M.Sc., APPLICABLE MATHEMATICS

Semester - I

S.No	Paper	Title of the paper	CA	ESEE	Max Marks	Credits
1.	Major 1	Algebra	25	75	100	4
2.	Major 2	Real Analysis	25	75	100	4
3.	Major 3	Programming in C++	25	75	100	4
4.	Elective 1	Probability and Distributions	25	75	100	3
5.	Practical	Computational Laboratory-I	40	60	100	4
6.	Soft Skill	Personality Development				2

Total 21

Semester - II

S.No	Paper	Title of the paper	CA	ESE	Max Marks	Credits
1.	Major 4	Complex Analysis	25	75	100	4
2.	Major 5	Differential equations(Revised)	25	75	100	4
3.	Major 6	Programming in Java	25	75	100	4
4.	Elective 2	Mathematical Statistics	25	75	100	3
5.	Practical	Computational Laboratory-II	40	60	100	4
6.	Non major Elective	Discrete Mathematics	25	75	100	3
7.	Soft skill	Communicative Skill				2
8.	Soft skill	Internship				2

Total 26

Semester - III

S.No	Paper	Title of the paper	CA	ESE	Max Marks	Credits
1.	Major 7	Topology	25	75	100	4
2.	Major 8	Differential Geometry and Tensor Calculus	25	75	100	4
3.	Major 9	Operations Research(Revised)	25	75	100	4
4.	Elective 3	Fluid Dynamics	25	75	100	3
5.	Practical	Computational Laboratory-III (Visual Programming and SQL)	40	60	100	4
6.	Non major Elective	Quantitative Aptitude	25	75	100	3
7.	Soft skill	Health Management				2

Total 24

Semester – IV

S.No	Paper	Title of the paper	CA	ESE	Max Marks	Credits
1.	Major 10	Functional Analysis	25	75	100	4
2.	Major 11	Data Base Management Systems	25	75	100	4
3.	Elective 4	Calculus of Variations and Integral Equations	25	75	100	3
4.	Elective 5	Fuzzy sets and their applications(Revised)	25	75	100	3
5.	Project	Project	20	80	100	4
6.	Soft skill	HR Skill				2

Total 20

Grand Total 91

PATTERN OF QUESTION PAPER

EXTERNAL : 75 Marks

SECTION –A

Answer any 10 out of 12 questions (10 x 2 =20)

SECTION – B

Answer any 5 out of 7 questions (5 x 5 = 25)

SECTION – C

Answer any 3 out of 5 questions (3 X10 = 3O)

TOTAL :75

INTERNAL: 25 MARKS

1. Test Marks (CAT-I, CAT-II and Model exam) : 10
2. Attendance : 5

   (65-74% :2Marks
   75-84% :3Marks
   85-94% :4Marks
   95-100 :5marks)
3. Assignment : 5
4. Seminar/Group Discussion : 5

TOTAL :25

Semester-I

Major 1:Algebra

Unit I:

Groups:

Groups of permutation – Orbits- Cycles – alternating groups- Cosets – Theorem of Lagrange – Homomorphism – Isomorphism– Cayley's theorem – Factor groups.

Chapter 2: 2.1, 2.2, 2.3 (Fraleigh)

Chapter 3 : 3.1, 3.2, & 3.3 (Fraleigh)

Unit II:

Rings and Fields – Integral Domain – Fermat's and Euler's theorem – Application to solutions of linear congruence – Fields of quotients of an integral domain – Rings of polynomials - Factorization of polynomials over a field .

(18 hrs)

Chapter 5: 5.1, 5.2, 5.3, 5.4, 5.5 & 5.6 (Fraleigh)

Unit III:

Linear mapping – Quotient spaces –Vector spaces of linear mappings – Linear mappings and matrices – change of basis – Rank of a linear mapping – Eigen vectors and Eigen values – Triangularization of a matrix – Jordan Canonical Form.

(18 hrs)

Chapter 5: 5.1, 5.2 , 5.3, 5.4, 5.5, 5.6 (P.B Bhattacharya ,et, al)

Chapter 6 : 6.1,6.2 , 6.3 (P.B Bhattacharya , et, al)

Unit IV:

Hermitian forms – Euclidean vector spaces .

Chapter 7 : 7.4 and 7.5 (P.B Bhattacharya , et, al)

Generalised inverses of a matrix.

(18 hrs)

Chapter 9 : 9.1 to 9.5 (P.B Bhattacharya , et, al)

Unit V:

Extension Fields – Algebraic extension – Finite fields.

(18 hrs)

Chapter 8: 8.1, 8.3 & 8.5 (Fraleigh)

Contents and treatment as in**:**

For units I, II and V

John B. Fraleigh , A first course in Abstract Algebra (5^{th} edition)
Addison Wesley, 1999.

For units III and IV

P.B. Bhattacharya ,S.K. Jain, S. R. Nagpaul,
First course in Linear Algebra, Wiley Eastern , New Delhi , 1985.

Books for Supplementary reading and reference :

1. I.N . Herstein , Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975

2. Hoffmann and Kunze , Linear Algebra, prentice Hall Ltd., New Delhi, 1978.

Major 2: REAL ANALYSIS

Unit I:

The Riemann – Stieltjes Integral:

Definition and existence of the integral - Properties of the integral

Integration and Differentiation – Integration of vector – valued functions – Rectifiable curves**.**

Chapter 6 : 6.1 to 6.27.

