Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE

Syllabus

for

S. Y. B. Sc. (Computer Science)

[Pattern 2019]

(B.Sc. Semester-III and Semester-IV)

From Academic Year

2020-2021

Deccan Education Society's
Fergusson College (Autonomous), Pune

S.Y. B.Sc. ComputerScience(Pattern 2019)

From academic year2020-21

Particulars	Name of Paper	Paper Code	Title of Paper	No. of Credits
S.Y. B.Sc. Semester III	Theory Paper - 1	CSC2301	Data Structures and Algorithms – I	2
	Theory Paper - 2	CSC2302	Software Engineering	2
	Practical Paper - 1	CSC2303	Computer Science Practical -III	2
S.Y. B.Sc. Semester IV	Theory Paper - 3	CSC2401	Data Structures and Algorithms – II	2
	Theory Paper - 4	CSC2402	Computer Networks - I	2
	Practical Paper - 2	CSC2403	Computer Science Practical -IV	2

S.Y. B.Sc. Semester III

Subject: Computer SciencePaper - 1(CSC2301):Data Structures and Algorithms – I
[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Differentiate primitive and non-primitive structures
CO2 Design and apply appropriate algorithms and data structures for solving computing problems
CO3 Apply sorting and searching algorithms to the small and large data sets.
CO4 Implementing data structures in various applications

Unit	Details	Lectures
I	**Introduction to Data Structure and algorithm analysis** 1.1 Concept 1.2 Data Type, Data Object, Abstract Data Type(ADT) 1.3 Need, Types of Data Structure 1.4 Applications of Data Structure 1.5 Algorithm types 1.6 Algorithm Analysis : Complexity (Time, Space),Asymptotic Notations (big O notation, Omega, Theta)	**[03]**
II	**Linear Data Structure - Array** 2.1 Array as ADT 2.2 Representation 2.3 Applications 2.3.1 Sorting: Concept, terminology, types. Methods: Bubble Sort, Insertion Sort, Selection sort, Quick Sort, Merge Sort, Radix sort. Comparison of sorting methods. 2.3.2 Searching: Linear,Binary	**[08]**
III	**Linear Data Structure - Stack** 3.1 Introduction 3.2 Static representation of Stack Operations (Init, Push, Pop, Peek) 3.3 Recursion 3.4 Applications: String reversal, Parenthesis balancing, polish notation, Evaluation, Backtracking, 4 queens' problem	**[06]**
IV	**Linear Data Structure- Queue** 4.1 Introduction 4.2 Representation of queue: Static 4.3 Operations(Insert, Delete, Display) 4.4 Types of queue(Circular, Priority, Dequeue) 4.5 Applications : Job scheduling with priority	**[07]**
V	**Linear Data Structure- Linked List** 5.1 Introduction, types (singly, doubly, circular) 5.2 Representation (dynamic) 5.3 Operations on linked list(Create, insert, delete, Search, traverse) 5.4 Dynamic implementation of stack and queue using singly linked list 5.5 Generalized linked list (Concept, representation, Example)	**[12]**

	5.6 Applications:Polynomial manipulation, memory management in OS(FIFO)	

Books-

1. Ellis *Horowitz*, Sartaj*Sahni* and SanguthevarRajasekara, Fundamentals of Computer Algorithms,Galgotia Pub. 2001 ed.
2. Y. Langsam, M. AugensteinAnd A. M. Tenenbaum, Data Structures using C & C++, Prenctice-Hall International.
3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill.
4. Gilberg&Forouzan, Data Structures: A Pseudo-code approach with C, Thomson Learning.
5. S.K.Srivastava and Deepali Srivastava, Data Structures Through C in Depth, BPB Publication

S.Y. B.Sc. Semester III

Subject: Computer Science Paper - 2 (CSC2302): Software Engineering

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Prepare students for industry ready
CO2 Understand the components of Unified Modeling Language
CO3 Implement Object Oriented analysis, design and testing
CO4 Draw various diagrams related to structural, behavioural and architectural modeling

