DHANRAJ BAID JAIN COLLEGE

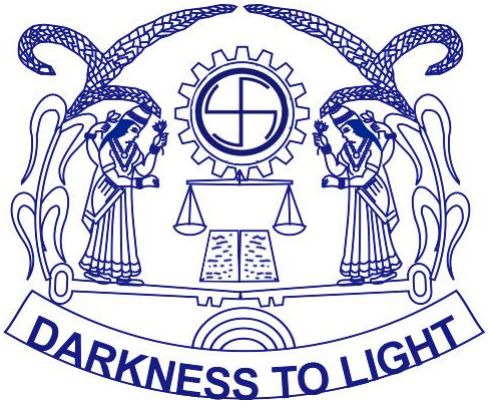
(Autonomous)

Thoraipakkam, Chennai – 600097

Affiliated to the University of Madras

DEPARTMENT OF MATHEMATICS

M.Sc. (Mathematics)



SYLLABUS
(Choice Based Credit System)

Total No. of Semesters: **4**

Total No. of Credits: **90**

SCHEME OF EXAMINATIONS

FIRST SEMESTER

Category	Paper	Title of the paper
Core	1	Algebra – I
Core	2	Real Analysis – I
Core	3	Ordinary Differential Equations
Core	4	Probability theory
Core	5	Elective – I: Graph theory
Soft	1	Skill based course - I

SECOND SEMESTER

Category	Paper	Title of the paper
Core	6	Algebra – II
Core	7	Real Analysis – II
Core	8	Partial Differential Equations
Core	9	Mathematical Statistics
Core	10	Elective – II: Mathematical Programming
Soft	2	Skill based Course - II

Summer internship

THIRD SEMESTER

Category	Paper	Title of the paper
Core	11	Complex Analysis – I
Core	12	Topology
Core	13	Mechanics
Core	14	Operation Research
Core	15	Elective - III: Java programming
Soft	3	Skill based course - III

FOURTH SEMESTER

Category	Paper	Title of the paper
Core	16	Complex Analysis – II
Core	17	Functional Analysis
Core	18	Differential Geometry
Core	19	Tensor Analysis and Relativity
Core	20	Elective – IV: Relational Database Management Systems
Soft	4	Skill based Course - IV

ELECTIVE SUBJECTS

One paper to be selected for each semester

1. Graph Theory
2. Numerical Analysis
3. Calculus of Variations and Integral Equations
4. Number theory and Cryptography
5. Formal languages and Automate theory
6. Object Oriented programming with C++
7. Fuzzy Sets and Applications
8. Mathematical Economics
9. Mathematical programming
10. Discrete Mathematics
11. Wavelets
12. Java Programming
13. Algebraic Theory of Numbers
14. Stochastic processes
15. Data Structure and Algorithm
16. Fluid Dynamics
17. Algebraic Topology
18. Difference Equation
19. Relational Data Base Management Systems
20. Financial Mathematics

COURSE CODE	COURSE TITLE	L	T	P	C
14P631A	ALGEBRA - I	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Another counting principle - class equation for finite groups and its applications - Sylow's theorems (For theorem 2.12.1, First proof only). **Chapter 2:** Sections 2.11 and 2.12 (Omit Lemma 2.12.5)
UNIT 2	Solvable groups - Direct products - Finite abelian groups- Modules (Definition and Examples) **Chapter 2:** Sections 2.13 and 2.14 (Theorem 2.14.1 only) **Chapter 4:** Section 4.5 (Omit theorem 4.5.1) **Chapter 5 :** Section 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1)
UNIT 3	**Linear Transformations**: Canonical forms –Triangular form - Nilpotent transformations. **Chapter 6:** Sections 6.4 , 6.5
UNIT 4	Jordan form - rational canonical form. **Chapter 6 :** Sections 6.6 and 6.7
UNIT 5	Trace and transpose - Hermitian, unitary, normal transformations, real quadratic form. **Chapter 6 :** Sections 6.8, 6.10 and 6.11 (Omit 6.9)

Recommended Text

I. N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Reference Books

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, Basic Algebra, Vol. I & II W.H.Freeman (1980); also published by Hindustan Publishing Company, New Delhi.

Website and e-learning sources

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,

COURSE CODE	COURSE TITLE	L	T	P	C
14P631B	**CORE 2: REAL ANALYSIS-I**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Functions of bounded variation** - Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation. **Chapter – 6 :** Sections 6.1 to 6.8 **Infinite Series :** Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series. Chapter 8 : Sections 8.8, 8.15, 8.17, 8.18
UNIT 2	**The Riemann - Stieltjes Integral** - Introduction - Notation - The definition of the Riemann - Stieltjes integral - Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral – Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper and lower integrals - Riemann's condition - Comparison theorems. Chapter - 7 : Sections 7.1 to 7.14
UNIT 3	**The Riemann-Stieltjes Integral** - Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of Riemann-Stieltjes integrals- Mean value theorems for Riemann - Stieltjes integrals - The integrals as a function of the interval - Second fundamental theorem of integral calculus-Change of variable in a Riemann integral-Second Mean Value Theorem for Riemann integral-Riemann-Stieltjes integrals depending on a parameter-Differentiation under the integral sign-Lebesgue criteriaon for the existence of Riemann integrals. Chapter - 7 : 7.15 to 7.26
UNIT 4	**Infinite Series and infinite Products** - Double sequences - Double series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series - Cesaro summability - Infinite products. **Chapter - 8 Sec, 8.20, 8.21 to 8.26** **Power series** - Multiplication of power series - The Taylor's series generated by a function - Bernstein's theorem - Abel's limit theorem - Tauber's theorem Chapter 9 : Sections 9.14 9.15, 9.19, 9.20, 9.22, 9.23

UNIT 5	**Sequences of Functions** - Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Definition of uniform convergence - Uniform convergence and continuity - The Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Uniform convergence and Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence. Chapter -9 Sec 9.1 to 9.6, 9.8,9.9, 9.10,9.11, 9.13

Recommended Text

Tom M.Apostol : Mathematical Analysis, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974.

Reference books

1. Bartle, R.G. Real Analysis, John Wiley and Sons Inc., 1976.
2. Rudin,W. Principles of Mathematical Analysis, 3rd Edition. McGraw Hill Company, New York, 1976.
3. Malik,S.C. and Savita Arora. Mathematical Anslysis, Wiley Eastern Limited.New Delhi, 1991.
4. Sanjay Arora and Bansi Lal, Introduction to Real Analysis, Satya Prakashan, New Delhi, 1991.
5. Gelbaum, B.R. and J. Olmsted, Counter Examples in Analysis, Holden day, San Francisco, 1964.
6. A.L.Gupta and N.R.Gupta, Principles of Real Analysis, Pearson Education, (Indian print) 2003.

Website and e-learning source

http://mathforum.org,
http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,
www.mathpages.com

COURSE CODE	COURSE TITLE	L	T	P	C
14P631C	**CORE 3: ORDINARY DIFFERENTIAL EQUATIONS**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Linear equations with constant coefficients:** 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	**Linear equations with constant coefficients:** Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation. **Chapter 2 :** Sections 7 to 11.
UNIT 3	**Linear equation with variable coefficients:** Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – reduction of the order of a homogeneous equation and non homogeneous equation with analytic coefficients-The Legendre equation. **Chapter :** 3 Sections 1 to 6 and 8 (Omit section 7 and 9)
UNIT 4	**Linear equation with regular singular points:** Euler equation – Second order equations with regular singular points – Bessel Function. **Chapter 4 :** Sections 1 to 3 and 7 to 8 (Omit sections 4,5,6 and 9)
UNIT 5	**Existence and uniqueness of solutions to first order equations:** Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition. **Chapter 5 :** Sections 1 to 5 (Omit Sections 6 to 9)

Recommended Text

E.A.Coddington, A introduction to ordinary differential equations (3rd Printing) Prentice-Hall of India Ltd., New Delhi, 1987.

Reference books

1. Williams E. Boyce and Richard C. DI Prima, Elementary differential equations and boundary value problems,John Wiley and sons, New York, 1967.
2. George F Simmons, Differential equations with applications and historical notes, Tata McGraw Hill, New Delhi, 1974.
3. N.N. Lebedev, Special functions and their applications, Prentice Hall of India, New Delhi, 1965.
4. W.T. Reid. Ordinary Differential Equations, John Wiley and Sons, New York, 1971
5. M.D.Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd. New Delhi 2001

B.Rai, D.P.Choudary and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House, New Delhi, 2002.

Website and e-learning source
http://mathforum.org,
http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,
www.mathpages.com

COURSE CODE	COURSE TITLE	L	T	P	C
14P631D	**CORE 4: PROBABILITY THEORY**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Random Events and Random Variables:** Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables. **Chapter 1:** Sections 1.1 to 1.7 **Chapter 2 :** Sections 2.1 to 2.9
UNIT 2	**Parameters of the Distribution :** Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types. **Chapter 3 :** Sections 3.1 to 3.8 (Generalization of Regression line of second type is omitted)
UNIT 3	**Characteristic functions :** Properties of characteristic functions – Characteristic functions and moments – semi invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions. **Chapter 4 :** Sections 4.1 to 4.7
UNIT 4	**Some Probability distributions:** Discrete distributions - One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions. **Continous distributions**: Uniform – normal - gamma – Beta – Cauchy and Laplace (continuous) distributions. **Chapter 5 :** Section 5.1 to 5.10 (Omit Section 5.11, examples 5.5.1 and 5.5.2)
UNIT 5	**Limit Theorems :** Stochastic convergence – Bernaulli law of large numbers – Levy-Cramer Theorems (only one part of the theorem can be asked) – de Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers. **Chapter 6 :** Sections 6.1 to 6.4, 6.6 to 6.9 , 6.11 and 6.12. (Omit Sections 6.5, 6.10,6.13 to 6.15, examples 6.9.1)

Recommended Text

M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

Reference books

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.
3. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.
4. V.K.Rohatgi An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).
5. S.I.Resnick, A Probability Path, Birhauser, Berlin,1999.