Unit II:

Sequences and Series of Functions:

Discussion of 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: 7.1 to 7. 27

Unit III:

Functions of Several Variables:

Linear Transformations - Differentiation – The Contraction

Principle – The Inverse Function Theorem – The Implicit Function Theorem – Derivatives of Higher order – Differentiation of Integrals.

Chapter 9: 9.1 to 9.29, 9.39 to 9.4 (Omit 9.30 to 9.38)

Unit IV:

Real Number System:

Open and Closed Sets of Real numbers – Continuous Functions – Borel Sets.

Chapter 2: (Sections 5, 6, 7)

Lebesgue Measure:

Introduction- outer measure – Measurable sets and Lebesgue Measure –A non measurable set – Measurable functions- Littlewood's three Principles .

Chapter 3 : (section 1- 6)

Unit V:

Lebesgue Integral:

Riemann Integral – The Lebesgue Integral of a Bounded Function over a Set of finite measure -. The Integral of Non- Negative Function – The General Lebesgue Integral–Convergence in Measure

Chapter :4 (Section 1 - 5)

Contents and Treatments as in:

For Units I, II and III

W.Rudin , Principle of Mathematical analysis,(3rd edition) , McGraw Hill Ltd., New york.

For Units IV and V

H.L.Royden, Real analysis (3rd edition) , Prentice Hall of India, New Delhi, 1975.

Reference Books:

1.Real Analysis – Gupta and others.
2.Real Analysis – Burkill and Burkill.
3.T.M.Apostol , Mathematical Analysis.Narosa Publishing House, New Delhi, 1985.
4.De Barra , Measure Theory and Integration , Wiley Eastern, New Delhi, 1981.
5.P.K.Jain and V.P.Gupta, Lebesgue Measure and Integration , New Age International Ltd., New Delhi , 2000.

Major 3 :PROGRAMMING IN C++

UNIT I:

Principles of Object Oriented Programming(OOP)-Software evaluation- OOP Paradigm-Basic Concepts of OOP-benefits of OOP-Application of OOP.

UNIT II:

Introduction to c++-Tokens-Keywords-Identifiers-Variables-operators-Manipulators-Expresssions and Control Structures-Pointers-Functions-Function Prototyping parameters Passing in Functions-Values return by Functions-Inline functions-Friend and Virtual functions.

UNIT III:

Classes and objects-Constructors-Operator overloading-Type Conversions-Type of Constructors-Function Overloading.

UNIT IV:

Inheritance- Types of Inheritance- Virtual Functions and Polymorphism Constructors in inheritance- Mapping Console I/O operations.

UNIT V:

Files-File Operations-File pointer-Error Handling during file operations-Command line arguments.

Books for Study:

E.Balaguruswamy-Object Oriented Programming With C++-TMH.

Books for Reference :

1. Robert Lafore-Object Oriented Programming in Microsoft C++ Galgotia
2. Venugopal – Programming with C++

Elective 1: Probability and Distributions (Revised)

Unit I:

Probability:

Sample space – Probability axioms – Addition theorem – Bon-Ferroni's inequality – Boole's inequality – conditional probability – multiplication theorem – Baye's rule – Independence of events.

Random variables:

Probability distribution of a random variable – Discrete and continuous Random variables – Functions of a Random Variable.

Unit II:

Moments and Generating functions:

Mathematical expectation – addition & multiplication theorems – PGF – MGF – characteristic function – inversion formula & uniqueness theorem of characteristic function.

Moment inequalities:

Liapounoff's inequality – Chebychev's inequality.

Unit III:

Multiple random variables:

Definition – joint distribution function – marginal & conditional distributions – Independent random variables – conditional expectation & conditional variance.

Unit IV:

Discrete Distributions:

Uniform, Binomial, Negative Binomial, Poisson, Hyper-Geometric, multinomial (mgf, mean & variance of the above distributions).

Continuous Distributions:

Uniform, Gamma, Beta (mgf, mean & variance of the above distributions), Cauchy distribution.

Unit V:

Modes of convergence:

Convergence in probability & distribution, convergence almost surely, convergence in rth mean – WLLN – SLLN.

Limit theorems:

Liapounoff's CLT, Lindberg-Levy CLT – applications of CLT.

Contents and Treatment as in:

V.K. Rohatgi, An Introduction to Probability Theory & Mathematical Statistics, Wiley Eastern Ltd, New Delhi(1988).

Books for Supplementary reading and reference:

1. G.G Roussas, A first Course in Mathematical Statistics.
2. S.C.Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics.
3. E.J. Dudewicz and S.N. Mishra, Modern Mathematical statistics.
4. M.Fisz,Probability Theory & Mathematical Statistics.
5. H.Cramer, Mathematical Methods of Statistics.
6. S.S. Wilks,Mathematical Statistics.

