Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2021-22

3rd & 4th Semester

Computer Science Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2020-21 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	CSE2201	Computer Architecture and Organisation	T	3	0	0	3	3	30	30	40	3 Hours
3	3	PC	CSE2202	Object Oriented Programming	T	3	0	0	3	3	30	30	40	3 Hours
4	3	PC	CSE2203	Lab: Object Oriented Programming	P	0	0	2	2	1		60	40	
5	3	PC	CSE2204	Data Structures I	T	3	0	0	3	3	30	30	40	3 Hours
6	3	PC	CSE2205	Lab: Data Structures I	P	0	0	2	2	1		60	40	
7	3	PC	CSE2206	Lab: Software Laboratory	P	0	0	2	2	1		60	40	
TOTAL						12	0	6	18	15				
Fourth Semster														
1	4	BS	GE2207	Discrete Mathematics & Graph Therory	T	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	CSE2251	Operating Systems	T	3	0	0	3	3	30	30	40	3 Hours
3	4	PC	CSE2252	Lab:Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CSE2253	Data Structures II	T	3	0	0	3	3	30	30	40	3 Hours
5	4	PC	CSE2254	Lab: Data Structures II	P	0	0	2	2	1		60	40	
6	4	PC	CSE2255	Introduction to Data Analysis	T	3	0	0	3	3	30	30	40	3 Hours
7	4	PC	CSE2256	Lab: Introduction to Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CSE2257	Theory of Computation	T	4	0	0	4	4	30	30	40	3 Hours
TOTAL						16	0	6	22	19				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT, CSE	T	2	0	0						

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 16 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	Jan 2020	1.00
		Date of Release	Version

Applicable for AY 2020-21 Onwards

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform,Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit No.	Contents	Max. Hrs.
1	**Unit I: Finite Differences** Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients.	6
2	**Unit II: Laplace Transform** **Laplace Transforms:** Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations	7
3	**Unit III: Z-transform** Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant coefficient.	6
4	**Unit IV: Fourier Series** Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions	7
5	**Unit V: Partial Differential Equation** Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficients. Application of variable separable method to solve first and second order partial differential equations.	7
6	**Unit VI : Fourier Transform :** Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.	6

III Semester
GE2201 - Engineering Mathematics III

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition,2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
CSE2201 : Computer Architecture and Organisation

Objective	Course Outcome
1. Understand basics of computer architecture, its components with peripheral devices, instruction set architecture 2. Comprehend the knowledge of combinational and sequential logic circuits in the architecture design process. 3. Know the function of each element of a memory hierarchy 4. Learn the concepts of pipelining and I/O devices	1. Acquire knowledge of basics of computer architecture, its components with peripheral devices, instruction set architecture 2. Apply knowledge of combinational and sequential logic circuits to solve the given problem. 3. Analyze the performance of cache memory design 4. Explain the concepts of pipelining and I/O devices

Unit No.	Contents	Max. Hrs.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software, addressing methods and machine program sequencing: Memory Locations, addressing and encoding of informatio Instructions and Instruction sequencing,	6
2	Addressing modes, Assembly language, Stacks, Subroutine. Processing Unit: Some fundamental concepts, Execution of a complete instruction, Single, two, three bus organization, Sequencing of control Signals.	6
3	Processor Design, hardwired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction.	7
4	Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm.	8
5	Integer Division, Floating point numbers and operations. The Main Memory: Basic concepts, Memory Hierarchy, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Speed Size and Cost, Cache Memory, Performance Considerations.	7
6	Mapping techniques, Pipelining: Basic Concepts, Data Hazards, Instruction Hazards Computer Peripherals: I/O Devices, I/O transfers – program controlled, interrupt driven and DMA, Interrupt handling.	6

III Semester
CSE2201 : Computer Architecture and Organisation

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Organization	5th edition	V.CarlHamacher, ZvonkoVranesic,	McGraw Hill Publications.
2	Computer Architecture: A Quantitative approach	6th edition	John L. Hennessy, David A. Patterson	MK series in computer architecture and design

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Organization and Architecture	6th edition	Willaiam Staliing	Pearson Education
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications

III Semester

CSE2202 : Object Oriented Programming

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement small programs using classes 5. Design, develop, test, and debug programs using object oriented principles of java

Unit No.	Contents	Max. Hrs.
1	Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. Declaring Classes and objects, Creating Classes and objects,methods,argument passing, Recursion, this keyword, constructors ,Visibility control	8
2	Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	7
3	Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes,	8
4	exception handling mechanism: Fundamentals exception types, uncaught exception,try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses,	7
5	Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap	7
6	IO Steam, applets and Thread: Introduction to stream classes, use of stream classes,I/O stream, bytes stream, character stream, predefined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files,transient and volatile modifiers, Introduction to applets, applet life cycle, creating and executing applets, Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	8

III Semester

CSE2202 : Object Oriented Programming

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java	4th	Bruce Eckel	Prentice Hall

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill
2	Programming with Java	-	E. Balagurusamy	TATA McGraw-Hill

III Semester

CSE2203 : Lab: Object Oriented Programming

Sr. No.	Experiments based on
1	Implement the concept of Class and its data members and member functions in Java
2	Implement the concept of function overloading in Java
3	Implement the concept of class constructor and its type in Java
4	Implement the concept of Abstraction in Java
5	Implement the concept of all types of inheritance in Java
6	Implement the collection listener to solve the problem in Java
7	Implement the concept of run time polymorphism in Java
8	Implement the concept of Files using command line arguments in Java
9	Implement the concept of exception in Java
10	Implement the concept of applet to prepare a web application in Java

III Semester
CSE2204 : Data Structures I

Objective	Course Outcome
1. To make students familiar with syntaxes and usages of various programming constructs of C language 2. To make student understand concept of abstract data types like stacks and queues 3. To make student understand file handling operations 4. To create thinking ability needed for implementation of programming logic with proper use of memory	1. To understand programming constructs like stack, queue, array, structures 2. To Apply appropriate data structures in problem solving. 3. To Implement various abstract data types and programming logic needed for solving given problem 4. Analyze the performance of operations performed on data structures.

Unit No.	Contents	Max. Hrs.
1	Types and operations, Iterative constructs and loop invariants, Quantifiers and loops, Structured programming and modular design, Illustrative examples, Scope rules, parameter passing mechanisms, recursion, program stack and function invocations including recursion	6
2	Overview of arrays and array based algorithms - searching and sorting: mergesort, quick sort, Sparse matrices.	7
3	Structures (Records) and array of structures (records). Database implementation using array of records. Dynamic memory allocation and deallocation. Dynamically allocated single and multi-dimensional arrays, polynomial representation.	7
4	Concept of an Abstract Data Type (ADT), Lists as dynamic structures, operations on lists, implementation of linked list using arrays and its operations. Introduction to linked list implementation using self-referential-structures/pointers.	6
5	Stack, Queues and its operations. Implementation of stacks and queues using both array-based and pointer-based structures. Applications of stacks and queues.	6
6	File organisation, examples of using file,file access methods , Hashing and collision resolution techniques	6

III Semester
CSE2204 : Data Structures I

Text books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures and Program Design in C	Robert Kruse, G. L. Tondo andB. Leung	latest edition	PHI-EEE
2	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	latest edition	W. H. Freeman and Company.
3	How to Solve it by Computer	R. G. Dromey	latest edition	Pearson Education

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH

III Semester
CSE2205 : Lab.: Data Structures I

Sr. No.	List of Experiment
1	C Programs for using various loop constructs
2	C Program for generating list
3	C Programs for illustrating recursion
4	C Programs for allocating memory dynamically for a single dimensional array and sorting it .
5	C Program for allocating memory dynamically for two-dimensional array , printing it
6	C Program to create a link list and print it.
7	C Program/s to create stack using array and link list
8	C Program/s to create Queue using array and link list
9	C Program to create file for storing , perform file operations
10	C Program on hashing

III Semester
CSE2206 : Lab: Software Lab-I

Objective	Course Outcome
1. Understanding data types, data structures, control and Loop statements in Python. 2. Learn def function definitions, and modules. 3. Learn basic object-oriented concepts using Python. 4. Developing applications in Python using customized and built in modules and packages.	After learning the course, the students will be able to 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python 2. Understand the concepts of functions, modules and packages and write complex programs using them. 3. Understand defining and handling Python objects and develop classes required for the given application 4. Develop a useful application in Python.

