13AE11 APPLIED MATHEMATICS 3 1 0 4

Unit I

Calculus of Variations

Introduction to variation problems - Euler's equation - Functional dependent on first and higher order derivatives - Functional dependent on functions of several independent variables - Some applications - Direct methods: Ritz methods.

9 Hours

Unit II

Vector space

Definition and examples of linear space - Linear dependence and independence - Basis and Dimension - lnner product space - Orthogonalisation process - Gram - Schmidt process Least - square problems - Applications of inner product spaces.

9 Hours

Unit III

Eigen values and Eigen vectors

Generalized Eigen values and Eigen vectors - Characteristic equation - Diagonalization - Eigen vectors & linear transformations - Complex eigen values - Applications to differential equations - Iterative estimates for Eigen values. **9 Hours**

Unit IV

Symmetric Matrices and Quadratic forms

Diagonalization of symmetric matrices - Quadratic forms - Singular values decomposition - Change of basis.

9 Hours

Unit V

Graph Theory

Introduction - Basic terminology - Representation of graphs - Connected graphs - Matrix representation of graphs (excluding graphs) - Applications - Critical path method - Shortest path problems - Trees - Definition - Binary tree. **9 Hours**

Total:**45+15 Hours**

Reference(s):

1. Elsgolts.L, *Differential Equation and Calculus of variations*, MIR Publishers, 1996.
2. David C Lay, *Linear Algebra and its Applications*, Pearson Education Asia, New Delhi, 2003.
3. Howard Anton, *Elementary Linear Algebra*", John Wiley & Sons, 2008.
4. Jonathan Gross and Jay Yellen, *Graph Theory and its Applications*, CRC Press, 2006.
5. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall, 2004.

13CO11 LINEAR ALGEBRA

3 1 0 4

Unit I

Vector Spaces

Vector spaces and subspaces – Linearly independent sets – Bases – Dimensions – Change of bases – Approximation to co-ordinate systems.

9 Hours

Unit II

Linear Transformations

System of linear equations – Row reduction and Echelon forms – Vector equations – The Matrix equation Ax = B – Solution sets of linear systems – Application of linear systems – Linear independence – Introduction to linear transformations – Matrix as linear transformation – Rank and Nullity – Linear equations.

9 Hours

Unit III

Inner Product Spaces

Inner product – Inner product spaces – Norm – Orthogonality – Gram-Schmidt orthogonalisation process – Orthogonal projections – Applications of inner product spaces.

9 Hours

Unit IV

Eigen values and Eigen vectors

Generalized Eigen values and Eigen vectors – Characteristic equation – Diagonalization – Eigen vectors and linear transformations – Complex Eigen values – Applications to differential equations – Iterative estimates for Eigenvalues.

9 Hours

Unit V

Symmetric Matrices and Quadratic forms

Diagonalization of symmetric matrices – Quadratic forms – Singular values decomposition – Applications to image processing.

9 Hours

Total: 45 + 15 Hours

Reference(s)

1. David C Lay, *Linear Algebra and its Applications*, Pearson Education Asia, New Delhi, 2003.
2. Seymour Lipschutz and Marc Lipson, *Schaum's Outline of Linear Algebra*, McGraw Hill Trade, New Delhi, Third Edition, 2000.
3. Howard A Anton, *Elementary Linear Algebra*, John Wiley & Sons, Singapore, Eight Editions, 2000.
4. Gilbert Strang, *Linear Algebra and its Applications*, Brooks/Cole Ltd, New Delhi, Third Edition, 2003

13CS11 THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE 3 1 0 4

Unit I

Fundamental Structures

Set theory - Relationship between sets - Operations on sets - Set identities - Principle of inclusion and exclusion - Minsets. Relations: – Binary relations - Partial orderings - Equivalence relations. Functions: – Properties of functions - Composition of functions – Inverse functions.

12Hours

Unit II

Logic

Propositional logic – Logical connectives – Truth tables – Normal forms (conjunctive and disjunctive) - Predicate logic - Universal and existential quantifiers - Proof techniques – Direct and indirect – Proof by contradiction – Mathematical Induction.

12 Hours

Unit III

Modeling Computation and Languages

Finite state machines – Deterministic finite state machines (DFA) and Non-deterministic finite state machines (NFA) – Equivalence of DFA and NFA - Formal Languages – Classes of Grammars – Type 0-Context sensitive – Context free- Regular Grammar.