COMPUTATIONAL LABORATORY – I

C++ LAB

Simple Programs

1. Generate the pyramid of digits
2. Generate Armstrong numbers upto a specific limit.
3. Generate Fibonacci series upto n (n<50) number

Functions

4. Construct a class for storage of dimensions of circle, triangle and rectangle and calculate their areas.

Recursion

5. Print String backwards
6. Factorial of a numbers.

Polymorphism

7. Overload Unary operator
8. Overload Binary operator

Inheritance

9. Illustrate multilevel inheritance

Virtual and Friend Functions

10. Illustrate runtime polymorphism
11. Illustrate working of a friend function

File Handling in C++

12. Copy a text file to another

Templates

13. Illustrate a class template

Semester-II

Major 4: COMPLEX ANALYSIS

Unit I:

Complex integration:

Zeros of an analytic function- the index of a closed curve – Cauchys theorem and integral formula – the homotopic version of Cauchy's Theorem and simple connectivity – Counting zeros & open mapping theorem – Goursat's theorem.

(18 hrs)

Chapter IV : Section 3 to 8

Unit II :

Singularities

Classification of Singularities –residues-the Argument principle.

The Maximum Modulus theorem **:**

The Maximum Principle – Schwarz 's lemma

(18 hrs)

Chapter V: Section 1 to 3
Chapter VI : Section 1 and 2

Unit III :

Compactness and convergence in the space of analytic functions:

The Riemann mapping theorem – Weierstrass Factorization theorem – Factorization of the sine function - The gamma function -The Riemann – zeta function.

(18 hrs)

Chapter VII: Section 4 to 8

Unit IV:

Harmonic functions :

Basic properties of Harmonic function – Harmonic functions on a disk- Subharmonic and superharmonic function – The Dirichlet problem – Green's functions.

(18 hrs)

Chapter X : Section 1 to 5

Unit V :

Entire functions:

Jensens formula – the genus and order of an entire function .

The Range of an Analytic function**:**

Bloch's theorem –the Little Picard theorem – Schottky's theorem – the Great Picard theorem

(18 hrs)

Chapter XI : Section 1 and 2
Chapter XII : Section 1 to 4

Contents and treatment as in :

John B. Conway , Functions of one complex variable, springer – Verlag,international student edition,Narosa publishing co.

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE**:**

1.H.A.Prestly, Introduction to complex Analysis, clarendon Press Oxford 1990.
2.Lars V. Ahlfors, Complex Analysis, (3rd edition) McGraw Hill Co., New York, 1979

3.E.Hille, Analytic function Theory (2 vols), Gonm & co, 1959.
4.M.Heins, Complex function Theory, Academic press, New York 1968

Major 5: DIFFERENTIAL EQUATIONS (Revised)

UNIT I:

SOLUTIONS IN POWER SERIES :

Introduction – Second order Linear equations with ordinary points, Legendre equation and Legendre polynomials- Second order equation with Regular singular point – Properties of Bessel functions.

Chapter 3: Section 3.1 to 3.5 (Deo et al)

UNIT II:

SYSTEMS OF LINEAR DIFFERENTIAL EQUATIONS:

Introduction – Systems of first order equations – Model for arms competition between two nations-Existence and uniquness theorem – Fundamental matrix – Non-homogeneous linear systems – Linear systems with constant coefficients.

Chapter 4 :Section 4.1 to 4.7 (Deo et al)

UNIT III:

EXISTENCE AND UNIQUENESS OF SOLUTIONS:

Introduction – Preliminaries,

Successive approximations,

Picard's theorem – Some examples.

Chapter 5 :Section 5.1 to 5.5 (Deo et al).

UNIT IV:

FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS:

Introduction – Partial differential equations of first order in two independent variables – Formulation of first order partial differential equations – Solution of linear first order partial

differential equations (Lagrange's method) – Integral surfaces passing through a given curve, Surfaces orthogonal to a given system of surfaces – Compatibility of first order partial differential equations – Classification of the solution of first order partial differential equations – Solution to Non-linear partial differential equations of first order – Charpits method – Jacobi's method.

Chapter 1 Section: 1.1 to 1.9(1.9.1&1.9.2) (Sharma et al.)

.

UNIT V:

SECOND ORDER PARTIAL DIFFERENTIAL EQUATIONS:

Origin of second order partial differential equations - Linear partial differential equations with constant coefficients – Method of solving linear partial differential equations – Solution of reducible equations – Solution of irreducible equations with constant coefficients – Rules for finding complimentary functions – Rules for finding particular integrals –classification of second order partial differential equations – Canonical forms – Adjoint operators – Riemann's method.

Chapter 2: Sections 2.1 to 2.5 (Sharma et al.)

CONTENTS AND TREATMENT AS IN:

For Units I , II and III

S.G. Deo, S.D. Lakshmikanthan and V. Raghavendra, Ordinary Differential Equations , Tata McGraw Hill Publishing Company, New Delhi, 1991.

For units IV and V

J.N .Sharma and Kehar singh , Partial Differential Equations for Engineers and Scientists ,Narosa Publishing , NewDelhi ,2000.

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE:

1.W.E. Willams, Partial Differential Equation, Oxford , Clarendon, 1980.

2. I.N. Smirnov, Second order partial differential equations, Leningrad , 1964.

3. lan Sneddon, Elements of partial differential equations, McGraw Hill, New Delhi, 1983.

4.R. Dennemeyer, Introduction to partial differential equations and Boundary

5.M.D.Raisinghania, Ordinary and partial Differential Equations, S.Chand & Company Ltd. New Delhi 2001.

