SRI VASAVI ENGINEERING COLLEGE (AUTONOMOUS)
(Sponsored by Sri Vasavi Educational Society)
(Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada)
(Accredited by NAAC with 'A' Grade ,Recognized by UGC under section 2(f) & 12(B))
Pedatadepalli, **TADEPALLIGUDEM – 534 101.**W.G.Dist**. (A.P)**
Department of Computer Science & Engineering (Accredited by NBA)

Minutes of the ThirdBoard of Studies held on 31/05/2020 at 11:30 AM through online mode

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Department of Computer Science & Engineering (Accredited by NBA)

Dt: 22.08.2020

The third meeting of Board of Studies in Department of Computer Science and Engineering is held at 11.30 AM on 31-05-2020 through online mode using GoToMeeting App (Access Code: 309-899-781).

The following members attended the meeting:

S.No.	Name of the Member	Designation	Role
1.	Dr. D Jaya Kumari	Professor, HoD-CSE, SVEC	Chairperson
2.	Dr. Krishna Mohan Ankala	Professor, UCEK, Kakinada	University Nominee
3.	Dr. R.B.V. Subramaanyam	Professor, Department of CSE, NIT Warangal	Academic Expert
4.	Prof. S. PallamSetty	Department of CS&SE, AU College of Engineering, Visakhapatnam	Academic Expert
5.	Sri. Srinivasa Raju Vuppalapati	Senior Consultant,MSR IT Services LLP,Hitech City, Hyderabad.	Industry Expert
6.	Mr.EEdala Rambabu	microfocus, Bangolore	Alumni
7.	Dr. V. Venkateswara Rao	Professor	Member
8.	Dr. G Loshma	Associate Professor	Member
9.	Ch. Raja Ramesh	Associate Professor	Member
10.	Dr. V.S.Naresh	Associate Professor	Member
11.	Dr. S.P.Malarvizhi	Associate Professor	Member
12.	Dr Veeraraghavan J	Associate Professor	Member
13.	Dr. K. Shirin Bhanu	Associate Professor	Member
14.	Dr. O. Sri Nagesh	Assistant Professor	Member
15.	Leelavathi Arepalli	Sr. Assistant Professor	Member
16.	D. Anjani Suputri Devi	Sr. Assistant Professor	Member
17.	G Sriram Ganesh	Assistant Professor	Member

The following are the Minutes of the Meeting

Item No.1: Welcome note by the Chairman BOS.

The HOD extended a formal welcome and introduced the members.

Item No.2: Review & Approval of the Course Structure for V and VI SEM -B.Tech (CSE) Programme under V18 Regulation.

Reviewed the Course Structure of V & VI semesters for B.Tech (CSE) Programme of V18 Regulation and following changes were made:

- **In SEM-V:**

  -The courses in Electives were rearranged as per the Threads (Electives) indicated in AICTE Model Curriculum.

  -The Courses approved in **Professional Elective-I** are:
  - Advanced Computer Architecture
  - Advanced Data Structures
  - Artificial Intelligence
  - Computer Graphics

- **In SEM-VI:**

  - Advanced Java and Web Technologies (**Course Code: V18CST20) is replaced with** Data Mining (**Course Code:V18CST20).**

  - Advanced Java and Web Technologies Lab (**Course Code: V18CSL09) is replaced with Data Mining Lab (Course Code:V18CSL09).**

  - Seminar (**Course Code: V18CSMPS) is replaced with** Mini Project (**Course Code: V18CSMPS)**

  - The Courses approved in **Professional Elective-II** are:
    - Software Testing Methodologies
    - Principles of Programming Languages
    - Machine Learning
    - Image Processing

- The approved Course Structure of V and VI SEM is given in **Annexure-I.**

Item No.3: Approval of Syllabi for the proposed courses offered in V and VI semesters of B.Tech(CSE) Programme under V18 Regulation.

- Approved the syllabi for the courses offered in V & VI semesters B.Tech(CSE) under V18 Regulation. The approved Syllabus is given in **Annexure-II (a).**

- For B.Tech(ECE) Programme, the following courses are offered in V and VI SEM .

S.No.	SEM	Course Code	Course Name
1	V	V18CST81	Introduction to Data Structures
		V18CSL34	Data Structures Lab
2	VI	V18CST11	Computer Networks
		V18CSL35	Computer Networks Lab

- For B.Tech (MECH) Programme, the following course offered in V SEM

Course Code	Course Name
V18CSL05	Python Programming Lab

- The approved Syllabus for B.Tech(ECE) and B.Tech(MECH) was given in **Annexure -II(b).**

Item No. 4: Approval of the Open Elective courses and their Syllabi offered in VI semester under V18 Regulation for all other branches.

- Approved the list of Open Elective courses and syllabi offered in VI Semester**,** details are given in **Annexure-III.**

Item No. 5: Review & Approval of Course Structure and Syllabus for the proposed courses offered in III and IV Semesters of B.Tech(CST) Programme under V18 Regulation.

- The BOS Members suggested and approved the III & IV SEM B.Tech(CSE) Course Structure and Syllabus for B.Tech (CST) Programme also.

- The approved Course Structure is given in **Annexure-IV.**

Item No.6: Seeking approval from Academic Council towards introduction of B.Tech(Hons) in line with the guidelines prescribed by AICTE.

- The BOS Members approved the **B.Tech(Hons) Data Science Course** for CSE ,Approved course structure and Syllabus is given in **Annexure-V.**

Dr.D Jaya Kumari
Chairperson of BOS

Head of the Department
Dept. of Computer Science & Engineering
Sri Vasavi Engineering College
TADEPALLIGUDEM-534 101

Annexure-I
Approved Course Structure in 3rd BOS Meeting (V18 Regulation)

V - Semester							
S.No.	**Course Code**		**Course**	**L**	**T**	**P**	**C**
1	V18CST10	PCC	Database Management Systems	3	0	0	3
2	V18CST11	PCC	Computer Networks	3	0	0	3
3	V18CST12	PCC	Operating Systems	3	0	0	3
4	V18CST13	PCC	Design and Analysis of Algorithms	3	0	0	3
5	V18CST14	PCC	Unix Programming	3	0	0	3
6	**Elective – I**						
	V18CST15	PEC	1. Advanced Computer Architecture	3	0	0	3
	V18CST16		2.Advanced Data Structures				
	V18CST17		3.Artificial Intelligence				
	V18CST18		4. Computer Graphics				
7	V18MBET53	HSS	Organizational Behavior	3	0	0	3
8	V18CSL06	PCC	Database Management Systems Lab	0	0	3	1.5
9	V18CSL07	PCC	Operating System and Unix Lab	0	0	3	1.5
10	V18ENT05		Professional Communication Skills –III	4	0	0	MNC
11	V18CST62		Technical Skills-III	4	0	0	MNC
Total Contact Hours: 35				**29**	**0**	**6**	**24**

VI - Semester							
S.No.	**Course Code**		**Course**	**L**	**T**	**P**	**C**
1	V18CST19	PCC	Compiler Design	3	0	0	3
2	V18CST20	PCC	Data Mining	3	0	0	3
3	V18CST21	PCC	Object Oriented Analysis and Design through UML	3	0	0	3
4	V18CST22	PCC	Cryptography & Network Security	3	0	0	3
5	**Elective - II**			3	0	0	3
	V18CST23	PEC	1. Software Testing Methodologies				
	V18CST24		2. Principles of Programming Languages				
	V18CST25		3. Machine Learning				
	V18CST26		4. Image Processing				
6	**Open Elective – I (Interdisciplinary)**	**OEC**	**OPE I(1-3) -(Interdisciplinary)**	3	0	0	3
7	V18CSL08	PCC	Object Oriented Analysis and Design through UML Lab	0	0	3	1.5
8	V18CSL09	PCC	Data Mining Lab	0	0	3	1.5
9	V18CSMPS	Mini Project	Mini Project with Seminar	0	0	4	2
10	V18ENT06		Professional Communication Skills –IV	4	0	0	MNC
11	V18CST63		Technical Skills-IV	4	0	0	MNC
Total Contact Hours: 36				**26**	**0**	**10**	**23**

Annexure - II (a)

Approved Syllabi for the courses offered in V & VI semesters B. Tech(CSE) under V18 Regulation

V Sem	**Database Management Systems**	Course Code: V18CST10	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate Database Systems, various Data Models and Database Architecture. (K2)
CO2: Apply ER Modeling to Design Relational Databases for Real Time Applications. (K3)
CO3: Apply SQL Constructs to Perform Database Operations. (K3)
CO4: Apply Normalization Techniques to Refine Schema. (K3)
CO5: Explain Transaction Management and Concurrency Control. (K2)
CO6: Experiment with various database indexing techniques. (K3)

UNIT-I: An Overview of Database Systems: Managing Data, File Systems verses DBMS, Advantages of DBMS, Data Independence. **Database System Architecture:** Three Levels of Architecture, External Level, Conceptual Level, Internal Level, Structure of DBMS, The Database Management Systems and Client/Server Architecture.

UNIT-II: Database Design: The E/R Models, Database Design and Er Diagrams, Entities, Attributes, Entity Sets, Relationships and Relationship Sets, Conceptual Design with ER Models. **Relational Model:** Integrity Constraints Over Relations, Key Constraints ,Foreign Key Constraints, General Constraints, Relational Algebra- Selection and Projection, Set Operation, Renaming, Joins, Division, Relational Calculus- Tuple Relational Calculus, Domain Relational Calculus.

UNIT-III: SQL Queries, Constraints and Triggers: The Form of Basic SQL Query, Union, Intersect, Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

UNIT-IV: Schema Refinement (Normalization): Purpose of Normalization or Schema Refinement, Concept of Functional Dependency, Normal Forms based on Functional Dependency (1NF, 2NF and 3NF), Concept of Surrogate Key, Boyce-Codd Normal Form (BCNF), Lossless Join and Dependency Preserving Decomposition, Fourth Normal Form(4NF).

UNIT-V:Transaction Management: Transaction, Properties of Transactions, Transaction Log, and Transaction Management with SQL Commit, Rollback and Savepoint. Concurrency Control: Concurrency Control for Lost Updates, Uncommitted Data, Inconsistent Retrievals and the Scheduler. **Concurrency Control with Locking Methods :** Lock Granularity, Lock Types, Two Phase Locking for Ensuring Serializability, Deadlocks, Concurrency Control with Time Stamp Ordering, Transaction Recovery.

