MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

(A Govt. Aided UGC Autonomous &NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Department of Engineering Mathematics and Computing

B. Tech. (Third Semester)

Discrete Mathematical Structures

(MAC – 250302/250400)

L	T	P	C
3	0	0	3

Course Objectives

- To understand the concept Set Theory
- To understand the various aspect of algebraic structures'
- To explore Graph Theory
- To perceive knowledge of tree and discrete numeric functions

Unit 1: Sets, Relations and Functions

Sets, Subsets, Power sets, Complement, Union and Intersection, De-morgan's law Cartesian products, Relations, relational matrices, properties of relations, equivalence relation, functions, Injection, Surjection and Bijective mapping, Composition of functions, Permutations, the characteristic functions and Mathematical induction.

Unit 2: Lattices

Partial order set, Hasse diagrams, upper bounds, lower bounds, Maximal and minimal element, first and last element, , Lattices, sub lattices, Isotonicity, distributive inequality, Lattice homomorphism, lattice isomorphism ,complete lattice ,complemented lattice distribution lattice .

Unit 3: Graphs

Introduction, Operation of graphs (Union, Intersection, complement, product and composition), Sub graph, Fusion of graph, Planer graphs, Region of graph, Euler's formula, Connected graph, Brook's theorem, directed graphs: Types of directed graphs, Digraphs and binary relations, Euler graphs, Hamiltonian paths, Walks and circuits, Graph colouring (vertex colouring), Chromatic Number, upper bound and lower bound of chromatic number, Network flows, Matrix representation of graph.

Unit 4: Trees & Spanning trees

Trees – Rooted and binary trees and Properties, Distance and centres in tree, Spanning trees, Binary Search tree, Spanning trees in a weighted graph, Connectivity and saperability, Network flows, cut sets, Properties of cut set, all cut sets, Fundamental circuits and cut sets.

Unit 5: Discrete Numeric function and Recurrence relation

Introduction to discrete numeric functions and generating functions, introduction to recurrence relations and recursive algorithms, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions and total solutions

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO'
CO1	Acquire the knowledge of Set Theory
CO2	Find the analytical solution of algebraic structures'
CO3	Express the Graph Theory
CO4	Acquire the knowledge of Tree
CO5	Illustrate the concept of discrete numeric functions

Recommended Books:

1. J.P Tremblay and R. Manohar: Discrete Mathematical Structures with Application to Computer science, McGraw Hill, 5th edition, 2008.
2. C.L. Liu: Elements of Discrete Mathematics, Tata McGraw Hill computer science series, 4th edition, 2016.
3. Swapam Kumar Sarkar: Discrete Mathematics, S. Chand & Company, 2nd edition, 2019.
4. Narsingh Deo: Graph Theory, PHI Learning, 3rd edition, 2014.
5. Rosen: Discrete Mathematics and its Applications, McGraw Higher Ed, 7th Edition 2008.

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Department of Engineering Mathematics and Computing

B. Tech. (Third Semester)

Simulation Modelling and Analysis

(MAC – 250301)

L	T	P	C
2	1	0	3

Course Objectives

To understand the system, specify systems using natural models of computation
To explore the modelling techniques
To discuss the prediction of behaviour and decision support

Unit-1: Introduction to System Modeling and Simulation:

Need and use of Simulation, System models, advantage and limitations of models, simplified representation of complex and large system, principles and steps in creating system models, capturing system environment, component of systems and selection of appropriate modeling techniques and simulation methodologies, relationships between selected models & simulation techniques.

Unit-2: System Modeling Concepts:

Types of System Models, Continuous and Discrete Systems, comparison of analytical & simulation methods, event and data modeling, model building, data modeling and techniques of building useful Input data models, multivariate & time series input models, Steps in system model building, Monte Carlo method, verification, calibration & validation of models for simple systems.

Unit-3: Probability and Random Number Generation:

Discrete and continuous random variable, probability functions, descriptive characteristic of a distribution, test of hypothesis and estimation of confidence interval, estimation of errors, parameter estimation, goodness of fit test, numerical computation techniques for continuous and discrete models, distributed lag and cobweb models, Generation of Pseudo Random numbers- Properties of random numbers, Techniques for generating random numbers, testing random number generators, Generating Random-Variates- Inverse Transform technique– Acceptance- Rejection technique, Composition & Convolution Method.