6.W.E.Boyce and Diprima, Elementary Differential Equation and Boundary value Problems, (7^{th} Edition)John Wilsey &Sons , Newyork 20.

Major 6 : PROGRAMMING IN JAVA

UNIT-I:

Introduction to Java-Features of Java-Object Oriented Concepts- Lexical Issues-data Types-Variables-Arrays-Operators-control Statements.

UNIT-II:

Classes –Objects-Constructors-Overloading method-Access Control- Static and fixed methods-Inner Classes-String Class-Inheritance- Overriding methods-Using super Abstract class.

UNIT-III:

Packages-AccessProtection-ImportingPackages-Interfaces-Exception Handling-Throw and Throws.

UNIT-IV:

Thread-Synchronization – Messaging – RunnableInterface - Interthread Communication-Deadlock- Suspending, Resuming and stopping threads-Multithreading.

UNIT-V:

I/O Streams-File Streams-Applets-String Objects-String Buffer- Char Array-Java Utilities-Code Documentation.

Books for Study:

1.Cay S.Horstmann, Gary Cornell-core Java 2 Volume I-Fundamentals, 5th Edition. PHI, 2000.

2.P.Naughton and H.Schildt-Java 2(The Complete Reference)-Third Edition TMH 1999.

Books for Reference:

1. Programming with Java, - A Primer – E.Baluguruswamy
2. Programming with Java 2 – Xavier, C
3. K.Arnold and J.Gosling- The Java Programming Language-Second Edition Addison Wesley, 1996

Elective 2: Mathematical Statistics (Revised)

Unit I:

Exact Sampling Distributions:

Chi-square – definition, derivation of the pdf, mgf, additive property – independence of $\overline{X}$ & S^2 – t & F statistic – definition, derivation of the pdf, mean and variance – interrelationship between χ^2, t and F.

Unit II:

Theory of Estimation:

Consistency, unbiasedness, sufficiency and completeness, Neyman-Fisher factorization theorem, MVUE, LMVUE, UMVUE – Rao-Blackwell theorem – Cramer-Rao inequality – Chapman-Robin's inequality – Lehman-Scheffe theorem.

Methods of estimation:

MLE, method of moments.

Unit III:

Testing of Hypothesis:

Errors in hypothesis testing – the Neyman-Pearson lemma – Most powerful tests – Families with MLR– unbiased and invariant tests – Generalized NP lemma.

Unit IV:

Generalized Likelihood ratio test – definition, LRT for Binomial, LRT for Normal(one and two populations only) – χ^2, t and F tests.

Unit V:

Confidence Estimation:

Methods of finding confidence interval – shortest length confidence interval – confidence intervals for the parameters of normal distribution – confidence intervals based on large samples.

Analysis of variance:

One way ANOVA- Two way ANOVA- Two way ANOVA with one observation per cell.

Contents and Treatment as in:

V.K. Rohatgi, An Introduction to Probability Theory & Mathematical Statistics, Wiley Eastern Ltd, New Delhi(1988).

Books for Supplementary reading and reference:

1. G.G Roussas, A first Course in Mathematical Statistics.
2. S.C.Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics.
3. E.J. Dudewicz and S.N. Mishra, Modern Mathematical statistics.
4. M.Fisz,Probability Theory & Mathematical Statistics.
5. H.Cramer, Mathematical Methods of Statistics.
6. S.S. Wilks,Mathematical Statistics.

COMPUTATIONAL LABORATORY – II

Java Programming Lab

Applications:

1. Substring Removal from a String. Use String Buffer class.
2. Finding area and Perimeter of a circle. Use Buffered Reader class
3. Determining the order of numbers generated randomly using Random class
4. Implementation of Point Class for Image manipulation.
5. String Manipulation using Char Array.
6. Usage of Vector Classes.
7. Implementing Thread based applications & Exception Handling.
8. Application using synchronization such as Thread based, Class based and synchronized statements.

Applets

9. Working with Frames and various controls.
10. Working with Dialogs and Menus.
11. Working with Panel and Layout.
12. Working with Colors and Fonts.

Semester-III

Major 7: TOPOLOGY

Unit I :

Metric Spaces:

Convergence, completeness and Baire's theorem; Continuous mappings; spaces of Continuous functions; Euclidean and Unitary spaces.

Topological Spaces:

The definition and some examples ; elementary concepts.

Chapter Two : (Sec 12 – 15)
Chapter Three: (Sec 16 & 17)

Unit II :

Topological spaces (contd…)

Open bases and sub bases.

Compactness

Compact spaces, Product of spaces.

Chapter Three (Sec 18)
Chapter Four (Sec 21 & 22)

Unit III:

Tychonoff's theorem and locally compact spaces; compactness for metric spaces; Ascoli's theorem

Chapter Four (Sec 23 – 25)

Unit IV :

T_1 – spaces and Hausdorff spaces ; completely regular spaces and normal spaces; Urysohn's lemma and Tietze extension theorem.

Chapter Five (Sec 26 – 28)

Unit V:

Connected spaces; The components of a space; Totally disconnected spaces ; Locally connected spaces.

Chapter Six (Sec 31 – 34)

Contents and treatments as in :

George F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co., 1963.