UNIT-VI: Storage and Indexing: Overview of Storages and Indexing, Data on External Storage, File Organization and Indexing, Clustered Indexing, Primary and Secondary Indexes, Index Data Structures, Hash based Indexing, Tree based Indexing, Comparison of File Organization

TEXT BOOKS:

1. Introduction to Databse Systems, CJ Date,8th Edition, Pearson Education.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition TATA McGraw Hill.

REFERENCE BOOKS:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition, Course Technology.
2. Fundamentals of Database Systems, ElmasriNavrate , 7th Edition, Pearson Education.
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom, 2nd Edition, Pearson.

V Sem	**Computer Networks**	Course Code: V18CST11	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss fundamentals of network concepts and Reference Models.(K2)
CO2: Discuss Communication media and switching techniques.(K2)
CO3: Demonstrate Error control and protocols.(K3)
CO4: Apply Routing algorithms and congestion control algorithms.(K3)
CO5: Discuss Transport layer services and protocols. (K2)
CO6: Describe Application layer protocols.(K2)

UNIT-I: Introduction: Reference models: The OSI Reference Model- the TCP/IP Reference Model, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

UNIT– II: Physical Layer: Transmission Media, Multiplexing: FDM, WDM and TDM- LAN Technologies, introduction to switching: Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT–III: Data link layer: Design issues, Framing, Flow control, error control, error detection and correction, CRC, Checksum: idea, one's complement internet checksum, MAC: ALOHA, CSMA. Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, HDLC, point to point protocol (PPP).Piggybacking.

UNIT-IV : Network Layer : Network layer design issues- Algorithm shortest path routing, Flooding, Hierarchical routing, Broad cast, Multi cast Routing algorithms-Congestion control and algorithms, Internet Protocol (IP) Addresses, Subnet masking

UNIT–V :Transport Layer: Services, Primitives and sockets, Elements of transport protocols, Internet Transport protocols(TCP,UDP,RPC,RTTP/RTP,RTCP) Segment headers, Primitives, Control, Congestion control, Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT–VI: Application layer: DNS, SMTP, POP,FTP HTTP Presentation formatting. Network security: Introduction to Cryptography, Authentication, Basics of Public key and private key cryptography, digital signatures and certificates firewalls and wireless security.

TEXT BOOKS:

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan.Third Edition TMH

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

V Sem	**Operating Systems**	Course Code: V18CST12	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe Operating System Services and System Calls (K2).
CO2: Illustrate Process Management Concepts and CPU Scheduling Algorithms (K3).
CO3: Demonstrate Process Synchronization primitives (K3).
CO4: Demonstrate Deadlock Prevention, Avoidance and Detection methods (K3).
CO5: Illustrate Memory Management Techniques and Page Replacement Algorithms (K3).
CO6: Describe File System Concepts and Mass Storage Structures (K2) .

UNIT-I:Introduction: Operating-System Structure, Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls.

UNIT-II:Process Management: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication. **Threads:** Overview, Multithreading Models. **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms

UNIT-III : Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors

UNIT-IV:Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

UNIT-V:Memory ManagementMain Memory: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table
Virtual Memory: Introduction, Demand Paging, Page Replacement, Allocation of Frames, Thrashing

UNIT-VI:Storage Management: Overview of Mass-Storage Structure, Disk Scheduling, File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Allocation Methods

Text Book:

1. Operating System Concepts, AbrahamSilberschatz, ,Peter Baer Galvin,Greg Gagne, 9th Edition, John Wiley and Sons Inc., 2012

Reference Books:

1. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2012
2. Modern Operating Systems, Andrew S. Tanenbaum, Third Edition, Addison Wesley,2007

V Sem	**Design and Analysis of Algorithms**	Course Code: V18CST13	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe asymptotic notation and basic concepts of algorithms (K2).
CO2: Apply divide and conquer paradigm to solve various problems (K3).
CO3: Use greedy technique to solve various problems (K3).
CO4: Apply dynamic programming technique to various problems (K3).
CO5: Employ backtracking technique to various problems (K3).
CO6: Apply branch and bound technique to various problems (K3).

UNIT-I: Introduction: What is an Algorithm, Algorithm Specification-Pseudo code Conventions Recursive Algorithm, Performance Analysis-Space Complexity, Time Complexity, Amortized Complexity, Amortized Complexity, Asymptotic Notation, Practical Complexities, Performance Measurement.

UNIT-II: Divide and Conquer: General Method, Defective Chessboard, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort-Performance Measurement, Randomized Sorting Algorithms.

UNIT-III: The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-cost Spanning Trees-Prim's Algorithm, Kruskal's Algorithms, An Optimal Randomized Algorithm, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-IV: Dynamic Programming: All Pairs Shortest Paths, Single Source Shortest paths General Weights, Explain Optimal Binary Search Trees, String Edition, 0/1 Knapsack, Reliability Design.

UNIT-V: Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles.

UNIT-VI: Branch and Bound: The Method-Least cost (LC) Search, The 15-Puzzle: an Example, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack Problem-LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson.

TEXT BOOKS:

1. Fundamentals of computer algorithms E. Horowitz S. Sahni, University Press

REFERENCE BOOKS:

1. Introduction to Algorithms Thomas H. Cormen, PHI Learning.
2. The Design and Analysis of Computer Algorithms, Alfred V. Aho, John E. Hopcroft, JeffreyD.Ullman.
3. Algorithm Design, Jon Kleinberg, Pearson.

V Sem	**Unix programming**	Course Code: V18CST14	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Illustrate the UNIX basics and the working of the built in commands in Unix (K2).
CO2: Demonstrate the file system and change the permissions associated with files (K2).
CO3: Develop basic programs using shell script (K3).
CO4: Demonstrate the grep family and data transforming programs sed, and awk (K2).
CO5: Construct programs for process system calls (K3).
CO6: Explain the concept of signals and its system call (K2).

UNIT-I : Introduction to UNIX: The UNIX Operating System, A brief history of UNIX, The UNIX Architecture, Basic features of UNIX. General Purpose Utilities- cal, date, man, echo, bc, clear, passwd, who, whoami,unameDirectory Handling Commands: pwd, cd, mkdir, rmdir. File Handling Utilities - cat, touch, cp, ls, rm, mv, nl, pg,tar,wc Displaying Commands: more,head,tail, simple filters and commands: cmp, comm., ulink, diff, head, tail, find, cut, paste,sort, uniq, tr, finger. Disk Utilities– du, df, mount, umount.Process Utilities–ps, kill. Networking Utilities– ping, telnet, rlogin, ftp.

UNIT-II : THE FILE SYSTEM : Types of Files, Directories and Files, UNIX File System, Absolute and relative pathnames, File Attributes and Permissions ,The File Command -knowing the File Type, Chmod Command- Changing File Permissions, Chown Command-Changing the Owner of a File, Chgrp Command- Changing the Group of a File. Vi editor-editing with vi, moving the cursor, editing, copying and moving text, pattern searching.

UNIT-III : Introduction to Shell Programming : Shell Variables-The Export Command-The Profile File a Script Run During Starting-The First Shell Script-The read Command-Positional parameters-The $? Variable knowing the exit Status-More about the Set Command-The Exit Command-Branching Control Structures-Loop Control Structures-The Continue and Break Statement-The Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document(<<)-I/O Redirection, The Sleep Command-Debugging Scripts-The Script Command-The Eval Command-The Exec Command. Command Line Structure - Met characters.

UNIT-IV : Regular Expressions:grep, egrep, fgrep, Sed- line addressing, context addressing, text editing,substitution.
Programming with awk: syntax of awk programming statement, structure of awk script, variables ,records fields, and special variables, patterns, operators ,simple input files, awk programming- simple awk programming, awk control structures, looping, functions in awk.

UNIT-V: Unix process: What is a process, process structure, process identifiers, starting new process, waiting for a process, zombie process, system call interface for process management - fork, vfork, exit, wait, waitpid, exec system call.

UNIT : VI Signals : Signal functions, unreliable signals, interrupted system calls, kill and raise functions, alarm, pause functions, abort, sleep functions

Text Books:

1. Introduction to Unix and shell programming, M G venkateshmurthy, Pearson education
2. Advanced programming in the unix environment, W. Richard Stevens, 3rd Edition, Pearson education

REFERENCES

1. Unix and shell Programming, B.A. Forouzan& R.F. Giberg, ,Thomson, First Edition, NewDelhi, 2003.

V Sem	**Advanced Computer Architecture (Elective-I)**	Course Code: V18CST15	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the basics of quantitative design and analysis (K2).
CO2: Illustrate memory hierarchy schemes (K2).
CO3: Illustrate concepts of Instruction-Level Parallelism (K2).
CO4: Explain concepts of Data-Level Parallelism (K2).
CO5: Explain concepts of Thread-Level Parallelism (K2).
CO6: Describe architectural aspects of Warehouse-Scale Computers (K2).

UNIT-I : Fundamentals of Quantitative Design and Analysis: Classes of Computers, Defining Computer Architecture, Designing the Organization and Hardware to Meet Goals and Functional Requirements, Quantitative Principles of Computer Design

UNIT-II : Memory Hierarchy Design: Basics of Memory Hierarchies, Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Virtual Memory and Virtual Machines.

UNIT-III : Instruction-Level Parallelism: Concepts and Challenges, Basic Compiler Techniques, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling, Tomasulo's Approach, Hardware-Based Speculation, Multiple Issue and Static Scheduling

UNIT-IV : Data-Level Parallelism: Vector Architecture, VMIPS, Vector Processors, SIMD Instruction Set Extensions for Multimedia

UNIT-V : Thread-Level Parallelism: Introduction, Centralized Shared-Memory Architectures- Multiprocessor Cache Coherence, Basic Schemes for Enforcing Coherence, Snooping Coherence Protocols

UNIT-VI : Warehouse-Scale Computers: Introduction, Programming Models and Workloads for Warehouse-Scale Computers, Computer Architecture of Warehouse-Scale Computers

TEXT BOOK:

1. Computer Architecture: A Quantitative Approach, John L. Hennessy, David A. Patterson, 5th Edition, Morgan Kaufmann, Elsevier.