Unit-4: Queuing System and Discrete System Simulation:

Modeling& Generation of Arrival Patterns, Exponential & Poisson distribution, service times, Normal Distribution Queuing Systems, Simulation of Single Server Queuing Systems, Simulation of Multiple Server Queuing Systems, gathering statistics, Measuring occupancy & Utilization

Unit-5: Real World Application of Simulation:

Transfer Line model, Inventory System model, Deadlock Detection model, Computer Center model, Job Shop model, Just-In-Time model, Pi value estimation, Capital recovery model, Economics of Insurance policy, Reliability Estimation, Warranty Problem & Estimation, Computer Network model, Interpretation of Confidence Interval of a Parameter.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Acquire the knowledge Simulation
CO2	Analyze the discrete and continuous Simulation Models
CO3	Evaluate random generation
CO4	Interpret the queueing models for single & multiple servers
CO5	Determine the real world problem of simulation

Recommended Books:

1. Jerry Banks and John Carson: Discrete Event System Simulation, PHI,Fourth Edition, 2005.
2. Geoffrey Gordon: System Simulation, PHI,Second Edition, 2006.
3. Frank L. Severance: System Modeling and Simulation, Wiley, 2001.
4. Averill M. Law and W.David Kelton: Simulation Modeling and Analysis, McGraw Hill, Third Edition, 2006.
5. Jerry Banks: Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice, Wiley,First edition, 1998.

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Department of Engineering Mathematics and Computing

B. Tech. (Third Semester)

Probability and Random Process

(MAC – 2350300)

Course Objective

- To have knowledge of Central Tendency & Skewness, Kurtosis.
- To describe probability theory and distribution
- To familiarize Correlation and Regression
- To know about the Hypothesis analysis
- To explore the theory of attributes and rules of association

L	T	P	C
3	1	0	4

Unit 1:

Definition–Classical and axiomatic approaches, Laws of total and compound probability, conditional probability, Bayes Theorem., Probability distribution function, Probability density function, Different modes of convergence laws of large numbers, central limit theorem, discrete and continuous probability distributions, some special distributions

Unit 2:

Measures of averages and Standard deviation, moments, moment generating function, skewness and kurtosis, Curve fitting, correlation and regression.

Unit 3:

Testing of Hypothesis, Basic concept of estimation, Concept of the theory of sampling, chi-square (χ^2) distribution, t-distribution, Fisher's Z-distribution, Analysis of Variance

Unit 4:

Concept of Random variable, one dimensional Random variable, two dimensional Random variable, distribution function, Joint probability distribution function, Marginal probability distribution, cumulative probability distribution, conditional distribution function.

Unit 5:

Random process, classification of random process, stationary process, Ergodic process, Markov process, Poisson process, Markov chain, classification of states, matrix transition probabilities, n-step transition probabilities .

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Interpret the theory of Probability and its distributions
CO2	Evaluate the Skewness, Kurtosis, curve fitting, correlation and regression.
CO3	Analyze the test of hypothesis
CO4	Acquire the knowledge of random variables.
CO5	Determine the random process

Recommended Books:

1. M Ray and H.S. Sharma: Mathematical Statistics, Ram Prasad Publications, 3rd Edition 2017.
2. V. K. Kapoor, S.C. Gupta: Statistical Methods, S. Chand& Company, 11th Edition 2018.
3. T. Veerarajan: Probability, Statistics and Random Processes, McGraw Hill, 3rd Edition 2008.
4. S. M. Rose: Introduction to Probability Models, Elsevier, 10th Edition 2011.

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B. Tech. (Third Semester)

Operating System Concepts

(MAC - 250303)

L	T	P	C
3	0	0	3

Course Objectives

- Recognize the concepts and principles of operating systems.
- Provide comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems.
- To teach understanding how the various elements that underlie operating system interact and provides services for execution of application software.

Unit-1:

Introduction: Evolution of operating systems, Types of operating systems, Different views of operating system, operating system concepts and structure.

Processes: The process concept, systems programmer's view of processes, operating system services for processes management, scheduling algorithms, Performance evaluation.

Unit-2:

Memory Management: Memory management without swapping or paging, swapping, virtual memory, page replacement algorithms, modelling paging algorithms, design issues for paging system, segmentation, Thrashing.