Unit	Details	Lectures
I	**Introduction to Software Engineering and Process Models** 1.1 Definition of Software 1.2 Nature of Software Engineering 1.3 Feasibility Study of General System 1.4 Object oriented concepts 1.5 OOSDLC Model 1.6 Prescriptive Process Models 1.6.1 The Waterfall Model 1.6.2 Incremental Process Models 1.6.3 Evolutionary Process Models 1.6.4 Concurrent Models 1.7 Agile Model	[06]
II	**Requirements Analysis and UML** 2.1 Requirement Engineering Tasks 2.1.1 Inception 2.1.2 Elicitation 2.1.3 Elaboration 2.1.4 Negotiation 2.1.5 Specification 2.1.6 Validation 2.2 Software requirement specification (SRS) 2.3 Unified Modelling Language 2.3.1 Advantages and Features of UML 2.3.2 UML Diagrams	[04]
III	**UML for Database Oriented Project** 3.1 Selection of topic and Scenario Discussion 3.2 Defining Objects and Classes 3.3 Requirement Analysis 3.4 Actors and types of actors 3.5 Use-case Diagram 3.6 Class Based Model 3.6.1 Difference between class element and object element 3.6.2 Relationships 3.6.3 Types of relationships 3.6.4 Class diagram 3.6.5 Object diagram 3.7 Behavioural Model 3.7.1 Sequence diagram	[13]

	3.7.2 Activity diagram 3.8 Package Diagram 3.9 Architectural Design Model 3.9.1 Component diagram 3.9.2 Deployment diagram	
IV	**UML for Game and Utility Based Project** 4.1 Selection of topic and Scenario Discussion 4.2 Use-case Diagram 4.3 Class Diagram 4.4 Behavioural Model 4.4.1 Collaboration diagram 4.4.2 State Diagram 4.5 Architectural Design Model 4.5.1 Component diagram [optional for the game project] **4.5.2** Deployment diagram	**[08]**
V	**Software Testing** 5.1 What is testing? 5.2 Different Testing Techniques 5.3 Writing Test cases 5.4 Validation testing	**[05]**

Books-

1. Grady Booch, James Rambaugh, The Unified Modeling Language User / Reference Guide,Pearson Education INC
2. Ivar Jacobson, Object Oriented Software Engineering, Pearson Education INC
3. Craig Larman, Applying UML and Patterns, Pearson Education INC
4. Bennett, Simon, Object Oriented Analysis and Design, McGraw Hill
5. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill (Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6

S.Y. B.Sc. Semester III

Subject: Computer Science Practical Paper – 1 (CSC2303): Computer Science Practical - III

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Understand different algorithms and design suitable programs
CO2 Implement using different data structures to simulate real-world problems
CO3 Compare various algorithms and understand the complexities
CO4 Apply Object Oriented analysis, design and testing

List of practicals(Compulsory 10 + 2 Activity)

	Title of Experiment / Practical
1	Searching Algorithms
2	Sorting Algorithms
3	Stack
4	Queue
5	Linked List
6	Activity
7	Problem Definition, Feasibility Study and Software Requirement Specification
8	Use Case Diagram
9	Class diagram
10	Behavioral Model (Sequence, Activity, State Diagram)
11	Architectural Model (Collaboration, Component, Deployment Diagram)
12	UML Case Study (Activity)

S.Y. B.Sc. Semester IV

Subject: Computer Science Paper - 3 (CSC2401): Data Structures and Algorithms – II [Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Understand the data structures Tree, Graph
CO2 Design and implement various data structures
CO3 Understand the applications of different data structures
CO4 Explore the concepts ofdesign and analysis of algorithms

Unit	Details	Lectures
I	**Non-Linear Data Structure - Tree** 1.1 Concept and terminologies 1.2 Binary Search Tree(BST) 1.3 Representation (Static, dynamic) 1.4 Operations on BST (Create, insert, delete) 1.5 Traversals (inorder, preorder, postorder), counting of nodes, 1.6 Application: Heap Sort, AVL tree, Huffman Coding , Expression tree 1.7 AVL Trees, Red Black Trees, M-way search tree, B and B+ tree	[18]
II	**Non-Linear Data Structure - Graph** 2.1 Concept and terminologies, 2.2 Representation (Adjacency matrix, Adjacency list, Adjacency Multilist) 2.3 Traversal (BFS, DFS) 2.4 Applications (Shortest path algorithm: Dijkstra's algorithm, Bellman ford, Floyd Warshalls) 2.5 AOV Network – Concept 2.6 AOE Network – Concept 2.7 Prims and Kruskal's algorithm	[12]
III	**Hashing** 3.1 Terminologies 3.2 Properties of good hash function 3.3 Hash Functions: Division Function, MID Square, Folding methods. 3.4 Collision resolution techniques: Open addressing: Linear Books: Quadratic probing, Rehashing. Chaining: Coalesced, separate chaining	[06]

Books-

1. Ellis *Horowitz*, Sartaj*Sahni* and SanguthevarRajasekara, Fundamentals of Computer Algorithms,Galgotia Pub. 2001 ed.
2. Y. Langsam, M. Augensteinand A. M. Tenenbaum, Data Structures using C & C++, Prenctice-Hall International.