Unit No.	Contents	Max. Hrs.
1	Introduction: Build-in Data types: Data type & Variables,, Python Strings, Python built in data structures: Lists, Dictionaries, Tuples, Sets, Arrays. Datatype conversion. Statements: Assignment statement, import statement, print statement, input statement, Python Control Statements: if, if – else, statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements.	4
2	Python Functions, Modules and Packages: The def statement, returning values, parameters, arguments, local variables, global variables and global statement, doc strings for functions, Mathematical Function, Generating Random numbers, File Handling.	3
3	Python Object and Classes: defining classes and creating classes, member variables, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules and packages.	2
4	Developing applications in Python using built in and customized modules and packages.	1

IV Semester

GE2207 – Discrete Mathematics & Graph Theory

Course Objectives	Course Outcomes
The objective of this paper is to study mathematical , logic and set theory and their methods of solution and graph theory, group theory with simple applications	With the completion of this syllabus students will be familiar with mathematical , logic and set theory and their methods of solutions and graph theory, group theory with simple applications

Unit No.	Contents	Max. Hrs.
1	UNIT I: Mathematical Logic and Set Theory: Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets, Partial order, Equivalence relations, mathematical induction. Propositions, Predicate, logic, formal mathematical systems. (PO-1,2)	6
2	UNIT II: Relations and Functions: Relation and Ordering, Properties of Binary in a set, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition and Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.(PO-1)	6
3	UNIT III: Group Theory: Groups (Definitions and Examples) Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups, Codes and Group Codes. Semi groups and Monoids (definitions and examples). Homomorphism of semigropups and monoids, Subsemi groups and monoids.(PO-1)	7
4	UNIT IV: (PO-1) Rings (Definitions and Examples): Integral domain, ring homomorphism, ideas of ring polynomial, Field, Lattice.	7
5	UNIT V: Fuzzy Sets and Fuzzy Logic : Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.	6
6	UNIT VI: Graph Theory: Basic concepts of graph theory, Basic definitions, Paths and circuits,Reach ability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.(PO-1,2,3)	7

IV Semester
GE2207 – Discrete Mathematics & Graph Theory

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Discrete Mathematics Structure with application to Computer Science	23rd re-print, 2005	J. P. Tremblay & R. Manohar	Tata McGraw-Hills Publication Company Limited, New Delhi.
2	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	by.S.Chand and Company Limited Delhi.
3	Fuzy Logic with Engineering Applications	-	T. J. Ross,	John Wiley &Sons, Ltd. ISBN: 978-81-265-3126-4

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Discrete Mathematics	2nd edition	Lipschutz	by Schaums's Outline series,,Tata McGraw-Hills Publication Company Limited, New Delhi.
2	Discrete Mathematical structures	3rd edition,2001,	Bernard Kolman ,Robert C.Busby,Sharon Ross,	Prentice Hall of India, New Delhi.

IV Semester
CSE2251– Operating Systems

Objective	Course Outcome
1. To understand the role, components, and designing issues associated with operating systems. 2. To understand processes and threads, CPU scheduling algorithms, and process synchronization mechanisms 3. To comprehend the concepts of memory management including virtual memory. 4. To understand issues related to file system interface and implementation, and disk scheduling.	After undergoing this course students will be able to 1. Understand the fundamental concepts in Operating Systems (OS) and understand how various hardware features support OS functionality. 2. Explain various OS mechanisms and policies for managing system resources. 3. Analyse algorithms and techniques for managing various OS resources in a multiprogramming and other environments. 4. Evaluate the performance of algorithms for managing various OS resources.

