from the Text-Book)
Unit 1: Finite, Countable and uncountable Sets, Metric Spaces (Chapter 2: Sections 2.1 to 2.30)

Unit 2: Compact Sets, Perfect Sets, Connected Sets (Chapter 2: Sections 2.31 to 2.47, Chapter 3: Sections 3.1 to 3.20)

Unit 3: Series, Series of Nonnegative Terms, The Number e, The Root and Ratio Tests, Power Series, Summation By Parts, Absolute Convergence, Addition and Multiplication of Series, Rearrangements (Chapter 3: Sections 3.21 to 3.55)

Unit 4: Limits of Functions, Continuous Functions, Continuity and Connectedness, Discontinuities, monotonic Functions, Infinite Limits and Limits at Infinity (Chapter 4: Sections 4.1 to 4.34)

Unit 5: The Derivative of a Real Function, Mean Value Theorems, The Continuity of Derivatives, L'Hospital's Rule, Derivatives of Higher Order, Taylor's theorem, Differentiation of Vector-valued Functions (Chapter 5: Sections 5.1 to 5.19)

Text Book: Principles of Mathematical Analysis by Walter Rudin, Third Edition McGraw Hill, International Student Edition, 1976

Chapter 2, Chapter 3, Chapter 4, Chapter 5 (All Chapters full)

Paper 3: Ordinary Differential Equations (4 credits)

Unit 1: Second order homogeneous equations, Initial Value Problems, Linear Dependence and Independence, Wronskian and a formula for Wronskian, Non-homogeneous equation of order two (Chapter 2: Sections 1 to 6)

Unit 2: Homogeneous and non-homogeneous equation of order n, Initial value problems, Annihilator method to solve non-homogeneous equation, Algebra of constant coefficient operators. (Chapter 2: Sections 7 to 12)

Unit 3: Introduction, Initial value problems for the homogeneous equation, Solutions of the homogeneous equation, The Wronskian and linear independence, Reduction of the order of a homogeneous equation, The non-homogeneous equation, Homogeneous equations with analytic coefficients, The Legendre equation. (From text book 1: Chapter 3: Sections 1 to 8).

Unit 4: Introduction, The Euler equation, Second order equations with regular singular points—an example, Second order equations with regular singular points-

the general case, A convergence proof, The exceptional cases, The Bessel equation, The Bessel equation (continued) (From text book 1: Chapter 4: Sections 1 to 8)

Unit 5 : Introduction, Equations with variables separated, Exact equations, The method of successive approximations, The Lipschitz condition, Convergence of the successive approximations, Non-local existence of solutions, Approximations to, and uniqueness of, solutions (From text book 1: Chapter 5: Sections 1 to 8)

Text Book :

An Introduction to ordinary differential equations by E. A. Coddington, Prentice Hall of India, 1987

Chapter 2: Sections 1 to 12

Chapter 3: Sections 1 to 8

Chapter 4: Sections 1 to 8

Chapter 5: Sections 1 to 8

Paper 4: Graph Theory I (4 credits)

(All units are from the text-book)

Unit 1: Graphs and simple graphs, Graph isomorphism, The incidence and adjacency matrices, Sub graphs, Vertex degrees, Paths and connection, cycles, The shortest path problem, Sperner's lemma (Chapter 1)

Unit 2: Trees, Cut edges and Bonds, Cut vertices, Cayley's formula, The connector problem, Connectivity, Blocks, Construction of Reliable communication Networks. (Chapter 2 and 3)

Unit 3: Euler tours, Hemiltonian cycles, The Chinese postman problem, The travelling salesman problem (Chapter 4).

Unit 4: Matchings, Matchings and coverings in Bipartite graphs, Perfect matching, The personnel assignment problem, The optimal assignment problem (Chapter 5).

Unit 5: Edge Chromatic number, Vizing's theorem, The timetabling problem (Chapter 6).

Text Book:
Graph Theory with Applications, J.A. Bondy and U.S.R. Murty
Chapters: 1, 2, 3, 4, 5 and 6

Paper 6: Algebra – II (5 credits)

Unit 1: Dual spaces, Inner product spaces, Modules (Chapter 4: Sections 4.3,4.4, 4.5)

Unit 2: Extension fields, The transcendence of e, Roots of polynomials, More about roots (Chapter 5: Sections 5.1, 5.2, 5.3, 5.5)

Unit 3: The elements of Galois theory, Solvability by radicals, Galois groups over the rationals (Chapter 5: Sections 5.6, 5.7.5.8)

Unit 4: The algebra of linear transformations, characteristic roots, Canonical forms, Triangular form, Nilpotent transformations, (Chapter 6: Sections 6.1, 6.2, 6.4,6.5)

Unit 5: A Decomposition of V: Jordan form Canonical forms: Rational canonical form, Trace and Transpose , Hermitian, Unitary and Normal Transformations (Chapter 6: Sections 6.6, 6.7, 6.8, 6.10, 6.11)

Text Book: Topics in Algebra by I.N. Herstein, Second Edition, John Wiley and Sons, 1999
Chapter 5: Sections 5.1 to 5.3 and 5.5 to 5.8 Chapter 6: Sections 6.1 to 6.11

Paper 7: Analysis – II (5 credits)

Unit 1: Definitions and existence of the Integral, Properties of the Integral, Integration and Differentiation, Integration of vector valued functions Rectifiable curves (Chapter 6: Sections 6.1 to 6.27)

Unit 2: Discussion of the main problem, uniform convergence, Uniform convergence and continuity, uniform convergence and integration, uniform

convergence and Differentiation, Equicontinuous families of functions, The Stone-Weierstrass Theorem (Chapter 7: Sections 7.1 to 7.33)

Unit 3: Power series, The exponential and Lograthmic functions, The trigonometric Functions, The algebraic completeness of the Complex field, Fourier series, The Gamma function (Chapter 8: Sections 8.1 to 8.22)

Unit 4: Linear Transformations – Differentiation – The contraction principle – The inverse function theorem (Chapter 9: Sections 9.1 to 9.25)

Unit 5: The implicit function theorem – The rank theorem – Determinants – Derivatives of higher order – Differentiation of integrals (Chapter 9: Sections 9.26 to 9.43)

Text Books:

Principles of Mathematical Analysis by Walter Rudin, Third Edition McGraw Hill, International Student Edition 1976.