12 Hours

Unit IV

Graph Theory

Introduction to Graphs-Graph operations - Graph and Matrices – Graph Isomorphism – Connected Graphs – Euler Graphs - Hamilton paths and circuits – Shortest path problem.

12 Hours

Unit V

Queue Models

Characteristics of Queueing Models- Kendal's Notation - Single and Multi-Server Markovian queuing models – M/M/1, M/M/C (finite and infinite capacity) and (M/G/1) :(∞/GD) - Queuing applications.

12 Hours

Total: 60 Hours

References:

1. Kenneth H. Rosen "*Discrete Mathematics and its Applications,"* Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.

2. Trembly J.P. and Manohar R., "*Discrete Mathematical Structures with Applications to Computer Science"*, Tata McGraw Hill Publications Co. Ltd., New Delhi 2008.

3. Alan Doerr and Kenneth Levasseur, " *Applied Discrete Structures for Computer Science*," Galgotia Publications Pvt. Ltd. Delhi. 2010.

4. Ralph P Girmaldi and B.V. Ramana "*Discrete and Combinatorial Mathematics*: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2007.

5. H. A.Taha, *Operations Research - An Introduction*, 8th Edition, Prentice Hall of India Ltd, New Delhi, 2008.

13ES11 DISCRETE MATHEMATICS AND AUTOMATA THEORY 3 1 0 4

Unit I

Fundamental Structures

Set theory - Relationships between sets - Operations on sets - Set identities - Principle of inclusion and exclusion - Minsets. Relations: – Binary relations - Partial orderings - Equivalence relations. Functions: – Properties of functions - Composition of functions – Inverse functions - Permutation functions. **9 Hours**

Unit II

Logic

Propositional logic – Logical connectives – Truth tables – Normal forms (conjunctive and disjunctive) - Predicate logic - Universal and existential quantifiers - Proof techniques – Direct and indirect – Proof by contradiction – Mathematical Induction. **9Hours**

Unit III

Combinatorics

Basics of counting – Counting arguments – Pigeonhole principle - Permutations and Combinations - Recursion and Recurrence relations – Generating functions. **9 Hours**

Unit IV

Modeling Computation and Languages

Finite state machines – Deterministic and Non- deterministic finite state machines – Turing Machines - Formal Languages – Classes of Grammars – Type_0 – Context Sensitive – Context Free – Regular Grammars – Ambiguity. **9 Hours**

Unit V

Finite State Automata

Finite State Automata- Deterministic Finite State Automata (DFA), Non Deterministic Finite State Automata (NFA) – Equivalence of DFA and NFA – Equivalence of NFA and Regular Languages.

9 **Hours**

Total: 45 +15 Hours

References:

1. 1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.
2. Trembly J.P. and Manohar R., *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill Publications Co. Ltd., New Delhi 2008..
3. Alan Doerr and Kenneth Levasseur, *Applied Discrete Structures for Computer Science*, Galgotia Publications Pvt. Ltd. Delhi. 2010.
4. Ralph P Girmaldi and B.V. Ramana, *Discrete and Combinatorial Mathematics: An Applied Introduction*, Fifth Edition, Pearson Education Asia, Delhi, 2007.
5. J.E. Hopcroft, R. Motwani and J.D. Ullman, *Introduction to Automata Theory, Languages and Computations* , Second Edition, Pearson Education, 2003.

13SE11 APPLIED PROBABILITY AND OPERATIONS RESEARCH 3 1 0 4

Unit I
Probability and Random Variables

Probability concepts – Random Variables – Moment generating function – Standard distributions - Binomial - Poisson - Rectangular or Uniform – Normal - Exponential distributions - Functions of random variables - Two dimensional random variables.

9 Hours

Unit II
Stochastic Processes

Classification – Stationary and Random process – Markov process – Markov chains – Transition probability – Classification of Markov chain – Limiting distribution – First passage time – Poisson process – Birth and death process.

9 Hours

Unit III
Queue Models

Characteristics of Queueing Models- Kendal's Notation-Single and Multi-Server Markovian queuing models M/M/1, M/M/C (finite and infinite capacity) and (M/G/1) :(∞/GD) - Queuing applications.

9 Hours

Unit IV
Simulation and Applications

Introduction – Types of simulation – Limitations of simulation techniques – Phases of simulation study – Generation of random numbers – Monte Carlo simulation – Applications to queuing problems.