REFERENCE BOOKS:

1. Advanced Computer Architectures: A Design Space Approach, D Sima, T Fountain, P Karsuk, 1st Edition, Pearson
2. Advanced Computer Architecture, K Hwang, N Jotwani, 2nd Edition, McGraw-Hill

V Sem	**Advanced Data Structures (Elective-I)**	Course Code: V18CST16	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain external sorting method (K2).
CO2: Discuss pattern matching Algorithms (K2).
CO3: Illustrate various hash functions with appropriate examples (K3).
CO4: Illustrate various priority queues with appropriate examples (K3).
CO5: Construct self balanced tree with appropriate examples (K3).
CO6: Discuss Multiway search trees(K2).

UNIT-I: SORTING: Introduction - External Sorting- K-way Merging - Buffer Handling for parallel Operation- Run Generation- Optimal Merging of Runs.

UNIT-II: STRING MATCHING ALGORITHMS: The Navi String matching algorithms – The Robin-Krap algorithm – String Matching algorithm using finite automata – The Knuth Morris Pratt algorithm.

UNIT-III: SKIP LIST AND HASHING: Dictionaries – ADT- Linear List representation - Skip List representation: Ideal case – Insertion and Deletion –Assigning levels – The struct skip node – The class skip list – complexity of skipList methods. Hash Table Representation: Ideal hashing – Hash functions and tables -Linear probing- Hashing with Chains

UNIT-IV: PRIORITY QUEUES (HEAPS) : Definition and Applications – ADT – Linear lists – Heaps : Definition – Max heap and Min heap operations, Applications – Heap Sort – Huffman Codes.

UNIT-V: EFFICIENT BINARY SEARCH TREES : Introduction to AVL Trees- Red-Black Trees- Definition- Representation of a Red- Black Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a Red-Black Tree- Joining Red-Black Trees, Splitting a Red-Black tree – Splay Trees – Introduction – operation – Amortized complexity.

UNIT-VI: MULTIWAY SEARCH TREES : ISAM - M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- search Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- Node Structure.

TEXT BOOKS:

1. Data Structures, Algorithms and Applications in C++; SartajSahni; UniverstiyPress ; Second Edition.
2. Introduction to Algorithms By Thomas H Cormen, Charless E leiserson, Ronald L Rivest and Cliford Stein PHI publication Third Edition (UNIT – II)

REFERENCES:

1. Data Structures, a Pseudocode Approach, Richard F Gilberg, BehrouzA Forouzan, Cengage.
2. An Introduction to Data Structures with applications By Jean Paul Trembly and Paul G Sorenson Tata McGraw Hill Second Edition
3. Fundamentals of Data Structures and algorithms by C V Sastry, Rakesh Nayak, Ch. Raja Ramesh, IK Publications, new Delhi.

V Sem	**Artificial Intelligence (Elective-I)**	Course Code: V18CST17	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Illustrate the concept of intelligent systems and current trends in AI. (K2)
CO2: Apply Problem solving, Problem reduction and Game Playing techniques in AI. (K3)
CO3: Illustrate the Logic concepts in AI. (K2)
CO4: Explain the Knowledge representation techniques in AI. (K2)
CO5: Describe Expert systems and their applications. (K2)
CO6: Illustrate Uncertainty Measures. (K2)

UNIT-I: Introduction to Artificial Intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, current trends in AI

UNIT-II: Problem solving: State-space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of problem, Exhaustive searches, Heuristic search techniques, Iterative deepening a*, constraint satisfaction
Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games

UNIT-III: Logic concepts: Introduction, Propositional Calculus, Proportional Logic, Natural Deduction system, Axiomatic system, Semantic tableau system in proportional logic, Resolution Refutation in Propositional logic, Predicate Logic

UNIT-IV: Knowledge representation: Introduction, approaches to Knowledge representation, Knowledge representation using Semantic Networks, Extended Semantic Networks for KR, Knowledge representation using Frames

UNIT-V: Expert Systems and Applications: Introduction phases in building Expert Systems, Expert System versus Traditional Systems, Rule-based Expert Systems, Blackboard systems, Truth maintenance systems, applications of Expert Systems.

UNIT-VI: Uncertainty measure: Probability theory- Introduction, Probability Theory, Bayesian Belief networks, Certainty Factor Theory, Dempster-Shafer theory

Text Book:

1. Artificial Intelligence, Saroj Kaushik, 1st Edition, Cengage Learning.

Reference Books:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B Nair, 3rd Edition, Tata McGraw Hill Education Private Limited., 2009
2. Artificial Intelligence- A modern Approach, 3rd Edition, Stuart Russel, Peter Norvig, Pearson Education.

V Sem	**Computer Graphics (Elective-I)**	Course Code: V18CST18	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Understand the applications of computer graphics and learn basic algorithms (K2).
CO2: Analyze the concepts of 2D graphics along with transformation techniques (K3).
CO3: Understand 2D Views of objects and clipping algorithms (K2).
CO4: Illustrate 3D graphics and will get an idea about projections views of objects (K2).
CO5: Determine different visible surface detection methods (K2).
CO6: Understand different animation sequences and Color Models (K2).

UNIT I: Introduction: Application of Computer Graphics, raster scan systems, random scan systems, raster scan display processors. Output Primitives : Points and lines, line drawing algorithms(Bresenham's and DDA Line derivations and algorithms), mid-point circle and ellipse algorithms.

UNIT II: Filled area primitives: Boundary-fill and flood-fill algorithms. **2-D geometrical transforms:** Translation, scaling, rotation, reflection and shear transformations, and homogeneous coordinates, composite transforms.

UNIT III: 2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland, Sutherland –Hodgeman polygon clipping algorithm.

UNIT IV: 3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3D Viewing pipeline, clipping, projections (Parallel and Perspective). **3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Bezier curve and B-Spline curves.

Unit V: Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, BSPtree methods, area sub-division.

Unit VI: Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages. **Color Models** – RGB, YIQ, CMY, HSV.

TEXT BOOKS:

1. Computer Graphics C version, Donald Hearn, M.Pauline Baker, Pearson

2. Computer Graphics, Schaum's outlines", Zhigand xiang,Roy Plastock, 2nd Edition,Tata Mc-Graw Hill Edition.

3. Principles of Computer Graphics, S. Govil-Pai, 1st Edition, Springer International Edtion,2005.

REFERENCE BOOKS:

1. Computer Graphics Principles & practice, 2/e, Foley, VanDam, Feiner, Hughes, Pearson

2. Computer Graphics, Peter, Shirley, CENGAGE

3. Principles of Interactive Computer Graphics, Neuman , Sproul, TMH.

.

V Sem	**Data Base Management System Lab**	Course Code: V18CSL06	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Build SQL Queries and Constraints (K3).
CO2: Experiment with various Database Indexing Techniques.(K3).
CO3: Construct PL/SQL Cursors and Exceptions (K3).
CO4: Develop application programs using PL/SQL (K3).
CO5: Develop PL/SQL Functions, Procedures, Packages (K3).
CO6: Apply projections and aggregation on collection of MongoDB database (K3).

List of Experiments

Part-A

1. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.
2. Queries using operators in SQL
3. Queries to Retrieve and Change Data: Select, Insert, Delete, and Update
4. Queries using Group By, Order By, and Having Clauses
5. Queries on Controlling Data: Commit, Rollback, and Save point
6. Queries to Build Report in SQL *PLUS
7. Queries for Creating, Dropping, and Altering Tables, Views, and Constraints
8. Queries on Joins and Correlated Sub-Queries
9. Queries on Working with Index, Sequence, Synonym, Controlling Access, and Locking Rows for Update, Creating Password and Security features PL/SQL.
10. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation.
11. Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL
12. Write a PL/SQL block using SQL and Control Structures in PL/SQL
13. Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types
14. Write a PL/SQL Code using Procedures, Functions, and Packages FORMS

Part-B

1. Install and start MongoDB
2. Create and drop database and collection
3. Insert,update ,delete,query document
4. Projection, limiting records, sorting records and aggregation in MongoDB

TEXT BOOKS:

1. Oracle Database 11g The Complete Reference by Oracle Press, Kevin Loney
2. Database Systems Using Oracle, Nilesh Shah, 2nd Edition ,PHI.
3. Introduction to SQL, Rick F Vander Lans, 4th Edition, Pearson Education.

REFERENCE BOOKS:

1. Introduction to SQL, Rick F. Vander Lans, 4th Edition, Pearson education.
2. Oracle PL/SQL Interactive Workbook, B. Rosenzweig and E. Silvestrova,2nd Edition, Pearson education.
3. SQL & PL/SQL for Oracle 10 g, Black Book, Dr. P. S. Deshpande, Dream Tech.

V Sem	**Operating System and Unix Lab**	Course Code: V18CSL07	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Illustrate CPU scheduling algorithms (K3)
CO2: Apply Bankers Algorithm for Deadlock Avoidance and Deadlock Prevention (K3)
CO3: Use Page replacement algorithms for memory management (K3)
CO4: Demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment. (K3)
CO5: Experiment with the concept of shell scripting programs. (K3)
CO 6: Illustrate the process of how the parent and child relationships (K3)

List of Experiments:

Part-A: OS Lab

1. Simulate the following CPU scheduling algorithms:
   a) FCFS b) SJF c) Round Robin d) Priority
2. Implement : fork (), wait (), exec() and exit () system calls
3. Simulate Producer and Consumer problem using Semaphores
4. Simulate Bankers Algorithm for Dead Lock Avoidance
5. Simulate Bankers Algorithm for Dead Lock Prevention
6. Simulate the following page replacement algorithms:
   a) FIFO b) LRU c) LFU
7. Simulate the following File allocation strategies:
   a) Sequenced b) Indexed c) Linked

Part-A: UNIX Lab

8. **Study of Unix Commands:** General Purpose Utilities, Directory Handling Commands, File Handling Utilities, Displaying Commands, Filters, Disk Utilities
9. Shell Script to list all of the directory files in a directory.
10. Shell Script to find the factorial of a given number
11. Shell Script to generate a Multiplication table.
12. Shell Script to Perform arithmetic operations
13. Implement an AWK script to count the number of lines in a file that do not contain vowels
14. Design an awk script to find the number of characters, words and lines in a file?
15. Design a C program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen
16. Demonstration of GDB tool to understand process programme.
17. Design a C program to create a Zombie Process.
18. Design a C program that illustrates how an orphan is created.