Chapter 6, Chapter 7, Chapter 8 and chapter 9 only

Paper 8: Partial Differential Equations (4 credits)

Unit 1: First Order P.D.E. – Curves and Surfaces – Genesis of First Order P.D.E. – Classification of Integrals – Linear Equations of the First Order – Pfaffian Differential Equations – Compatible Systems – Charpit's Method – Jacobi's Method (Chapter 1: Sections 1.1 to1.8)

Unit 2: Integral Surfaces Through a Given Curve – Quasi-Linear Equations – Non-linear First Order P.D.E. (Chapter 1: Sections 1.9 to1.11)

Unit 3: Second Order P.D.E.: Genesis of Second Order P.D.E. – Classification of Second Order P.D.E. One-Dimensional Wave Equation – Vibrations of an Infinite String – Vibrations of a Semi-infinite String –Vibrations of a String of Finite Length (Method of separation of variables) (Sections 2.1 to 2.3.5, except 2.3.4)

Unit 4: Laplace's Equation: Boundary Value Problems – Maximum and Minimum Principles – The Cauchy Problem – The Dirichlet Problem for the Upper Half

Plane – The Neumann Problem for the Upper Half Plane – The Dirichlet Interior Problem for a Circle - The Dirichlet Exterior Problem for a Circle – The Neumann Problem for a Circle – The Dirichlet Problem for a Rectangle – Harnack's Theorem . (Chapter 2: Sections 2.4.1 to 2.4.10)

Unit 5: Green's function, Heat Conduction Problem – Heat Conduction –Infinite Rod Case – Heat Conduction Finite Rod Case – Duhamel's Principle – Wave Equation – Heat Conduction Equation (Sections 2.4.11 to 2.6.2.)

Text Books:

T.Amarnath, An Elementary Course in Partial Differential Equations , Narosa Publishing Company, 1997.

Chapter 1: Sections 1.1 to1.11

Chapter 2: Sections 2.1 to 2.3.5, except 2.3.4, 2.4.1 to 2.4.10, 2.4.11 to 2.6.2

REFERENCE(S)

[1] Tyn Myint-U: Partial differential equations for scientists and engineers, 3rd ed. North Holland, 1989.

[2] I.C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, Vol. 19 AMS, 1998.

[3] I.N. Snedden, Elements of Partial Differential Equations, McGraw Hill, 1985.

[4] F. John, Partial Differential Equations, Springer Verlag, 1975.

[5] Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, Wiley-Eastern Ltd, 1985.

Paper 9: Numerical Analysis (4 credits)

Unit 1: Introduction, Bisection method, iteration methods based on first degree equation, Iteration methods based on second degree equation, Rate of convergence, General iteration methods, Methods for complex roots, Polynomial equations (Chapter 2: Sections 2.1 to 2.8)

Unit 2: Introduction, Direct methods, Error analysis for direct methods, Iteration methods, Eigen values and eigen vectors, Power method
(Chapter 3: Sections 3.1 to 3.6)

Unit 3: Introduction, Lagrange and Newton interpolations, Finite difference Operators, Interpolating polynomials using finite differences, Hermite interpolation, Piecewise and spline interpolation (Chapter 4: Sections 4.1 to 4.6)

Unit 4: Introduction, Numerical Differentiation, Extrapolation methods, Partial Differentiation, Numerical integration, Methods based on interpolation, Composite integration methods, Romberg method (Chapter 5: Sections 5.1, 5.2, 5.4 to 5.9, 5.10)

Unit 5: Introduction, Difference equation, Numerical methods, Single step methods, (Chapter 6: Sections 6.1 to 6.4.)

Text Book:
Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain, Third Edition, New Age International Publishers, 2003.

(Note: Section B of the Question paper for the end semester examination will contain only numerical problems. Scientific Calculator is allowed).

Chapter 2: Sections 2.1 to 2.8(exclude 2.7)
Chapter 3: Sections 3.1 to 3.6
Chapter 4: Sections 4.1 to 4.6
Chapter 5: Sections 5.1, 5.2, 5.4 to 5.7, 5.9, 5.10
Chapter 6: Sections 6.1 to 6.4

Paper 11: Algebra – III (5 credits)

Unit 1: Finite fields, Wedderburn's theorem on finite division rings (Text Book 1: Chapter 7: Section 7.1, 7.2)

Unit 2: Introduction, Binary devices and states, Finite-state machines, Covering and equivalence, Equivalence states, A minimization procedure, Turing machines, Incompletely specified machines (Text Book 2: Chapter 3 Sections 3.1 to 3.9)

Unit 3: Boolean Algebras: Introduction, order, Boolean Polynomials, Boolean subalgebras, Disjunctive normal form (Text Book 2: Chapter 5 Sections 5.1 to 5.3, 5.8, 5.9)

Unit 4: Introduction, Encoding and decoding, Block codes, Matrix encoding techniques, Group codes, Decoding tables, Hamming codes, Polynomial codes, Advantageous Properties, Shift Registers
(Text Book 2: Chapter 8: Sections 8.1 to 8.7, Chapter 11: Sections 11.3 to 11.5)

Unit 5: Lattices: Lattices and posets, lattices as posets. Sublattices; direct products, distributive lattices, modular and geometric lattices, Boolean lattices(Text Book 2: Chapter 9 Sections 9.1 to 9.7)

Text Book(s):

1) Topics in Algebra by I.N. Herstein, Second Edition, John Wiley and Sons, 1999

2) Modern Applied Algebra by Garrot Birkoff and Thomas Bartee, CBC Publishers and Distributors, New Delhi1999.

Text Book 1: Chapter 7: Sections 7.1 and 7.2

Text Book 2: Chapter 3 Sections 3.1 to 3.9,
Chapter 5 Sections 5.1 to 5.3, 5.8, 5.9,
Chapter 8: Sections 8.1 to 8.7, Chapter 11: Sections 11.3 to 11.5,
Chapter 9 Sections 9.1 to 9.7

Paper 12: Analysis III (5 credits)

Unit 1: Lebesgue outer measure–Measurable sets–Regularity (Chapter 2: Sections 2.1, 2.2 and 2.3).