B.R.Bhat , Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999

COURSE CODE	COURSE TITLE	L	T	P	C
14P631E	**CORE 5: ELECTIVE I – GRAPH THEORY**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Graphs, subgraphs and Trees :** Graphs and simple graphs – Graph Isomorphism – The Incidence and Adjacency Matrices – Subgraphs – Vertex Degrees – Paths and Connection – Cycles – Trees – Cut Edges ana Bonds – Cut Vertices. **Chapter 1:** Section 1.1 – 1.7 **Chapter 2 :** Section 2.1 – 2.3
UNIT 2	**Connectivity, Euler tours and Hamilton Cycles :** Connectivity – Blocks – Euler tours – Hamilton Cycles. **Chapter 3:** Section 3.1 – 3.2 **Chapter 4:** Section 4.1 – 4.2
UNIT 3	**Matchings, Edge Colourings :** 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
UNIT 4	Independent sets and Cliques, **Vertex Colourings :** 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
UNIT 5	**Planar graphs :** 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

Recommended Text

J.A.Bondy and U.S.R. Murthy , Graph Theory and Applications , Macmillan, London, 1976.

Reference books

1. J.Clark and D.A.Holton , A First look at Graph Theory, Allied Publishers, New Delhi , 1995.
2. R. Gould. Graph Theory, Benjamin/Cummings, Menlo Park, 1989.
3. A.Gibbons, Algorithmic Graph Theory, Cambridge University Press, Cambridge, 1989.
4. R.J.Wilson and J.J.Watkins, Graphs : An Introductory Approach, John Wiley and Sons, New York, 1989.
5. R.J. Wilson, Introduction to Graph Theory, Pearson Education, 4th Edition, 2004, Indian Print.

A.Choudum, A First Course in Graph Theory, MacMillan India Ltd. 1987.

Website and e-learning source

http://mathforum.org,
http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,
www.graphtheory.com

COURSE CODE	COURSE TITLE	L	T	P	C
14P632G	**CORE 6: ALGEBRA – II**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Extension fields – Transcendence of e. Chapter 5: Section 5.1 and 5.2
UNIT 2	**Roots or Polynomials.- More about roots** Chapter 5: Sections 5.3 and 5.5
UNIT 3	Elements of Galois theory. Chapter 5 : Section 5.6
UNIT 4	Finite fields - Wedderburn's theorem on finite division rings. **Chapter 7:** Sections 7.1 and 7.2 (Theorem 7.2.1 only)
UNIT 5	Solvability by radicals - A theorem of Frobenius - Integral Quaternions and the Four - Square theorem. **Chapter 5:** Section 5.7 (Theorem 5.7.2 only) **Chapter 7 :** Sections 7.3 and 7.4

Recommended Text

I.N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Reference books

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997.

N.Jacobson, Basic Algebra, Vol. I & II Hindustan Publishing Company, New Delhi.

Website and e-learning source

http://mathforum.org,
http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,
www.algebra.com

COURSE CODE	COURSE TITLE	L	T	P	C
14P632H	**CORE 7: REAL ANALYSIS – II**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Measure on the Real line** - Lebesgue Outer Measure - Measurable sets - Regularity - Measurable Functions - Borel and Lebesgue Measurability **Chapter 2:** Sections 2.1 to 2.5 (de Barra)
UNIT 2	**Integration of Functions of a Real variable** - Integration of Non- negative functions - The General Integral - Riemann and Lebesgue Integrals **Chapter 3:** Sections 3.1,3.2 and 3.4 (de Barra)
UNIT 3	**Fourier Series and Fourier Integrals** - Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Thorem - The convergence and representation problems in for trigonometric series - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series - Riemann's localization theorem - Sufficient conditions for convergence of a Fourier series at a particular point - Cesaro summability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem **Chapter 11 :** Sections 11.1 to 11.15 (Apostol)
UNIT 4	**Multivariable Differential Calculus** - Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of R^n to R^1 **Chapter 12 :** Section 12.1 to 12.14 (Apostol)
UNIT 5	**Implicit Functions and Extremum Problems :** Functions with non-zero Jacobian determinants – The inverse function theorem-The Implicit function theorem-Extrema of real valued functions of several variables- Extremum problems with side conditions. **Chapter 13 :** Sections 13.1 to 13.7 (Apostol)

Recommended Text

1. G. de Barra, Measure Theory and Integration, Wiley Eastern Ltd., New Delhi, 1981. (for Units I and II)

Tom M.Apostol : Mathematical Analysis, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. (for Units III, IV and V)

Reference books

1. Burkill,J.C. The Lebesgue Integral, Cambridge University Press, 1951.
2. Munroe,M.E. Measure and Integration. Addison-Wesley, Mass.1971.
3. Roydon,H.L.Real Analysis, Macmillan Pub. Company, New York, 1988.
4. Rudin, W. Principles of Mathematical Analysis, McGraw Hill Company, New York,1979.
5. Malik,S.C. and Savita Arora. Mathematical Analysis, Wiley Eastern Limited. New Delhi, 1991.

Sanjay Arora and Bansi Lal, Introduction to Real Analysis, Satya Prakashan, New Delhi, 1991

Website and e-learning source

http://mathforum.org,
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http://www.opensource.org,
www.algebra.com

COURSE CODE	COURSE TITLE	L	T	P	C
14P632J	**CORE 8: PARTIAL DIFFERENTIAL EQUATIONS**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Mathematical Models and Classification of second order equation:** Classical equations-Vibrating string – Vibrating membrane – waves in elastic medium – Conduction of heat in solids –Second order equations in two independent variables – canonical forms – equations with constant coefficients. **Chapter 2 :** Sections 2.1 to 2.5 **Chapter 3 :** Sections 3.1 to 3.3 (Omit 3.4 and 3.5)
UNIT 2	**Cauchy Problem :** The Cauchy problem –Homogeneous wave equation – Initial Boundary value problem- Non-homogeneous boundary conditions – Finite string with fixed ends – Non-homogeneous wave equation – Riemann method **Chapter 4 :** Sections 4.1, 4.3 to 4.8
UNIT 3	**Method of separation of variables:** Separation of variable- Vibrating string problem – Existence and uniqueness of solution of vibrating string problem.- Heat conduction problem – Existence and uniqueness of solution of heat conduction problem – Laplace and beam equations **Chapter 6 :** Sections 6.1 to 6.6 (Omit section 6.7)
UNIT 4	**Boundary Value Problems :** Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorem – Dirichlet Problem for a circle , a circular annulus, a rectangle **Chapter 8 :** Sections 8.1 to 8.7
UNIT 5	**Green's Function:** The Delta function – Green's function – Method of Green's function – Dirichlet Problem for the Laplace and Helmholtz operators – Method of images and eigen functions. **Chapter 10 :** Section 10.1 to 10.7

Recommended Text

Tyn Myint-U and Lokenath Debnath, Partial Differential Equations for Scientists and Engineers (Third Edition), North Hollan, New York, 1987.

Reference books

1. M.M.Smirnov, Second Order partial Differential Equations, Leningrad, 1964.
2. I.N.Sneddon, Elements of Partial Differential Equations, McGraw Hill, New Delhi, 1983.
3. R. Dennemeyer, Introduction to Partial Differential Equations and Boundary Value Problems, McGraw Hill, New York, 1968.
4. M.D.Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd., New Delhi, 2001.
5. S, Sankar Rao, Partial Differential Equations, 2nd Edition, Prentice Hall of India, New Delhi. 2004

Website and e-learning source
http://mathforum.org,
http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,
www.mathpages.com

COURSE CODE	COURSE TITLE	L	T	P	C
14P632K	**CORE 9: MATHEMATICAL STATISTICS**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Sample Moments and their Functions:** Notion of a sample and a statistic – Distribution functions of X, S^2 and - (X , S^2) - χ^2 distribution – Student t-distribution – Fisher's Z-distribution – Snedecor's F-distribution – Distribution of sample mean from non-normal populations **Chapter 9 :** Sections 9.1 to 9.8
UNIT 2	**Significance Test :** Concept of a statistical test – Parametric tests for small samples and large samples - χ^2 test –Independence Tests by contingency tables. **Chapter 12 :** 12.1 to 12.4 and 12.7(omit 12.5, 12.6)
UNIT 3	**Estimation :** Preliminary notion – Consistency estimation – Unbiased estimates – Sufficiency – Efficiency – Asymptotically most efficient estimates – methods of finding estimates – confidence Interval. **Chapter 13 :** Sections 13.1 to 13.8 (Omit Section 13.9, examples 13.6.3, 13.6.4 and 13.7.2 to 13.7.4)
UNIT 4	**Analysis of Variance :** One way classification and two-way classification (theory only) **Hypotheses Testing:** Poser functions – OC function- Most Powerful test – Uniformly most powerful test – unbiased test. **Chapter 15 :** Sections 15.1 and 15.2 **Chapter 16 :** Sections 16.1 to 16.5 (Omit Section 16.6 and 16.7, examples 16.2.3)
UNIT 5	**Sequential Analysis :** SPRT – Auxiliary Theorem – Wald's fundamental identity – OC function and SPRT – E(n) and Determination of A and B – Testing a hypothesis concerning p on 0-1 distribution and m in Normal distribution. **Chapter 17 :** Sections 17.1 to 17.9 (Omit Section 17.10)

Recommended Text

M. Fisz , Probability Theory and Mathematical Statistics, John Wiley and sons, New Your, 1963.

Reference books

1. E.J.Dudewicz and S.N.Mishra , Modern Mathematical Statistics, John Wiley and Sons, New York, 1988.
2. V.K.Rohatgi An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern New Delhi, 1988(3rd Edn)
3. G.G.Roussas, A First Course in Mathematical Statistics, Addison Wesley Publishing Company, 1973

B.L.Vander Waerden, Mathematical Statistics, G.Allen & Unwin Ltd., London, 1968.