Reference Books:

1. Operating System Concepts,AbrahamSilberschatz, ,Peter Baer Galvin,Greg Gagne, 9th Edition, John Wiley and Sons Inc., 2012
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2012
3. Modern Operating Systems, Andrew S. Tanenbaum, Third Edition, Addison Wesley,2007
4. M G venkateshmurthy Introduction to Unix and shell programming Pearson education
5. W. Richard Stevens, Advanced programming in the unix environment, 3rd EditionPearson education.

V Sem	**Technical Skills-III**	Course Code: V18CST62	L	T	P	C
			0	0	4	MNC

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Apply fundamental data structures like List, Stack to solve real work problems in linear time i.e. O(n). (K3)
CO2: Make use of advanced data structures like queue, to solve complex problems in linear time , logarithmic time i.e. O(n) or O(nlogn).(K3)
CO3: Develop programs to solve problems by with the help of searching and sorting techniques. (K3)
CO4: Analyze linked list by comparing with Array List and develop programs to solve optimization Problems. (K4)
CO5: Experiment with types of Linked List to solve complex combinatorial problems. (K3)
CO6: Develop programs to solve complex problems by using combination of stack, Queue and List. (K3)

Data Structures

1. Problem solving using ArrayList
2. Problem solving using LinkedList
3. Problem solving using Stack
4. Problem solving using Queue
5. Problem solving using Searching
6. Problem solving using Sorting

TEXT BOOKS:

1. Introduction to Algorithms, Second Edition, Thomas H. Cormen Charles E. Leiserson.
2. Data Structures and Algorithms Made Easy: Narasimha Karumanchi .
3. The Algorithm Design Manual, Springer series, Steven Skiena.

VI Sem	**Compiler Design**	Course Code: V18CST19	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the compilation process and lexical analyzer (K2)
CO2: Construct top down parsing Techniques (K3)
CO3: Construct bottom up parsing techniques (K3)
CO4: Construct syntax directed translation (K3)
CO5: Produce intermediate code generation process and run time environments (K3)
CO6: Explain the code generation process. (K2)

UNIT-I: Introduction: Language Processors, the Structure of a Compiler. **Lexical Analysis:** The Role of the Lexical Analyzer, Specification of Tokens, Recognition of Tokens and the Lexical-Analyzer Generator Lex.

UNIT-II: Syntax Analysis: Definition of CFG, Lexical Versus Syntactic Analysis, Writing a Grammar- Elimination of Left Recursion, Left Factoring. **Top Down Parsing:** Recursive Descent Parsing, First and Follow, LL(1) Grammars, Non recursive Predictive Parsing, Error Recovery in Predictive Parsing.

UNIT-III: Bottom-Up Parsing: Bottom Up Parser Classification, Reductions, Handle Pruning, Shift-Reducing, Conflicts During Shift Reduce Parsing. Introduction to LR Parsing: Difference between LR and LL Parsers, Why LR Parsers?, Items and the LR(0) automaton, The LR-Parsing Algorithm, Constructing SLR Parsing Tables

UNIT-IV: More powerful LR parsers: construction of CLR (1), LALR Parsing tables, Comparison of all Bottom Up approaches. Semantic Analysis: Syntax Directed Definitions, Evaluation Orders for SDD's, Applications of SDT.

UNIT-V: Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Control Flow, Back-patching. Run-Time Environments: Storage Organization, Stack Allocation of Space, Heap Management.

UNIT-VI: Code Generation: Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment. **Machine-Independent optimizations:** The Principal Sources of Optimizations, Introduction to Data-Flow Analysis.

.**TEXT BOOKS:**

1. Compilers, Principles Techniques and Tools- Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman,2nded, Pearson,2007

REFERENCE BOOKS:

1. Principles of compiler design, V. Raghavan, 2nd ed, TMH, 2011
2. Compiler Design, K. Muneeswaran, Oxford

VI Sem	**Data Mining**	Course Code: V18CST20	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain the concept of Data Mining and its functionalities (K2)
CO2: Discuss various Data Preprocessing Techniques (K3)
CO3: Demonstrate Association Analysis Techniques (K3)
CO4: Illustrate various Classification Techniques (K3)
CO5: Demonstrate Alternative techniques for Classification (K3)
CO6: Use different Clustering techniques to cluster data (K3)

UNIT-I : Introduction: Need for Data Mining, Knowledge Discovery from Data, Kinds of Data mined, Kinds of Patterns mined, Technologies used, Kinds of Applications targeted, Major Issues in Data Mining, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity

UNIT-II: Data Preprocessing: Overview of Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization

UNIT-III: Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Frequent Itemset Mining Methods- Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, Pattern-Growth Approach for Mining Frequent Itemsets

UNIT-IV: Classification: Basic Concepts, Decision Tree Induction, Attribute Selection Measures, Tree Pruning

UNIT-V: Bayes Classification Methods: Bayes' Theorem, Naive Bayesian Classification. **Bayesian Belief Networks:** Concepts and Mechanisms, Training Bayesian Belief Networks

UNIT-VI: Cluster Analysis: Basic Concepts and Methods, Partitioning Methods, Hierarchical Methods, Density Based Method-DBSCAN

Text Books:

1. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei,3rd Edition, Morgan Kaufmann Publishers

Reference Books:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, 1st Edition, Pearson Education.
2. Data Mining and Analysis,Mohammed J Zaki, Wagner Meira JR, 1st Edition ,Cambridge University Press.

VI Sem	**Object Oriented Analysis and Design Through UML**	Course Code: V18CST21	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss importance of modeling. [K2]
CO2: Describe classes and relationships. [K2]
CO3: Develop class diagrams and object diagrams. [K3]
CO4: Develop Interaction, Use case and Activity Diagrams. [K3]
CO5: Illustrate advanced behavioral modeling. [K3]
CO6: Develop component and deployment diagrams.[K3]

UNIT-I: Introduction to UML: Importance of modeling - Principles of modeling - Object oriented modeling - Conceptual model of the UML – Architecture - Software Development Life Cycle.

UNIT-II: Advanced Structural Modeling: Classes – Relationships - Common Mechanisms and diagrams - Advanced classes - Advanced relationships – Interfaces - Types and Roles – Packages.

UNIT-III: Class & Object Diagrams: Terms, concepts - Modeling techniques for Class Diagrams - Modeling techniques for Object Diagrams.

UNIT-IV: Basic Behavioral Modeling-I: Interactions - Interaction diagrams. **Basic Behavioral Modeling-II:** Use cases - Use case Diagrams - Activity Diagrams.

UNIT-V: Advanced Behavioral Modeling: Events and signals - State machines - Processes and Threads - Time and space - State chart diagrams.

UNIT-VI: Architectural Modeling: Component- Deployment - Component diagrams - Deployment diagrams.

TEXT BOOK:

1. The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

REFERENCE BOOKS:

1. UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEY-Dreamtech India Pvt. Ltd.
2. Fundamentals of Object Oriented Design in UML, Meilir Page-Jones, Pearson Education.
3. Modeling Software Systems Using UML2, Pascal Roques, WILEY-Dreamtech IndiaPvt. Ltd.

VI Sem	**Cryptography and Network Security**	Course Code: V18CST22	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the fundamentals of networks security, security architecture, threats and vulnerabilities (K2)
CO2: Discuss the mathematical support for both symmetric and asymmetric key cryptography (K2)
CO3: Discuss the concept of developing encryption and decryption algorithms (K2)
CO4: Illustrate various techniques of encryption and message authentication functions (K3)
CO5: Apply various Key management and Distribution techniques and its importance (K3)
CO6: Discuss the Need of Transport level and Email security algorithms (K2)

UNIT-I: Computer Security concepts, security services, and Active vs. Passive attacks, Security mechanisms, OSI Security Architecture, A Model for Network security, Classical Encryption Techniques, Substitution ciphers, Transposition ciphers.

UNIT-II: Introduction to Number Theory, Fermat's and Euler's Theorem, the Chinese Remainder Theorem, Euclidean Algorithm, and Modular Arithmetic.

UNIT-III: Block Ciphers, Data Encryption Standard (DES), Block Cipher Design Principles, Advanced Encryption Standard (AES), Simplified AES, Multiple Encryption and Triple DES, Pseudorandom Number Generators, Pseudorandom Number Generation Using a Block Cipher, Stream Ciphers, RC4.

UNIT-IV: RSA, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code-Message Authentication Functions, Requirements, and Security, HMAC, Hash functions, Secure Hash algorithm,SHA-512.

UNIT-V: Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, Key Management and Distribution, X.509 Digital Certificate, NIST Digital Signature Algorithm.

UNIT-VI: Transport Level Security: Web Security Considerations, Secure Socket Layer, Transport Layer Security.Electronic mail security: Pretty Good Privacy (PGP),S/MIME.

TEXT BOOKS:

1. "Cryptography and Network Security, Principles and Practices", William Stallings Pearson Education, Sixth Edition.
2. "Network Security Essentials (Applications and Standards)", William Stallings, Pearson Education Fourth Edition.
3. Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay, (3e) Mc Graw Hill.

REFERENCE BOOKS:

1. "Network Security – PrivateCommunication in a Public World" Charlie Kaufman, Radia Perlman and Mike Speciner , Pearson/PHI.

VI Sem	**Software Testing Methodologies (Elective-II)**	Course Code: V18CST23	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe Software testing objectives and methodology. (K2)
CO2: Apply various Software testing techniques. (K3)
CO3: Discuss Static testing techniques for software testing. (K2)
CO4: Differentiate software testing and debugging process. (K2)
CO5: Construct test cases by understanding test suite management. (K3)
CO6: Explain modern software testing tools to support software testing. (K2)

UNIT-I: Introduction to Software Testing: Evolution of software Testing, Myths and Facts, Goals of software Testing, Definitions of Testing, Model for Software Testing, Software Testing Terminology, Software Testing Life Cycle.

UNIT-II: Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, Verification of High level and low level designs, How to verify code, Validation. **Dynamic Testing I:** Black Box testing techniques: Boundary Value Analysis, Equivalence Class Testing, Decision Table based Testing,

UNIT-III: Dynamic Testing II: White-Box Testing: Need of White-Box Testing, Logic coverage criteria, Basis path testing, Loop testing. **Static Testing:** Inspections, Structured Walkthroughs, Technical reviews.

UNIT-IV: Regression Testing: Progressive Vs Regressive Testing, Regression testability, Objectives of regression testing, When is Regression Testing done? Regression Testing Types, Regression testing techniques. **Debugging:** Debugging process, Techniques, correcting bugs.