Unit 2: Measurable functions–Borel and Lebesgue measurability (Chapter 2: Sections 2.4 and 2.5).

Unit 3: Integration of non-negative functions – The general integral – Integration of series (Chapter 3: Sections 3.1, 3.2 and 3.3).

Unit 4: Riemann and Lebesgue integrals – The four derivatives – Continuous non-differentiable functions (Chapter 3: Sections 3.4, Chapter 4: Sections 4.1 and 4.2).

Unit 5: Functions of bounded variations – Lebesgue differentiation theorem – Differentiation and integration – The Lebesgue set (Chapter 4: Sections 4.3 to 4.6).

Text Book:

Measure Theory and Integration, G. de Barra, Willey Eastern Ltd 2 ed. 1991.

Chapter 2: Sections 2.1 to 2.5, Chapter 3: 3.1 to 3.4, Chapter 4: Sections 4.1 to 4.6

Paper 13: Topology (5 credits)

Unit 1: Topological spaces – Basis for a topology – The order topology – The product topology on X x Y – The sub space topology – Closed sets and limit points – Continuous functions – The product topology (Chapter 2: Sections 12 to 19).

Unit 2: The metric topology – Connected spaces – Connected subspaces of the real line (Chapter 2: Sections 20 and 21, Chapter 3: Sections 23 and 24).

Unit 3: Compact spaces – Compact sub spaces of the real line – Limit point compactness – Local compactness (Chapter 3: Sections 26 to 29).

Unit 4: Countability axioms – The separation axioms – Normal spaces (Chapter 4: Sections 30 to 32).

Unit 5: The Urysohn Lemma – The Urysohn metrization theorem – Tietze Extension theorem – The Tychonoff theorem
(Chapter 4: Sections 33 to 35, Chapter 5: Section 37).

Text Book:

Topology (Second Edition), James R. Munkres, Prentice – Hall of India Private Ltd, New Delhi

Chapter 2: Sections 12 to 21
Chapter 3: Sections 23, 24, 26, 27, 28, 29
Chapter 4: Sections 30, 31, 32, 33, 34, 35
Chapter 5: Sections 37

Paper 14: Statistics I **(5 credits)**
(All units are from the text-book)

Unit 1: Introduction, Set theory, The probability set function, Conditional probability and Independence, Random variables of the discrete type, Random variables of the continuous type, properties of the distribution function, Expectation of a random variable, Some special expectations, Chebyshev's inequality (Chapter 1: Sections 1.1 to 1.10)

Unit 2: Distributions of two random variables, Conditional distributions and expectations, The correlation coefficient, Independent random variables, Extension to several random variables (Chapter 2: Sections 2.1 to 2.5)

Unit 3: The binomial and related distributions, The Poisson distribution, The Gamma and Chi-square distributions, The normal distributions, The Bivariate normal distributions (Chapter 3: Sections 3.1 to 3.5)

Unit 4: Sampling theory, Transformations of variables of the discrete type, Transformations of variables of the continuous type, The Beta, t, F distributions, Extensions of the change-of-variable technique, The moment generating function technique, Some Specific distribution-The distributions of X- , and nS2/□2, Expectations of functions of random variables (Chapter 4: Sections 4.1 to 4.9)

Unit 5: Convergence of distribution, Convergence of probability, Limiting moment generating functions, the central limit theorem, Some theorems of limiting distributions (Chapter 5: Sections 5.1 to 5.5)

Text Book:

Introduction to Mathematical Statistics, V Edition by R.V.Hogg and A. T. Craig, Pearson Education, Asia, 2002

Chapter 1: Sections 1.1 to 1.10, Chapter 2: Sections 2.1 to 2.5
Chapter 3: Sections 3.1 to 3.5, Chapter 4: Sections 4.1 to 4.9
Chapter 5: Sections 5.1 to 5.9

Paper 16: Complex Analysis (5 credits)

Unit 1: The algebra of complex numbers, The geometric representation of complex numbers (Chapter 1: Sections 1, 2)

Unit 2: Introduction to the concept of analytic function, Elementary theory of Power series, The exponential and trigonometric functions (Chapter 2: Sections 1,2,3)

Unit 3: Conformality, Linear transformations, Elementary conformal mappings (Chapter 3: Section 2, Section 3 (3.1 to 3.3 only), Section 4)

Unit 4: Fundamental theorems, Cauchy's integral formula, Local properties of analytical functions, (Chapter 4: Sections 1, 2, 3)

Unit 5: The general form of Cauchy's theorem, The calculus of residues, Harmonic functions, Power series expansions
(Chapter 4: Sections 4 (4.1 to 4.5 only), 5, 6 and Chapter 5: Section 1)

Text Book:

Complex Analysis by L. V. Ahlfors (III edition) McGraw Hill ISE, 1981
Chapter 1: Sections 1 and 2, Chapter 2: Sections 1, 2 and 3
Chapter 3: Section 2, Section 3 (3.1 to 3.3 only), Section 4

Chapter 4: Sections 1, 2, 3, 4 (4.1 to 4.5 only), 5 and 6
Chapter 5: Section 1 only

Paper 17: Number Theory and Cryptography (5 credits)

Unit 1: Preliminaries: Well-ordering principle, induction, binomial coefficients, Greatest integer function – Divisibility: Notion of divisibility, G.C.D, Euclids Algorythm, G.C.D via E. A, L.C.M, Representations of integers to bares – Primes: Definition, Prime counting function, Prime number theorem, Test of primality, Sieve of Eratosthenes, Canonical factorization, Fundamental theorem of arithmetic (Chapters 1, 2, 3).

Unit 2: Congruences: Congruences and equivalence relations, Linear congruence, Linear Diophantine equations, Chinese remainder theorem, Polynomial congruences, Modular arithmetic, Fermat's, Wilson's theorem, Pythagorean equation (Chapter 4).

Unit 3: Arithmetic functions: Sigma, Tau functions, dirichlet product, Dirichlet inverse, Moebius function, Euler's function, Euler's theorem (Chapter 5).