9 Hours

Unit V
Classical Optimization Theory

Unconstrained external problem – Newton Raphson method – Equality constraints – Lagrangian method – Kuhn Tucker conditions. **9 Hours**

Total: 45+15= 60 Hours

References

1. Richard Johnson, *Miller and Freund's Probability and Statistics for Engineers*, Prentice Hall, New Delhi, 7th Edition, 2007.

2. S. D. Sharma, *Operations Research*, Kedar Nath, Ramnath & Co, Meerut, 2004.

3. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 2001.

4. H. A. Taha, *Operations Research – An Introduction*, 8th Edition, Prentice Hall of India Ltd, New Delhi, 2008.

13VL11 GRAPH THEORY AND OPTIMIZATION TECHNIQUES **3 1 0 4**

Unit I

Basic Concepts in Graph Theory

Graph-degree of a vertex- degree sequence- sub graphs- vertex induced sub graphs. Complement of a graph- self complementary graphs- walk- path- connectivity- eccentricity- radius-diameter- vertex and edge cuts- vertex partition- Independent set- clique.

12 Hours

Unit II

Special Classes of Graphs

Digraph- orientation, strongly, weakly and unilaterally connected digraphs- Directed acyclic graph. Adjacency matrix and incidence matrix of graphs. Trees- Spanning Trees- Matrix Tree theorem. Complete graphs-Bipartite graphs-Grid graphs.

12 Hours

Unit III

Eulerian and Hamiltonian Graphs

Eulerian graphs- Euler's theorem-Hamiltonian graphs- Bondy- Chvatal theorem- Traveling salesman problem. Planar graphs- Euler's formula-Kuratowski's theorem- Embedding and dual graphs.

12Hours

Unit IV

Linear Programming

Definition- Simplex-Two-phase simplex- Big M-method and Dual simplex algorithms.

12 Hours

Unit V

Dynamic Programming

Multistage decision process- Computational procedure-Final and Initial value problems- Continuous Dynamic programming- Discrete Dynamic programming.

12 Hours

Total: 60 Hours

Reference(s)

1. Yellen J and Gross J, *Graph Theory and its Applications*, Chapman & Hall, 2006.
2. Taha H. A, *Operations Research – An Introduction*, Eighth Edition , Prentice Hall of India Ltd, New Delhi, 2008.
3. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science*. Prentice Hall, 2004.
4. West D.B, *Introduction to Graph Theory*, Pearson Education, 2007.
5. Kocay. W and Kreher D.L., *Graphs, Algorithms and Optimization*, Chapman & Hall, 2006.

13ED11/13CC11 COMPUTATIONAL METHODS 3 1 0 4

Unit I

Solution of System of Linear and Nonlinear Equations and Curve Fitting

Solution of system of linear equations: Gauss Elimination Method, Choleski Method, Iterative Methods, Relaxation Method- System of Non-Linear Equations-: Newton Raphson Method- Least Square Approximation- Fitting of Non-Linear Curves By Least Squares.

12 Hours

Unit II

Numerical Integration: Newton-Cotes Integration

Numerical Integration : Trapezoidal rule, Simpson's rules, Gaussian quadrature, adaptive integration, cubic spline functions - Bezier curves and B-splines.

12 Hours

Unit III

Boundary Value Problems and Characteristic Value Problems

Introduction - Shooting method, solution through a set of equations, derivative boundary conditions, Rayleigh-Ritz method, characteristic value problems, solution using characteristic polynomial method, Jacobi method, power method and Inverse power method.

12 Hours

Unit IV

Numerical Solutions of Stationary Partial Differential Equations

Laplace's equation: Laplace's equations, representations as a difference equation, Iterative methods for Laplace's equations, Poisson equation, derivative boundary conditions, irregular and non-rectangular grids, Matrix patterns, ADI method, applications to two dimensional heat flow problems.