Books for Supplementary reading and Reference :

1. James R. Munkres, Topology (2^{nd} edition) Pearson Education Pvt Ltd., Delhi – 2002(Third Indian Reprint)
2. J. Dugundji , topology, Prentice Hall of India, New Delhi, 1975,
3. J.L. Kelly, General Topology , Van Nosttand, Reinhold Co., New york.
4. S.Willard, General Topology, Addison – Wesley , Mass., 1970.

Major 8:DIFFERENTIAL GEOMETRY AND TENSOR CALCULUS

UNIT I :

SPACE CURVES :

Definition of a space curve – Arc length – Tangent, normal and binormal – Curvature and torsion - Contact between curves and surfaces - Tangent surfaces, involutes and evolutes - Intrinsic equations - Fundamental Existence Theorem for space curves-Helices.

Chapter I :Section 1 to 9.

UNIT II:

INTRINSIC PROPERTIES OF A SURFACE :

Definition of a surface – Curves on a surface - Surface of revolution –Helicoids – Metric - Direction Coefficients - Families of curves – Isometric correspondence - Intrinsic properties.

Chapter II :Section 1 to 9

UNIT III:

GEODESICS :

Geodesics - Canonical geodesic equations – Normal property of geodesics –Existence Theorems – Geodesic parallels –Geodesics curvature – Gauss Bonnet Theorem.

Chapter II : Section 10 to 16.

UNIT IV :

Invariance –Transformation of coordinates and its properties – Transformation by Invariance- Transformation by covariance and contra variance – The Tensor concept: Contravariant and Covariant Tensors-Tensor Character of Covariant and Contravariant Laws - Algebra of tensors – Quotient Laws - Symmetric and Skew- Symmetric Tensors.

Chapter II : section 18 to 27 (omit sec.28) (I.S.Sokolnikoff)

Unit V :

The Metric tensor – The Fundamental and Associated Tensors – Christoffel's symbols – Transformation of Christoffel's symbols - Covariant Differentiation of Tensors – Formulas for Covariant Differentiation – Ricci's theorem.

Chapter II : section 29 to 35 (I.S.Sokolnikoff **)**

Contents and treatment as in :

For units I, IIand III:

T.J Willmore, An Introduction to Differential Geometry , Oxford University press, (17^{th} impression) New Delhi 2002. (Indian print).

For units IV and V:

I.S Sokolnikoff, Tensor Analysis, John Wiley and Sons ,New york, 1964.

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE:

1. Struik, D.T Lecturers on classical differential geometry ,addition – 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.
4. J.A Thorpe Elementary topics in differential geometry ,under- graduate texts in mathematics springer –verlag 1979**.**

Major 9: OPERATIONS RESEARCH (Revised)

UNIT I:

DYNAMIC PROGRAMMING PROBLEMS (DPP) :

Dynamic programming terminology –Developing optimal decision policy - Dynamic programming under certainity- Dynamic programming approach for solving LPP.

CHAPTER 22: SEC 22.1-22.5

UNIT II:

DECISION THEORY:

Steps in decision theory approach – types of decision making environments - decision making under uncertainity- decision making under risk .

CHAPTER 11: SEC 11.1 – 11.5

SIMULATION:

Steps of simulation process- Advantages and disadvantages of simulation- Stochastic simulation and random numbers- Simulation of inventory problems- Simulation of queueing problems.

CHAPTER: 19: SEC 19.1-19.7

UNIT III:

INVENTORY MODELS:

Introduction-Basic concepts- Inventory control models without shortages(model I(a) EOQ model with constant rate of demand) , (model I (c) :EOQ model with Economic production model when supply is gradual) –Inventory control models with shortages (model II (a): EOQ model with constant rate of demand and variable order cycle time ,(model II (b): EOQ model with constant rate of demand and fixed reorder cycle time,) (model II (c):EOQ model with gradual supply)

CHAPTER 14: SEC 14.1 – 14. 8 (18 Hrs)

PROBABILISTIC INVENTORY CONTROL MODELS :

Instantaneous probabilistics demand without set up cost models (model II:EOQ model under un certain demand in a single period) , (model III : EOQ model Instantaneous demand with shortages , discrete replenishment)

CHAPTER 15: SEC 15.1-15.2

UNIT – IV

QUEUEING THEORY :

Introduction-Basic concepts -Classification of queuing models and their solutions –Single server queuing models ((M/M/1) : (α /FCFS) Exponential service unlimited queue), {(M/M/1):(N/ FCFS) Exponential service limited queue }– Multi server queuing models- ((M/M/S:(α /FCFS) Exponential service unlimited queue),{(M/M/S):(N/ FCFS) Exponential service limited queue}–Probability distribution of arrivals and Departures- Erlangian service time distribution with k- phases.

CHAPTER 16:SEC 16.1- 16.7 Appendix : 16. A,16. B

UNIT V:

CLASSICAL OPTIMIZATION THEORY:

Unconstrained optimization –constrained multi variable optimization with equality constrained multi variable optimization with inequality constrained.

CHAPTER 23 : SEC 23.1–23.4

NON – LINEAR PROGRAMMING :

The general non linear programming problem – Quadratic programming .