Unit 4: Primitive roots: Definition, Properties, Existence – Quadratic congruences: Quadratic residues, Legendre symbols, Gauss Lemma, Law of quadratic reciprocity (Chapter 6: Sections 1, 2 and 3 only, Chapter 7: Sections 1, 2 and 3 only)

Unit 5: Cryptology: Introduction, Character ciphers, Block ciphers, Pubhe-key cryptography signatures (Chapter 12).

Text Book:
Beginning of Number Theory, Second Edition, by Neville Robbins, Narosa Publications, 2006
Chapters: 1, 2, 3, 4, 5
Chapter 6: Sections 1, 2 and 3 only, Chapter 7: Sections 1, 2 and 3 only, Chapter 12.

Paper 18: Functional Analysis (5 credits)

(All units from the text book)

Unit 1: Normed linear spaces –Continuity of Linear maps (Chapter2:Sections 5, 6).

Unit 2: Hahn – Banach Theorems, Banach spaces (Chapter 2: Sections 7, 8)

Unit 3: Uniform boundedness principle – Closed graph theorem and Open mapping theorem, Bounded inverse theorem (Chapter 3: Sections 9 (pages 138 to 144 only), 10,11).

Unit 4: Spectrum of a bounded operator – Duals and Transposes – Duals of L^p ([a,b]) and C([a,b]) (Chapter 3: Section 12, Chapter 4: Sections 13 (pages 235 to 248 only), 14).

Unit 5: Weak and Weak* convergence–Reflexivity (Chapter 4: Sections 15, 16)

Text Book:

Functional Analysis, Second Edition, by B.V. Limaye
New Age International (P) Ltd, Publishers, New Delhi, 2002

Chapter 2: Sections 5, 6, 7 and 8 Chapter 3: Sections 9 (pages 138 to 144 only), 10, 11 and 12
Chapter 4: Sections 13 (pages 235 to 248 only), 14, 15 and 16

Paper 19: Operations Research (4 credits)

Unit 1: Scope of Network applications, Network definitions, Minimal spanning tree algorithm, Shortest route problem, Maximal flow model, Minimum-Cost capacitated flow problem, CPM and PERT (Chapter 6: Sections 6.1 to 6.8).

Unit 2: Integer programming (Chapter 8: Sections 8.1 to 8.5) Dynamic (Multistage) programming, (Chapter 9: Sections 9.1 to 9.5)

Unit 3: Decision Theory and Games. (Chapter 11: Sections 11.1 to 11.4)

Unit 4: Inventory Models. (Chapter 13: Sections 13.1 to 13.4)

Unit 5: Non-Linear Programming algorithms. (Chapter 19: Sections 19.1 and 19.2.)

TEXT BOOK(S)

[1] Hamdy A. Taha, Operations Research (7th Edn.), McGraw Hill Publications, New Delhi.2002.

Chapter 6: Sections 6.1 to 6.8

Chapter 8: Sections 8.1 to 8.5

Chapter 9: Sections 9.1 to 9.5

Chapter 11: Sections 11.1 to 11.4

Chapter 13: Sections 13.1 to 13.4

Chapter 19: Sections 19.1 and 19.2.

REFERENCE(S)

[1] O.L. Mangasarian, Non Linear Programming, McGraw Hill, New York, 1979.
[2] Mokther S. Bazaraa and C.M. Shetty, Non Linear Programming, Theory and Algorithms, Willy, New York, 1979.
[3] Prem Kumar Gupta and D.S. Hira, Operations Research : An Introduction, S. Chand and Co., Ltd. New Delhi, 1983.
[4] S.S. Rao, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi, 1979.

(Note: Section B of the Question paper for the end semester examination will contain only numerical problems. Scientific Calculator is allowed).

Major Elective List I

Mechanics **(4 credits)**

Unit 1: Mechanics of a particle, Mechanics of a system of particles, Constraints (Chapter 1: Sections 1.1 to 1.3)

Unit 2: D'Alembert's principle and Lagrange's equations, Velocity-dependent potentials and the dissipation function, Hamilton's principle, Some techniques of the calculus of variations (Chapter 1: Sections 1.4,1.5 and Chapter 2: Sections 2.1,2.2)

Unit 3: Derivation of Lagrange's equations from Hamilton's principle, Extension of Hamilton's principle to nonholonomic systems, Advantage of a variational principle formulation, conservation theorems and symmetry properties (Chapter 2: 2.3 to 2.6)

Unit 4: Reduction to the equivalent one-body problem, The equations of motion and first integrals, The equivalent one-dimensional problem and classification of orbits, The Virial theorem (Chapter 3: Sections 3.1 to 3.4)

Unit 5: The differential equation for the orbit and integrable power-law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem: Inverse square law of force, The motion in time in the kepler problem, The Laplace-Runge-Lenz vector (Chapter 3: Sections 3.5 to 3.9)

Text Book:

Classical Mechanics by H. Goldstein, Second edition, Addison Wesley, New York, 1980

Chapter 1: Sections 1.1 to 1.5, Chapter 2: Sections 2.1 to 2.6
Chapter 3: Sections 3.1 to 3.9

Differential Geometry (4 credits)

Unit 1: Introductory remarks about space curves, Definition, Arc length, Tangent, normal and binomial, Curvature and torsion of a curve given as the intersection of two surfaces, Contact between curves and surfaces, Tangent surface, involutes, and evolutes (Chapter 1: Sections 1 to 7)

Unit 2: Intrinsic equations, fundamental existence theorem for space curves, Helices (Chapter 1 Sections 8, 9) and Definition of a surface, Curves on a surface, Surfaces of revolution, Helicoids (Chapter 2: Sections 1 to 4)

Unit 3: Metric, Direction coefficients, Families of curves, Isometric correspondence, Intrinsic properties, Geodesics, Canonical geodesic equations, Normal property of geodesics (Chapter 2: Sections 5 to 12)

Unit 4: Existence theorems, Geodesic parallels, Geodesic curvature, Gauss – Bonnet theorem Gaussian curvature, Surfaces of constant curvature (Chapter 2: Sections 13 to 18)

Unit 5: The Second fundamental form, Principal curvatures, Lines of curvature Developables, Developables associated with space curves, Developables associated with curves on surfaces, Minimal surfaces, Ruled surfaces, The fundamental equations of surface theory (Chapter 3: Sections 1 to 9)

Text Book:

An Introduction to Differential Geometry by T.G. Willmore, Oxford University Press (1983)

Chapter 1: Sections 1 to 9 (omitting appendix)
Chapter 2: Sections 1 to 18 (omitting appendix)
Chapter 3: Sections 1 to 9

Combinatorial Mathematics (4 credits)

Unit 1: Introduction - The rules of sum and product – Permutations – Combinations - Distribution of distinct Objects - Distributions of Non-distinct objects
(Chapter 1: Sections 1.1 to 1.6)

Unit 2: Introduction - Generating functions for combinations - Enumerators for permutations - Distributions of distinct objects into non-distinct cells - Partitions of integers - Elementary relations (Chapter 2: Sections 2.1 to 2.5 and 2.7).