Website and e-learning source
http://mathforum.org,
http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,
www.casact.org

COURSE CODE	COURSE TITLE	L	T	P	C
14P632L	**CORE 10: ELECTIVE II- MATHEMATICAL PROGRAMMING**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Integer Linear Programming:** Types of Integer Linear Programming Problems – Concept of Cutting Plane – Gomory's All Integer Cutting Plane Method – Gomory's mixed Integer Cutting Plane method – Branch and Bound Method. – Zero-One Integer Programming. **Chapters: 7**
UNIT 2	**Dynamic Programming:** Characteristics of Dynamic Programming Problem – Developing Optimal Decision Policy – Dynamic Programming Under Certainty – DP approach to solve LPP. **Chapters: 20.**
UNIT 3	**Classical Optimization Methods:** Unconstrained Optimization – Constrained Multi-variable Optimization with Equality Constraints **Chapter:**
UNIT 4	**Non-linear Programming Methods:** Examples of NLPP – General NLPP – Quadratic Programming – Wolfe's modified Simplex Methods – Beale's Method. **Chapter: 23**
UNIT 5	**Revised Simplex Method:** Standard forms for Revised simplex Method – Computational procedure for Standard form I – comparison of simplex method and Revised simplex Method. **Chapter: 26**

Recommended Text

J.K.Sharma, Operations Research , Macmillan (India) New Delhi 2001

Reference books

1. Hamdy A. Taha, Operations Research, (seventh edition) Prentice - Hall of India Private Limited, New Delhi, 1997.
2. F.S. Hillier & J.Lieberman Introduction to Operation Research (7^{th} Edition) Tata- McGraw Hill Company, New Delhi, 2001.
3. Beightler. C, D.Phillips, B. Wilde ,Foundations of Optimization (2^{nd} Edition) Prentice Hall Pvt Ltd., New York, 1979

S.S. Rao - Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi. 1990

COURSE CODE	COURSE TITLE	L	T	P	C
14P633M	**CORE 11: COMPLEX ANALYSIS-I**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Cauchy's Integral Formula:** The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. **Local Properties of analytical Functions :** Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle . **Chapter 4 :** Section 2 : 2.1 to 2.3 **Chapter 4 :** Section 3 : 3.1 to 3.4
UNIT 2	**The general form of Cauchy's Theorem :** Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Multiply connected regions - Residue theorem - The argument principle. **Chapter 4 :** Section 4 : 4.1 to 4.7 (Omit 4.6) **Chapter 4 :** Section 5: 5.1 and 5.2
UNIT 3	**Harmonic Functions:** Definition of Harmonic function and basic properties - Mean value property - Poisson formula. **Chapter 4 :** Sections 6 : 6.1 to 6.3
UNIT 4	**Harmonic Functions and Power Series Expansions:** Schwarz theorem - The reflection principle - Weierstrass theorem – Taylor's Series – Laurent series . **Chapter 4 :** Sections 6.4 and 6.5 **Chapter 5 :** Sections 1.1 to 1.3
UNIT 5	**Partial Fractions and Entire Functions:** Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – **Chapter 5 :** Sections 2.1 to 2.4 **Chapter 5 :** Sections 3.1

Recommended Text

Lars V. Ahlfors, Complex Analysis, (3rd edition) McGraw Hill Co., New York, 1979

Reference books

1. 1.H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford, 1990.
2. 2.J.B. Conway, Functions of one complex variables Springer - Verlag, International student Edition, Naroser Publishing Co.1978
3. E. Hille, Analytic function Thorey (2 vols.), Gonm & Co, 1959.

4.M.Heins, Complex function Theory, Academic Press, New York,1968

COURSE CODE	COURSE TITLE	L	T	P	C
14P633N	**CORE 12: TOPOLOGY**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Topological spaces :** Topological spaces – Basis for a topology – The order topology – The product topology on X × Y – The subspace topology – Closed sets and limit points. Chapter 2 : Sections 12 to 17
UNIT 2	**Continuous functions:** Continuous functions – the product topology – The metric topology. **Chapter 2 :** Sections 18 to 21 (Omit Section 22)
UNIT 3	**Connectedness:** Connected spaces- connected subspaces of the Real line **Chapter 3 :** Sections 23 to 24.
UNIT 4	**Compactness :** Compact spaces – compact subspaces of the Real line – Limit Point Compactness. **Chapter 3 :** Sections 26 to 28.
UNIT 5	**Countability and Separation Axiom:** The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohn metrization Theorem. **Chapter 4 :** Sections 30 to 34.

Recommended Text

James R. Munkres, Topology (2nd Edition) Pearson Education Pve. Ltd., Delhi-2002 (Third Indian Reprint)

Reference books

1. J. Dugundji , Topology , Prentice Hall of India, New Delhi, 1975.
2. George F.Sinmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co., 1963
3. J.L. Kelly, General Topology, Van Nostrand, Reinhold Co., New York
4. L.Steen and J.Subhash, Counter Examples in Topology, Holt, Rinehart and Winston, New York, 1970.

S.Willard, General Topology, Addison - Wesley, Mass., 1970

COURSE CODE	COURSE TITLE	L	T	P	C
14P633P	**CORE 13: MECHANICS**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Mechanical Systems :** The Mechanical system- Generalised coordinates – Constraints - Virtual work - Energy and Momentum Chapter 1: Sections 1.1 to 1.5
UNIT 2	**Lagrange's Equations:** Derivation of Lagrange's equations- Examples- Integrals of motion. **Chapter 2 :** Sections 2.1 to 2.3 (Omit Section 2.4)
UNIT 3	Hamilton's Equations : Hamilton's Principle - Hamilton's Equation - Other variational principle. **Chapter 4 :** Sections 4.1 to 4.3 (Omit section 4.4)
UNIT 4	**Hamilton-Jacobi Theory :** Hamilton Principle function – Hamilton-Jacobi Equation - Separability **Chapter 5 :** Sections 5.1 to 5.3
UNIT 5	**Canonical Transformation :** Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets. **Chapter 6 :** Sections 6.1, 6.2 and 6.3 (omit sections 6.4, 6.5 and 6.6)

Recommended Text

D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985

Reference books

1. H. Goldstein, Classical Mechanics, (2nd Edition) Narosa Publishing House, New Delhi.
2. N.C.Rane and P.S.C.Joag, Classical Mechanics, Tata McGraw Hill, 1991.

J.L.Synge and B.A.Griffth, Principles of Mechanics (3rd Edition) McGraw Hill Book Co., New York, 1970.

COURSE CODE	COURSE TITLE	L	T	P	C
14P633Q	**CORE 14: OPERATIONS RESEARCH**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Decision Theory:** Introduction -Decision making environments-Decion making under certainty-Decision making under uncertainty-Decision making under risk-Posterior propabilities and Bayesian analysis -Decision Tree Analysis. **Chapter 15**
UNIT 2	**Project Management : PERT and CPM :** Basic Differences between PERT and CPM – Steps in PERT/CPM Techniques – PERT/CPM Network Components and Precedence Relationships – Critical Path Analysis – Probability in PERT Analysis – Project time-cost Trade Off – Updating the Project – Resource Allocation **Chapter 17**
UNIT 3	**Inventory Control:** Relevant inventory costs – steps of inventory modi building –Deterministic inventory models-EOQ Model with constant rate of demand –EOQ Models with different rates of demand-Economic production quantity model when supply (Replenishment) is gradual **Chapter18**
UNIT 4	**Queuing Theory :** Introduction-Essential features of Queuing system – Performance measures of a Queuing system-Transient State and Steady state-Relation among performance measures-Classifications of Queuing Models and their solutions. **Chapter 19**
UNIT 5	**Replacement and Maintenance Models:Introduction-Types of failure-** Replacement of Items whose efficiency deteriorates with Time **Chapter 20.**

Recommended Text

J.K.Sharma, Operations Research , MacMillan India, New Delhi, Second edition -2004.

Reference books

1. F.S. Hillier and J.Lieberman -,Introduction to Operations Research (8th Edition), Tata McGraw Hill Publishing Company, New Delhui, 2006.
2. Beightler. C, D.Phillips, B. Wilde ,Foundations of Optimization (2nd Edition) Prentice Hall Pvt Ltd., New York, 1979
3. Bazaraa, M.S; J.J.Jarvis, H.D.Sharall ,Linear Programming and Network flow, John Wiley and sons, New York 1990.
4. Gross, D and C.M.Harris, Fundamentals of Queueing Theory, (3rd Edition), Wiley and Sons, New York, 1998.

Hamdy A. Taha , Operations Research (sixth edition), Prentice - Hall of India Private Limited, New Delhi.