CHAPTER 24: SEC 24.1, 24.2, 24.4 (omit 24.3 & 24.4.3)

CONTENTS AND TREATMENT AS IN :

J.K. SHARMA Operations Research Theory and Application

(II Edition), Macmillan India Limited (1997-2003)

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE **:**

1. J.K .SHARMA , Operations Research Macmillan India Limited
2. F.S.Hiller and G.J .Liebermen , Introduction to operation (IV Edition) Mc Graw Hill Book Company, New York,1989.
3. Philips D.T.Ravindra A. and Solberg J, Operations Research, Principles and Practice,John wileyand sons New York.

ELECTIVE 3: FLUID DYNAMICS

UNIT I :

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 – worked examples – Acceleration of a fluid – Conditions at a rigid Boundary.

Chapter 2: Sec 2.1 to 2.10 (omit 2.7)

UNIT II:

Equations of motion of a fluid :

Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary of two invicid immiscible fluids – Euler's equation of motion – Bernouli' s equation-worked examples-Discussion of the case of steady motion under conservative body forces.

Chapter 3: Sec 3.1 to 3.7

UNIT III:

Some three dimensional flows :

Introduction – Sources, sinks and doublets – Images in a rigid infinite plane Axis symmetric flows – stokes stream function

Chapter 4: Sec 4.1,4.2,4.3 and 4.5

UNIT IV:

Some two dimensional flows :

Meaning of two dimensional flow – Use of Cylindrical polar coordinate – 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.

Chapter 5: Sec 5.1 to 5.8 (omit 5.7)

UNIT V:

Viscous Flows:

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 –Stress analysis in fluid motion – Relation between stress and rate of strain- the coefficient of viscosity and Laminar flow – The Navier – Stokes equations of motion of a viscous fluid

Chapter 8: Sec 8.1 to 8.9

CONTENTS AND TREATMENT AS IN:

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

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE:

1. Milne Thomson, Theoretical Hydrodynamics, Macmillan, 1949.

2.Rutherford, Fluid Dynamics Bansal, Viscons flow, IBA Publishing Company.

COMPUTATIONAL LABORATORY – III

VISUAL PROGRAMMING & SQL LAB

SQL LAB:

1. Simple Queries
2. Set Operations & Aggregate functions
3. DML commands.
4. DDL Commands**.**

VISUAL BASIC:

1. Write a program to design a calculator with arithmetic, sqrt and trigonometric functions.
2. Write a program to perform temperature conversion and inches to feet conversion.The program should include facility to change font size, to display with precision (decimal places). The program should use MDI forms.
3. Write a program to select items from one list and move them to another list.
4. Write a program to implement the timer and shape controls.
5. Write a program to drag the controls within the form
6. Write a program to create a sketchpad using picture box.

For the following programs use Oracle, create a database and perform the operations given below.

Menu Driven program.

(a) Insertion,
(b) Deletion,
(c) Modification,
(d) Generate simple reports using queries.

7. Payroll
8. Electricity bill preparation system

Semester-IV

Major 10: FUNCTIONAL ANALYSIS

UNIT I :

BANACH SPACES :

Definition - Some examples - Continuous Linear Transformations - The Hahn-Banach Theorem – The natural embedding of N in N**.

(18 hrs)

Chapter 9 : Sections 46 to 49.

UNIT II:

BANACH SPACES AND HILBERT SPACES :

Open mapping theorem - conjugate of an operator - Definition and some simple properties.Orthogonal complements - Orthonormal sets.

(18 hrs)

Chapter 9 : Sections 50 and 51

Chapter 10 : Sections 52, 53 and 54

UNIT III:

HILBERT SPACE :

Conjugate space H* - Adjoint of an operator - Self-adjoint operator - Normal and Unitary operators.

(18 hrs)

Chapter 10 : Sections 55, 56 57 and 58.

UNIT IV **:**

GENERAL PRELIMINARIES ON BANACH ALGEBRAS :

Definition and some examples - Regular and single elements - Topological divisors of zero spectrum - the formula for the spectral radius - the radical and semi-simplicity.

Chapter 12 : Sections 64 to 69. . (18 hrs)

UNIT V :

STRUCTURE OF COMMUTATIVE BANACH ALGEBRAS :

The Gelfand mapping - Applications of the formula

$r(x) = \lim \|x^n\|^{1/n}$ - Involutions in Banach Algebras - The Gelfand-Neumark Theorem.

Chapter 13 : Sections 70 to 73. (18 hrs)

CONTENTS AND TREATMENT AS IN :

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

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE :

1.W .Rudin , Functional Analysis Tata Mc graw-Hill Publising Company New Delhi

2. G. Bachman & L. Narici, Functional Analysis Academic

3. H.C. Goffman and G. Fedrick, First course in Functional Analysis, Press New York (1963)

Major 11: DATABASE MANAGEMENT SYSTEMS

UNIT- I:

Advantages and Components of a Database Management Systems - Feasibility Study – Class Diagrams – DataTypes – Events – Normal Forms - Integrity – Converting Class Diagrams to Normalized Tables – Data Dictionary.

UNIT- II:

Query Basics – Computation Using Queries – Subtotals and GROUP BY Command – Queries with Multiple Tables – Subqueries – Joins –DDL & DML – Testing Queries.

UNIT- III:

Effective Design of Forms and Reports – Form Layout – Creating Forms – Graphical Objects – Reports –Procedural Languages – Data on Forms – Programs to Retrieve and Save Data – Error Handling.