Unit 3: Introduction - Linear recurrence relations with constant coefficients - Solution by the technique of generating functions - Recurrence relations with two indices (Chapter 3: Sections 3.1 to 3.3 and 3.5).

Unit 4: Introduction - The principle of inclusion and exclusion - The general formula - Derangements - Permutations with restrictions on relative positions.
(Chapter 4: Sections 4.1 to 4.5)

Unit 5: Introduction - Equivalence classes under permutation group - Equivalence classes of functions - Weights and inventories of functions - Polya's fundamental theorem - Generealization of Polya's theorem (Chapter 5: Sections 5.1, 5.3 to 5.7).

Text Book: Introduction to Combinatorial Mathematics by C. T. Liu, McGraw Hill, 1968

Chapter 1: Sections 1.1 to 1.6, Chapter 2: Sections 2.1 to 2.5 and 2.7
Chapter 3: Sections 3.1 to 3.3 and 3.5, Chapter 4: Sections 4.1 to 4.5
Chapter 5: Sections 5.1, 5.3 to 5.7

Analysis of Algorithms (4 credits)

Unit 1: Analysis Basics: What is analysis?, What to count and consider, Mathematical Background, Rates of Growth, Recurrence Relations, Analyzing Programs (Chapter 1, 1.1 to 1.4, 1.6, 1.7)

Unit 2: Searching and Selection Algorithms: Sequential Search, Binary search, Selection, Programming exercise (Chapter 2, 2.1 to 2.4)

Unit 3: Sorting Algorithms: Insertion Sort, Bubble Sort, Shellsort, Quicksort, (Chapter 3, 3.1, 3.2, 3.3, 3.7)

Unit 4: Numeric Algorithms: Calculating Polynomials, Matrix Multiplication, Linear Equations (Chapter 4, 4.1, 4.2, 4.3)

Unit 5: Graph Algorithms: Graph Background and Terminology, Data Structure Methods for Graphs, Depth-first and Breadth-first Traversal algorithms, Minimum Spanning Tree Algorithm, Shortest-Path Algorithm (Chapter 6, 6.1,6.2,6.3,6.4,6.5)

Text-Book: Analysis of Algorithms (an active learning approach), by Jeffrey J.MacConnell, Narosa Publishing House, 2002

Chapter 1: Sections 1.1 to 1.4, 1.6, 1.7

Chapter 2: Sections 2.1 to 2.4

Chapter 3: Sections 3.1, 3.2, 3.3, 3.7

Chapter 4: Sections 4.1, 4.2, 4.3

Chapter 6: Sections 6.1, 6.2, 6.3, 6.4, 6.5

Major Elective List II

Fluid Mechanics 4

Unit 1: Real Fluids and Ideal Fluids - Velocity of a Fluid at a point - Streamlines and Path lines; Steady and Unsteady Flows - The Velocity potential – The Vorticity 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 equations of motion - Bernoulli's equation - worked examples. (Chapter 2 and Chapter 3: Sections 3.1 to 3.6)

Unit 2: Discussion 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
(Chapter 3: Sections 3.7 to 3.11 and Chapter 4: Sections 4.1, 4.2, 4.3, 4.5)

Unit3: Some Two-Dimensional Flows: Meaning of a Two-Dimensional Flow - Use of cylindrical Polar coordinates – 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 (Chapter5 : Sections: 5.1 to 5.9 except 5.7)

Unit 4: The use of conformal Transformation and Hydrodynamical 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 Quadric and Principal Stresses - Some Further properties of the Rate of Strain Quadric - 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 . (Chapter 5: Section 5.10 , 5.12 and Chapter 8: Sections 8.1 to 8.9)

Unit 5: 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 (Chapter 8: Sections 8.10 to 8.16)

TEXT BOOK(S)

[1] Content and Treatment as in Text Book of Fluid Dynamics by F. Chorlton (CBS Publishers & Distributors, New Delhi-110 002) 1985.

Chapter 2 Complete

Chapter 3: Sections 3.1 to 3.11

Chapter 4: Sections 4.1, 4.2, 4.3, 4.5

Chapter5 : Sections: 5.1 to 5.12 except 5.7 and 5.11

Chapter 8: Sections 8.1 to 8.16

Graph theory II (4 credits)

Unit 1: Independent sets, Ramsey's theorem, Turan's theorem, Schur's theorem, A Geometry problem (Chapter 7).

Unit 2: Chromatic number, Brook's theorem, Hajo's conjecture, Chromatic polynomials, Girth and Chromatic number, A storage problem (Chapter 8).

Unit 3: Plane and planar graphs, Dual Graphs, Euler's formula, Bridges, Kuratowski's theorem, The five-color theorem and Four color conjecture, Non Hamiltonian planar graphs, A planarity Algorithm (Chapter 9)

Unit 4: Directed graphs, Directed paths, Directed cycles, A job sequencing problem, Designing an efficient computer drum, Making a road system one way, Ranking the participants in a tournament (Chapter 10).

Unit 5: Network, Flows, Cuts, The Max-Flow, Min-cut theorem, Menger's theorem, Feasible flows, Circulation and Potential differences, The number of spanning trees, prefect squares (Chapters 11 and 12).