COURSE CODE	COURSE TITLE	L	T	P	C
14P633R	**CORE 15: ELECTIVE III - JAVA PROGRAMMING**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Java Tokens – Java statements – Constants – Variables – Data types **Chapters 3 and 4**
UNIT 2	Operators – Expressions – Decision making and Branching. **Chapters 5,6 and**
UNIT 3	Classes – Objects – Methods – Arrays – Strings – Vectors – Multiple Inheritance **Chapters 8, 9 and 10**
UNIT 4	Multithreaded Programming – Managing errors and Exceptions **Chapters 12 and 13**
UNIT 5	Applet Programming **Chapter 14**

Recommended Text

E. Balagurusamy, Programming with Java – A primer , Tata McGraw Hill Publishing Company Limited, New Delhi, 1998.

Reference books

1. Mitchell Waite and Robert Lafore, Data Structures and Algorithms in Java, Techmedia (Indian Edition), New Delhi, 1999

Adam Drozdek, Data Structures and Algorithms in Java, (Brown/Cole), Vikas Publishing House, New Delhi, 2001.

Website and e-learning source

http://www.java.sun.com ,
www.cafeaulait.org/course/
http://en.wikiepedia.org

COURSE CODE	COURSE TITLE	L	T	P	C
14P634S	**CORE 16: COMPLEX ANALYSIS-II**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Riemann Zeta Function and Normal Families:** Product development – Extension of $\zeta(s)$ to the whole plane – Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions . **Chapter 5 :** Sections 4.1 to 4.3 **Chapter 5 :** Sections 5.1 to 5.4
UNIT 2	**Riemann mapping Theorem :** Statement and Proof – Boundary Behaviour – Use of the Reflection Principle. **Conformal mappings of polygons :** Behaviour at an angle Schwarz-Christoffel formula – Mapping on a rectangle. **Harmonic Functions :** Functions with mean value property – Harnack's principle. **Chapter 6 :** Sections 1.1 to 1.3 (Omit Section1.4) **Chapter 6 :** Sections 2.1 to 2.3 (Omit section 2.4) **Chapter 6 :** Section 3.1 and 3.2
UNIT 3	**Elliptic functions :** Simply periodic functions – Doubly periodic functions **Chapter 7 :** Sections 1.1 to 1.3 **Chapter 7 :** Sections 2.1 to 2.4
UNIT 4	**Weierstrass Theory :** The Weierstrass $\wp$-function – The functions $\zeta(s)$ and $\sigma(s)$ – The differential equation – The modular equation $\lambda(\tau)$ – The Conformal mapping by $\lambda(\tau)$. **Chapter 7 :** Sections 3.1 to 3.5
UNIT 5	**Analytic Continuation :** The Weiertrass Theory – Germs and Sheaves – Sections and Riemann surfaces – Analytic continuation along Arcs – Homotopic curves – The Monodromy Theorem **Chapter 8 :** Sections 1.1 to 1.6

Recommended Text

Lars F. Ahlfors, Complex Analysis, (3rd Edition) McGraw Hill Book Company, New York, 1979.

Reference books

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford, 1990.
2. J.B. Corway, Functions of one complex variables, Springer -Verlag, International student Edition, Narosa Publishing Co.
3. E. Hille, Analytic function Thorey (2 vols.), Gonm & Co, 1959.

M.Heins, Complex function Theory, Academic Press, New York,1968.

COURSE CODE	COURSE TITLE	L	T	P	C
14P634T	**CORE 17: FUNCTIONAL ANALYSIS**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Banach Spaces :** Definition – Some examples – Continuous Linear Transformations – The Hahn-Banach Theorem – The natural embedding of N in N**(concept only) Chapter 9 : Sections 46 to 49
UNIT 2	**Banach spaces and Hilbert spaces:** Open mapping theorem – conjugate of an operator – Definition and some simple properties – Orthogonal complements – Orthonormal sets **Chapter 9 :** Sections 50 and 51 **Chapter 10 :** Sections 52 to 54.
UNIT 3	**Hilbert Space** : Conjugate space H* - Adjoint of an operator – Self-adjoint operator – Normal and Unitary Operators – Projections **Chapter 10 :** Sections 55 to 59.
UNIT 4	**Preliminaries on Banach Algebras :** Definition and some examples – Regular and single elements – Topological divisors of zero – spectrum – the formula for the spectral radius **Chapter 12 :** Sections 64 to 68.
UNIT 5	**Structure of commutative Banach Algebras :** Gelfand mapping – Applications of the formula $r(x) = \lim \|x^n\|^{1/n}$ - Involutions in Banach Algebras – Gelfand-Neumark Theorem. **Chapter 13 :** Sections 70 to 73.

Recommended Text

G.F.Simmons, Introduction to topology and Modern Analysis, McGraw Hill International Book Company, New York, 1963.

Reference books

1. W. Rudin Functional Analysis, Tata McGraw-Hill Publishing Company, New Delhi , 1973
2. G. Bachman & L.Narici, Functional Analysis Academic Press, New York,1966.
3. H.C. Goffman and G.Fedrick, First course in Functional Analysis, Prentice Hall of India, New Delhi, 1987

E. Kreyszig Introductory Functional Analysis with Applications, John wiley & Sons, New York.,1978.

COURSE CODE	COURSE TITLE	L	T	P	C
14P634U	**CORE 18: DIFFERNETIAL GEOMETRY**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Space curves:** Definition of a space curve – Arc length – tangent – normal and binormal – curvature and torsion – contact between curves and surfaces- tangent surface- involutes and evolutes- Intrinsic equations – Fundamental Existence Theorem for space curves- Helies. **Chapter I :** Sections 1 to 9.
UNIT 2	**Intrinsic properties of a surface:** Definition of a surface – curves on a surface – Surface of revolution – Helicoids – Metric- Direction coefficients. **Chapter II:** Sections 1 to 6.
UNIT 3	**Geodesics:** Geodesics – Canonical geodesic equations – Normal property of geodesics- Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature- surface of constant curvature. **Chapter II:** Sections 10 to 18 (omit sections 13 and 14)
UNIT 4	**Non Intrinsic properties of a surface:** The second fundamental form- Principle curvature – Lines of curvature – Developable - Developable associated with space curves and with curves on surface. **Chapter III: Sections 1 to 6.**
UNIT 5	**Differential Geometry of Surfaces :** Fundamental Existence Theorem for surfaces -Compact surfaces whose points are umblics- Hilbert's lemma – Compact surface of constant curvature. **Chapter IV :** Sections 1 to 4

Recommended Text

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

Reference books

1. Struik, D.T. Lectures on Classical Differential Geometry, Addison – Wesley, Mass. 1950.
2. Kobayashi. S. and Nomizu. K. Foundations of Differential Geometry, Interscience Publishers, 1963.
3. Wilhelm Klingenberg: A course in Differential Geometry, Graduate Texts in Mathematics, Springer-Verlag 1978.

J.A. Thorpe Elementary topics in Differential Geometry,Under - graduate Texts in Mathematics, Springer - Verlag 1979.

COURSE CODE	COURSE TITLE	L	T	P	C
14P634V	**CORE 19: TENSOR ANALYSIS AND RELATIVITY**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Tensor Algebra:** Systems of Different orders – Summation Convention – Kronecker Symbols – Transformation of coordinates in S_n – Invariants – Covariant and Contravariant vectors – Tensors of Second Order – Mixed Tensors – Zero Tensor – Tensor Field – Algebra of Tensors – Equality of Tensors – Symmetric and Skew-symmetric tensors – Outer multiplication, Contraction and Inner Multiplication – Quotient Law of Tensors – Reciprocal Tensor of Tensor – Relative Tensor – Cross Product of Vectors. **Chapter I :** I.1 – I.3 **Chapter II :** II.1 –II.18
UNIT 2	**Tensor Calculus:** Riemannian Space – Christoffel Symbols and their properties **Chapter III:** III.1 and III.2
UNIT 3	**Tensor Calculus (contd):** Covariant Differentiation of Tensors, **Chapter III: III.3**
UNIT 4	**Special Theory of Relativity:** Galilean Transformation – Maxwell's equations – The ether Theory – The Principle of Relativity **Relativistic Kinematics :** Lorentz Transformation equations **Chapter 7 :** Sections 7.1 and 7.2
UNIT 5	**Relativistic Dynamics :** Momentum – Energy – Momentum-energy four vector – Force – Conservation of Energy – Mass and energy – Example – inelastic collision – Principle of equivalence – Lagrangian and Hamiltonian formulations. **Chapter 7 :** Sections 7.3

Recommended Text

For Units I,II and III

U.C. De, Absos Ali Shaikh and Joydeep Sengupta, Tensor Calculus, Narosa Publishing House, New Delhi, 2004.

For Units IV and V

D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985.

Reference books

1. J.L.Synge and A.Schild, Tensor Calculus, Toronto, 1949.
2. A.S.Eddington. The Mathematical Theory of Relativity, Cambridge University Press, 1930.
3. P.G.Bergman, An Introduction to Theory of Relativity, New York, 1942

C.E.Weatherburn, Riemannian Geometry and the Tensor Calculus, Cambridge, 1938.