12 Hours

Unit V

Parabolic and Hyperbolic Partial Differential Equations:

Introduction-Crank-Nicholson method, explicit method, derivative boundary condition, stability and convergence criteria, Parabolic equations in two or more dimensions, applications to one dimensional heat flow problems-Hyperbolic Partial differential equations: Solving wave equation by finite differences, stability of numerical method, method of characteristics, Wave equation in two space dimensions

12 Hours

Total: 60 Hours

Reference(s)

1. Gerald C. F and Wheatley P. O, *Applied Numerical Analysis*, Pearson Education, 2003.
2. Rajasekaran S, *Numerical Methods in Science and Engineering – A Practical Approach*, Wheeler Publishing, 2005.
3. Faires J.D and Burden R, *Numerical Methods*, Brooks/Cole Publishing Company, 2006.
4. Chapra C.S and Canale P.R, *Numerical Methods for Engineers with Software and Programming Applications*, Tata McGraw Hill, 2004.

13PE11 APPLIED MATHEMATICS **3 1 0 4**

Unit I

Advanced Matrix Theory

Matrix norms - Jordan canonical form - Eigen values - Generalized eigenvectors - Some applications of Eigen value problems - Singular value decomposition - Pseudo inverse - Least square approximations - QR algorithm.

12 Hours

Unit II

Calculus of Variations

Introduction to calculus of variational problems - Euler's equation - Functional dependent on first and higher order derivatives - Functional dependent on functions of several independent variables -Some applications - Direct methods: Ritz and Kantorovich methods.

12 Hours

Unit III

Fourier Series

Euler's formula - Dirichlet's conditions - General Fourier series - Fourier series expansion to different types of wave forms - change of intervals - Harmonic Analysis.

12 Hours

Unit IV

Fast Fourier Transform

Discrete convolution - Periodic sequence and circular convolution - Linear convolution through circular convolution - Discrete Fourier series and discrete Fourier transform - Fast Fourier transform - Decimation in time algorithm - decimation in frequency algorithm - Inverse DFT.

12 Hours

Unit V

Soft Computing Techniques.

Genetic Algorithm - ANT colony Optimization - Particle Swam Optimization.

12 Hours

Total: 60 Hours

Reference Books:

1. Elsgoltis, *Differential equations and Calculus of Variations*, MIR publishers, Moscow, 1970.

2. Bronson.R, *Matrix Operations*, Schaum's outline series, McGraw Hill, Newyork, 1989.

3. Gupta.A.S, *Calculas of Variations with Applications* Prentice Hall of India, New Delhi,1999.

4. Sankara Roa, *Introduction to Partial Differential Equations*, Prentice Hall of India, New Delhi, 2004.

5. Ervin Kreyszig, *Advanced Engineering Mathematics*, 8th Edition, John Wiley & sons, 2006.

6. Jun Sun and Choi-Hang Lai, *Particle Swarm Optimisation: Classical and Quantum Perspectives*, CRC Press, Florida, 2012.

13BT53 APPLIED MATHEMATICS

3 0 0 3

Unit – I

Differentiation, integration and matrices

First order and second order differential equations, functions - applications in Biological Sciences, Integrating factors and Bernoulli equations, Linear ODE's with constant coefficients: Numeric integration and differentiation - exposure to software packages like Matlab or Scilab: Basics: vectors, matrices, determinants; Matrix addition and multiplication.

9 Hours

Unit – II

Curve fitting

Curve Fitting –fitting a straight line and second degree curve, Correlation and Regression. fitting a non linear curve, Bivariate correlation - application to Biological Sciences.

9 Hours

Unit –III

Design of Experiments

Design of Experiments – One way, two way classifications – Randomized Block Designs-Latin Square Designs – biological samples

9 Hours

Unit –IV

Sampling distributions - Large samples and Small samples. Testing of Null hypothesis-Z test, t test and χ^2 test. Type I and Type II errors. Fisher's F Test. Goodness of fit.

9 Hours

Unit-V

Design of Experiments –One way, Two way classifications – Randomied Block Designs-Latin Square Designs.

9 Hours

Total: 45 Hours

References:

1. E. Kreyszig, Advanced engineering mathematics, 8th Edition, John Wiley Co., 1999.
2. W. E. Boyce and R. DiPrima, Elementary Differential Equations, 8th Edition, John Wiley Co., 2005.
3. W.L.Mc-Cabe, J.C.Smith and P.Harriot, *Unit Operations in Chemical Engineering*, 5th Edition, McGraw Hill Inc., New York, 1993.
4. R.A.Johnson, *Probability and Statistics for Engineers* 6th Edition. Prentice Hall Publication.
5. Merton R .Hubbard, *Statistical Quality control for the Food Industry*. Kluwer Academic/Plenum Publishers, 2003.