Unit-3:

Inter process communication and synchronization: The need for inter process synchronization, mutual exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problems in concurrent programming, critical region and conditional critical region, monitors messages. Deadlocks: Deadlock prevention, deadlock avoidance.

Unit-4:

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface – File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery.

Unit-5:

Performance measurement: Monitoring and evaluation introduction, important trends affecting performance issues, why performance monitoring and evaluation are needed, performance measures, evaluation techniques, bottlenecks and saturation, feedback loops.

Case study: Unix Operating System.

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Outline the basic concept of operating systems
CO2	Analyze the working of operating system
CO3	Examine the working of various scheduling/allocation approaches
CO4	Measure the performance of various scheduling/allocation approaches
CO5	Compare the various operating system problems/issues

Recommended Books:

1. Silberschatz, Galvin: Operating System Concepts, Wiley, 9/E, 2013.
2. StallingWilliam: Operating Systems, Pearson Education, 5/E, 2006.
3. Andrew S. Tanenbaum: Modern Operating Systems, 3/E, PHI, 2006.
4. J. Bach Maurice: The Design of Unix Operating System, Pearson, First Edition, 2015.
5. Bovet &Cesati: Understanding the Linux Kernel, O' Reily, 3/E, 2005.
6. Peter Norton: Complete Guide to Windows XP, SAMS, 2002.

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B. Tech. (Third Semester)

Numerical Techniques

(MAC – 250305)

L	T	P	C
2	1	0	3

Course Objective

To perceive the Errors, Algebraic & Transcendental
To expose the concept of Interpolation, Extrapolation, Numerical differential and Integration
To understand Numerical solution of Ordinary Differential Equation
To explore the Finite Difference Methods

Unit 1: Algebraic & Transcendental Function

Introduction to numerical computing, approximations and errors in numerical computations, Bisection method, Regula Falsi method, Newton Raphson method, Secant method, convergence of iterative methods.

Unit 2: Simultaneous Equations & Finite Difference Operators

Solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU decomposition, Jacobi method, Gauss Seidel method, SOR method, Ill and well condition of equations, finite differences operators, relation between operators.

Unit 3: Interpolation, Numerical Differential and Integration

Newton's forward and backward interpolation, Lagrange interpolation, Newton's divided difference, Inverse Interpolation, Numerical differentiation Numerical integration: Newton-Cotes integration formulas, Trapezoidal, Simpson's rules (1/3 & 3/8) and Weddle rules.

Unit 4: Numerical Solution of Ordinary Differential Equation

Taylor series method, Picard's method, Euler's method, Modified Euler's method, Runge Kutta methods fourth order, Multistep methods: Milne's Predictor corrector method.

Unit 5: Numerical Solution of Partial Differential Equation

Classification of partial differential equation, Finite difference method, Numerical solution of Partial Differential equations, five-point formula, Laplace and Poisson equation.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Identify the concepts Algebraic & Transcendental Equations
CO2	Acquire the knowledge of finite difference
CO3	Describe numerical integration and differentiation
CO4	Illustrate the problems of ordinary differential equation
CO5	Analyze the Partial differential equations

Recommended Books:

1. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt. Ltd., 5th Edition, 2016.
2. S.S. Sastry: Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 4th edition, 2007.
3. J. H. Mathews and K. D. Fink: Numerical Methods using MATLAB, PHI, 4th edition, 2007.
4. C.F. Gerald and P.O. Wheatley: Applied Numerical Analysis, Pearson Education, 6th edition, 2006.
5 M. K. Jain, R. K. Jain and S. R. K. Iyengar: Numerical Methods for Scientific & Engineering, New Age International Pvt Ltd Publisher, 6th Edition (2014).

B. Tech. (Third Semester)
Engineering Mathematics II (100001)

L	T	P	C
3	1	0	4

Objective of Course

- To perceive the transform techniques in engineering problems
- To expose the concept of ordinary and partial differential equations
- To understand vector calculus and its applications
- To explore the statistical abilities

Unit 1:
Fourier series and half range Fourier series, Harmonic analysis, Laplace transform and their basic properties, Convolution Theorem, Applications of Laplace transform to solve the ordinary differential equations.

Unit 2:
Second order differential equations with variable coefficients, Methods: one integral is known, Removable of first derivative, changing of independent variable and variation of parameters, Solution of Differential equation by series method.