COURSE CODE	COURSE TITLE	L	T	P	C
14P634W	**CORE 20: ELECTIVE 4 - RELATIONAL DATABASE MANAGEMENT SYSTEM**	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Data, information and information processing – secondary storage devices – files, file organization and file structure – indexing and hashing – introduction to DBMS- software development life cycle- database development life cycle- introduction to RDBMS **Chapter 1 – 7**
UNIT 2	Database Architecture and data modeling – ER modeling – enhanced entity relationship model – data normalization **Chapter 8 – 11**
UNIT 3	Relational algebra and relational calculus – tables – SQL – tables – views and indexes and Null Queries and sub queries – aggregate functions. **Chapter 12- 18**
UNIT 4	Insert, update, delete operations – cursors – joins and unions –programming with SQL – query by example – QUEL triggers – Query processing and optimization **Chap 19 – 26**
UNIT 5	Database security – data integrity – transaction management and concurrency control –backup and recovery **Chap : 27 – 30**

Recommended Text

Alex Leon and Mathews Leon, Database Management Systems, Leon Vikas, Chennai

Reference books

1. Elamasri, R. and Navathe S. Fundamentals of Data Base Systems (3rd Edition) Person Education 2000
2. Silberschatiz A. Korth H.F. and Sudarshan , S. Database System Concepts (3rd Edn) McGraw Hill Publishing Company, New York 1997
3. Ullman , J.O. Principles of Database System (2nd Edn) Computer Science Press Inc, 1984

Date. C.J. Introduction to Database Systems (7th Edition), Addison Wesley, Mass 2000.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - GRAPH THEORY	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Data, information and information processing – secondary storage devices – files, file organization and file structure – indexing and hashing – introduction to DBMS- software development life cycle- database development life cycle- introduction to RDBMS **Chapter 1 – 7**
UNIT 2	Database Architecture and data modeling – ER modeling – enhanced entity relationship model – data normalization **Chapter 8 – 11**
UNIT 3	Relational algebra and relational calculus – tables – SQL – tables – views and indexes and Null Queries and sub queries – aggregate functions. **Chapter 12- 18**
UNIT 4	Insert, update, delete operations – cursors – joins and unions –programming with SQL – query by example – QUEL triggers – Query processing and optimization **Chap 19 – 26**
UNIT 5	Database security – data integrity – transaction management and concurrency control –backup and recovery **Chap : 27 – 30**

Recommended Text

J.A.Bondy and U.S.R. Murthy , *Graph Theory and Applications* , Macmillan, London, 1976.

Reference books

1. J.Clark and D.A.Holton , *A First look at Graph Theory*, Allied Publishers, New Delhi , 1995.
2. R. Gould. *Graph Theory*, Benjamin/Cummings, Menlo Park, 1989.
3. A.Gibbons, *Algorithmic Graph Theory*, Cambridge University Press, Cambridge, 1989.
4. R.J.Wilson and J.J.Watkins, *Graphs : An Introductory Approach*, John Wiley and Sons, New York, 1989.
5. R.J. Wilson, *Introduction to Graph Theory*, Pearson Education, 4th Edition, 2004, Indian Print.

A.Choudum, *A First Course in Graph Theory*, MacMillan India Ltd. 1987.

Website and e-learning source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org, www.graphtheory.com

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - NUMERICAL ANALYSIS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Non Linear Equation:** Bisection method – The secant method – Regulafalsi method – Newton Raphson method – The fixed point method – Mueller's method – Newton's method for multiple roots – System of non Linear equations by Newton's method and fixed point method **Chapters 2 :** (Devi Prasad)
UNIT 2	**Interpolation:** Lagrange's formula – Newton's divided difference formula – Netwon's forward and backward Interpolation formula. **Numerical Differentiation:** Derivatives based on Newton's forward and backward Interpolation formula **Chapters 4,5:** 4.1 to 4.3, 5.1 (Devi Prasad)
UNIT 3	**Numerical Integration:** Basic Trapezoidal rule – Composite Trapezoidal rule – Basic Simpson's one third rule – Composite Simpson's one third rule – Basic Simpson's three eight rule – composite Simpson's three eighth rule – Numerical double integration with constant limits by composite trapezoidal and composite Simpson's on third rule. **Chapters 5 :** 5.3, 5.7.1, 5.7.3 (Devi Prasad)
UNIT 4	**Numerical Solution of Ordinary differential equation:** Difference equation – Taylor's series method – Euler's method – Runge-Kutta method (fourth order only) – Predictor – corrector methods – Milne's method and Adam's method **Chapter 6:** 5.1 to 6.1 to 6.4 (Devi Prasad)
UNIT 5	**Numerical Solution of Partial Differential Equations:** Introduction – Solution of Laplace's equation $U_{xx} + U_{yy} = 0$ and Poission's Equations by Jacobi's and Gauss seidel method. Solution of parabolic heat conduction equation U_{xx} = Cut by Bender Schmidt recurrence relation and Crank Nickolson formula. **Chapter 8:** 8.1,8.2,8.3.1,8.3.2,8.4 (S.S.Sastry)

Recommended Text

1. Devi Prasad, An Introduction to Numerical Analysis (3rd ed) Narosa Publishing House, New Delhi, 2006.

S.S.Sastry, Itroductory methods of Numerical Analysis (4th ed.), PHI Learning Pvt Ltd, New Delhi, 2009

Reference books

1. K.Sankara Rao, Numericla Methods for Scientists and Engineers, 3rd ed., Narosa Publishing house, New Delhi, 2008.

Jain, Iyengar, Jain Numerical Methods, 5th ed., New Age Publishers, 2010.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	The Method of Variations in Problems with Fixed Boundaries **Chapter 6 :** Sections 1 to 7 (Elsgolts)
UNIT 2	Variational Problems with Moving Boundaries and certain other problems and Sufficient conditions for an Extremum **Chapter 7 :** Sections 1 to 4 (Elsgolts) **Chapter 8 :** Sections 1to 3(Elsgolts)
UNIT 3	Variational Problems Involving a conditional Extremum **Chapter 9 :** Sections 1 to 3. (Elsgolts)
UNIT 4	Integral Equations with Separable Kernels and Method of successive approximations. **Chapter 1 :** Sections 1.1 to 1.7 (Kanwal) **Chapter 2 :** Sections 2.1 to 2.5 (Kanwal) **Chapter 3 :** Sections 3.1 to 3.5 (Kanwal)
UNIT 5	Classical Fredholm Theory , Symmetric Kernels and Singular Integral Equations **Chapter 4 :** Sections 4.1 to 4.5 (Kanwal) **Chapter 7 :** Sections 7.1 to 7.6 (Kanwal) **Chapter 8 :** Sections 8.1 to 8.5 (Kanwal)

Recommended Text
For Units I,II and III :

L. Elsgolts , *Differential Equations and the Calculus of Variations*, Mir Publishers, Moscow, 1973 (2^{nd} Edition)
For Units IV and V :

Ram P.Kanwal,*Linear Integral Equations*, Academic Press, New York, 1971.

Reference books

1. I.M.Gelfand and S.V.Fomin, *Calculus of Variations*, Prentice-Hall Inc. New Jersey, 1963.
2. A.S.Gupta, *Calculus of Variations with Applications*, Prentice-Hall of India, New Delhi, 1997.
3. M.Krasnov, A.Kiselev and G.Makarenko, *Problems and Exercises in Integral Equations*, Mir Publishers, Moscow, 1979.
4. S.G.Mikhlin, *Linear Integral Equations*, Hindustan Publishing Corp. Delhi,1960.
5. L.A.Pars, *An Introduction to the Calculus of Variations*, Heinemann, London, 1965.
6. R.Weinstock, *Calculus of Variations with Applications to Physics and Engineering*, McGraw-Hill Book Company Inc. New York, 1952.

Website and e-learning source
http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics
http://www.opensource.org

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - NUMBER THEORY AND CRYPTOGRAPHY	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Elementary Number Theory – Time Estimates for doing arithmetic – divisibility and Euclidean algorithm – Congruences – Application to factoring.
UNIT 2	Introduction to Classical Crypto systems – Some simple crypto systems – Enciphering matrices DES
UNIT 3	Finite Fields and quadratic Residues – Reciprocity
UNIT 4	Public Key Cryptography
UNIT 5	Primality , Factoring and Elliptic Curves

Recommended Text

Neal Koblitz, *A Course in Number Theory and Cryptography*, Springer-Verlag, New York,1987

Reference books

1. Niven and Zuckermann, *An Introduction to Theory of Numbers* (Edn. 3), Wiley Eastern Ltd., New Delhi,1976
2. David M.Burton, *Elementary Number Theory*, Wm C.Brown Publishers, Dubuque, Iowa,1989

K.Ireland and M.Rosen, *A Classical Introduction to Modern Number Theory*, Springer Verlag, 1972

Website and e-learning source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org , www.numbertheory.org

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - FORMAL LANGUAGES AND AUTOMATA THEORY	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Finite automata, regular expressions and regular grammars Finite state systems – Basic definitions – Nondeterministic finite automata – Finite automata with ε moves – Regular expressions – Regular grammars. **Chapter 2:** Sections 2.1 to2.5 **Chapter 9:** Section 9.1
UNIT 2	**Properties of regular sets:** The Pumping lemma for regular sets – Closure properties of regular sets – Decision algorithms for regular sets – The Myhill-Nerode Theorem and minimization of finite automata. Chapter 3 : **Sections 3.1 to 3.4**
UNIT 3	**Context-free grammars:** Motivation and introduction – Context-free grammars – Derivation trees- Simplification of context-free grammars – Chomsky normal form – Greibach normal form. Chapter 4 : **Section 4.1 to 4.6**
UNIT 4	**UNIT-IV : Pushdown automata** Informal description- Definitions-Pushdown automata and context-free languages – Normal forms for deterministic pushdown automat. **Chapter 5 :** Sections 5.1 to 5.3
UNIT 5	**Properties of context-free languages:** The pumping lemma for CFL's – Closure properties for CFL's – Decision algorithms for CFL's. Chapter 6 : **Sections 6.1 to 6.3**

Recommended Text

John E.Hopcraft and Jeffrey D.Ullman, *Introduction to Automata Theory, Languages and Computation*, Narosa Publishing House, New Delhi, 1987.