Unit No.	Contents	Max. Hrs.
1	Introduction to OS**:** evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, process concept, process state transitions , Services provided by OS, system calls, privileged instructions, Dual mode of operation, I/O bound and CPU bound processes, concept of multiprogramming and multiprocessing.	5
2	Process management: process control block, process context switch, process versus threads, CPU scheduling, goals of scheduling, CPU scheduling algorithms, Algorithmic evaluation of CPU scheduling algorithms, multi-queue scheduling, multithreading	6
3	Interposes communication and Synchronization: Operations on processes, Interposes communication, process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores, other synchronization constructs.	6
4	Memory management techniques: -contiguous allocation, static and dynamic partitioning, non-contiguous allocation, paging, translation look aside buffer (TLB) and overheads, segmentation.	6
5	Virtual memory: demand paging, page replacement algorithms, thrashing, working set model. Deadlocks: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	7
6	File systems : introduction, Access methods, Directory Structure disk space management and space allocation strategies, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm.	6

IV Semester
CSE2251– Operating Systems

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Operating system Principles	9th Edition	A. Silberchatz and P.Galvin	John Wiley & Sons Inc.
2	Operating Systems Internals and Design Principles	2nd	William Staling	Pearson

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Operating Systems: A Design-Oriented Approach	-	-Charles Crowley	McGraw Hill
2	Operating system concepts and Design	2nd	Milan MilenKovic	Tata McGraw Hill

IV Semester
CSE2252– Lab.: Operating Systems

Expt. No.	Name of Experiment / Problem Statement	Topic	CO Mapped
1	Study of Window task manager (Exploring various Labs: applications,, Processes, services, networking, performance)	Windows	CO-1
2	Study of Advanced Linux shell commands (Process management, Memory management, Networking ,etc.	Linux Commands	CO-1
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.	Process Control	CO-1
4	Write a multithreaded program to multiply two given matrices	Threads	CO-1
5	Simulate a) Any preemptive CPU Scheduling Algorithm b) Any Non preemptive CPU Scheduling Algorithm	CPU Scheduling	CO-4
6	Write a program to perform Inter-Process-Communication using shared memory or pipes or message queues	Inter-Process Communication	CO-4
7	Write a program that solves two process Producer –Consumer problem with bounded buffer suing semaphores OR Write a program that give as deadlock and starvation free solution to the dining philosophers problem using semaphores	Semaphore	CO-4
8	Simulate a) First Fit (static Memory allocation algorithm) and b) Worst Fit (Dynamic Memory allocation algorithm)	Memory Allocation algorithms	CO-4
9	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal	Page Replacement Algorithms	CO-4
10	Write a program to simulate Banker's Deadlock avoidance algorithm	Deadlock	CO-4

IV Semester
CSE2253 – Data Structures II

Objective	Course Outcome
1. To get overview of fundamental data structures and their application 2. To explore different operations performed on various data structures 3. Understand practical implementation of different types of data structures 4. Comprehend working of advanced data structures like list, disjoint set, multidimensional trees 5. Compare different data structures	1. Create and manipulate various data structures like linked list, disjoint sets, trees, graph for real world problem 2. Apply appropriate data structure for implementation of real world applications 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Unit No.	Contents	Max. Hrs.
1	**Linked Lists**- Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list: traversal, addition, deletion of nodes, list reversal, Applications of lists in polynomial representation, multi-precision arithmetic. Multi linked structures, implementation of priority queues.	8
2	**Sets**: data structures for disjoint set representation and operations, sorting, searching	6
3	**Binary Trees:**binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs. Heaps and heap sort	8
4	**Balanced trees**: Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications	8
5	**Multidimensional tree:**Tries and Pattern matching algorithms	6
6	G**raphs: Representation** & traversals. Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths	6

IV Semester
CSE2253 – Data Structures II

Text books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures and Program Design in C	Robert Kruse, G. L. Tondo andB. Leung	latest edition	PHI-EEE
2	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	latest edition	W. H. Freeman and Company.
3	How to Solve it by Computer	R. G. Dromey	latest edition	Pearson Education