UNIT-V: Efficient Test Suite Management: Why does a Test Suite grow, minimizing the Test suite and its benefits, Test suite prioritization, Types of Test case prioritization, Prioritization techniques, measuring the effectiveness of a prioritized Test Suite.

UNIT-VI: Software Quality Management: Software quality concept, Quality control and Quality Assurance, Software Quality metrics. **Automation and Testing Tools:** Need for automation, categorization of Testing tools, selection of testing tools, Overview of some commercial testing tools.

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TEXT BOOKS:

1. Software Testing, Principles and Practices, Naresh Chauhan, 9th Edition, Oxford Publisher.

REFERENCE BOOKS:

1. Software testing techniques - Boris Beizer, 2nd Edition, Dreamtech publisher..
2. Foundations of Software testing, Aditya P Mathur, 2nd ed, Pearson.
3. Software Testing- Yogesh Singh, CAMBRIDGE.

VI Sem	**Principles of Programming Languages (Elective-II)**	Course Code: V18CST24	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe Syntax and Semantics of Programming Languages (K2).
CO2: Illustrate Data, Data Types and basic statements of Programming Languages (K3).
CO3: Explain various sub programming Issues (K2).
CO4: Construct programs using Object Oriented, Concurrency and Event Handling (K3).
CO5: Distinguish Programming Languages, schemes and ML (K2).
CO6: Describe Logic Programming Languages (K2).

UNIT I: SYNTAX AND SEMANTICS: Reasons for studying Programming Languages, Programming Domains, Evolution of programming languages, describing syntax, context free grammars, attribute grammars, describing semantics, lexical analysis, parsing, recursive – decent bottom – up parsing.

UNIT II: DATA TYPES AND BASIC STATEMENTS: Introduction, primitive data types, strings, array types, associative arrays, record types, tuple types , union types, pointers and references, Arithmetic expressions, overloaded operators, type conversions, relational and Boolean expressions, assignment statements , mixed mode assignments, control structures – selection, iterations, branching, guarded Statements.

UNIT III: SUBPROGRAMS AND IMPLEMENTATIONS: Subprograms, design issues, local referencing, parameter passing, overloaded methods, generic methods, design issues for functions, semantics of call and return, implementing simple subprograms, stack and dynamic local variables, nested subprograms, blocks, dynamic scoping.

UNIT IV: OBJECT- ORIENTED PROGRAMMING,EVENT HANDLING: Object Model – Classes, Visibility and Information Hiding, Inheritance, Polymorphism, Abstract Classes, Event Handling- Mouse Clicks, Mouse Motion, Buttons, Labels, Text areas, Combo boxes, Examples.

UNIT V: FUNCTIONAL PROGRAMMING LANGUAGES: Introduction to lambda calculus, fundamentals of functional programming languages, Programming with Scheme, – Programming with ML.

UNIT VI: LOGIC PROGRAMMING LANGUAGES: Introduction to logic and Horn Clauses, logic programming – Programming in Prolog, Prolog Examples-Solving Word Puzzles, Eight Queens Problem.

TEXT BOOKS

1. Concepts of Programming Languages, Robert W. Sebesta ,Tenth Edition, Addison Wesley, 2012.
2. Programming Languages, Principles & Paradigms, 2ed, Allen B Tucker, Robert E Noonan, TMH

REFERENCES

1. The Scheme programming language, R. Kent Dybvig, Fourth Edition, MIT Press, 2009.
2. Elements of ML programming, Jeffrey D. Ullman, Second Edition, Prentice Hall, 1998.
3. The craft of Prolog, Richard A. O'Keefe MIT Press, 2009.

VI Sem	**Machine Learning (Elective-II)**	Course Code: V18CST25	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate basics of Machine Learning.(K2)
CO2: Explain Various Classification Techniques.(K2)
CO3: Explain Tree Based Learning and Ensemble Learning (K2)
CO4: Demonstrate Neural Networks and Multi Layer Perceptrons. (K2)
CO5: Explain Multi Layer Perceptrons and Back Propagation (K2).
CO6: Demonstrate Dimensionality Reduction Techniques (K2).

Unit-I: Introduction: Learning: Machine Learning, Types Of Machine Learning, Supervised Learning, Regression, Classification, The Machine Learning Process. Some Terminology: Weight Space, The Curse Of Dimensionality. Knowing What You Know: Testing Machine Learning Algorithms, Over fitting, Training, Testing, And Validation Sets. Some Basic Statistics: Averages Variance And Covariance, The Bias-Variance Tradeoff.

UNIT II: Classification: The General Problem, Logistic Regression, K-Nearest Neighbor Classifiers, Support Vector Machines. Assessing Performance Of Classifiers: The Confusion Matrix, Accuracy, 0/1 Loss, Sensitivity And Specificity, The Receiver Operator Characteristic (Roc) Curve. Unbalanced Datasets Measurement: Precision, Recall And F1 Score.

UNIT-III: Ensemble Learning : Boosting, Adaboost, Stumping, Bagging , Subbagging, Random Forests.

UNIT-IV: Neural Networks: The Brain And The Neuron, Hebb's Rule, Mcculloch And Pitts Neurons, Limitations Of The Mcculloch And Pitts Neuron Model, Neural Networks, The Perceptron, The Learning Rate, The Bias Input The Perceptron Learning Algorithm, An Example Of Perceptron Learning: Logic Functions Implementation, Linear Separability, Linear Regression, Linear Regression Examples

UNIT-V: The Multi Layer Perceptron(MLP):Going Forwards, Going Backwards(Back Propagation of Errors), The MLP in practice, Examples of using the MLP: Classification and Regression, Deriving Back-Propagation.

UNIT-VI: Dimensionality Reduction: Linear Discriminant Analysis (LDA), Principal Components Analysis (PCA), Relation With The Multi-Layer Perceptron, Kernel PCA, Factor Analysis, Independent Components Analysis (ICA) Locally Linear Embedding.

TEXT BOOKS:

1. Machine Learning: An Algorithmic Approach.Stephen Marsland, 2nd Edition, CRC Press.
2. A First Course in Machine Learning; Volume in Machine Learning and Pattern Recognition Series – CRC-Taylor & Francis-Chapman & Hall Rogers S., Girolami M., (2011).

REFERENCE BOOKS:

1. Machine Learning: The art and Science of Algorithms that Make sense of Data. Peter Flach, Cambridge, First Edition, 2012.
2. Machine Learning: Tom Mitchel, McGraw Hill Learning, 1997

VI Sem	**Image Processing (Elective-II)**	Course Code: V18CST26	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Illustrate the different Transforms Techniques & their use in Image Processing applications (K3).
CO2: Demonstrate Spatial & frequency domain filtering (like smoothing & sharpening operations) on Images (K3).
CO3: Describe Restoration operations/techniques on Images (K2).
CO4: Demonstrate the Image compression Techniques and multi-resolution processing on Images (K3).
CO5: Illustrate Morphological operations on Images & Image segmentation (K3).
CO6: Illustrate the different color Image Processing Techniques on Images (K3).

UNIT-I : Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. **Image Transforms:** Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform.

UNIT-II: Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters. **Filtering in the Frequency Domain:** Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

UNIT-III: Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering ,geometric mean filter .

UNIT-IV: Image compression: Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-Length coding, Bit-Plane coding. **Wavelets and Multiresolution Processing:** Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT-V: Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. **Morphological Image Processing:** Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology.

UNIT-VI: Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

TEXT BOOKS:

1. Digital Image Processing, R. C. Gonzalez and R. E. Woods, 3rd edition, Prentice Hall, 2008.
2. Digital Image Processing, Jayaraman, S. Esakkirajan, and T. Veerakumar, Tata McGraw-Hill Education, 2011.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing, Anil K.Jain, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. Digital Image Processing and Analysis, B.Chanda, D.Dutta Majumder, PHI, 2009.

VI Sem	**Object Oriented Analysis and Design Through UML Lab**	Course Code: V18CSL08	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Develop OOAD and UML concepts to identify Classes, Use Cases and their relationships (K3).
CO2: Develop Class diagrams (K3).
CO3: Develop Use case diagrams (K3).
CO4: Construct Interaction diagrams (K3).
CO5: Develop State chart, Activity diagrams (K3).
CO6: Develop Component and Deployment diagrams (K3).

List of Experiments

1. Draw basic class diagrams to identify and describe key concepts like classes, and their relationships.
2. Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include template showing description and steps of the Use Case for various scenarios.
3. Draw sequence diagrams OR communication diagrams with advanced notation for system to show objects and their message exchanges.
4. Draw activity diagrams to display either business flows or like flow charts.
5. Develop State chart diagrams.
6. Draw component diagrams assuming that build the system reusing existing components along with a few new ones.
7. Draw deployment diagrams to model the runtime architecture of system.
8. Design Case study on Library Management System
9. Design Case Study on Hospital Management System
10. Case study-Railway Reservation System
11. Design Case study on Library Management System using C4 Model.

TEXT BOOKS:

1. The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

.

REFERENCE BOOKS:

1. UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEY-Dreamtech India Pvt. Ltd.
2. Fundamentals of Object Oriented Design in UML, Meilir Page-Jones, Pearson Education.
3. Modeling Software Systems Using UML2, Pascal Roques, WILEY- Dreamtech India Pvt. Ltd.
4. (https://c4model.com/)

VI Sem	**Data Mining Lab**	Course Code: V18CSL09	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate Data Preprocessing techniques.(K3)
CO2: Demonstrate Association Rule Mining techniques.(K3)
CO3: Demonstrate Classification techniques. (K3)
CO4: Demonstrate the Clustering techniques. (K3)

List of Experiments (Using Weka Tool):

1. Demonstrate Data Preprocessing on predefined Weka dataset labor.arff
2. Create a student.arff dataset and Demonstrate Data Preprocessing on it
3. Demonstrate Association rule process on predefined Weka dataset contactlenses.arff using apriori algorithm.
4. Create an employee.arff dataset and demonstrate Association rule process on it using apriori algorithm
5. Demonstrate Classification process on student.arff dataset using j48 algorithm
6. Create a customer.arff dataset and demonstrate Classification process on it using j48 algorithm
7. Demonstrate Classification process on employee.arff dataset using id3 algorithm
8. Demonstrate Classification process on employee.arff dataset using Naïve Bayes algorithm
9. Demonstrate Clustering process on predefined Weka dataset iris.arff using simple k-means algorithm.
10. Demonstrate Clustering process on dataset student.arff using simple k- means algorithm.