Reference books

1. A. Salomaa, *Formal Languages*, Academic Press, New York, 1973.

John C. Martin, *Introduction to Languages and theory of Computations* (2nd Edition) Tata-McGraw Hill Company Ltd., New Delhi, 1997.

Website and e-learning source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, www.jflap.org

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - OBJECT ORIENTED PROGRAMMING WITH C++	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Variables – Operators – Manipulators – Expressions and their types – Control Structures – Functions – Main Function – Function Prototyping – Call by Reference – Return by Reference – Inline Functions – Default Arguments – Function Overloading **Chapters:** 3 (3.1 to 3.24) and 4 (4.1 to 4.7, 4.9)
UNIT 2	Classes and Objects – Specifying a Class – Defining Member Functions – A C++ Program with Class – Static Members – Arrays of Objects – Objects as Function Arguments – Friend Functions – Returning Objects **Chapters:** 5 (5.3 to 5.5, 5.11 to 5.16)
UNIT 3	Constructors and Destructors – Parameterized Constructors – Multiple Constructors in a Class – Copy constructors – Destructors – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Using Friend Function – Rules for Overloading Operators **Chapter: 6** (6.1 to 6.4, 6.7, 6.11) and 7(7.1 to 7.5, 7.7)
UNIT 4	Inheritance – Defining Derived Clases – Single Inheritance – Multilevel Inheritance – Multiple iNheritance – Virtual Base Classes – Pointers to Objects – this pointer – Pointer to Derived Classes – virtual Functions and Polymorphism – Pure Virtual Function. **Chapters:** 8(8.1 to 8.3, 8.5, 8.6,8.9), 9(9.1 to 9.7)
UNIT 5	Managing Console I/O Operations – C++ Streams – C++ Stream Classes – Unformatted I/O Operations – Formatted Console I/O Operations – Working with Files – Classes for File Stream Operations – Opening and Closing a File – Detcting End – of File – File Modes **Chapters:** 10 (10.1 to 10.5) and 11 (11.1 to 11.5)

Recommended Text

Object – Oriented Programming with C++, 3rd ed., E.Balagurusamy, Tata McGraw Hill Pub, New Delhi

Reference books

1. Mastering C++, Venugopal and Prasad, Tata McGraw Hill Pub,

Object Oriented Programming with C++, Ashok N Kamthane, pearson education.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - FUZZY SETS AND APPLICATIONS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Fundamental Notions **Chapter 1:** Section 1 to 8
UNIT 2	Fuzzy Graphs **Chapter 2:** Section 10 to 18
UNIT 3	Fuzzy relations **Chater 2 :** Section 19 to 29
UNIT 4	Fuzzy Logic **Chapter 3:** Section 31 to 40 (omit section 37,38,49)
UNIT 5	The Laws of Fuzzy Composition **Chapter 4:** Section 43 to 49

Recommended Text

A.Kaufman, Introduction to the theory of Fuzzy subsets, Vol.1, Academic Press, New York, 1975

Reference books

H.J.Zimmermann, Fuzzy set theory and its applications, Allied publishers, Chennai, 1996.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - MATHEMATICAL ECONOMICS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**The theory of Consumer Behaviour:** Utility function – Indifference Curves – Rate of Commodity Substitution – Existence of Utility Function – Maximization of Utility – Choice of a utility Index – demand function – Income and Leisure – Substitution and Income Effects – Generalization to n variables – Theory of Revealed Preference – Problem of Choice in Risk **Chapter 2:** 2.1 to 2.10
UNIT 2	**The Theory of Firm :** Productio Function – Productivity Curves – Isoquents – Optimization behavior – Input Demand functions – cost Functions (short run and long-run) – Homogeneous Production functions and their properties – CES Production Function and their Properties – Joint Products – Generalisation to m variables
UNIT 3	**Market Equilibrium:** Assumptions of Perfect Competition – Demand Functions – supply functions – commodity Equilibrium – Applications of the Analysis – Factor Market Equilibrium – existence of uniqueness of Equilibrium – Stability of Equilibrium – Dynamic Equilibrium with lagged adjustment
UNIT 4	**Imperfect competition:** Monopoly and its Applications – duopoly and Oligopoly – Monopolistic Composition – Monopsony, Duopsony and Oligopsony –Bilateral Monopoly **Chapter 6:** Section 6.1 to 6.7
UNIT 5	**Welfare Economics:** Parato Optimality and the efficiency of perfect competition – The efficiency of Imperfect competition – External Effects in consumption and Production – Taxes, Subsidies and Compensation – Social Welfare functions – The theory of Second best **Chapter 7:** Sections 7.1 to 7.7

Recommended Text

Henderson and R.e.Quandt, Micro Economic Theory – a Mathematical Approach 2nd ed., Tata McGraw Hill, New York, 1971.

Reference books

1. William J Baumol, Economic theory and operations analysis, Prentice Hall of India, New Delhi, 1978
2. A.c.Chiang, Fundamental Methods of Mathematical Economics, McGraw Hill, New York, 1984
3. Michael D Intriligator, Mathematical Optimization and Economic Theory, prentice Hall, New York, 1971

Kautsoyiannis, Modern Microeconomics, 2nd ed, Macmillan, New York, 1979

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - MATHEMATICAL PROGRAMMING	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Integer Linear Programming:** Types of Integer Linear Programming Problems – Concept of Cutting Plane – Gomory's All Integer Cutting Plane Method – Gomory's mixed Integer Cutting Plane method – Branch and Bound Method. – Zero-One Integer Programming. **Dynamic Programming:** Characteristics of Dynamic Programming Problem – Developing Optimal Decision Policy – Dynamic Programming Under Certainty – DP approach to solve LPP. **Chapters: 7 and 21.**
UNIT 2	**Classical Optimization Methods:** Unconstrained Optimization – Constrained Multi-variable Optimization with Equality Constraints - Constrained Multi-variable Optimization with inequality Constraints **Non-linear Programming Methods:** Examples of NLPP – General NLPP – Graphical solution – Quadratic Programming – Wolfe's modified Simplex Methods – Beale's Method. **Chapters: 22 and 23**
UNIT 3	**Theory of Simplex method :** Canonical and Standard form of LP – Slack and Surplus Variables – Reduction of any Feasible solution to a Basic Feasible solution – Alternative Optimal solution – Unbounded solution – Optimality conditions – Some complications and their resolutions – Degeneracy and its resolution. **Chapter 24**
UNIT 4	**Revised Simplex Method:** Standard forms for Revised simplex Method – Computational procedure for Standard form I – comparison of simplex method and Revised simplex Method. **Bounded Variables LP problem:** The simplex algorithm **Chapters 25 and 27**
UNIT 5	**Parametric Linear Programming :** Variation in the coefficients c_j , Variations in the Right hand side, b_i . **Goal Programming :** Difference between LP and GP approach – Concept of Goal Programming – Goal Programming Model formulation – Graphical Solution Method of Goal Programming – Modified Simplex method of Goal Programming. **Chapters 28 and 29**.

Recommended Text

J.K.Sharma, *Operations Research* , Macmillan (India) New Delhi 2001

Reference books

1. Hamdy A. Taha, *Operations Research*, (seventh edition) Prentice - Hall of India Private Limited, New Delhi, 1997.
2. F.S. Hillier & J.Lieberman *Introduction to Operation Research* (7^{th} Edition) Tata- McGraw Hill Company, New Delhi, 2001.

3. Beightler. C, D.Phillips, B. Wilde ,*Foundations of Optimization* (2nd Edition) Prentice Hall Pvt Ltd., New York, 1979

S.S. Rao - *Optimization Theory and Applications*, Wiley Eastern Ltd. New Delhi. 1990

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - DISCRETE MATHEMATICS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Lattices:** Properties of Lattices: Lattice definitions – Modular and distributive lattice; Boolean algebras: Basic properties – Boolean polynomials, Ideals; Minimal forms of Boolean polynomials. **Chapter 1:** § 1 A and B § 2A and B. § 3.
UNIT 2	**Applications of Lattices:** Switching Circuits: Basic Definitions - Applications **Chapter 2:** § 1 A and B
UNIT 3	**Finite Fields** **Chapter 3: § 2**
UNIT 4	**Polynomials :** Irreducible Polynomials over Finite fields – Factorization of Polynomials **Chapter 3:** § 3 and §4.
UNIT 5	**Coding Theory :** Linear Codes and Cyclic Codes **Chapter 4:** § 1 and 2

Recommended Text

Rudolf Lidl and Gunter Pilz, *Applied Abstract Algebra*, Spinger-Verlag, New York, 1984.

Reference books

1. A.Gill, *Applied Algebra for Computer Science*, Prentice Hall Inc., New Jersey.
2. J.L.Gersting, *Mathematical Structures for Computer Science*(3rd Edn.), Computer Science Press, New York.

S.Wiitala, *Discrete Mathematics- A Unified Approach*, McGraw Hill Book Co.

