

Department of Computer Science

SEMESTER-III

CC-5 (Theory): Data Structures

Theory: 60 Lectures		Credit: 4
1.	Arrays	(5 L)
	Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)	
2.	Stacks	(5 L)
	Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack	
3.	Linked Lists	(10 L)
	Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular	
	representation of Stack in Lists; Self Organizing Lists; Skip Lists	
4.	Queues	(5 L)
	Array and Linked representation of Queue, De-queue, Priority Queues, Queue using Stack	
5.	Recursion	(5 L)
	Developing Recursive Definition of Simple Problems and their implementation; Advantages	
	and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation)	
6.	Trees	(20 L)
	Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion , Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals);	
7.	Searching and Sorting	(5 L)
	Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Bubble Sort, Insertion Sort, Shell Sort, Comparison of Sorting Techniques	
8.	HASHING: Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collusion by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function	(5 L)

CC-6: Operating Systems

Theory: 60 Lectures

Credit:4

1. Introduction	10L
Basic OS functions, resource abstraction, types of operating systems– multiprogramming systems, batch systems , time sharing systems; operating systems for personal computers & workstations, process control & real time systems.	
2. Operating System Organization	6L
Processor and user modes, kernels, system calls and system programs.	
3. Process Management	20L
System view of the process and resources, process abstraction, process hierarchy, threads, threading issues, thread libraries; Process Scheduling, non-pre-emptive and pre-emptive scheduling algorithms; concurrent and processes, critical section, semaphores, methods for inter-process communication; deadlocks.	
4. Memory Management (10L)	10L
Physical and virtual address space; memory allocation strategies –fixed and variable partitions, paging, segmentation, virtual memory	
5. File and I/O Management	10L
Directory structure, file operations, file allocation methods, device management.	
6. Protection and Security	4L
Policy mechanism, Authentication, Internal access Authorization.	

CC-7: Computer Networks

Theory: 60 Lectures

Credit: 4

1. Introduction to Computer Networks	8L
Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.	
2. Data Communication Fundamentals and Techniques	10L
Analog and digital signal; data-rate limits; digital to digital line encoding schemes; pulse code modulation; parallel and serial transmission; digital to analog modulation-; multiplexing techniques- FDM, TDM; transmission media (twisted-pair, coaxial-cable, fibre-optic cable), satellite communications.	
3. Network Switching Techniques and Access mechanisms	10L
Circuit switching; packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.	
4. Data Link Layer Functions and Protocol	10L
Error detection and error correction techniques (CRC, Hamming-codes); data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet.	
5. Multiple Access Protocol and Networks	5L
ALOHA & CSMA protocols; CDMA; Ethernet LANs; connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways;	
6. Networks Layer Functions and Protocols	5L
Routing; static and dynamic routing algorithms; network layer protocol of Internet- IP protocol, Internet control protocols.	
7. Transport Layer Functions and Protocols	5L
Transport services- error and flow control, Connection establishment and release- three way handshake, TCP and UDP.	
8. Overview of Application layer protocol	5L
Overview of DNS protocol; overview of WWW & HTTP protocol.	

SEC-1

SEC-1: Programming in Python

Theory: 15 Lectures

(1 Th. + 2 Labs)

Credit: 1

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.	(2L)
Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.	(2 L)
Overview of Programming: Structure of a Python Program, Elements of Python	(3 L)
Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).	(4L)
Creating Python Programs : Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments	(4L)

SEC-1: R-Programming

Theory: 15 Lectures

(1 Th.+2 Labs)

Credit: 1

Introduction: Overview and History of R, Getting Help, Data Types, Subsetting, Vectorized Operations, Reading and Writing Data.	(5L)
Control Structures, Functions, lapply, tapply, split, mapply, apply, Coding Standards.	(5L)
Scoping Rules, Debugging Tools, Simulation, R Profiler.	(5L)

SEMESTER – IV

CC-8 (Theory): Design and Analysis of Algorithms

Theory: 60 Lectures

Credit: 4

1. Introduction Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.	(5 L)
2. Algorithm Design Techniques Iterative techniques, Divide and Conquer (Karatsuba integer multiplication, Strassen's matrix multiplication, etc.), Dynamic Programming (Convex hull, DFT & FFT), Greedy Algorithms (Knapsack, Denomination of notes/coins), Scheduling.	(8 L)
3. Sorting and Searching Techniques Elementary sorting techniques– Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Medians & Order Statistics, complexity analysis.	(17 L)
4. Lower Bounding Techniques: Decision Trees	(2 L)
5. Balanced Trees: AVL Trees, Red-Black Trees	(10 L)
6. Advanced Analysis Technique: Amortized analysis	(5 L)
7. Graphs Graph Algorithms–Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees (Prim, Kruskal), Shortest Paths (Dijkstra, Bellman-Ford, Floyd-Warshall).	(5 L)
8.String Processing: String Matching, Edit Distance, Document distance, Rabin-Karp, KMP, Boyer-Moore Techniques	(5 L)
9.Cryptographic algorithms and Overview of complexity Classes: Basic cryptographic algorithms like DSA, RSA; P, NP, NP-Hard, NP-Complete	(3 L)