Text Book: Graph Theory With Applications, J.A. Bondy and U.S.R. Murty

Chapters: 7, 8, 9, 10, 11 and 12

Automata Theory and Formal Language (4 credits)

Unit 1: Why study automata theory? Introduction to formal proof, Additional forms of proof, Inductive proofs, The central concepts of Automata theory (Chapter 1: Sections 1.1 to 1.5)

Unit 2: An informal picture of finite automata, Deterministic finite automata, Non-deterministic finite automata, An application: Text search, Finite automata with epsilon transitions (Chapter 2: Sections 2.1 to 2.5)

Unit 3: Regular expressions, Finite automata and regular expressions, Applications of regular expressions, Algebraic laws of regular expressions (Chapter 3: Sections 3.1 to 3.4)

Unit 4: Proving languages are not regular, Closure properties of regular languages, Decision properties of regular languages, Equivalence and Minimization of automata (Chapter 4: Sections 4.1 to 4.4)

Unit 5: Context-free grammars, Parse trees, Applications of context-free grammar, Ambiguity in grammars and languages, Definition of Push Down Automata, Languages of PDA,Equivalence of PDA's and CFG's, Deterministic PDA (Chapter 5: Sections 5.1 to 5.4 and Chapter 6: Sections 6.1 to 6.4)

Text Book: Introduction to Automata, Languages, and Computation, II Edition by J. E. Hopcroft, R. Motwani, and J.D. Ullman, Pearson Edition, 2001

Chapter 1: Sections 1.1 to 1.5, Chapter 2: Sections 2.1 to 2.5
Chapter 3: Sections 3.1 to 3.4, Chapter 4: Sections 4.1 to 4.4
Chapter 5: Sections 5.1 to 5.4, Chapter 6: Sections 6.1 to 6.4

VISUAL BASIC 6.0 (4 credits)

Unit 1: Getting started VB – Why windows and Why Visual Basic? What you need to run Visual Basic – Setting VP Visual Basic – Running the set up program –

Starting Visual Basic – Working with Visual Basic – The initial Visual Basic Screen – Title bar – Menu Bar – Tool Bar – Tool Box (Page: 1-6 and 19 – 47).

Unit 2: File Menu – Edit menu – View menu – Project menu – Format menu – Starting a New Project – The properties window – Common form properties – Scale properties colour properties (Pages: 48 – 82).

Unit 3: Properties of common Buttons Hons – Access Keys Image Controls – Text boxes – Labels – Navigating Between controls – Message Boxes – The Grid (Pages: 108-128).

Unit 4: Variables – Data Types – Working with variables – More on strings – More on Numbers – Constant – Input Boxes Determinate loops - Indeterminate loops – Making Decisions (Pages: 151 – 159 and 220 – 248).

Unit 5: Build in functions – String Functions – Numeric functions - Date and time functions – An introduction to Graphics – Fundamental of Graphics - Screen Scales – Lines and Boxes Circles, Ellipses and Pie charts (Pages: 255 – 287, 589 – 599 and 613 – 635)

Text Book:

VISUAL BASIC 6 from the GROUND UP

by "Gary Cornell Tata McgrawHill-Edition 1999"

Unit 1: Page: 1-6 and 19 – 47

Unit 2: Pages: 48 – 82

Unit 3: Pages: 108 – 128

Unit 4: Pages: 151 – 159 and 220 – 248

Unit 5: Pages: 255 – 287, 589 – 599 and 613 – 635.

Non-Major Electives

List III

Bio Statistics (4 credits)

(Units 1 to 4 are from the text book 1 and unit 5 is from the text book 2.)

Unit 1: Collection of data - primary & secondary data - Classification and Tabulation-Diagrammatic representation, measures of central tendency; mean, median, mode - geometric mean, harmonic mean - C Class history rows (From text book 1: Chapters 4,6,7,9)

Unit 2: Measures of dispersion - Range, quartile deviation of combined set, Standard deviation, Coefficient of variation, correlation, regression lines and Rank correlation (From text book 1: Chapters 10,12,13).

Unit 3: Probability - Addition Theorem & Multiplication Theorem -Binomial distribution- Poisson distribution - Normal distribution- Simple problems (From text book 1: Chapters 18,19).

Unit 4: Chi-Square Test - Degrees of freedom - Test of Goodness of fit - Test of independence (From text book 1: Chapters 21 and 22).

Unit 5: Applications - Health Surveys - Sample Size determinations -Methods of mortality data analysis - Path coefficient analysis in medicine - Statistical Modeling in health and disease (From text book 2: Chapters 1,2,3,4,5,10).

Text Books:

1) Statistics - Theory and Practice by R.S.N Pillai & V.Bagavathi S.Chand Company 7th Revised Edition- 2008

2) Bio Statistics. Edited by B.L Verma,G.D Shukla & R.N srivastava., C.B.S Publishers & Distributors. 485, Bhola Nath Nagar, Delhi

From Text Book 1: Chapters: 4,6,7,9,10,12,13,18,19,21

From Text Book 2: Chapters 1,2,3,4,5,10 for unit 5 only

Business Statistics (4 credits)

Unit 1: Measures of central tendency – Definition – Mean – Median – Mode – Their merits and demerits – Weighted Arithmetic mean (Chapter 7: Pages 155-198).

Unit 2: Measures of dispersion and skewness – Range – Quartile deviation – Standard deviation – Coefficient of variation – Pearsons and Bowley Coefficient of skewness (Chapters 8 and 9: Pages 249-277, 315-326).

Unit 3: Scatter diagram – Pearson's Coefficient of correlation – Rank correlation (Chapter 10: Pages 371-425).

Unit 4: Index numbers – Meaning and uses – Methods of construction – Laspeyer's method – Paasche method – Fisher's Ideal Index – Marshall Edgeworth method – Kelley's method (Chapter 12: Pages 460-475).

Unit 5: Analysis of time series – Estimation of trend – Methods of least squares (Straight line only) – Free hand curve (Chapter 13: Pages 522-588).

Text Book: Elements Statistical Methods, by S.P. Gupta, Publishers: Sultan Chand & Sons, 16th Edition (2005),

Uni1: Chapter 7: Pages 155-198

Unit 2: Chapters 8 and 9: Pages 249-277, 315-326

Unit 3: Chapter 10: Pages 371-425

Unit 4: Chapter 12: Pages 460-475

Unit 5: Chapter 13: Pages 522-588

Mathematics for Competitive Examinations (5 credits)

(Units 1 to 4 are from the text book 1 and unit 5 is from the text book 2.)