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH

IV Semester
CSE2254 – Lab.: Data Structures II

Sr. No.	List of Experiment
1	Program/s based on operations on singly linked list
2	Program/s based on operations on doubly linked list
3	Program based on Binary trees- traversal
4	Programs based on Binary search tree
5	Programs based on Tries
6	Program based on Balanced trees
7	programs based on Graph operations - traversal

IV Semester
CSE2255 – Introduction to Data Analysis

Course Learning Objectives	Course Outcomes
1. To introduce the basic statistical formulae and visualization techniques 2. To comprehend the concepts of probability and probability distribution 3. To understand the concepts of sampling, sampling distribution and estimation 4. To understand the concept of hypothesis testing	Upon successful completion of the course students will be able to: 1. Apply fundamental concepts of statistics and probability for data analysis(PO1-3) 2. Apply appropriate statistical methods on simple datasets(PO2-3) 3. Formulate and solve problems in a systematic manner.(PO2-3) 4. Conduct investigation and Interpret output obtained from statistical analysis on datasets (PO4-3) 5. Obtain hands on experience with some popular software (like R)for analysis and visualization of data(PO4-3,PO5-3)

Unit No.	Contents	Max. Hrs.
1	Introduction to statistics and probability : The role of statistics. Numerical and graphical methods for describing and summarizing data.Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence.	6
2	Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various probability distributions.	6
3	Sampling and Sampling Distribution: introduction to sampling, random sampling, Introduction to sampling distribution. Design of experiment	6
4	Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations	6
5	Testing Hypothesis: Introduction,, null hypothesis, tests of hypothesis and significance, type I and type II errors, one tailed and two tailed tests , p-value one sample tests for means and proportions of large samples (z-test), one sample tests for means of small samples (t-test), Chi-square tests for goodness of fit. Analysis of variance.	7
6	Regression and correlation : : Estimation of regression line by least square method, linear and multiple regressions, Correlation analysis	6

IV Semester
CSE2255 – Introduction to Data Analysis

Text Books:

Sr. No.	Title	Author	Edition	Publisher
1	Introduction to probability and statistics for engineers and scientist	Sheldon M. Ross	3rd Edition	Elsevier
2	Statistics for Management	Richard I. Levin & David S. Rubin	7th Edition	Pearson Education
3	Probability and Statistics	Murray R. Spiegel, John J.Schiller, R AluSrinivasan	Third edition .	Mc Graw Hill education

Reference Book:

Sr. No.	Title	Author	Edition	Publisher
1	Practical Statistics for Data Scientists, 50 Essential Concepts.	Peter Bruce & Andrew Bruce		
2	An Introduction to Statistical Learning with Applications in R	Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani		

IV Semester
CSE2256– Lab: Introduction to Data Analysis

Sr. No.	List of Experiment
1.	Implement basic functionality of R
2.	Implement data import and export functionality in R
3.	Implement R functions to calculate basic statistics of data source
4.	Apply the basic visualization techniques in R to understand data
5.	Apply some advanced visualization techniques in R to analyze the data
6.	Solve the problems using probability distributions in R
7.	Using a case study compare various probability distributions
8.	Analyze the data using sampling technique
9.	Analyze the data to find out estimated value
10.	Analyze the data using hypothesis testing

IV Semester
CSE2257– Theory of Computation

Objective	Course Outcome
1. To understand the basic properties of formal languages and Finite Automata, regular expression and Regular Grammar. 2. To study of different types of grammars and the properties of Context Free Grammar 3. To understand the basic properties of CFL and Designing of Push Down Automata 4. To understand the basic properties of Turing machine and study of Recursive Language, undecidability, post Correspondence problem and Recursive enumerable language	1. Apply basic properties of formal languages and to design finite automata for regular expression and Regular Grammar. 2. Construct context free grammar for various languages. 3. Solve various problems of push down automata for context free language 4. Design Turing Machines for given any computational problem.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets, Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church‟s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machine	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

IV Semester
CSE2257– Theory of Computation

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Automata Theory, Languages, and computation	3rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3rd Edition	John C.Martin	Mc Graw Hill

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation	2nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1st Edition	Dr. O. G. Kakde	Laxmi Publication