Website and e-learning source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - WAVELETS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**An Overview:** Fourier to Wavelets – Integral Wavelet Transform and Time-frequency analysis – Inversion formulas and duals – Classification of Wavelets – Multiresolution analysis – Splines and Wavelets. **Fourier Analysis:** Fourier and Inverse Fourier Transforms – Continuous time convolution – The delta fnction – Fourier Transform of square integrable functions. **Chapter 1:** Sections 1.1 to 1.6 Chapter 2: Sections 2.1 to 2.3
UNIT 2	**Fourier Analysis (contd):** Fourier Series - Basic Convergence Theory – Poisson Summaton Formula. **Wavelet Tranforms and Time Frequency Analysis:** The Gabor Transform – Short time Fourier Transforms and the uncertainty principle – The integral Wavelet Transform – Dyadic Wavelets – Inversions – Frames – Wavelet Series . **Chapter 2:** 2.4 and 2.5 Chapter 3: Section 3.1 to 3.6
UNIT 3	**Cardinal Spline Analysis:** Cardinal Spline spaces.- B-Splines and their basic properties – The time scale relation and an interpolating graphical display algorithm – B-Net representations and computation of cardinal splines – Construction of cadrdinal splines – construction of spline aaplication formulas – Construction of Spline interpolation formulas. **Chapter 4:** Sections 4.1 to 4.6
UNIT 4	**Scaling functions and Wavelets:** Multiresultion analysis – Scaling functions with finite two scale relation – Direction sum Decompositions of $L^2(R)$ – Wavelets and their duals. **Chapter 5:** Sections 5.1 to 5.4 (omit 5.5 and 5.6)
UNIT 5	**Cardinal Spline Wavelets:** Interpolating splines wavelets – Compactly supported spline – Wavelets – Computation of Cardinal spline Wavelets – Euler –Frebenious Polynomals. **Orthogonal Wavelets:** Examples of orthogonal Wavelets – Identification of orthogonal two scale symbols – Construction of compactly supported orthogonal wavelets. **Chapter 6 :** Sections 6.1 to 6.4 (omit 6.5 and 6.6) **Chapter 7:** Sections 7.1 to 7.3 (omit 7.4 and 7.5)

Recommended Text

Charles K.Chui , *An Introduction to Wavelets*, Academic Press, New York, 1992.

Reference books

1. Chui. C.K. (ed) *Approximation theory and Fourier Analysis,* Academic Press Boston, 1991.
2. Daribechies,I. *Wavelets,* CBMS-NSF Series in Appl.. math. SIAM. Philadelphia, 1992.
3. Schumaker,L.L. *Spline Functions: Basic Theory* , Wiley, New York 1981.
4. Nurnberger, G. *Applicatins to Spline Functions,* Springer Verlag, New York. 1989.
5. Walnut,D.F. *Introduction to Wavelet Analysis,*Birhauser, 2004.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - JAVA PROGRAMMING	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Java Tokens – Java statements – Constants – Variables – Data types **Chapters 3 and 4**
UNIT 2	Operators – Expressions – Decision making and Branching. **Chapters 5,6 and 7**
UNIT 3	Classes – Objects – Methods – Arrays – Strings – Vectors – Multiple Inheritance **Chapters 8, 9 and 10**
UNIT 4	Multithreaded Programming – Managing errors and Exceptions **Chapters 12 and 13**
UNIT 5	Applet Programming **Chapter 14**

Recommended Text

E. Balagurusamy, Programming with Java – A primer , Tata McGraw Hill Publishing Company Limited, New Delhi, 1998.

Reference books

1. Mitchell Waite and Robert Lafore, Data Structures and Algorithms in Java, Techmedia (Indian Edition), New Delhi, 1999

Adam Drozdek, Data Structures and Algorithms in Java, (Brown/Cole), Vikas Publishing House, New Delhi, 2001.

Website and e-learning source

http://www.java.sun.com ,
www.cafeaulait.org/course/
http://en.wikiepedia.org

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - ALGEBRAIC THEORY OF NUMBERS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Algeraic background**: Rings and Fields – Factorization of Polynomials – Field Extensions – Symmetric Polynomials – Modules Free Abelian Groups **Chapter 1: Section 1.1 to 1.6**
UNIT 2	**Algebraic Numers**: Algebraic numbers – conjugates and Discriminants – Algebraic Integers – Integral Bases – Norms and Traces – Rings of Integers **Chapter 2:** Section 2.1. to 2.6
UNIT 3	**Quadratic and Cyclotomic Fields**: Quadratic fields and cyclotomic fields **Factorization into Irreducibles:** Trivial factorization – Factorization into irreducible – Examples of non-unique factorization into irreducibles **Chapter 3: Section 3.1 and 3.2** **Chapter 4: Section 4.1 to 4.4**
UNIT 4	Prime Factorization – Euclidean Domains – Euclidean Quadratic fields – consequences of unique factorization – The Ramanujan – Nagell Theorem **Chapter 4 :** Section 4.5 to 4.9
UNIT 5	Ideals: Prime Factorization of Ideals: The norms of an Ideal – Non-unique Factorization in Cyclotomic Fields **Chapter 5:** Section 5.1. to 5.4

Recommended Text

Stewart and D.Tall, Algebraic Number Theory and Fermat's Last Theorem, 3rd ed., A.K.Peters Ltd, Natrick, Mass, 2002

Reference books

1. Z.I.Borevic and I.R.Safarevic, Number Theory, Academic Press, Newyork, 1966
2. J.W.S. Cassels and A.Frohlich, Algebraic Number Theory,
3. P..Ribenboim, Algebraic Number theory, Academic Press, Newyork, 1967

P.Samuel, Algebraic Theory of Numbers, Houghton Mifflin Company, Boston, 1970

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - STOCHASTIC PROCESSES	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Poisson Process :** Inter arrival and waiting time distributions – conditional distributions of the arrival times – Non-homogenous Poisson process – Compound Poisson Random variables and processes- Conditional Poisson processes. **Chapter 2:** Sections 2.1 to 2.6
UNIT 2	**Renewal Theory:** Distribution of N(t) – Some Limit Theorems – The Key Renewal Theorem and applications – Delayed Renewal Processes – Renewal Reward Process. **Chapter 3:** 3.1 to 3.6 only
UNIT 3	**Markov Chains :** Chapman Kolmogorov Equations and classification of states – Limit theorems – Transitions among classes – The Gambler's Ruin Problem and mean times in transient states – Branching processes. **Chapter 4:** Section 4.1 to 4.5 only
UNIT 4	**Continuous Time Markov Chains:** Birth and Death Processes – Kolmogorov Differential equations – Limiting Probabilities **Martingales:** Stopping times – Azuma's inequality for martingales – **Chapter 5:** Section 5.1 to 5.5 only **Chapter 6 :** Section 6.1 to 6.3 only
UNIT 5	**Brownian Motion and other Markov Processes:** Brownian Motion – Hitting times – Maximum variable and the Arc sine laws - Variations of Brownian Motion – Brownian Motion with drift. **Chapter 8:** Sections 8.1 to 8.4 only

Recommended Text

Sheldon M. Ross, *Stochastic Processes* (2nd Ed) Wiley, New York, 1996

Reference books

1. Cinler E., *Introduction to Stochastic Processes,* Prentice Hall Inc., New Jersey, 1975
2. Cox D.R. & H.D.Miller, *Theory of Stochastic Processes* (3rd Edn.), Chapman and Hall, London, 1983
3. Kannan D., *An Introduction to Stochastic Processes*, North Holland, New York 1979
4. Ross S.M., *An Introduction to Probability Models (8th edn)* Academic Press, New York,2005 (reprinted)

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

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - DATA STRUCTURES AND ALGORITHMS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Algorithms and Elementary Data Structures:** Algorithms – structured programs – analysis of algorithms – stacks and queues – trees – heaps and heapsort – sets and disjoint set union –graphs – hashing **Chapter 1 :** 1.1 to 1.4 **Chapter 2 :** 2.1 to 2.6
UNIT 2	**The Divide and Conquer Method:** The general method – binary search – finding the max and min – merge sort – quick sort – selection sort – strassen's matrix multiplication **Chapter 3 :** 3.1 – 3.7
UNIT 3	**The Greedy Method:** The general method – optimal storage on tapes – Knapsack problem – job scheduling with deadlines –optimal merge pattern – min spanning trees – single source shortest path. **Chapter 4 :** 4.1 – 4.7
UNIT 4	**Backtracking:** The general methods –the 8 queens problem- sum of subsets – graph coloring – Hamiltonian cycles – Knapsack problems **Chapter 7 :** 7.1 – 7.6
UNIT 5	**Branch and Bound and Np Hard and Np Complete Problems:** Branch and Bound method – 0/1 knapsack problem – traveling salesperson – efficiency considerations – basic concepts of NP – Hard problems – Cook's theorem- NP Hard graph problems – NP Hard scheduling problems **Chapter 8 :** 8.1 – 8.4 **Chapter 11 :** 11.1 – 11.4

Recommended Text

E. Horowitz and S.Sahni, Fundamentals of Computer Algorithms, Galgotia Publishing (P) Ltd., New Delhi, 1992

Reference books

Adam Drozdek, Data Structures and Algorithms in C++, Vikas publishing House, New Delhi, 2001

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - FLUID DYNAMICS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Kinematics of Fluids in motion:** Real fluids and Ideal fluids – Velocity of a fluid at a point, Stream lines, Path lines, Steady and unsteady flows – Velocity potential – The vorticity vector – Local and particle rates of changes – Equations of continuity – worked examples – Acceleration of a fluid – Conditions at a rigid boundary. **Chapter 2:** Section 2.1 to 2.10
UNIT 2	**Equations of motion of a fluid:** Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditons at a boundary of two inviscid immiscible fluids – euler's equation of motion – Discussion of the case of steady motion under conservative body forces **Chapter 3: Section 3.1 to 3.7**
UNIT 3	**Some three dimensional flows:** Introduction – Sources, sinks and doublets – Images in a rigid infinite plane – Axis symmetric flows – Stokes stream function **Chapter 4:** Section 4.1., 4.2, 4.3, 4.5
UNIT 4	**Some two dimensional flows:** Meaning of two dimensional flow – Use of Cylindrical polar coordinates – The stream function – The complex potential for two dimensional, irrotational incomepressible flow – Complex velocity potentials for standard two dimensional flwos – some worked examples – Two dimensional Image systesm – The Milne Thompson circle theorem. **Chapter 5: Section 5.1. to 5.8**
UNIT 5	**Viscous flows:** Stress components: Stress components in a real fluid – Relations between Cartesian components of stress – Translational motion of fluid elements – The rate of strain quadric and principle stresses – some further properties of the rate of strain quadric – Stres analysis in fluid motion – Relation between stress and rate of strain – The coefficient of viscosity and Laminar flow – The Navier – Stokes equations of mition of a Viscous fluid. **Chapter 8: Section 8.1 to 8.9**

Recommended Text

F.Chorlton, Text Book of Fluid dynamics, CBS Publications, Delhi, 1985.