UNIT- IV:

Power of Application Structure – User Interface Features – Transaction – Forms Events – Custom Reports –Distributing Application – Table Operations – Data Storage Methods – Storing Data Columns – Data Clustering and
Partitioning.

UNIT - V:

Database Administration – Development Stages – Application Types – Backup and Recovery – Security and Privacy – Distributed Databases – Client/Server Database – Web as a Client/server System – Objects – Object Oriented Databases –
Integrated Applications.

References:

1. G.V. Post – Database Management Systems Designing and Building Business Application- McGraw Hill International edition – 1999.
2. Raghu Ramakrishnan – Database Management Systems – WCB/McGraw Hill – 1998.
3. C.J. An Introduction to Database Systems – 7th Edition – Addison Wesley- 2000.

ELECTIVE 4: CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

UNIT I :

THE METHOD OF VARIATIONS IN PROBLEMS WITH FIXED BOUNDARIES :

Variation and its properties – Euler's equation – Functionals of the form $\int F(x,y_1,y_2,\ldots y_n,y_1',y_2',\ldots y_n')dx$. – functionals dependent on higher-order derivatives - functionals dependent on the functions of several independent variables – variational problems in parametric form – some applications.

Chapter 6 : Sections 1 to 7 (Elsgolts)

UNIT II :

VARIATIONAL PROBLEMS WITH MOVING BOUNDARIES AND CERTAIN OTHER PROBLEMS AND SUFFICIENT CONDITIONS FOR AN EXTREMUM:

An elementary problem with moving boundaries - the moving – boundary problem for a functional of the form $\int f(x,y,z,y',z')dx$ – extremals with corners – one-sided variations.

Field of extremals – the function E(x,y,p,y') – transforming the Euler's equations to the canonical form.

Chapter 7 : Sections 1 to 4 (Elsgolts)

Chapter 8 : Sections 1 to 3 (Elsgolts)

UNIT III:

INTEGRAL EQUATIONS:

INTRODUCTION:

Definition-regularity conditions-special kinds of kernels-eigen values and eigen functions-convolution integral-the inner or scalar product of two functions.

INTEGRAL EQUATIONS WITH SEPARABLE KERNELS:

Reduction to a system of algebraic equations-examples-Fredholm alternative-examples-an approximate method.

Chapter 1 : Sections 1.1 to 1.7 (Kanwal)

Chapter 2 : Sections 2.1 to 2.5 (Kanwal)

UNIT-IV:

METHOD OF SUCCESSIVE APPROXIMATIONS:

Iterative scheme-examples-Volterra integral equation-examples-Some results about the resolvent kernel.

CLASSICAL FREDHOLM THEORY:

The method of solution of Fredholm-Fredholm's first theorem-examples-Fredholm's second theorem-Fredholms third theorem.

Chapter 3 : Sections 3.1 to 3.5 (Kanwal)

Chapter 4 : Sections 4.1 to 4.5 (Kanwal)

UNIT V

SYMMETRIC KERNELS:

Introduction-fundamental properties of eigen values and eigen functions for symmetric kernels-expansion in eigen functions and bilinear form-Hilbert-Schmidt theorem and some immediate consequences-solution of a symmetric integral equation-examples.

SINGULAR INTEGRAL EQUATIONS:

The Abel integral equation-examples-Cauchy principle value for integrals-the Cauchy-type integrals-solution of the Cauchy-type singular integral equation.

Chapter 7 : Sections 7.1 to 7.6 (Kanwal)

Chapter 8 : Sections 8.1 to 8.5 (Kanwal)

CONTENTS AND TREATMENT AS IN :

For Units I and II :

L. Elsgolts, Differential Equations and the Calculus of Variations, Mir Publishers, Moscow,1973 (2nd Edition)

For Units III, IV and V :

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

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE :

1. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice-Hall Inc. New Jersey, 1963.
2. A.S. Gupta, Calculus of Variaticns 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,London1965.
6. R.Weinstock, Calculus of Variations with Applications to Physics and Engineering, McGraw-Hill Book Company Inc. New York, 1952.

ELECTIVE 5: FUZZY SETS AND THEIR APPLICATIONS (Revised)

UNIT I:

FUNDAMENTAL NOTIONS:

Introduction-Review of the notion of membership-The concept of a fuzzy subsets-Dominance relations-Simple operations on Fuzzy subsets-sets of Fuzzy subsets for E and M finite-Properties of the set of fuzzy subsets-algebraic product and sum of two fuzzy subsets.

CHAPTER 1: SEC 1-8

UNIT II:

FUZZY GRAPHS:

Introduction-Fuzzy graphs-Fuzzy relation-Composition of two Fuzzy relation-Fuzzy subsets induced by a mapping-conditioned Fuzzy subsets –Properties of Fuzzy binary relation-Transitive closure of Fuzzy binary relation-A path in a finite Fuzzy graphs.

CHAPTER-2 : SEC 10-18

UNIT III:

FUZZY RELATION :

Relation of Fuzzy pre order-Relation of similititude-antisymmetry Fuzzy order relations-Dissimilitude relations-Resemblance relation-similitude and resemblance-Fuzzy perfect order relations.