Reference Books:

1. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank, Mark A. Hall, 3rd Edition, Morgan Kaufmann Publishers
2. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann Publishers
3. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, 1st Edition, Pearson Education Inc.

VI Sem	**Technical Skills-IV**	Course Code: V18CST63	L	T	P	C
			0	0	4	MNC

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate java fundamentals to solve real world computational problems. (K2)
CO2: Illustrate object orientated concepts in solving problems with reusability feature. (K2)
CO3: Apply collections on java to solve complex problems in linear time. (K3)
CO4: Make use of StringBuffer and StringBuilder to solve problems in linear and logarithmic time. (K3)
CO5: Experiment with Object Oriented concepts toreduce complexity of problems.(K3)
CO6: Develop programs to solve robust programs by using Exception Handling. (K3)

Java Programming

1. Problem solving using Control Statements
2. Problem solving using Arrays
3. Problem solving using Strings ,StringBuffer, StringBuilder
4. Problem solving using OOP Concepts
5. Problem solving using Inheritance
6. Problem solving using Polymorphism
7. Problem solving Collections (includes all)
8. Problem solving using Exception Handling

TEXT BOOKS:

1. Thinking on Java - O'Reilly.
2. Java Complete Reference.
3. Effective Java. Third Edition. Joshua Bloch

Annexure - II(b)

Approved Syllabi for the courses offered in V & VI semesters B. Tech(ECE) under V18 Regulation

V Sem	**Introduction to Data Structures**	Course Code: V18CST81	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain Sorting and searching techniques. (k2)
CO2: Demonstrate algorithm notations. (K2)
CO3: Develop Singly Linked Lists, Double Linked List. **(K3)**
CO4: Interpret the Basic Concepts in Data Structures, Stacks and Queues **(K3)**
CO5: Develop Binary trees and BST **(K3)**
CO6: Develop various graph algorithms. **(K3**)

Unit I: Sorting: Bubble sort, Insertion sort, selection sort, quick sort, merge sort, heap sort, radix sort. Searching: linear search, binary search. Introduction to hashing, hash functions.

Unit II: Introduction to data structures – Basic terminology, classification of data structures, operation on data structures, ADT. **Arrays**: Representation of arrays - polynomial representation, addition of two polynomials, sparse representation, transpose of sparse matrix. (**Refer Reference Text book 1**)

Unit III: Linked list: Introduction, **single linked list** Representation of node, operations on single linked list, reverses the linked list. **Double linked list**: operations (insert delete and display). **Circular linked List** and its operations (create and display single circular linked list).

Unit IV: Stacks introduction, array representation, operations, linked list representation, operation on linked stacks, infix to postfix conversion, evolution of arithmetic expression. **Queues** Introduction, Array representation, operations linked list representation, linked queue operations, circular queues.

Unit V: Trees: Introduction, Terminology, Representation of Trees, types of trees, **Binary Trees:** Properties of Binary Tress, creating a binary tree from general tree, Tree Traversals. **Binary Search Tree:** introduction, creation, insertion, delete, display and search operations.

Unit VI: Graphs: introduction, Terminology, directed graphs, Graph Representation, **Graph Traversal techniques**: Depth First Search, Breadth First Search. **Spanning Trees**: Krushkal's Algorithm, Prim's algorithm.

TEXT BOOKS:

1. Data Structures using C by Reema Thareja, Second Edition, oxford publications.
2. Data Structures, algorithms and applications in C++, Sartaj Sahni, Universities press, Second Edition.

REFERENCE BOOKS:

1. Fundamentals of Data Structures and algorithms by C V Sastry, Rakesh Nayak, Ch. Raja Ramesh, Distributed by Wiley publications, new Delhi.
2. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, 2nd Edition, Universities Press (India) Pvt. Ltd.
3. An Introduction to Data Structures with Application, Jean-Paul Tremblay , Paul Sorenson, Second Edition.
4. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
5. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

V Sem	**Data Structures and Algorithms Lab**	Course Code: V18CSL34	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Construct Sorting and searching methods. (K3)
CO2: Construct hash table (K3)
CO3: Implement programs using Singly Linked Lists, Double Linked List. (K3)
CO4: Construct Stacks, Queues and Applications. (K3)
CO5: Construct Binary search tree (K3)
CO6: Implement various graph Traversal algorithm. (K3)

List of Experiments

1. Implement the following sorting techniques
   (a)Selection sort (b) Quick sort (c) Merge sort
2. Implement the following searching methods
   (a)Linear search (b) Binary search.
3. Implement hash table and its operations.(Note: Use at least one collision resolution technique)
4. Implement addition of two polynomials. (Using arrays).
5. Implement single linked list and its operations. (create, insert, delete, display, reverse list)
6. Implement double linked list and its operations.
7. Implement stack operations using arrays.
8. Implement queue operations using arrays.
9. Develop a Program to convert infix expression to postfix expression.
10. Develop a Program to implement Binary search Tree and its operations.
11. Implement Depth First Search for traverse a given graph.
12. Implement Breadth First Search for traverse a given graph.

TEXT BOOKS:

1. Data Structures, algorithms and applications in C++, Sartaj Sahni, Universities press, Second Edition.
2. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, 2nd Edition, Universities Press (India) Pvt. Ltd.

REFERENCE BOOKS:

1. An Introduction to Data Structures with Application, Jean-Paul Tremblay , Paul Sorenson, Second Edition.
2. Fundamentals of Data Structures and algorithms by C V Sastry, Rakesh Nayak, Ch. Raja Ramesh, IK Publications, new Delhi.
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
4. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

VI Sem	**Computer Networks**	Course Code: V18CST11	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss fundamentals of network concepts and Reference Models.(K2)
CO2: Discuss Communication media and switching techniques.(K2)
CO3: Demonstrate Error control and protocols.(K3)
CO4: Apply Routing algorithms and congestion control algorithms.(K3)
CO5: Discuss Transport layer services and protocols. (K2)
CO6: Describe Application layer protocols.(K2)

UNIT-I: Introduction: Reference models: The OSI Reference Model- the TCP/IP Reference Model, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

UNIT– II: Physical Layer: Transmission Media, Multiplexing: FDM, WDM and TDM- LAN Technologies, introduction to switching: Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT–III: Data link layer: Design issues, Framing, Flow control, error control, error detection and correction, CRC, Checksum: idea, one's complement internet checksum, MAC: ALOHA, CSMA. Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, HDLC, point to point protocol (PPP).Piggybacking.

UNIT-IV : Network Layer : Network layer design issues- Algorithm shortest path routing, Flooding, Hierarchical routing, Broad cast, Multi cast Routing algorithms-Congestion control and algorithms, Internet Protocol (IP) Addresses, Subnet masking

UNIT–V :Transport Layer: Services, Primitives and sockets, Elements of transport protocols, Internet Transport protocols(TCP,UDP,RPC,RTTP/RTP,RTCP) Segment headers, Primitives, Control, Congestion control, Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT–VI: Application Layer: DNS, SMTP, POP,FTP HTTP Presentation formatting. Network security: Introduction to Cryptography, Authentication, Basics of Public key and private key cryptography, digital signatures and certificates firewalls and wireless security.

TEXT BOOKS:

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan.Third Edition TMH

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

VI Sem	**Computer Networks Lab**	Course Code: V18CSL35	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Implement Error detection techniques **[K3]**

CO2: Implement Routing Algorithms **[K3]**

CO3: Implement Congestion Algorithms [K3]

CO4: Implement Sliding Window Algorithms. **[K3]**

CO5: Implement socket programming **[K3]**

List of Experiments:

From 1-4 simulation and 5-11 implement using C/C++/Java/Python

1. Study of basic network commands and Network configuration commands.
2. Implementation of Bit Stuffing
3. Implementation of Character Stuffing
4. Implementation of Dijkstra's algorithm
5. Implementation Distance vector algorithm
6. Construct Detecting error using CRC-CCITT
7. Implementation of stop and wait protocol
8. Implementation of Congestion control using leaky bucket algorithms
9. Implementation using Socket TCP both client and server programs.
10. Implementation using Socket UDP both client and server programs

TEXT BOOKS:

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan.Third Edition TMH

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

V Sem	**Python Programming Lab**	Course Code: V18CSL05	L	T	P
			0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate Basic Python Programs (K3)
CO2: Construct control structures in python (K3)
CO3: Demonstrate functions and packages. (K3)
CO4: Construct python programs using structured data types. (K3)
CO5: Demonstrate Text Files (K3)

Syllabus

Basics of python programming: Features of python – History of Python - The Future of Python installation and execution - Data types – Identifiers - variables – type conversions- Literal Constants – Numbers – Strings. I/O statements. Operators and expressions, operator precedence – expression evaluation.

Exercise 1 - Basics

a) A sample Python Script using command prompt, Python Command Line and IDLE
b) A program to purposefully raise an Indentation Error and correct it

Exercise 2 - Operations

a) A program to compute distance between two points taking input from the user (Pythagorean Theorem)
b) A program on add.py that takes 2 numbers as command line arguments and prints its sum.

Decision Control statements: conditional (if), alternative (if-else), chained conditional (if-elif-else); **Iteration:** while loop, for loop, nested for loop, range function, break, continue and pass statements.