Unit 1: H.C.F and L.C.M of numbers – Decimal – Fractions – Simplifications – Average – Problems on Numbers – Problems on Ages (From text-book 1: Pages 30–116 and 139-194).

Unit 2: Percentage – Profit and loss – Ratio and proportion – Partnership – Simple interest – Compound interest (From text-book 1: Pages 208-325 and 445-486).

Unit 3: Time and work – Time and Distance – Problems on Trains – Allegation of Mixture (From text-book 1: Pages 341-370, 384-424 and 435-444).

Unit 4: Stocks and shares – Calendar – Clocks – Odd man out and series (From text-book 1: Pages 593-612 and 649-657).

Unit 5: Verbal reasoning: General Mental ability and non-verbal reasoning (From text-book 2: Part 1. Pages 1-297, 416-481 and 628-653, Part 2: pages 1 to 407).

Text Books:

1) Quantitative Aptitude, by R.S. Agarwal, Publishers: S.Chand & Co
2) Verbal and Non-verbal reasoning, by R.S. Agarwal, Publishers: S.Chand & Co

From text book 1:

Unit 1: Pages 30 – 116, 139-194

Unit 2: Pages 208-325 and 445-486

Unit 3: Pages 341-370,384-424 and 435-444

Unit 4: Pages 593-612 and 649-657

Econometrics (4 credits)

(All the units are from the text-book)

Unit 1: Definition and scope of econometrics – Goals of econometrics – Division of econometrics – Methodology of econometric research – Specification of the model, Estimation of the model – Evaluation of the parameter estimates – Evaluation of the forecasting power of the model – Desirable properties of an econometric model.

(Sections 1.1 – 1.3 and 2.1 -2.5)

Unit 2: The simple linear regression model – Assumptions of the linear stochastic regression model – The Distribution of the dependent variable Y – the least squares criterion and the normal equations of OLB – Estimation of a function whose intercept is Zero – Estimation of elasticities from an estimator regression line – Desirable properties of estimators – properties of the least squares estimators. (Sections 4.1 – 4.6 and 6.1 – 6.2)

Unit 3: The method of analysis of variance as a statistical method – Regression analysis and analysis of variance – Comparison of regression analysis and analysis of variance – Testing the overall significance of a regression – Testing the improvement of fit from additional regrestors – Test of equality between coefficient from different samples.

(Sections 8.1 – 8.6)

Unit 4: Econometric problems – The assumption of randomness of Y – The assumption of zero mean of Y – The assumption of elasticity –Autocorrelation – The assumption of serial independence – Sources of auto correlation – Plausibility of the assumption – The first order auto regressive scheme – consequences of auto correlation – Test for auto correlation regrestors – plausibility of assumption consequence of multicollinearity – Test for detecting multicollinearity – Errors in variable. (Sections 9.1 – 9.3, 10.1 – 10.6, 11.1 -11.4 and 12.1)

Unit 5: Models of simultaneous relationship – simultaneous equation models – Simultaneous dependence of economic variables – consequences of simultaneous relations – solution to the simultaneous equation bias – The problem of

identification – Implications of the identification state of model – Formal rules for identification – Reduced form method or Indirect Least squares (ILS) – Two stage least squares – (2SLS). (Sections 14.1 – 14.3, 15.1 – 15.3, 16.1, 16.3)

Text Book

A Koustsoyanni, " Theory of Econometrics"
Second Edition – Reprinted 2006 – Palgrave publishers.

Unit – 1 Sections 1.1 – 1.3 and 2.1 – 2.5

Unit – 2 Sections 4.1 – 4.6 and 6.1 – 6.2

Unit – 3 Sections 8.1 – 8.6

Unit – 4 Sections 9.1 – 9.3, 10.1 – 10.6, 11.1 -11.4 and 12.1

Unit – 5 Sections 14.1 – 14.3, 15.1 – 15.3, 16.1, 16.3

1. Chow G.C., "Econometrics", McGraw Hill, New York.
2. Intrilligator M.D., "Econometrics, methods, Techniques and Applications", Prentice Hall.
3. Theil H., "Introduction to Econometrics", Prentice Hall.
4. Goldberge A.S., "Introductory Econometrics", Harvard University Press.
5. Gujarathi. D.N., "Basic Econometrics", McGraw Hill.
6. Ape P.G., "Text Book of Econometrics", Tata McGraw Hill.

Major Electives List 4

Statistics II (4 credits)

Unit 1: Point estimation, Confidence intervals for means, Confidence intervals for differences of means, Tests of Statistical Hypotheses, Additional comments about statistical tests, chi-squared tests (Chapter 6: Sections 6.1 to 6.6)

Unit 2: Measures of quality of estimators, A sufficient statistic for a parameter, Properties of a sufficient statistic, Completeness and uniquness, The exponential class of probability density functions, Functions of a parameter, The case of several parameters, Minimal sufficient and ancillary statistics (Chapter 7: Sections, 7.1 to 7.8)

Unit 3: Bayesian estimation, Fisher information and the Rao-Cramer inequality, Limiting distribution of maximum likelihood estimators (Chapter 8: Sections 8.1 to 8.3)

Unit 4: Certain best tests, Uniformly most powerful tests, Likelihood ratio tests, The sequential probability ratio test (Chapter 9: Sections 9.1 to 9.4)

Unit 5: Distributions of certain quadratic forms, A test of the equality of several means, Noncentral 2 and noncentral F, Multiple comparisons, The analysis of variance, A regression problem, A test of independence (Chapter 10: Sections 10.1 to 10.7)

Text Book:

Introduction to Mathematical Statistics, V Edition, by R.V.Hogg and A. T. Craig, Pearson Education, Asia, 2002

Chapter 6: Sections 6.1 to 6.6, Chapter 7: Sections 7.1 to 7.8
Chapter 8: Sections 8.1 to 8.3, Chapter 9: Sections 9.1 to 9.4
Chapter 10: Sections 10.1 to 10.7

Advanced Topology (4 credits)

Unit 1: The Stone-cech Compactification – Local finiteness (Chapter 5: Section 38 and Chapter 6: Section 39).