CHAPTER 11 : SEC 19-28 (OMIT SEC 24)

UNIT IV:

FUZZY LOGIC :

Introduction characteristic function of a Fuzzy subsets-Polynomial forms-Analysis of a function of Fuzzy variables-Logical structure of a function of fuzzy variables-composition of intervals-Fuzzy propositions and their functional representation-Theory of fuzzy subsets theory of probability.

CHAPTER III : SEC 31-40(OMIT SEC 37,38)

UNIT-V

THE LAWS OF FUZZY COMPOSITION:

Introduction-Review of the notion of a law of composition-Law of Fuzzy internal composition-Fuzzy Groupoids-Principal properties concerning Fuzzy Groupoids-Fuzzy monoids-Fuzzy external composition operations on Fuzzy numbers.

CHAPTER IV: SEC 43-49

CONTENTS AND TREATMENT AS IN:

A.Kaufman,Introduction to the theory of Fuzzy subsets ,Volume 1.

BOOKS FOR SUPPLEMENTARY READING AND REFERENCE:

1.H.J.Zimmermann-Fuzzy set theory and its applications.

2.George J.Klir and Bo Yuan,Fuzzy sets and Fuzzy Logic-theory and applications.

PROJECT

The projects can be done based on Visual Basic.

Semester -III

Non-Major Elective

Discrete Mathematics

Unit I:
Mathematical Logic:

Logical Statement or proposition-Type of proposition-The propositional calculus- The Negation of proposition-Disjunction-Conjunction-Tautologies and contradictions (Only simple problems)

Unit II:
Mathematical logic (conti.,)

Logical equivalence – The algebra of propositions – Conditional propositions – Converse Inverse and contra positive propositions – The Negation of a conditional proposition – Byconditional propositions – Argument (Only simple problems)

Unit III:

Boolean Algebra – Basic properties (Only simple problems)

Unit IV:
Relation :

Relation – Equivalence relation (Only simple problems)

Unit V:
Function :

Function(mapping) – Inverse mappings – Composition of mappings (Only simple problems)

Book for study :

Vatssa B.S : Discrete Mathematics , Third Edition, Wishwa Prakashan , New Delhi 1986.

Book for Reference :

1.Venkataraman M.K : Engineering Mathematics, Vol 1 & 2,The National Pub.co, Madras (1993 & 1992)

Elective 1: Probability and Distributions [old]

Unit I:

Probability:

Introduction- Sample space – Probability axiom- Probability on finite sample space- Conditional probability – Bayes Theorem – Independence of events.

Random variables-Probability distribution of a random variables-Discrete and continuous Random variables-Functions of a Random Variable.

Unit II:

Moments Generating functions and characteristics functions:

Introduction-Moments of a distribution function-Generating function-some moment inequalities-Characteristics function: Definition-Simple properties –Inversion Formula– Characteristics function and moments.

Unit III:

Random variable - Independent random variable- Multiple random variables.

Unit IV:

Introduction - Some discrete distribution- Some continuous distribution- Mode of convergences.

Chapter 5:5.2 to 5.9 omit (5.3.6)

Unit V:

Weak law of large No's – Strong law of large No's – Limiting moment generating functions- Central limit theorem.

Content and Treatment as in:

1. V.K.Rohatgi,An introduction to Probability Theory &Mathematical Statistics Wiley Eastern Ltd,New Delhi(1988)

2. B.R.Bhat Modern Probability(for unit II):Theory (3rd Edition),New international(P)Ltd New Delhi(1999).

Books for Reference:

1.M.Fisz,Probability theory & Mathematical Statistics,John Wiley and Sons,Newyork,1963.

2.R.Durelt,Probility theory & Examples

3. S.I. Resnick,Aprobability Path.

4. R B Ash,Real Analysis and Probability.

Elective 2: Mathematical Statistics[old]

Unit I:

Sampling Distribution:

Introduction – Random Sampling – Sample characteristics and their distributions – Chisquare, t, F – distributions. Exact sampling distribution independence of X and S_2.

Unit II:

Point Estimation:

Properties of estimates – unbiased estimates – minimum variance of an estimate FCR and CRK inequalities – Sufficiency- Completeness and Ancillarity – method of moments – maximum likelihood estimates.

Unit III:

Testing of Hypothesis:

Some fundamental notions of hypothesis testing – the Neyman – Pearson lemma – families with monotone likelihood ratio – unbiased and invariant tests.

Unit IV

Some properties of Hypothesis testing:

Introduction – Generalised likelihood ratio test – Chisquare test – t test – F test.

Unit V:

Confidence Estimation:

Some fundamental notions of confidence estimation method of finding confidence intervals, shortest length confidence intervals.

Analysis of variance – One way ANOVA, Two way ANOVA with one observation per cell.

Two way ANOVA with interaction

Contents and Treatments as in:

V.K. Rohatgi, An Introduction to Probability Theory & Mathematical Statistics Wiley Eastern Ltd,New Delhi(1988)

Book for Supplementary reading and reference:

1. G.G Roussas, A first Course in Mathematical Statistics.

2. E.J. Dudewicz and S.N. Mishra, Modern Mathematical statistics.

3. M.Fisz,Probability Theory & Mathematical Statistics.

4. H.Cramer, Mathematical Methods of Statistics.

5. S.S. Wilks,Mathematical Statistics.