Exercise - 3 Control Flow

a) A Program to implement for checking whether the given number is a even number or not.
b) A program to construct reverse the digits of a given number and add it to the original, If the sum is not a palindrome repeat this procedure.
c) A program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow – Continued

a) A program to construct the following pattern, using a nested for loop.

```
*
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Functions and modules : Introduction - Function Definition - Function Call – argument types- Scope and Lifetime - The return statement - More on Defining Functions - Lambda Functions or Anonymous Functions.

Exercise - 5 – Problem Solving using Functions
a) Find mean, median, mode for the given set of numbers passed as arguments to a function
b) Develop a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
c) Develop a Recursive Function to find the Factorial of a given number .
d) Develop function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Lists: list operations, list slices, list methods, mutability, cloning lists, list parameters. **Tuples**: tuple assignment, tuple as return value. **Set:** Set Creation, Set Operations. **Dictionaries**: Creation, operations; comprehension, operations on strings.

Exercise - 6 Structured Data types
a) a program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
b) a program to develop unzip a list of tuples into individual lists and convert them into dictionary.

Exercise – 7 Structured Data types Continued
a) A program to count the numbers of characters in the string and store them in a dictionary data structure
b) a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Documentation Strings- Modules – Packages

Exercise - 8– Modules
a) Install packages requests, flask and explore them using (pip)
b) A program to implement a script that imports requests and fetch content from the page. Eg. (Wiki)
c) Develop a simple script that serves a simple HTTP Response and a simple HTML Page

Introduction - Types of files - Text files - reading and writing files

Exercise - 9 Files
a) a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
b) a program to compute the number of characters, words and lines in a file.

Classes, Methods, Constructor, Inheritance, Overriding Methods, Data hiding

Exercise - 10 OOP
a) Class variables and instance variable and illustration of self variable
i) Robot
ii) ATM Machine

Annexure III

List of Open Elective -I courses offered in VI semester under V18 Regulation for all other branches:

S.No.	Course Code	Name of the Course
1.	V18CSTOE01	Data Base Management Systems
2.	V18CSTOE02	Software Engineering
3.	V18CSTOE03	Python Programming

Approved Syllabi for the Courses offered under Open Elective – I

VI Sem	**Database Management Systems**	Course Code: V18CSTOE01	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate Database Systems, various Data Models and Database Architecture. (K2)
CO2: Apply ER Modeling to Design Relational Databases for Real Time Applications. (K3)
CO3: Apply SQL Constructs to Perform Database Operations. (K3)
CO4: Apply Normalization Techniques to Refine Schema. (K3)
CO5: Explain Transaction Management and Concurrency Control. (K2)
CO6: Experiment with various database indexing techniques. (K3)

UNIT-I: An Overview of Database Systems: Managing Data, File Systems verses DBMS, Advantages of DBMS, Data Independence. **Database System Architecture:** Three Levels of Architecture, External Level, Conceptual Level, Internal Level, Structure of DBMS, The Database Management Systems and Client/Server Architecture.

UNIT-II: Database Design: The E/R Models, Database Design and Er Diagrams, Entities, Attributes, Entity Sets, Relationships and Relationship Sets, Conceptual Design with ER Models. **Relational Model:** Integrity Constraints Over Relations, Key Constraints ,Foreign Key Constraints, General Constraints, Relational Algebra- Selection and Projection, Set Operation, Renaming, Joins, Division, Relational Calculus- Tuple Relational Calculus, Domain Relational Calculus.

UNIT-III: SQL Queries, Constraints and Triggers: The Form of Basic SQL Query, Union, Intersect, Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

UNIT-IV: Schema Refinement (Normalization): Purpose of Normalization or Schema Refinement, Concept of Functional Dependency, Normal Forms based on Functional Dependency (1NF, 2NF and 3NF), Concept of Surrogate Key, Boyce-Codd Normal Form (BCNF), Lossless Join and Dependency Preserving Decomposition, Fourth Normal Form(4NF).

UNIT-V:Transaction Management: Transaction, Properties of Transactions, Transaction Log, and Transaction Management with SQL Commit, Rollback and Savepoint. Concurrency Control: Concurrency Control for Lost Updates, Uncommitted Data, Inconsistent Retrievals and the Scheduler. **Concurrency Control with Locking Methods :** Lock Granularity, Lock Types, Two Phase Locking for Ensuring Serializability, Deadlocks, Concurrency Control with Time Stamp Ordering, Transaction Recovery.

UNIT-VI: Storage and Indexing: Overview of Storages and Indexing, Data on External Storage, File Organization and Indexing, Clustered Indexing, Primary and Secondary Indexes, Index Data Structures, Hash based Indexing, Tree based Indexing, Comparison of File Organization.

TEXT BOOKS:

1. Introduction to Databse Systems, CJ Date,8th Edition, Pearson Education.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition TATA McGraw Hill.

REFERENCE BOOKS:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition, Course Technology.
2. Fundamentals of Database Systems, ElmasriNavrate , 7th Edition, Pearson Education.
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom, 2nd Edition, Pearson.

VI Sem	**SOFTWARE ENGINEERING**	Course Code: V18CSTOE02	L	T	P
			3	0	0

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate Software Process Models. (K3)
CO2: Illustrate Requirement Engineering Process. (K3)
CO3: Discuss Software architecture and Design. (K2)
CO4: Apply Coding principles and Testing techniques. (K3)
CO5: Discuss Software Estimation and Maintenance. (K2)
CO6: Describe Quality Management and Metrics. (K2)

UNIT-I: The Nature of Software: Defining Software, Software application Domains, Legacy software, Software engineering, Software Myths. **Software Process:** Process and project, Component software process, Software development process models: Waterfall model, Prototyping, Iterative development, Unified process, Time boxing model, Extreme programming and agile process. Merits and Demerits of Software Process Models.

UNIT-II: Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the Software requirements document.**Requirements engineering process:** Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

UNIT-III : Software Architecture: Role of software architecture, Architecture views, components and connector view, architecture styles for C & C view, documenting architecture design, evaluating architectures. **Design:** Design concepts, Function-oriented design, Object oriented design, Detailed design.

UNIT-IV: Coding and Testing: Programming principles and guidelines, incrementally developing code, managing evolving code. Testing concepts, Testing process, Black-box testing, White-box testing.
Risk management: Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, RMMM Plan.

UNIT-V: Software Project estimation: Decomposition techniques, Empirical Estimation Models. **Software Maintenance:** Maintenance Process, Maintenance Models, Reverse Engineering, Reengineering, Configuration Management

UNIT-VI: Metrics for Process and Products: Software Measurement, Metrics for software quality.
Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, SEI-CMM Model, Six Sigma and ISO 9000 quality standards.

Text Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 7th Edition, McGrawHill International Edition.
2. Software Engineering- Ian Sommerville, 9th Edition, Pearson education.

Reference Books:

1. Software Engineering, A Precise approach, PankajJalote, Wiley
2. Software Engineering principles and practice, W S Jawadekar, 3rd Edition,TMH.

VI Sem	**PYTHON PROGRAMMING**	Course Code: V18CSTOE03	L	T	P
			3	0	0

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Illustrate basic concepts of Python Programming (K2)
CO2: Describe control structures in python (K2)
CO3: Demonstrate functions and packages. (K3)
CO4: Construct python programs using structured data types. (k3)
CO5: Compare TextFiles and Binary Files (K4)
CO6: Apply OOPs concepts to Develop Test cases (K3)

UNIT-I: INTRODUCTION TO PYTHON, DATA TYPES & OPERATORS :Basics of python programming: Features of python – History of Python - The Future of Python installation and execution - Data types – Identifiers - variables – type conversions- Literal Constants – Numbers – Strings. I/O statements. Operators and expressions, operator precedence – expression evaluation.

UNIT-II: Control Structures: Decision Control statements: conditional (if), alternative (if-else), chained conditional (if-elif-else); **Iteration:** while loop, for loop, nested for loop, range function, break, continue and pass statements.

UNIT-III Functions: Functions and modules: Introduction - Function Declaration &Definition - Function Call – Variable Scope and Lifetime -The return statement-More on Defining Functions - Lambda Functions or Anonymous Functions - Documentation Strings- Modules – Packages.

UNIT-IV Structured Data Types: Lists: list operations, list slices, list methods, cloning lists, list parameters. **Tuples**: tuple assignment, tuple as return value. **Set:** Set Creation, Set Operations. **Dictionaries**: Creation, operations; comprehension, operations on strings.

UNIT-V Files & Exception Handling: Introduction - Types of files - Text files - reading and writing files; Errors and exceptions handling.

UNIT-VI OOPS concepts and Testing Basics: Classes, Methods, Constructor, Inheritance, Overriding Methods, Data hiding, GUI programming with TKINTER.

Text Books:

1. "Python Programming using problem solving Approach" ReemaThareja, Oxford University Press – 2017.
2. Python with Machine Learning by "A.Krishna Mohan, Karunakar & T.Murali Mohan" by S. Chand Publisher

Reference Books:

1. Think Python: How to Think Like a Computer Scientist‘‘,Allen B. Downey, 2nd edition, Updated for Python 3, Shroff /O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)
2. An Introduction to Python – Revised and updated for Python 3.2, Guido van Rossum and Fred L. Drake Jr Network Theory Ltd., 2011.
3. Introduction to Computation and Programming Using Python‘‘,John V Guttag ,Revised and expanded Edition, MIT Press , 2013
4. Introduction to Programming in Python, Robert Sedgewick, Kevin Wayne, Robert Dondero, 1st Edition Pearson -2016

Annexure –IV

Approved Course Structure for the courses offered in III and IV Semesters of B.Tech(CST) Programme under V18 Regulation

S.No.	III - Semester						
	Course Code		Course	L	T	P	C
1	V18MAT04	BSC	Probability & Statistics	3	1	0	4
2	V18ECT06	ESC	Digital Electronics	3	0	0	3
3	V18CST02	PCC	Data Structures and Algorithms	3	0	0	3
4	V18CST03	ESC	Discrete Mathematics	3	0	0	3
5	V18CST04	ESC	Object Oriented Programming for problem Solving	3	0	0	3
6	V18ECL04	ESC	Digital Electronics Lab	0	0	2	1
7	V18CSL02	PCC	Data Structures and Algorithms Lab	0	0	3	1.5
8	V18CSL03	ESC	Object Oriented Programming for problem Solving Lab	0	0	3	1.5
9	V18ENT03		Professional Communication Skills – I	3	0	0	MNC
10	V18CST60		**Technical Skills-I**	4	0	0	MNC
Total Contact Hours: 31				**22**	**1**	**8**	**20**

IV - Semester							