Reference books

1. R.W.Fox and AT. McDonald, Introduction to Fluid Mechanics, Wiley, 1985
2. E.Krause, Fluid Mechanics with Problems and Solutions, Springer, 2005
3. B.S.Massey, J.W.Smith and A.J.W Smith, Mechanics of Fluids, Taylor and Francis, Newyork, 2005
4. P.Orlandi, Fluid Flow Phenomena, Kluwer, New York, 2002

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - ALGEBRAIC TOPOLOGY	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Cohomology and Homology:** De Rham Cohomology and the Jordan Curve Theorem. Definition of the De Rham Graphs – The Coboundary map – the Jordon Curve Theorem – Applications and Variations. **Homology:** Chains, Cycles, and H_0U - Boundaries, H_1U , and Winding Numbers – Chains on Grids – Maps and Homology – The First Homology Group for General Spaces. **Chapter 5:** (a) to (d) **; Chapter 6:** (a) to (e)
UNIT 2	**Cohomology and Homology:** De Rham Cohomology and the Jordan Curve Theorem. Definition of the De Rham Graphs – The Coboundary map – the Jordon Curve Theorem – Applications and Variations. **Homology:** Chains, Cycles, and H_0U - Boundaries, H_1U , and Winding Numbers – Chains on Grids – Maps and Homology – The First Homology Group for General Spaces. **Chapter 5:** (a) to (d) **; Chapter 6:** (a) to (e)
UNIT 3	**Holes and Integrals:** Multiply connected regions – Integrations over continuous Paths and Chains – Periods of Integrals – Complex Integration **Mayer-Victoris:** The Boundary map – Mayer-Victoris for Homology – Variations and applications – Mayer-Victoris for Cohomology **Chapter 9:** (a) to (d) **; Chapter 10:** (a) to (d)
UNIT 4	**Covering Spaces and Fundamental Groups: Covering Spaces:** Definition – Lifting paths and Homotopies – G-coverings – Covering Transformations. **The Fundamental Groups:** Definitions and Basic Properties – Homotopy – Fundamental Group and Homology. **Fundamental Groups and Covering Spaces:** Fundamental Group and Coverings – Automorphisms of Coverings – The Universal Covering – Coverings and Subgroups of the Fundamental Group **Chapter 11 :** (a) to (d) **;Chapter 12 :** (a) to (c) **;Chapter 13:** (a) to (d)
UNIT 5	**The Van Kampen Theorem:** G-Coverings from the Universal Covering – Patching Coverings together – The Van Kampen Theorem **Cohomology:** Patching Coverings and Cech cohomology – Cech Cohomology and Homology – De Rham Cohomology and Homology – Proof of Mayer-Victoris for De Rham Cohomology. **Chapter 14 :** (a) to (d) **; Chapter 15:** (a) to (d)

Recommended Text

William Fulton, *Algebraic Topology* – A First Course, Springer-Verlag, New York, 1995

Reference books

1. M.K.Agoston, *Algebraic topology- A First Course*, Marcel Dekker, 1962
2. Satya Deo, *Algebraic Topology*, Hindustan Book Agency, New Delhi, 2003.
3. M.Greenberg and Harper, *Algebraic Topology-A First course*, Benjamin/Cummings, 1981.
4. C.F. Maunder, *Algebraic topology*, Van Nastrand, New York, 1970

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - DIFFERENCE EQUATIONS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Linear Difference Equations of Higher Order:** Difference Calculus – General Theory of Linear Difference Equations – Linear Homogeneous Equations with constant Coefficients – Linear non-homogeneous equations – Method of Undertermined coefficients, the method of variation of constants – Limiting behavior of solutions **Chapter 2:** Sections 2.1 to 2.5
UNIT 2	**System of Difference Equations:** Autonomous System – the Basic Theory – The Jordan form – Linear Periodic system **Chapter 3:** Section 3.1 to 3.4
UNIT 3	**The Z-Transform Method:** Definition, Examples and properties of Z-transform – The Inverse Z-transform and solution of Difference Equations- Power series method, partial fraction method, the inverse integral method – Volterra Difference Equation of convolution types – Volterra systems **Chapter 5: Sections 5.1 to 5.3, 5.5 (omit 5.4)**
UNIT 4	**Asymptotic behavior of difference equation:** Tools and Approximations – Poincare's theorem – Second order difference equations – Asymptotic diagonal systems – Higher order Difference Equations **Chapter 8:** Sections 8.1 to 8.5
UNIT 5	**Oscillation Theory:** Three-term difference equations – Non-linear Difference Equations – Self-Adjoint second order equations. **Chapter 7:** Sections 7.1 to 7.3

Recommended Text

An Introduction to Difference Equations, Saber N elaydi, Springer Verlag, New York, 1996

Reference books

1. Difference Equations and Inequalities, Marcel Dekkar, R.P.Agarwal, 1999
2. Introduction to Difference Equatinos, S.Goldberg, Dover Publications, 1986
3. Theory of Difference Equations, V.Lakshmi Kantham and Triginate, Academic press, Newyork, 1988.
4. A difference Equations, an Introduction with applications Peterson, Academic press, newyork, 1991.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - RELATIONAL DATABASE MANAGEMENT SYSTEM	5	1	-	4

UNIT	SYLLABUS
UNIT 1	Data, information and information processing – secondary storage devices – files, file organization and file structure – indexing and hashing – introduction to DBMS- software development life cycle- database development life cycle- introduction to RDBMS **Chapter 1 – 7**
UNIT 2	Database Architecture and data modeling – ER modeling – enhanced entity relationship model – data normalization **Chapter 8 – 11**
UNIT 3	Relational algebra and relational calculus – tables – SQL – tables – views and indexes and Null Queries and sub queries – aggregate functions. **Chapter 12- 18**
UNIT 4	Insert, update, delete operations – cursors – joins and unions –programming with SQL – query by example – QUEL triggers – Query processing and optimization **Chapter 19 – 26**
UNIT 5	Database security – data integrity – transaction management and concurrency control –backup and recovery **Chapter 27 – 30**

Recommended Text

Alex Leon and Mathews Leon, Database Management Systems, Leon Vikas, Chennai

Reference books

1. Elamasri, R. and Navathe S. Fundamentals of Data Base Systems (3rd Edition) Person Education 2000
2. Silberschatiz A. Korth H.F. and Sudarshan , S. Database System Concepts (3rd Edn) McGraw Hill Publishing Company, New York 1997
3. Ullman , J.O. Principles of Database System (2nd Edn) Computer Science Press Inc, 1984

Date. C.J. Introduction to Database Systems (7th Edition), Addison Wesley, Mass 2000.

COURSE CODE	COURSE TITLE	L	T	P	C
	ELECTIVE - FINANCIAL MATHEMATICS	5	1	-	4

UNIT	SYLLABUS
UNIT 1	**Single period models:** Definitions from Finance – Pricing a forward One-step Binary Model – A Ternary Model – Characterization of no arbitrage – Risk – Neutral Probability Measures **Chapter 1**
UNIT 2	Binomial Trees and Discrete parameter martingales: Multi-period Binary model – American Options – Discrete parameter martingales and Markov processes – Martingale Theorems – Binomial Representation Theorem – Overture to Continuous models **Chapter 2**
UNIT 3	Brownian Motion: Definition of the process – Levy's Construction of Brownian Motion – the Reflection Principles and Scaling – Martingales in Continuous time **Chapter 3**
UNIT 4	Stochastic Calculus: Stock prices are not differentiable – Stochastic Integratin – Ito's formula – Integration by parts and Stochastic Fubini Theorem – Girsanov Theorem – Brownian Martingale REpresentaiton Theorem – Geometric Brownian Motion – the Feynman – Kac Representation **Chapter 4**
UNIT 5	Block-Scholes Model: Basic Block-Scholes Model – Block- Scholes price and hedge for European Options – Foreign Exchange – Dividends – Bonds – market Price of risk **Chapter 5**

Recommended Text

Alison Etheridge, A course in Financial Calculus, Cambridge University Press, Cambridge 2002

Reference books

1. Martin Boxter and Andrew Rennie, Financial Calculus: An introduction to Derivatives pricing, Cambridge University Press, Cambridge, 1996
2. Damien Lamberton and Bernard Lapeyre, Translated by Nicolas Rabeau and Farancois Mantion), Introduction to Stochastic Calculus applied to Finance, Chapman and Hall, 1996
3. Marek Musiela and Marek Rutkowski, Martingale methods in Financial modeling, Springer Verlag, New york 1988

4. Robert J Elliott and P. Ekkehard Kopp, Mathematics of Financial Markets,Springer Verlag, New York, 2001