Unit 2: The Nagata – Smirnov Metrization theorem – Para compactness – The Smirnov Metrization theorem (Chapter 6: Sections 40,41 and 42).

Unit 3: Complete metric spaces – A space filling curve (Chapter 7: Sections 43, 44).

Unit 4: Compactness in metric spaces – Point wise and Compact convergence – Ascoli's theorem (Chapter 7: Sections 45, 46 and 47).

Unit 5: Baire spaces – A Nowhere differentiable function (Chapter 8: 48, 49).

Text Book:

James R. Munkres, "Topology", Second Edition, Prentice Hall of India Private Ltd, New Delhi.

Chapter 5: Section 38, Chapter 6: Sections 39, 40, 41, and 42.
Chapter 7: Sections 43, 44, 45, 46 and 47, Chapter 8: Sections 48 and 49.

Fuzzy sets and Logics (4 credits)

UNIT 1: Fuzzy sets – Basic types – Fuzzy sets – Basic concepts – Additional properties of α – cuts – Representation of fuzzy sets – Extension principle for fuzzy sets – Types of operations – Fuzzy complements. (Chapter 1: Sections 1.2 to 1.4, Chapter 2: Sections 2.1 to 2.3, Chapter 3: Sections 3.1,3.2)

UNIT 2: Fuzzy numbers – Linguistic variables – arithmetic operations on intervals – arithmetic operation on fuzzy numbers. (Chapter 4: Sections 4.1 to 4.4)

UNIT 3: Fuzzy relation – Crisp versus fuzzy relations – projections and cyclinderic extensions – Binary fuzzy relations on a single set – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy ordering relations. (Chapter 5: Sections 5.1 to 5.7)

UNIT 4: Fuzzy logic – Classical logic-An over view – multivalued logic – Fuzzy propositions – Fuzzy quantifiers – Linguistic Hedges - Inference from conditional fuzzy propositions – Inference from conditional and quantified propositions – Inference from quantified propositions. (Chapter 8 full)

UNIT – 5: Applications – Applications to Civil Engineering – Computer Engineering – Reliability Theory – Robotics – Medicine – Economics – Fuzzy Regressions – Interpersonal Communications. (Chapter 16: Sections 16.1,16.2, 16.5 to 16.7, Chapter 17: Sections 17.1 to 17.3, 17.5 and 17.6)

Text Book: Fuzzy sets and Fuzzy logic – Theory and applications – Second edition, by George J. Klir and B. Yuan. Publisher – Prentice Hall – 1995

Unit 1. Chapter 1: Sections 1.2, 1.3, 1.4, Chapter 2: Sections 2.1, 2.2, 2.3
Chapter 3: Sections 3.1, 3.2,

Unit 2. Chapter 4: Sections 4.1, 4.2, 4.3, 4.4

Unit 3. Chapter 5: Sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6,

Unit 4. Chapter 8 Full

Unit 5. Chapter 16: Sections 16.2,16.5,16.6, 16.7, Chapter 17: Sections 17.2, 17.3, 17.5, 17.6

Reference Book:
Fuzzy Set Theory and its Applications – Fourth edition, by A.J Zimmermann. Springer – International Edition
Chapter 4, Chapter 5, Chapter 8: Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8
Chapter 16, Chapter 17

STOCHASTIC PROCESSES (4 credits)

Unit 1: Stochastic Processes: Some notions – Specification of Stochastic processes – Stationary processes – Markov Chains – Definitions and examples – Higher Transition probabilities – Generalization of Independent Bernoulli trails – Sequence of chain – Dependent trains.
(Chapter 2: Sections 2.1 to 2.3, Chapter 3: Sections 3.1 to 3.3)

Unit 2: Markov chains: Classification of states and chains – determination of Higher transition probabilities – stability of a Markov system – Reducible chains – Markov chains with continuous state space.
(Chapter 3: Sections 3.4 to 3.6, 3.8, 3.9 and 3.11)

Unit 3:
Markov processes with Discrete state space : Poisson processes and their extensions – Poisson process and related distribution – Generalization of Poisson process- Birth and Death process – Markov processes with discrete state space (continuous time Markov Chains).
(Chapter 4: Sections 4.1 to 4.5)

Unit 4: Renewal processes and theory : Renewal process – Renewal processes in continuous time – Renewal equation – stopping time – Wald's equation – Renewal theorems. (Chapter 6 : Sections 6.1 to 6.5)

Unit 5: Stochastic processes in Queuing – Queuing system – General concepts – the queuing model M/M/1 – Steady state behaviour – transient behaviour of M/M/1 Model – Non-Markovian models - the model GI/M/1. (Chapter 10: Sections 10.1 to 10.3, 10.7 and 10.8 (omitting 10.2.3 & 10.2.3.1))

TEXT BOOK(S)

[1] J. Medhi, Stochastic Processes, Wiley Eastern, 1982.
Chapter 2: Sections 2.1 to 2.3
Chapter 3: Sections 3.1 to 3.6, 3.8, 3.9 and 3.11
Chapter 4: Sections 4.1 to 4.5
Chapter 6: Sections 6.1 to 6.5
Chapter 10: Sections 10.1 to 10.3, 10.7 and 10.8 (omit 10.2.3 & 10.2.3.1)

REFERENCE(S)

1. Samuel Karlin, Howard M. Taylor, A first course in stochastic processes, 2nd edition, Academic Press, 1975.
2. Narayan Bhat , Elements of Applied Stochastic Processes, 2nd edn, John Wiley, 1984.
3. S.K. Srinivasan and K.Mehata, Stochastic Processes, Tata McGraw Hill, 1976.
4. N.U. Prabhu, Stochastic Processes. Macmillan, 1965.

Question Paper Pattern

Time: 3 hrs

Max. Marks: 75

Section A (10 x 1 = 10 marks)
(Can include multiple choice questions and/or definitions and examples)
Answer all questions
Two questions from each unit.

Section B (5 x 7 = 35 marks)
Answer all questions choosing either (a) or (b).
One question from each unit.

Section C (3 x 10 = 30 marks)
Answer any three questions out of five questions. One question from each unit.

PRINCIPAL
Arulmigu Palaniandavar College
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PALANI - 624 601.