CC-9: Software Engineering

Theory: 60 Lectures

Credit: 4

1. Introduction The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).	(8L)
2. Requirement Analysis Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.	(10L)
3. Software Project Management Estimation in Project Planning Process, Project Scheduling.	(8L)
2. Risk Management Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.	(8 L)
5. Quality Management Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.	(8 L)
6. Design Engineering Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.	(10 L)
7. Testing Strategies & Tactics	(8 L)

CC-10: Database Management Systems

Theory: 60 Lectures

Credit: 4

1.Introduction Characteristics of database approach, data models, database system architecture and data independence.	(6L)
2.Entity Relationship (ER) Modeling Entity types, relationships, constraints.	(8L)
3.Relation data model Relational model concepts, relational constraints, relational algebra, SQL queries	(20L)
4. Database design Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF).	(15L)
5. Transaction Processing ACID properties, concurrency control & recovery	(3L)
6. File Structure and Indexing Operations on files, File of Unordered and ordered records, overview of File organizations, Indexing structures for files(Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.	(8L)

SEC-2

PHP Programming

(1 +2 Lab)

Theory: 15 Lectures

Credit:

<p>Introduction to PHP:</p> <ul style="list-style-type: none">❑ PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.)❑ PHP with other technologies, scope of PHP❑ Basic Syntax, PHP variables and constants❑ Types of data in PHP , Expressions, scopes of a variable (local, global)❑ PHP Operators : Arithmetic, Assignment, Relational , Logical operators, Bitwise , ternary and MOD operator.❑ PHP operator Precedence and associativity	(3L)
<p>Handling HTML form with PHP:</p> <ul style="list-style-type: none">➤ Capturing Form Data➤ GET and POST form methods➤ Dealing with multi value fields➤ Redirecting a form after submission	(2L)
<p>PHP conditional events and Loops:</p> <ul style="list-style-type: none">➤ PHP IF Else conditional statements (Nested IF and Else)➤ Switch case, while ,For and Do While Loop➤ Goto , Break ,Continue and exit	(3L)
<p>PHP Functions:</p> <p>Function, Need of Function , declaration and calling of a function PHP Function with arguments, Default Arguments in Function Function argument with call by value, call by reference Scope of Function Global and Local</p>	(3L)
<p>String Manipulation and Regular Expression:</p> <ul style="list-style-type: none">❑ Creating and accessing String , Searching & Replacing String❑ Formatting, joining and splitting String , String Related Library functions❑ Use and advantage of regular expression over inbuilt function❑ Use of preg_match(), preg_replace(), preg_split() functions in regular expression	(2L)

<p>Array:</p> <ul style="list-style-type: none"> ❑ Anatomy of an Array ,Creating index based and Associative array ,Accessing array ❑ Looping with Index based array, with associative array using each() and foreach() ❑ Some useful Library function 	(2L)
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SEC-2: UNIX / Linux Programming

(1+2

Labs)

Theory: 15 Lectures

Credit: 1

<p>Introduction</p> <ul style="list-style-type: none"> ➤ What is linux/unix Operating systems ➤ Difference between linux/unix and other operating systems ➤ Features and Architecture ➤ Various Distributions available in the market ➤ Installation, Booting and shutdown process ➤ System processes (an overview) ➤ External and internal commands ➤ Creation of partitions in OS ➤ Processes and its creation phases – Fork, Exec, wait 	(5L)
<p>User Management and the File System</p> <ul style="list-style-type: none"> ➤ Types of Users, Creating users, Granting rights ➤ User management commands ➤ File quota and various file systems available ➤ File System Management and Layout, File permissions ➤ Login process, Managing Disk Quotas ➤ Links (hard links, symbolic links) 	(5L)
<p>Shell introduction and Shell Scripting (6L)</p> <ul style="list-style-type: none"> ➤ What is shell and various type of shell, Various editors present in linux ➤ Different modes of operation in vi editor ➤ What is shell script, Writing and executing the shell script ➤ Shell variable (user defined and system variables) ➤ System calls, Using system calls ➤ Pipes and Filters ➤ Decision making in Shell Scripts (If else, switch), Loops in shell ➤ Functions ➤ Utility programs (cut, paste, join, tr , uniq utilities) ➤ Pattern matching utility (grep) 	(6L)

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