Unit 3:
Linear and Non-Linear Partial differential equations of first and second order with constant coefficients, Separation of variable method, Application in solution of wave and heat conduction equations (one-dimensional).

Unit 4:
Vector calculus: Vector differentiation, Divergence, Gradient and Curl, Directional derivative, Solenoidal and Irrotational vectors, Vector Integration, Gauss divergence theorem and Stoke's theorem.

Unit 5:
Concept of Probability and its distributions, probability density functions, probability mass functions, first and second moments about origin and about mean, Binomial, Poisson and Normal distributions and their properties, Bivariate distribution, variance and Covariance, curve fitting correlation & regression.

Course Outcomes
After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Apply the Fourier series and Laplace Transform for solving engineering Problems.
CO2	Solve Ordinary Differential Equation of Second Order.
CO3	Solve Partial Differential equations application for various engineering problems.
CO4	Solve problems of Vector Calculus.
CO5	Apply probability theory with distributions for statistically analysis of given data.

Recommended Books:

1. E. Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10th Edition (2011).
2. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt. Ltd., 5th Edition (2016).
3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publisher, 43rd Edition (2015).
4. H. K. Dass: Advance Engineering Mathematics, S. Chand Publisher (2018).
4. B.V. Ramanna: Higher Engineering Mathematics, McGraw Hill Education, 1st Edition (2017).

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Department of Engineering Mathematics and Computing

B. Tech. (Third Semester)

Data Structures and Algorithms

(MAC - 250304)

L	T	P	C
2	0	2	3

Course Objectives

- To be familiar with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit-1:

Prerequisites: Array, Structure, pointers, pointer to structure, functions, parameter passing, recursion. Stack and Queue: Contiguous implementations of stack, various operations on stack, various polish notations-infix, prefix, postfix, conversion from one to another-using stack; evaluation of post and prefix expressions. Contiguous implementation of queue: Linear queue, its drawback; circular queue; various operations on queue.

Unit-2:

General List: list and it's contiguous implementation, it's drawback; singly linked list-operations on it; doubly linked list-operations on it; circular linked list; linked list using arrays. Linked implementation of stack and queue,various applications of Linked List, like polynomial representation, Josephus Problem.

Unit-3:

Trees: Definitions-height, depth, order, degree, parent and children relationship etc;Binary Trees- various theorems, complete binary tree, almost complete binary tree; Tree traversals-preorder, pre order and post order traversals, their recursive and non-recursive implementations; expression tree- evaluation; Linked representation of binary tree-operations. Threaded binary trees; forests, conversion of forest into tree. Heap-definition.AVL tree- definition, insertion & deletion operations; Basic idea of B tree and B+ Tree: definition, order, degree, operations and comparison.

Unit-4:

Searching, Hashing and Sorting: Requirements of a search algorithm; sequential search, binary search, indexed sequential search, interpolation search; hashing-basics, methods, collision, resolution of collision, chaining; Internal sorting- Bubble sort, selection sort, insertion sort, quick sort, merge sort on linked and contiguous list, shell sort, heap sort, tree sort.

Unit-5:

Graphs: Related definitions: Graph representations- adjacency matrix, adjacency lists, adjacency multi-list; traversal schemes- Depth first search, Breadth first search; Minimum spanning tree; Shortest path algorithm: Prim's,Kruskal&Dijkstra algorithm. Sparse Matrix.

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Outline the basics of Algorithms and their performance criteria's.
CO2	Explain the working of linear/Non Linear data structures.
CO3	Identify the appropriate data structure to solve specific problems
CO4	Analyze the performance of various data structures & their applications
CO5	Evaluate the time/space complexities of various data structures & their applications.

Recommended Books:

1. AM Tanenbaum, Y Langsam& MJ Augustein: Data structure using C, PHI, 2007.
2. Robert Kruse, Bruse Leung: Data structures & Program Design in C, Pearson Education, 2007.
3. Richard, Gilberg Behrouz, Forouzan: Data structure – A Pseudocode Approach with C, Thomson press, 2005.
4. Jean – Paul Trembly , Paul Sorenson: An Introduction to Structure with application, TMH, 2007.
5. A. H. Ullman: Data Structures and Algorithms, Pearson Education, 2002. .
6. Sartaj Sahni : Data Structures, Algorithms and Applications in C++, Universities Press, 2014.