3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill.
4. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Thomson Learning.
5. S. K. Srivastava and Deepali Srivastava, Data Structures Through C in Depth, BPB Publication

S.Y. B.Sc. Semester IV

Subject: Computer Science Paper -4 (CSC2402): Computer Networks – I

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Explore basic concepts of computer network with application areas
CO2 Understanding the layers of OSI and TCP / IP Reference model
CO3 Learning various line encoding schemes and switching methods
CO4 Explore various protocols at Data Link Layer
CO5 Learning logical addressing, network layer protocol and routing concepts

Unit	Details	Lectures
I	**Introduction to Computer Network** 1.1 Data Communication - Definition, components, data representation, Data Flow, Key elements of protocol, Standards, Standards organizations 1.2 Network Hardware - Broadcast and point-to-point 1.3 Network Types-LAN, MAN, WAN, Wireless Networks, Home Networks, Internetwork 1.4 Topologies - bus, star, ring, mesh, hybrid 1.5 Design issues of the layers - addressing, error control, flow control, multiplexing and demultiplexing, routing, Connection-oriented andconnectionless service	**[04]**
II	**Network Models** 2.1 OSI Reference Model - Functionality of each layer 2.2 TCP/IP Reference Model - Functionality of each layer 2.3 Comparison of OSI and TCP / IP Model 2.4 Addressing - Physical, Logical and Port addresses	**[04]**
III	**The Physical Layer** 3.1 Transmission impairment - Attenuation, Distortion and Noise 3.2 Line Coding Characteristics, Line Coding Schemes - Unipolar - NRZ, Polar-NRZ-I, NRZ-L, RZ, Manchester and Differential Manchester, AMI, HDB3, B8ZS 3.3 Switching - Circuit Switching, Message Switching and Packet Switching 3.4 Comparison of circuit & packet switching 3.5 Application of switching - Telephone and mobile network 3.6 Physical Layer Device - Repeater	**[08]**
IV	**The Data Link Layer** 4.1 Design Issues - Services provided to the Network Layer 4.2 Framing - Concept, methods - Character Count, Flag bytes with Byte Stuffing, Starting & ending Flags with Bit Stuffing and Physical Layer Coding Violations, Error Control, Flow Control	**[10]**

	4.3 Data Link Layer Protocols –Noiseless channel -A Simplex, Stop-And-Wait protocol, Noisy channel –stop & wait, ARR, Pipelining, Go –back –N, ARR & ARQ, Concept of sliding window, selective repeat ARR 4.4 Piggybacking-Need, Advantages / Disadvantages 4.5 Data Link Layer Device – Bridge	
V	**Multiple Access** 5.1 Random Access Protocols ALOHA - pure and slotted Controlled Access Protocol - Reservation, Polling and Token Passing	**[2]**
VI	**Network Layer** 6.1 Design Issues of network layer - Store and forward packet switching, services provided to transport layer, Implementation of connectionless and connection oriented services, comparison of virtual circuit and datagram 6.2 Logical Addressing - IPV4, addresses, Address space, Notations, Classful addressing, Classless addresses 6.3 IPV4 Datagram format 6.4 Network layer device - Router, Router table 6.5 Network addresstranslation	**[8]**

Books-

1. Andrew Tanenbaum, Computer Networks, Pearson Education. [4th Edition]
2. Behrouz Forouzan, Data Communication and Networking, Tata McGraw Hill. [4th Edition]

S.Y. B.Sc. Semester IV

Subject: Computer Science Practical Paper –2(CSC2403):Computer Science Practical - IV

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Develop codes for the data structures Tree and Graph

CO2 Implement the real-world problems based on the data structures Tree and Graph

CO3 Implement the technique of hashing

CO4 Understand networking commands and user management commands in Linux

List of practicals (Compulsory 10 + 2 Activity)

	Title of Experiment / Practical
1	Assignments on Trees - I
2	Assignments on Trees - II
3	Assignments on Graphs - I
4	Assignments on Graphs - II
5	Assignments on Hashing methods
6	Activity
7	Study of Linux environment
8	Study of Shell Interface
9	Network based Linux commands
10	User management in Linux
11	Study of various web browsers and types of servers used in Linux
12	Case study: Wireshark Tool (Activity)