S.No	**Course Code**		**Course**	**L**	**T**	**P**	**C**
1	V18CST05	PCC	Computer Organization	3	0	0	3
2	V18CST06	PCC	Software Engineering	3	0	0	3
3	V18CST07	PCC	Formal Languages and Automata Theory	3	0	0	3
4	V18CST08	PCC	Java Programming	3	0	0	3
	V18CST09	PCC	Python Programming	3	0	0	3
5	V18MBET51	HSS	Managerial Economics and Financial Accountancy	3	0	0	3
6	V18CSL04	PCC	Java Programming Lab	0	0	3	1.5
7	V18CSL05	PCC	Python Programming Lab	0	0	3	1.5
8	V18ENT11		Constitution of India	2	0	0	MNC
9	V18ENT04		Professional Communication Skills – II	3	0	0	MNC
10	V18CST61		**Technical Skills-II**	4	0	0	MNC
Total Contact Hours: 33				**27**	**0**	**6**	**21**

Annexure –V

B.Tech(Hons) -Data Science course structure and Syllabus

List of NPTEL based courses recommended for B.Tech(Hons) in Data Science

S.No.	Course Code	Course	NPTEL Course ID	NPTEL Relevant Course*	Course Duration (Weeks)	Credits
1	V18CSH01	Introduction to Data Science	106106212	Python for Data Science	4	2
2	V18CSH02	Artificial Intelligence	106106126	Artificial Intelligence Search Methods for Problem Solving	12	4
3	V18CSH03	Machine Learning	106106139	Introduction to Machine Learning	12	4
4	V18CSH04	Deep Learning	106105215	Deep Learning	12	4
5	V18CSMPH	Mini Project	-	-	-	4

***Will be updated in every semester as per the courses offered by NPTEL.**

The institution is offering honors degree in **"Data Science"** under V18 regulation. The rules and regulations, eligibility, evaluation process is as follows:

Rules &Regulations:

- A student will be eligible to get Under Graduate degree with Honors, if he/she completes additional 18-20 credits.
- A student can register after satisfying the eligibility criteria.
- The main objective of Honors degree is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. Programme.

Eligibility:

- Students should have a CGPA of 8.0 or above till III SEM and without any backlogs
- Students aspiring for Honors degree must register in V semester only.
- Student may register for mini project from V semester onwards and complete the same before VIII semester.

Course Details:

- In order to earn a Honors degree in his/her discipline, a student has to earn 18-20 extra credits (Four advanced courses – 14 credits and mini project - 4 credits in the concerned branch of Engineering).
- He/she can study equivalent NPTEL courses available in SWAYAM portal ie. https://swayam.gov.in/with prior approval from the department.
- The complete details are mention in **(Appendix-I)**
- The mini project shall be evaluated by the committee, which consists of Head of the department, Course Incharge and senior faculty of the department.
- The credits will be awarded for each course only after submission of required documents as Proof of Completion (NPTEL).

Syllabi for the courses offered in B. Tech(Hons.) – Data Science Course under V18 Regulation

Course Code: V18CSH01	**Introduction to Data Science**	L	T	P	C
		3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate the data science workflow. (K2)
CO2: Make use of Exploratory Data Analysis and the Data Science Process. (K3)
CO3: Experiment with Ndarray manipulation using NumPy library. (K3)
CO4: Apply various operations on paneled data. (K3)
CO5: Build visualizations on data using matlplotlib and seaborn libraries. (K3)
CO6: Build regression and classification models. (K3)

UNIT-I: Introduction: Introduction to Data Science, Roles exist in Data Science, Data science workflow, Tools and approaches data scientists use to analyze data. Define a problem and identify appropriate data sets using the data science workflow.

UNIT-II: Statistics Fundamentals: Exploratory Data Analysis and the Data Science Process, Analyze datasets using basic summary statistics: mean, median, mode, max, min, quartile, Inter quartile range, variance, standard deviation and correlation.

UNIT-III: The Numpy Library: NumPy installation, Ndarray, Basic operations, Indexing, Slicing, Iterating an array, Conditions and Boolean arrays, Shape manipulation and Array manipulation, Copies or Views of objects, Vectorization, Broadcasting, Structured arrays, Reading and Writing array data on files.

UNIT-IV: The Pandas Library: Installation, Introduction to pandas data structures – The series, The DataFrame, The index Objects. Other functionalities on indexes, Operation between data structures, Function application and mapping, Sorting and Ranking, "Not a number" data, Hierarchical indexing and leveling.

UNIT-V: Data Visualization using matplotlib and seaborn: Scatter plots, Scatter matrix, Line graph, Box blots, and Histograms. Identify a normal distribution within a dataset using summary statistics and visualization. Causation vs. Correlation. Test a hypothesis with a sample case study, Validate your findings using statistical analysis.

UNIT-VI: Foundations of Data Modeling: Introduction Regression – Categorical variables versus Continuous variables, linear regression, Build the linear regression model using a dataset and evaluate. Introduction to Classification - define classification model, apply k-NN and Decision trees. Build the classification model using a dataset and evaluate.

TEXT BOOKS:

1. The Art of Data Science, A Guide for Anyone Who Works with Data Roger D.Peng and Elizabeth Matsui.
2. Python Data Analytics, Fabio Nelli, Second edition, Apress
3. Data Science for Business, Foster Provost, Tom Fawcett, O'reilly

REFERENCE BOOKS:

1. Mining of Massive Datasets, JureLeskovek, AnandRajaraman and Jeffrey Ullman. Cambridge University Press. 2014.
2. Machine Learning: A Probabilistic Perspective.Kevin P. Murphy, MIT Press, 2013.
3. Python for Data Science for Dummies, Luca Massaron and John Paul Mueller, John Wiley and Sons, 2015.

Course Code: V18CSH02	**Artificial Intelligence**	L	T	P	C
		3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Illustrate the concept of intelligent systems and current trends in AI. (K2)
CO2: Apply Problem solving, Problem reduction and Game Playing techniques in AI. (K3)
CO3: Illustrate the Logic concepts in AI. (K2)
CO4: Explain the Knowledge representation techniques in AI. (K2)
CO5: Describe Expert systems and their applications. (K2)
CO6: Illustrate Uncertainty Measures. (K2)

UNIT-I: Introduction to Artificial Intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, current trends in AI

UNIT-II: Problem solving: State-space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of problem, Exhaustive searches, Heuristic search techniques, Iterative deepening a*, constraint satisfaction
Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games

UNIT-III: Logic concepts: Introduction, Propositional Calculus, Proportional Logic, Natural Deduction system, Axiomatic system, Semantic tableau system in proportional logic, Resolution Refutation in Propositional logic, Predicate Logic

UNIT-IV: Knowledge representation: Introduction, approaches to Knowledge representation, Knowledge representation using Semantic Networks, Extended Semantic Networks for KR, Knowledge representation using Frames

UNIT-V: Expert Systems and Applications: Introduction phases in building Expert Systems, Expert System versus Traditional Systems, Rule-based Expert Systems, Blackboard systems, Truth maintenance systems, applications of Expert Systems.

UNIT-VI: Uncertainty measure: Probability theory- Introduction, Probability Theory, Bayesian Belief networks, Certainty Factor Theory, Dempster-Shafer theory

Text Book:

2. Artificial Intelligence, Saroj Kaushik, 1st Edition, Cengage Learning.

Reference Books:

3. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B Nair, 3rd Edition, Tata McGraw Hill Education Private Limited., 2009
4. Artificial Intelligence- A modern Approach, 3rd Edition, Stuart Russel, Peter Norvig, Pearson Education.

Course Code: V18CSH03	**Machine Learning**	L	T	P	C
		3	0	0	3

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate basics of Machine Learning.(K2)
CO2: Explain Various Classification Techniques.(K2)
CO3: Explain Tree Based Learning and Ensemble Learning (K2)
CO4: Demonstrate Neural Networks and Multi Layer Perceptrons. (K2)
CO5: Explain Multi Layer Perceptrons and Back Propagation (K2).
CO6: Demonstrate Dimensionality Reduction Techniques (K2).

Unit-I: Introduction: Learning: Machine Learning, Types Of Machine Learning, Supervised Learning, Regression, Classification, The Machine Learning Process. Some Terminology: Weight Space, The Curse Of Dimensionality. Knowing What You Know: Testing Machine Learning Algorithms, Over fitting, Training, Testing, And Validation Sets. Some Basic Statistics: Averages Variance And Covariance, The Bias-Variance Tradeoff.

UNIT II: Classification: The General Problem, Logistic Regression, K-Nearest Neighbor Classifiers, Support Vector Machines. Assessing Performance Of Classifiers: The Confusion Matrix, Accuracy, 0/1 Loss, Sensitivity And Specificity, The Receiver Operator Characteristic (Roc) Curve. Unbalanced Datasets Measurement: Precision, Recall And F1 Score.

UNIT-III: Ensemble Learning : Boosting, Adaboost, Stumping, Bagging , Subbagging, Random Forests.

UNIT-IV: Neural Networks: The Brain And The Neuron, Hebb's Rule, Mcculloch And Pitts Neurons, Limitations Of The Mcculloch And Pitts Neuron Model, Neural Networks, The Perceptron, The Learning Rate, The Bias Input The Perceptron Learning Algorithm, An Example Of Perceptron Learning: Logic Functions Implementation, Linear Separability, Linear Regression, Linear Regression Examples

UNIT-V: The Multi Layer Perceptron(MLP):Going Forwards, Going Backwards(Back Propagation of Errors), The MLP in practice, Examples of using the MLP: Classification and Regression, Deriving Back-Propagation.

UNIT-VI: Dimensionality Reduction: Linear Discriminant Analysis (LDA), Principal Components Analysis (PCA), Relation With The Multi-Layer Perceptron, Kernel PCA, Factor Analysis, Independent Components Analysis (ICA) Locally Linear Embedding.

TEXT BOOKS:

1. Machine Learning: An Algorithmic Approach.Stephen Marsland, 2nd Edition, CRC Press.
2. A First Course in Machine Learning; Volume in Machine Learning and Pattern Recognition Series – CRC-Taylor & Francis-Chapman & Hall Rogers S., Girolami M., (2011).

REFERENCE BOOKS:

1. Machine Learning: The art and Science of Algorithms that Make sense of Data. Peter Flach, Cambridge, First Edition, 2012.
2. Machine Learning: Tom Mitchel, McGraw Hill Learning, 1997

Course Code: V18CSH04	**Deep Learning**	L	T	P	C
		3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the mathematical foundation of neural network. (K2)
CO2: Describe the machine learning basics. (K2)
CO3: Discuss the overfitting problem and ways to overcome it. (K2)
CO4: Discuss various optimization techniques. (K2)
CO5: Develop a convolutional neural network model. (K3)
CO6: Develop RNN and LSTM models. (K3)

UNIT-I: Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis. Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

UNIT –II: Machine Learning: Basics, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

UNIT-III: Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier.

UNIT-IV: Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT-V: Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

UNIT-VI: Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

1. TEXT BOOKS:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, First Edition, 2016.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

2. REFERENCE BOOKS:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligencealgorithms, Nikhil Buduma, O'Reilly, Shroff Publishers, First Edition, 2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers, 2019.